War work + after war /39

2nd War

ANNUAL REVIEW

of

HAROLD CRABTREE

President

CANADIAN MANUFACTURERS' ASSOCIATION

71st Annual General Meeting

good but dull

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THE PRESIDENT'S ANNUAL REVIEW

AT OUR Annual Meeting in June, 1941, we reviewed what was then a year of the greatest war production in Canadian history. Now, we survey another year that has broken, by a wide margin, all previous records.

Canada, in addition to supplying most of her own needs, is making war products that are being shipped all round the world, to the British Isles, the United States, Russia, North and South Africa, the middle East, Australia, New Zealand and China. Canadians are manufacturing in vast quantities products that were never made here before and that few thought could be manufactured here at all.

Canada's industrial system has been largely adapted to war production. This process is being rapidly expanded and intensified and will be pressed forward to the greatest possible extent.

The inventive genius and skill of Canadian manufacturers, engineers, managers and industrial employees have been put to the test, have overcome great obstacles and are delivering the goods. Moreover, the quality of Canadian war products compares favourably with that of any produced elsewhere in the world, according to the evidence of leaders of fighting forces.

When the war broke out there was a scarcity of skilled employees. There was no adequate reserve, so we had to organize our own training schemes, in addition to those set up by the Dominion, provincial and municipal governments. Factories became schools where scores of thousands of men, women, boys and girls were taught new crafts, especially those consisting largely of repetitive processes, in a surprisingly short space of time. It has been demonstrated that the Canadian people are not only intelligent and industrious, but also that they have a distinct inclination for and peculiar skill in the mechanics of production. Otherwise, our armies of industrial workers could not have been mobilized and trained in the time available, nor could they have produced such remarkable results. It is gratifying to report that Canadian industrial workers have contributed much in the way of ideas and suggestions to speed and improve processes and this practical co-operation, by which full use is made of the capacities and ingenuity of all engaged in production, should be encouraged in every possible way.

Relations between employers and employees have improved since this time last year, and especially during the past six months. Most of our industrial relations troubles have been reflections of similar troubles in the United States. The treacherous onslaught made by Japan upon the United States last December brought home tragically to the people of the United States that the crisis of a world war was too serious a time to indulge in domestic disputes. A similar wave of public opinion rolled over Canada, and sternly discouraged industrial dissension. There should now exist no doubt in anyone's mind of the imperative need of the utmost co-operation in our war effort and it is to be hoped that the few whose activities were restricting production will work loyally and vigorously to the end with the great majority who, from the outbreak of war, have given their best.

For a long period we experienced a scarcity of war orders, and stood by with waiting capacity and skill. Then the flood of orders came and we have been almost too busy to think of anything else. Now we have new scarcities with which to contend, scarcity of materials, scarcity of workers and, above all and most vital, scarcity of time.

In speaking to you a year ago, I said:

"Concentration of production is well under way in the United Kingdom. Concentration of production is on the way in Canada also. Heavy taxes have been imposed on certain commodities, not primarily to secure revenue, but to diminish manufacture. Controls have been established. New models have been restricted. A system of priorities has been put into operation. Similar policies and practices are being introduced in the United States. These are indications of trends which cannot be disregarded—as they are certain to increase as the war continues and intensifies."

At the beginning of the war, all governments were faced with increased prices, followed by increased costs, followed by increased wages. Experience shows that such increases accumulate throughout a war and, unless controlled, bring about a dangerous degree of inflation which bears most heavily on those with the smallest incomes. When the upward spiral gets out of control, incomes and particularly the smaller ones, never overtake increasing prices. Well aware of this fact, the British Government, immediately after the outbreak of war, put into operation an extensive system of controls. We followed their example, with variations suited to our different conditions, and went farther than the British in some respects, notably in regard to the control of prices. Our system is not working perfectly. No system, which interferes so violently with the law of supply and demand, can function without creating hardships and disturbing normal economy. There are many troubles and difficulties. Changes will have to be made in some respects. Controls cannot be rigid. They must be flexible so that they can be adapted to conditions and needs, but the central fact remains that Canada is much better off today than she would have been if no controls had been established.

New scarcities are developing daily. Sources of supply, which we thought permanent because we had used them for a long time, suddenly disappeared. Unusual competition tended to dry up other sources. A few years ago there was abundance. Now we are going about looking for scraps. Nothing must be wasted. All materials have become precious. Not only must materials of all kinds be employed to the best possible advantage, but also manpower and productive capacity must be managed so as to produce the greatest possible results in the shortest space of time.

How fortunate it is that, in spite of discouragements and difficulties, an industrial system had been developed in this country. It took several generations to accomplish this, as the founders of industry had to contend with the view that Canada should concentrate on the production of primary products and leave manufacturing to older countries. Sporadic and partial applications of this theory retarded manufacturing and resulted in a smaller industrial system being in existence than if a steady and consistent policy of expansion had been followed, but, in spite of all obstacles, the foundations were truly laid and well have they served us in this war. Where would Canada have been today if she had no established and proved industrial system and experienced industrial employees? We could not have undertaken the industrial tasks, most of them entirely new, that have been placed on the shoulders of Canadian manufacturers and their employees since the beginning of the war. With the experience, the personnel, the equipment, and the factories of a long-established system available, Canadians have grappled with the most difficult and complicated problems of war production, have solved many and will solve many more.

Many people are thinking about what will happen after the war. This is a wise thing to do, provided it does not divert anything from the supreme effort, which is to fight on until victory is won.

It is not inevitable, as some assume, that there will be a long period of exhaustion and prostration after the war owing to the appalling loss of life and destruction of property and trade. We know from history that great wars were followed usually by afterglows of false prosperity, succeeded by depressions, and that, after the depressions, in most cases, constructive periods developed. We must expect to face great problems, economic and social. How far-reaching these may be remains to be seen. Let us bear in mind, however, that there is a new factor in this war, the extraordinary development of science and industry. The capacity of production has been expanded in a manner unknown in previous times. Scientific production is now available to repair damage more quickly and effectively than in the past. Mechanical skill, which has reached its highest point in the world's history, will not disappear after the war. It will be at its zenith but the problem will be how to use it intelligently and swiftly to rebuild the world. Under the exigencies of war the length of time necessary for certain manufacturing operations has been reduced in a remarkable manner. Why can not the time required for rehabilitation and readjustment be diminished also? The speed of destruction has been inconceivably increased. Why cannot the speed of rebuilding be accelerated? War calls forth from unknown sources extraordinary powers of intelligence and action. As an example, reflect upon the development of air knowledge and air craft and air communication during this war. What will be done with all this? Can it be utilized in peace to advance civilization? We think that it can and will.

In the same way, in many other departments of human endeavour, the intelligence, skill and invention, the offspring of this war, can be adapted to peace. If that is done, many of the evil effects of the conflict, which otherwise would have been inevitable, may be averted. New fields of activity can be found and used to advantage. Additional wants will come with better standards of living and new forms or extensions of old forms of production will be required to supply them. Production is the chief insurance against unemployment, and full employment prevents or cures most economic and social ills.

Most governments have designated ministers, set up committees, and established machinery to attempt to prepare for post-war conditions. Many plans, representing different schools of political and economic thinking, are being advocated or are in course of preparation. The Government of Canada and many organizations, including our own, are giving attention to this important subject. The problems that have to be dealt with are extensive and the chief one will be employment or how to find work when peace comes for the men and women who are now engaged in war activities. Intelligent and experienced people, with time to spare, should be thinking about post-war conditions, and, in so far as plans can be made without impeding war efforts, they should be formulated, developed and advanced as far as possible to meet post-war needs.

It seems reasonable, in the light of history, to believe that, in the formulation and execution of post-war plans, the experience of the past will have its proper place. Individual initiative, personal industry, thrift and saving are well-known phrases describing qualities which have proved their worth in the application of the principle of private enterprise by peoples of great nations in their most vigorous and progressive periods. We believe that these qualities, with due allowance for progress and changing conditions, can and should be of vital importance in helping to solve the problems of the future and to improve the lots of peoples in all parts of the world.

In the meantime it would be wise for us, in making our plans and in carrying on our war activities, to consider our own situation and difficulties in comparison with those of our allies.

British factories are in the front line. The industrial population of the British Isles toils in blackouts, through bombing raids, without sufficient food, sleep or clothing, repairing and reconstructing shattered buildings and machinery, short of supplies, in the midst of ever-present danger and death. Nevertheless, they insisted on working such long hours that they had to be restrained, lest fatigue injure their health and defeat their purpose.

The Chinese people, when their chief industrial centres were captured, dismantled their factories and, with incredible hardships, carried away parts of their machinery and supplies to remote places where they set up small co-operative establishments, labouring chiefly by hand, to make the inadequate but priceless weapons with which they withstood their foes.

The Russians lost many of their great factory towns. More appeared to be in the shadow of capture but the Russians moved thousands of industrial workers with machines and supplies far inland and carried on the fight. In certain factories Russian women constitute from sixty-five to seventy-five per cent of the employees and they work eleven hours a day for six days a week. Vital factories operate seven days a week, twenty-four hours a day, and yet it is reported that devoted Russian women line up behind their machines well before the time for the changing of the shift so that not a moment shall be lost.

Contrast these conditions in Britain, China and Russia with conditions in North America. The only real sacrifices and hardships in North America to date have been suffered by those serving in the armed forces, the merchant marine and auxiliary forces and by their families. To all of these, their countries owe a debt of gratitude which must be remembered always. As for the rest of us, what real sacrifices have we made or what real hardships have we endured? The plain truth is that the people of Britain, China and Russia have been brought face to face with realities. They see and hear their enemies. Bombers are over their heads. They know that deeds, not words, will save them.

In North America, apparently so safe and comfortable, up to the present, reality has not been revealed and imaginations have not been stirred sufficiently to galvanize the whole continent into furious endeavour.

It is not because North Americans have not the courage, intelligence and persistence of the British, Chinese and Russians; it is because the war is not yet in our midst.

It is to be hoped that invaders will be kept away from this continent and that we shall not require the spur of actual invasion to stimulate us to use our full powers, but, if we North Americans do not rouse ourselves, we, too, will learn by the hard way the inevitable result of lethargy and selfishness.

We North Americans have had some rude shocks of late but our pre-war sleep was so profound that it is doubtful if even yet we are fully awake to our danger. Let us think of the fighting, toiling, sacrificing, British, Chinese and Russian peoples and fling ourselves, while there is time, into the conflict with all our brains, energy and resources, in battle, in the factories, on the farms, in the forests and mines and in every other activity that will help to win the war.

The extension of the war over practically the whole world, and the increasing fury of conflict by sea, land and air, are convincing and terrible proofs of the absolute necessity for the greatest possible united war effort on the part of all Canadians.

In view of the facts that Canada was unprepared for war, short of trained men and war supplies, following twenty years of sincere but unavailing efforts to maintain peace, this country has accomplished a great deal since September, 1939.

Canada has enlisted on a voluntary basis and trained large numbers of men for the Navy, Army and Air Force, who are a credit to their country.

Our industries are largely converted to war production. Vast stores of equipment and supplies have been manufactured and a greater programme is under way. Similar activities and results are visible in other national departments.

This is all commendable and encouraging, but is there anyone who, looking over this raging world, will say that it is enough? The answer is a resounding NO.

The people of Canada, in their hearts, believe that an all-out effort is their only method of salvation but we have acted too slowly. There is evidence now that Canadians are becoming fully aroused, and that we will act together and with undivided purpose and energy.

Canada will provide men needed for the fighting forces abroad and at home and will ensure that adequate reinforcements will be available as the numbers needed are determined from time to time by the Government of Canada in consultation with her allies.

Production of munitions of war, already very large, will be pressed forward and the necessary industrial employees and materials for this purpose will be provided.

Farmers will be guaranteed adequate assistance in manpower and in other ways to enable them to maintain and to increase the supplies of food and of other agricultural products used in making war supplies and they can be counted on to deliver the goods.

From the forests, the mines and the fisheries will come necessary supplies.

Transportation, public utility, police, fire, hospital and other services will be kept in a state of efficiency in order to meet war and essential civilian requirements.

A great part of the national income from all sources is being used already to finance the war and anything more that can be taken without weakening the national economy will be used.

The people of Canada have accepted restrictions of many kinds, and there is no doubt that they are ready to bear still greater burdens and sacrifices. They are willing, but this great reservoir of human enthusiasm and energy needs still more intelligent and intensive organization and direction.

More extensive and more concentrated application of manpower and womanpower to the war economy of this country will take place as the war goes on. So far as the severities of the climate, physical nature of certain tasks and other factors will permit, men unfit or too old for active service will be substituted for young and physically active men. More young people, more women, and more middle-aged and elderly people, will be employed in greater numbers in all kinds of clerical duties and light work, in all departments of national activity. Wherever they can be used to make available young and strong men for the forces and for exhausting labor in manufacturing, agriculture, forestry, mining, fishing, transportation and other essential industries this will be done, always bearing in mind that all these departments require a reasonable proportion of directors, key employees, skilled workers, and physically strong men, if adequate and continuous production, urgently required for both war and essential civilian activities, is to be maintained and increased.

What is needed is for this nation to determine, as quickly as possible, the numbers of men and women who can serve to the best advantage of the country in the combatant services, in the auxiliary services, in production, in distribution, and in other departments of national activity; to endeavour to see that all are in their proper places where they can do their best; to induce them to stay in such occupations, and, thus, to save the waste of unnecessary moving about; in brief, to utilize the abilities of all in the best possible way for the single purpose of helping to the utmost limits of our capacity to defeat the enemy, to achieve victory and to bring this dreadful conflict to a conclusion in the shortest possible time.

We will scarcely recognize this country a year from now because the impending changes will be so great and far-reaching. Let us adjust our minds, habits and personal requirements to what is coming and get on with our work.

During the uneasy period between the last war and this, many countries imagined that talk, resolutions, and the pursuit of their own affairs, would ensure their safety and happiness. They must know now that there is no safety, no guarantee of life or property or happiness without security from attack and pillage. It is understood now what happens when enemies gain a partial, even if temporary, control, of the air or of the seas, or of the land. We Canadians, to some degree, had forgotten what the British Navy has done in the world. We realize now what it means to belong to the British Empire and we hope that we will never forget this great truth. We appreciate what it means to have a friendly and practical understanding among English-speaking peoples and co-operation with other peoples who have similar ideals. We know now that, if we hope to survive and protect our liberties and all that we have, it is necessary to take our full share in the responsibilities of protecting them. These, we hope, are the guarantees of our future. But the grim present overshadows everything, future as well as past. The vital necessity is to smash our enemies. Those enemies can only be defeated in battles, in the air and on the seas and on the land. They must be dealt crushing blows and those blows can be struck only by seamen, airmen and soldiers. Piles of munitions and food and stores of all kinds are useless in themselves. They are only future prizes for the enemy unless we win battles and in order to win battles, the navies, the air fleets and the armies of the United Nations must be strengthened, maintained, replenished and supported before all other needs. The part to be played by industry is important. Men without machinery and equipment are of little use. They cannot fight without weapons and supplies, food, and transport; but put first things first and in this war fighting comes first and peace will never be achieved until victories are won and these victories must be overwhelming and final. This is the task to which we must bend every effort. We must fight and work and pay and sacrifice. Let no one ever think that he or she is doing enough. The constant question must be, "What more can I do?"

HAROLD CRABTREE,
President.

Good but dull

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WE OR THEY

(A Study of the Herrenvolk Mentality)

AN ADDRESS

by

*DR. LOUIS K. ANSPACHER

before the

CANADIAN CLUB OF MONTREAL

on

MONDAY, 20th NOVEMBER, 1944

at the

WINDSOR HOTEL

In 1936 Mussolini was the mouthpiece of the Axis philosophy. In that year, he stated bluntly that this planet was not big enough for Dictatorships and Democracies to inhabit together. He said one or the other must go. "It is either we or they." I must say that it took us a very long time to realize that the Axis powers were bent upon our utter destruction—ours as well as England's.

The definite belief in the Herrenvolk ideal—the master-race ideal—justified, by fair means or foul, to destroy or to enslave the rest of the world, and the Teutonic ambition to subject the rest of the world by military conquest,—these ideas have animated the purposes of the German General Staff for well over a hundred years. The German General Staff is the villain of the drama of liberty; and they will continue to threaten the peace, the liberty, and the security of the rest of the world, unless we obliterate them ruthlessly. They are the real enemy. And in a short span of eighty years they have threatened five times to encroach upon or to destroy the liberties, the peace, and the civilization of the world. This present war represents their fifth attempt to do so; and the terrible thing to reflect upon is that each successive attempt has carried them relentlessly nearer to their goal of world-conquest.

Yes—it is either we or they.

**Dr. Anspacher is recognized as one of America's most distinguished dramatists, philosophers and authors. He is the author of many successful plays including "Tristand and Isolde", "Embarrassment of Riches", "The Washerwoman Duchess", "The Achievement of Happiness" and "The Intruder".*

Hitler, Goering, Goebbels and Himmler are bad enough, God knows, but they are only the instruments of the cold foresight and the implacable long-range planning of the Pan-German General Staff, which is the directive head of the "cartel vertical." This vertical monopolly controls and has controlled the whole of Germany since Bismarck's time.

At the top of this monopoly are the General Staff and the Junker officer-class. Immediately below and under them and taking orders from them, were and are the big banking interests, who control the money, the credit, and the production of the great industrialists, the **Grosse Industrielle** as they are called, particularly in the heavy goods industries, like munitions, chemicals and motorized armament. The German General Staff also controls the whole educational system. Every teacher in the Reich, from the greatest philosopher, the greatest professor, down to the humblest kindergarten teacher, is **ein Staats-Angestellter**—an appointee of the State, who is obliged to inculcate Pan-Germanism. There is and was no independent thinking and teaching possible in this country. No modern nation at least is more completely integrated in its purposes than Germany. I doubt if liberty of thought ever existed there in modern times. The modern professor has always liberty of speech to express himself—on an unimportant subject.

This powerful General Staff controls, accordingly, the economy, the industry, the education, the manufacturing, and the whole domestic and foreign policy of this nation. The German General Staff has made war and the preparation for war the national industry of Germany since 1807.

This German General Staff saw in Hitler and his gangsters a rabble-rousing bunch whom they could utilize, even though they loathed him. So it was inevitable that some of the Junkers and the General Staff should have attempted, and will again attempt, to blow up Hitler or cut his throat and get rid of the top-flight Nazis. Then they will come before the world and say just exactly as they did in the first World War: "Now we've got rid of the bad men, we've destroyed these awful Nazis who got hold of the Government and led us all astray. We are really all nice, good, sweet Germans now, We love good music and children and beer and sauerkraut. We are the dear, good fairy-tale Haensel and Gretel Germans, we are gentle toy-makers from Nuremberg; so, for Heaven's sake, let us stop the killing, let's kiss and make up"—and if we fall for that again as we did in the first World War, if we stop before we have liquidated that

General Staff, the pan-Germans, and abolished the Junkers whom they represent—if we stop or try to stop Russia, if we get soft and sentimental as we did the last time, or if we listen to the seductive voices of those who will exploit our war-weariness—if we listen to our Lindberghs and our Nyes, to our Tobeys and Wheelers and Hiram Johnsons—to our Reynoldses, Father Coughlins, and our Robert McCormicks and to our American Firsters,—to the enemies within our country—if we listen to our Doctrinaire Pacifists, our Isolationists, our Hamilton Fishs or the Hyphenates—the peace criminals in our midst—(you have heard a lot about war-criminals, they are the peace criminals in our midst)—if we don't finish the job this time, we shall make the most irreparably tragic—the most fantastic and criminal blunder in universal history.

My friends, we now know who the powerful enemy of our civilization is. We can eradicate this monstrous, this Apocalyptic evil, and establish a world that can devote itself to getting rid of poverty, to sharing the benefits of progress, and to doing something else besides stepping up the pace in the international munitions-race. In other words, we have again the chance nobly to save or meanly to lose, the last, best hope on earth.

Let us realize that the disappearance of Hitler will not suppress or abolish the peril of Pan-Germanism. The danger does not reside in a man, but in the mentality of the German people. In other words, Hitlerism is not a phenomenon dependent only upon the emergence or the disappearance of the man Hitler. Hitler, my friends, is only a cork floating on an iron inevitable stream of tendency. Hitlerism and its political expression, Nazism ,are essential manifestations of the Pan-German mind. We are not only fighting a man and an army. We are fighting a perverted mentality in a people—a mentality whose good qualities have not been emphasized by good historical conditioning, but whose perverse qualities have long been indurated by bad historical conditioning.

Now I am frequently asked: "Are there no good Germans?" Of course there are good Germans; but what is the good of the good Germans when they have never been able to do any good in Germany? As our distinguished novelist, and my very dear old friend, Booth Tarkington, says: "Yes, of course, there are good Germans in Germany. But we cannot risk the destruction of all civilized existence for the sake of a minority so impotent." Yes, the good German has always been powerless. That is why Germany is known by the historians as the land that has never had a successful revolution. Germany has never had a John Hampden, it has never had a John Eliot, a Pym, a John Milton, a Cromwell, a Patrick Henry, a Thomas Jefferson, or a George Washington. Their greatest historical leader after all was Luther and he sold out his people to the Nobles and Junkers of his day.

And believe it or not, I am not anti-German. I myself have South German ancestors. My grandfather came over here in 1848, at the same time that Wendell Willkie's people came over. These 1848 Germans resented the beginnings of that kind of Soldier-Socialism which Bismarck was later to impose, and which finally developed into the obscene social order we are fighting today. Those 1848 Germans were a superb, magnificent breed. In addition to giving us such great leaders as Carl Schurz, Franz Sigel, and Abraham Jacoby, these forty-eighters gave thirty-four major and brigadier generals to Lincoln's various staffs. They provided over 200,000 volunteers for the Union Army. 40,000 of them died on the field of battle to establish the Union and to liberate the slave; which was a tremendous proportion of their quota of the population.

That same magnificent breed of men gave us Admiral Nimitz, Chief of Operations in the Pacific—and the Japs are now discovering that there are no limits to Nimitz—they further gave us General Spaatz in the European Theatre and General Ike Eisenhower, the incomparable soldier and gentleman and the chief military statesman of the whole Allied cause in Europe, and many others of sterling incorruptible character and distinction. No—I am not anti-German. But I am anti the mass of the present, latter-day Germans, who have been so foully conditioned for so long a time. Believe it or not, the lovely fragrant lily is only an onion differently conditioned.

Knowing these things, it is well to be above race-prejudice. But it is also well to be awake to the perils and dangers that can come from a people so perversely environmentalized, I mean mentalized by their environment and condition as the modern Germans are.

Now in the first place, let us realize that the German people have always lived under absolute monarchs or dictators. Frederick the Great, Scharnhorst, Gneisenau, Clausewitz, Moltke, Metternich, Bluecher, Bismarck and the Kaisers—the name doesn't matter. The Government is always the same. The Germans say "**Wir sind zu blindem Gehorsam verpflichtet**"—we are duty-bound to blind obedience. As a people the Germans have never participated in their government. They don't know what democratic participation means. They have been educated into serf-like obedience to force and to brutal compulsion.

The German soldier is still a serf. He accepts no moral or civic responsibility whatever. He would rather obey than think. He is trained to unconditional and unthinking blind obedience. This Herrenvolk, master-race, soldier is the most slavishly roboting animal in history. That is why this German soldier at command will murder innocent civilians, shoot hostages, will slaughter and strangle millions of Jews by mass-murder, in his lethal vans and in his Lublins, he will strip and whip the wives of hostages to death, as he did in the public squares of Belgrade, in Serbia; he will rape the helpless women, he will bayonet the babies, he will commit blood-curdling and incredible atrocities; and he will do all these things with a cold and methodical ferocity that appals the rest of the civilized world. He will utilize pain, agony, and torture systematically as military weapons. Even savages got beyond doing that fifty thousand years ago. He will use his enemy's old men, women and children, as a front-line screen, behind which he advances and shoots at us; but we can't shoot back without killing those whom we love. He will even utilize his own dead as booby traps to kill our soldiers who try to give them decent burial. You will find all these things justified in their political philosophies and in their military manuals.

Before I try to explain historically how the modern Nazi and Pan-German became the monstrous thing he is, I wish to deal briefly with two other false and sentimental ideas that afflict the generous-minded people in our midst. Now you have all heard good and worthy people in America, and Canada as well as in the States, say "Oh, the German people in themselves are all right. My cobbler is a German, and he's a grand fellow", or "my corner groceryman is a German, and he's just wonderful. It isn't the Germans—no, they are nice, sweet, lovely people. But they are in the hands of a few Prussians; and it is these few Prussians that make all the trouble." Yes, these few Prussians. Oh, what a foul and transparent alibi. Look at your geographies, my friends. Prussia is well over two-thirds of Germany in size; and Prussia has over two-thirds of the population of Germany. Yes—a few Prussians, Out of sixty millions of people in Germany by the last census, 42,000,000 are Prussians.

The next whining alibi I wish to discuss is Hitler's breast-thumping and rabble-rousing tosh about what he calls the "Mis-Treaty of Versailles." Now, then, when you hear German sympathisers talk about the evils and the injustices of the Treaty of Versailles, I should like you to remember that, in comparison with any treaty that Germany ever imposed, the terms of Versailles are mother's milk for babes. They are as tender and generous as a lover's marriage settlement. Study the terms of the Treaty of Sedan, which a victorious Germany under Bismarck, imposed upon a prostrate and helpless France in 1871. Study the terms of the Treaty of Brest-Litovsk, which Germany imposed upon a prostrate and helpless Russia in the last war, as late as 1917. By that treaty Germany took from Russia more than one-third of her population, took over 32 per cent of her best agricultural land, took more than half of her industries, and then took away from Russia 90 per cent of her coal mines, and Russia is an awfully cold land in which to live. That was a German treaty, and it was vivisectional. Study the terms of the Treaty of Bucharest with which Germany crushed a prostrate Rumania in the last war. Germany just took everything that could be pried loose with bayonets or blasted out with dynamite. Hitler's fake attitude towards the Treaty of Versailles is just a shameless depravity, a perverse whining. The rape of the whole continent of Europe, which the Nazis almost succeeded in accomplishing, may give you some faint idea of the terms that Germany would now exact and impose upon the world if she came out to be the victor. In 1915, long before Hitler came to power, General O. R. Tannenberg, the Pan-German propagandist gave the real German attitude to treaties in one single sentence, when he urged "Leave the vanquished nothing but their eyes, and those to weep with." That is the German idea.

Do you realize that by the Armistice with Petain, the French people since 1940 have been obliged to pay between 300,000,000 and 500,000,000 francs a day ($8,000,000 a day) to support the German divisions, those German murderers in France. The Germans make the conquered people not only work for them in their munition factories—there are now over eleven million people of the subject nations doing slave-labor in Germany—but the Germans also make them fight for them and pay for their armies of occupation.

I have come to a conclusion about the Germans; and this is borne out in practically every relation. They are intolerable when victorious, and they are insufferable when defeated. Apart from that I have no prejudices.

As far back as 1807, a year after the battle of Jena, the German philosopher Fichte practically writes the first edition of "Mein Kampf". There is nothing new in "Mein Kampf". It is just repeating what Fichte wrote, which proved that the Germans were not defeated. In Fichte's "Speeches to the German Nation" he proves, with a perversion of the facts which Goebbels might envy, that the Germans are the only great race in the world. All other nations and races, says Fichte, have passed their zenith and are declining. The future, therefore, belongs to the Germans, who must be recognized as world-leaders.

Now by the terms of the Treaty of Tilsit, concluded after the decisive defeat of Prussia at the battle of Jena, Napoleon permitted Prussia to maintain an army of only 42,000 men, and the Prussians agreed, But they soon treated that treaty like a scrap of paper. A man by the name of Scharnhorst thought up a scheme of evading that treaty, just as the Germans ultimately evaded every term in the Versailles Treaty. Scharnhorst arranged that this army of 42,000 men should be constantly re-created by new men, and that those who had received their training in the ranks should accordingly be retired into the reserves. By means of this subterfuge, Scharnhorst militarized and regimented the whole available male population. This subterfuge, with the militarization of the entire male population, has had baleful consequences in Europe. It is like munitions and armaments. If one nation begins it, the race is on; and all the other nations, at their peril, must follow. Europe becomes an armed camp, and Prussia becomes the strutting, shouting top-sergeant.

All German political philosophy follows in Fichte's and Scharnhorst's footsteps. War is glorified. Might is apotheosized. Military conquest is justified. Force, blood and iron supplant the ideals of peaceful civilization. So, when the Prussian officer swaggers down Under den Linden, the civilian population humbly scrambles into the gutter in order to make way for him. And the highest ambition of the daughters of the rich bourgeoisie is to marry a pair of epaulettes and subsidize a sword with papa's money.

Hegel, who died in 1831, became the official philosopher of Prussianism. Hegel taught—now get this—Hegel taught that the Germans had the duty of imposing their Kultur upon the world. So war and conquest became the instruments of nationalistic and patriotic progress.

Then there came a really poisonous fellow. This time it is a Frenchman, I am sorry to say, Count Joseph Arthur de Gobineau, who in 1854 published a book with a very innocent title. He called it "The Inequality of Human Races." This book, with its disarming title, is the fountain source of many of the most inhuman and fanatical ideas. It animates many of the cruellest prejudices in modern life. Gobineau's book is the foundation of the Nordic-Aryan racial mythology, so dear to the heart of Hitler and Goebbels today. Gobineau writes of the "pure Nordic", as if there were such a thing. And what the German does with Gobineau is nobody's business—the Teuton-Prussian-German is the pure race, and must be kept pure. The Poles, the Jews, the Greeks, the Russians, the Czechs, the Slavs, and anybody Hitler, Rosenberg, and the Prussians don't like, are therefore inferior races and must be obliterated. It is difficult to believe that such murderous, homicidal fanaticism exists in the world today. But there it is; and this poisonous attitude towards helpless minorities has spread like a contagion.

Then, of course, came Nietzsche. In Nietzsche's theory, the strongest are the best and that is all about it. Nietzsche accordingly exalts force—ugly, brutal, unscrupulous force as the only criterion of ethical or social value. Might becomes right. The blond, roaming beast—those are Nietzsche's own words—callous to pity or sympathy, functioning beyond any considerations of good or evil, is the superman-hero of the Nietzschean Saga. Nietzsche becomes the classic philosopher of the modern German General Staff. Nietzsche urges the powerful to "be hard". These are his very words: "Be hard, lest you degenerate to the status of those you pity."

Of course, the Prussian-Germans become the Supermen. Now these theories, my friends, these theories animate the purposes of the Germans today. Indeed, most of the ideological justifications for Germany's attitude to smaller nations and minorities, and most of the terrifying formulas like "World-power or downfall" and that "A good peace justifies any war" can be derived directly from Nietzsche.

One cannot speak of the Germans today without some reference to Bismarck. Bismarck charted the course and set the compass of Germany to the goals that horrify the world today. My friends, Bismarck was a bone-and-marrow Prussian, with a hypnotic, fanatical singleness of purpose, with inexhaustible energy, with a callous, concentrated, and gloomy ferocity of unscrupulousness, with only one program, force, and with only one method, summarized in his famous maxim "Blood and Iron." Bismarck was the personification of all the German ruthlessness that appals the world today. Bismarck gave Hitler and Goebbels a complete example of filthily perfidious statecraft. But he unified Germany and started her on her career of power-politics and Pan-German conquest.

This all means, my friends, that Hitler is no accident. The whole of the nineteenth century in Germany was a highly conscious preparation for the advent of the Hitler regime. That is why it is perfectly possible to say: "Though Nazism is evil incarnate, Nazism is the culmination of tendencies in Germany which are far older than Hitler and may presumably survive him."

Long before Hitler was dreamed of, the Pan-German, General Staff ideal of Teutonic conquest was expressed in monstrously baroque terms by General Count von Haessler, who was the mouthpiece of the Pan-German General Staff philosophy. Haessler declared in 1893 that "Our Pan-German civilization must build its altar on mountains of corpses, oceans of tears, and the death-rattle of countless people." 1893. I am going to repeat that again. General Count von Haessler, the mouthpiece of Pan-German philosophy declared in 1893: "Our Pan-German civilization must build its altar on mountains of corpses, oceans of tears, and the death-rattle of countess people." The dear, sweet, sentimental German of the fairy tales has become a collective fairy tale for foreign consumption. The Pan-German General Staff, which represents the permanent collective consciousness of the German nation is the German that we must reckon with, if we would know our enemy.

Now I must speak of Haushofer and his "Geopolitik." Haushofer invented that combination of geography and politics based upon the Pan-German conquest of the whole world. Yes, the conquered people of this whole world were to be put to work for the benefit of the master-race of the world, the Germans. Two thousand millions of people were to be turned into helots and slaves and put to work for the Germans.

For example, part of the British, the Spaniards, the Scandinavians, and the Alsatians shall do the mining. The other British, Scandinavians, and northern French shall do the shipping, for the Germans. The rest of the French, the Danes, the Czechs, and some of the Slavs, shall do the agricultural work. Manufacturing and textiles shall also be allocated. Other nations shall do the grazing and the wheat growing—and here is where you in Canada had another chance to grow wheat for them—all as helots and slaves of the Herrenvolk, the German Masters, who will keep for themselves the monopoly of the manufacture of heavy goods, armament and munitions. No other people will be permitted to arm, or to have any weapons whatever. Some peoples, like the Jews, the Poles, and the Greeks, are to be eliminated by starvation or mass-murder. You can find it all written down definitely in Haushofer's book. Others like the Czechs and the European Slavs are to be made half-German by forcible rape and breeding with the German army. All conquered people are to be given just enough food to enable them to work, but not enough food to give them vitality to revolt. This is the geo-political theory of food control.

The cripling of the economic structure of all other people, the killing of all leading citizens as hostages, the systematic underfeeding of the infants and children, while all the German children are bursting with health, food and vitamins, is all part of a plan, that whether or not the Germans win this war, the next generation will find the Germans to be the physical supermen of Europe, with the only leadership, political and economic, left in Europe. The children of the conquered nations—poor, underfed and starved, rachitic, anaemic and tubercular, will never grow up into men that will be a match for the Germans. It all sounds monstrous, incredible and fantastic, but it is all part of a diabolical plan which the Germans have been pursuing with implacable, cold, methodical, and systematic ferocity. No matter what happens, unless we know these plans and work against them, Germany, even though defeated, will remain the strongest power in Europe.

On March 12th, 1944, that is only six months ago, General Otto von Stuelpnagel, the military governor of Paris, made this statement: "What does a provisional defeat matter to us? The conquest of the whole world will require numerous stages; but the essential is that the end of each stage brings us an economic and industrial potential greater than our enemies. With the war booty which we have accumulated, with the enfeebling of two generations of the manpower of our neighbors, and with the destruction of their industry, we shall be better placed to conquer twenty-five years from now than we were in 1939." So don't rock yourself to sleep with the idea that they are not thinking of the next war.

Again, Marshal Gerd von Rundstedt, the Supreme Commander of Hitler's anti-invasion forces, recently issued these instructions to the War Academy in Berlin—these are his instructions to the War Academy: "The destruction"—not the conquest mind you, the destruction—"of neighboring peoples and their riches is indispensable to our victory. One of the greatest mistakes we made in 1918," he continued, "was to spare the civil life of the enemy countries; for it is necessary for us Germans to be at least double the number of peoples in contiguous countries. We are, therefore, obliged to destroy at least a third of their inhabitants. The only means is organized underfeeding, which in this case is better and cheaper than machine guns."

I give the attitude of the German philosophy of world conquest in these simple lines that I wrote over a quarter of a century ago:

"Our Empire must expand.
Until our earth lies subject to the Hun;
So drive all other peoples from the land.
First learn to hate,
And then—exterminate
Whatever stands between us and the sun."

—(From The Pledge.)

It is time that we realize what the enemy means by total, global war. It is not only war against the armed forces. It is war against the whole population and all the economic and human resources of the Allied Countries. It is total war. It is not only military; it is biological warfare at its fiercest on the next generation. It is Geopolitik and General Staff pan-Germanism openly expressing itself; and if we would know our enemy, if we would know what he really thinks in his heart, if we would know what is going to confront us at the peace table, there it is, expressed out of his own mouth and in his own words. So, my friends, if we do not win this peace, we have already lost the next war.

An Address

BY

FIELD MARSHAL THE RIGHT HONOURABLE

JAN CHRISTIAAN SMUTS,

P.C., C.H., K.C., D.T.D.,

Prime Minister of South Africa

GIVEN BEFORE A LUNCHEON MEETING

OF THE

CANADIAN CLUB OF OTTAWA

ON JUNE 29th, 1945

INTRODUCTION

BY

MR. H. P. HILL,

President, The Canadian Club, Ottawa

Your Excellency, Mr. Prime Minister and gentlemen, in Canada the slow and sometimes violent evolution from colonial status to independent statehood has spanned a century and a half. But in our great sister Dominion of South Africa it is embraced within the lifetime of a single generation. From first to last in this sturdy growth Field Marshal Smuts has had a distinguished part. It is he perhaps more than any man alive today who proved to the world that freedom is consonant with Empire, and that these two great principles may march side by side through the pages of history for many years to come.

The many faceted genius of our guest today, in statesmanship in war, in philosophy and in science mark him as the modern successor to the great men of the Renaissance.

We, in Canada, are proud that he belongs to the British Commonwealth, we are proud to belong to a Commonwealth that can produce such a man.

It is with a very real sense of privilege that I introduce to you the Prime Minister of South Africa, Field Marshal Smuts.

AN ADDRESS

BY

FIELD MARSHAL THE RIGHT HONOURABLE

JAN CHRISTIAAN SMUTS, P.C., C.H., K.C., D.T.D.,

Prime Minister of South Africa,

given before a Luncheon Meeting of the Canadian Club of Ottawa on June 29th, 1945

Mr. President, Your Excellency, Mr. Prime Minister, and gentlemen: I thank you, Mr. President, most sincerely for your kind words of welcome. I think you have rather over-shot the mark, but on an occasion like this I suppose it is permissible—flattery is sometimes welcome.

I am very pleased to be here in Canada, even if only for a few brief moments. As many of you know, I was here last fifteen years ago, and then also for a very short visit. After the many kind and pressing invitations I have had to revisit Canada, I am glad to have this opportunity to be here with you again, and once more with the old Canadian Club. The unexpected length of the San Francisco Conference and my long absence from South Africa make this also only a flying visit in both senses of the word.

One special pleasure in this visit is to see once more your Governor General and Princess Alice, whom I have not seen for many long years. I bring them in person the greetings and good wishes, indeed the affections of South Africa, the land who loves them as I am sure they still love us. The mark they have made in South Africa, the happy memories they have left behind them, are still deeply cherished by all of us. You who know them will understand how we must feel towards them. Our great Commonwealth is indeed fortunate in having such links of goodwill and high service as they represent.

This visit is also a call, personal and official, on your Prime Minister in response to his repeated invitations to me. When I was last in Ottawa I was the guest of my old friend, Sir Robert Borden, with whom in other days I collaborated so closely in the advance of our Dominion status. After his long rule you have had the advantage of an even longer rule by your present Prime Minister, whom Canadians have now once more honoured with their confidence. Politics is a hard business—difficult to get in, harder to get out. I have always looked upon a general election as an opening to a pleasant release but it seldom comes. You have to bear your yoke. Canada's long record of stable governments is indeed a very remarkable one. And I sometimes wonder whether that is not one of the reasons for the most remarkable progress which this country has made during this century. Stability in an unsettled rapidly changing world is no mean asset. I know this by experience. In South Africa during the last 35 years of union we have had only three Prime Ministers, and one of them is still going. I had better touch wood. (Laughter).

Our progress, our performance during that stormy period, has also been astonishing, and may have been due in part to this stability of government.

I am, however, not here to speak about South Africa. I wish to speak for a moment of Canada. But indeed it is difficult to speak of her without appearing to flatter you. The rise of Canada in recent years and especially during this war has been one of the most amazing events of our time. Nothing has surprised me more than the distance Canada has covered in this war. I am sure it is not only outside observers who are amazed, but Canada herself must have been astonished by her war effort, her industrial effort, the revelation of her vast potentialities for expansion in all directions, and the position to which she has so suddenly risen in the world. And all this in years which you can count on your fingers. How far is she going? We live in an age of miracles, and in years to come, when the ranking of great powers will be very different from today, historians may look upon Canada's coming out of this war as little short of miraculous. The mark Canada has made at San Francisco and her outstanding contributions to the charter are only some indication of the influence she has come to wield in world affairs today.

You may wish me to say a few words about the San Francisco Conference, which will without doubt rank among the greatest events of our time. Coming at the end of this greatest of world wars in an epoch of history, fraught with far-reaching changes, San Francisco may well come to mark a turning point in our human affairs, the closing of one great chapter and the opening of a new one. Let me, however, give you a word of caution and warning in advance. Do not let us make the same mistake we made at the end of the last war, when in a spirit of extravagant optimism we thought that all war danger had passed and that the new age of perpetual peace had arrived. The new age had not arrived. We disarmed, and when new and greater dangers emerged from Nazi Germany, we were unprepared, defenceless, and came as near total disaster as western civilization has ever been for hundreds of years. The charter of San Francisco will succeed and will only succeed if we can continue to keep prepared for all contingencies in our lifetime. Let preparedness be part of our contribution to peace. It is an essential part of our peace effort. Only on that condition may we succeed in maintaining peace in this still dangerous period through which we are moving.

The conference has been an illustration of the democratic way of life among the united peoples. Fifty united nations gathered there to thresh out in free discussion the wide differences of opinion and outlook among them. In friendly discussion they ironed out those differences and achieved a measure of compromise and agreement which is one of the most heartening signs of these tremendous times. If this can happen in the dead wood of war what may we not expect in the green trees to come, and the spring time which surely must follow this bitter winter of our era. May San Francisco be the herald of that dawn and of the new comradeship among the nations which will follow after this long cycle of wars through which we have passed.

The conference did not achieve perfection—far from it. Most of those connected with it are only too sensible of the shortcomings of the new charter, and the critical tests of the future may disclose still more of them. But that is no reason for discouragement. This charter is the child of goodwill among the nations, and where there is the goodwill the good way will be found in due course. By experience and through failures we learn how to go, as the child learns to walk through falling. And mankind is still very young and immature in its political development.

The charter secures at least this great advance on the past, that in future there will be teeth in the world organization, there will be force, organized international force, to bring to bear on an aggressor, and that the spearhead and motive power of this force will be the great powers acting in unison. The rest of the United Nations will form up with their contributions and contingents behind this strong lead so as to bring the weight of the whole United Nations to bear on the aggressor. While the Covenant of the League built largely on hope and goodwill among the nations, the charter will in addition have that solid core of enforcement power without which our peace plan might once more prove to be wishful thinking. The advance is real and substantial, though in fact much will depend on the unity among the great powers. That unity is the central idea round which the new plan for peace is built in the charter.

War power is now more and more being concentrated in the hands of the great powers, and the first step towards world peace is to have the great powers all in the pool, and to keep them together. Perhaps this, gentlemen, is the most essential lesson we have painfully learned in our day and especially since the last war, and it is now written into the charter. The last peace might have been a success if the U.S.A. and Russia had been in the league from the start. The two greatest war powers of today were both out of it, and so a defeated Germany once more built her immense war machine up outside the league, with results we know but too well.

This fundamental fact, linking war power with world peace, we have at last learned to appreciate fully and have embodied in the charter. And so, even at a sacrifice by the smaller powers of some of their *amour propre*, unity among the great powers is at least secured in the charter, and total war-power is brought into a position to control itself. What appears to the smaller nations most objectionable in this charter is in fact today the most necessary basis for future peace.

The obvious way to maintain unity among the great powers was the adoption of the principle of unanimity in voting among them, the so-called veto of the Yalta conference, which proved to be the most criticised provision of the charter at San Francisco, but which was under the circumstances not only unavoidable but a necessary step to take in the interests of world peace. Without the closest cooperation of the great powers, especially in the Security Council, the organization might prove a broken reed to lean on for security against war, and for that cooperation, unanimity in the council was in fact essential.

The Yalta veto created another difficulty which had to be carefully considered. It is possible that the rule of unity and unanimity may produce the paralysis of the Security Council in a crisis. One great power may, by the exercise of its veto, prevent the council from taking action or agreeing to action being taken, in the interests of peace, and thereby defeat the object for which this organization exists. In a great crisis the great powers may thus be helpless, and the security provisions of the charter reduced to a nullity. It is argued that with the veto the Security Council is a misnomer and cannot be safely relied on for security.

This criticism is however very much exaggerated. While the veto can theoretically be abused, it is not to be lightly assumed that the great powers will be guilty of what would in effect be a betrayal and sabotage of the organization itself. An abuse of the veto would be the end of the organization, and one asks why the great powers would have taken the trouble to form and join the organization at all. Surely they must be credited with some sense of responsibility, at least with some common-sense and good faith. We have the explicit declaration of the representatives both of the U.S.A. and U.S.S.R., that the veto would only be resorted to as a very exceptional procedure. And indeed any other course would be senseless on their part. Why not believe them? Why conjure up bogies as arguments?

Of course there may be grave and exceptional cases where the veto may be justified on good grounds. But a curious development at San Francisco has happened to meet such a situation. In such cases the veto may be bypassed by a way which the charter now itself provides. It is found in the concept of the regional group for which the South American delegations fought so hard in the Pan American interests, but which now comes to serve also another and perhaps far more important purpose. So do people build better than they know! In the charter the right of self-defence is expressly preserved. The right of combined defence is also preserved. The right of regional collective self-defence is accepted and expressly provided for. And so it follows that when the council cannot act because of disagreement among its members, the regional group concerned, with no veto limitations on its action can itself take action against a would-be aggressor. The regional group, with its right to take action where the council is in default, thus comes as a happy, though unintended, solution to meet the case of the veto and the case of a non-unanimous council. In fact it erects the regional group concerned into a small *ad hoc* council, unless and until the council recovers its unanimity and exercises its power of action once more. The regional group, unhampered by veto is thus a necessary safety valve in case the veto in the council should render it incapable of discharging the functions for which it has been created. It comes into action with the failure of the council, and it again goes out of action as soon as the council assumes the function it has temporarily abdicated.

The regional concept is also in other respects a most fruitful one and may prove of far-reaching importance for the future world pattern not only for purposes of security, but also for general purposes of organization and collaboration. The grouping of the many countries and their national units along lines of affinity, culture, efficiency and interest would be a natural evolution of human government, and may solve many questions bearing not only on peace but on human welfare in general; for the preservation of peace, for the organization of the world, and the large scale welfare of mankind much may depend on the elaboration and application of the regional principle to different parts of the world within the pattern of the organization. In one particular instance a regional group has already saved not only itself but also the world. I refer to the British Commonwealth of Nations. People forget that it is the greatest regional group in the world.

In acknowledging and recognizing the regional group, the charter incidentally provides a place in its programme for the British Commonwealth of Nations—the oldest and most successful existing regional group in the world. This was a serious omission on the part of the Covenant of the League of Nations which is now repaired in the charter. It is a curious fact that in the Covenant of the League of Nations no place is provided for our British Commonwealth of Nations, and we all signed it as independent powers without recognition of the idea and the concept of the group. The regional group is therefore not a novel conception but in the case of our Commonwealth an existing and very real thing. The Pan American group which was the aggressor in the discussion in the San Francisco conference is still a group in the making, an experiment, which we all hope will become a grand success. But the British Commonwealth of Nations is not an experiment. It is a proved fact, tested in the most terrible ordeals of our age.

The looseness and freedom from all bonds of compulsion which distinguish it has made people think that it could not last, that in any great crisis a break-up was inevitable, even if it did not come about in the ordinary course of events. In fact, I have heard that this loose union of freedom has proved stronger, much stronger than the strongest bonds of empire. Germany calculated that such a loose assortment of heterogeneous peoples and countries could not possibly endure in a crisis, and she counted as a certainty on the dissolution of the Commonwealth in a great war and planned accordingly. We have now gone through the test of the two greatest wars of history. In those tests the close-knit German empire has itself gone under, perhaps finally, perhaps never to return as an empire again. But this free Commonwealth of ours, spreading over the continents and the oceans, still goes muddling on in its loose free ways, having already left behind a trail of glory such as no Empire in the world has ever had. If it is true that wisdom is justified of her children, we may with no less truth say that freedom has been justified of her children. The political creed of our group, its faith in man's freedom, in free human self-government has not been shamed. Such is our group, the first and greatest regional group in history, and in my humble opinion the forerunner of other similar groups which may eventually solve the vast problem of human government. We have pointed the great way, we have set the example, and San Francisco has now advised others also to follow our example, although it may not be possible for them to reach this grand scale which we have realized in our Commonwealth.

Mr. President, our Commonwealth and Empire! Let me pause for a moment. Let us look at this show for a moment. It is difficult even for us of the Commonwealth to realize what we are, and what this group have achieved in this war, now ended in the west. We do not realize what a miracle has been performed. If ever there has been a miracle wrought in history then surely the lone successful stand of our Commonwealth against the embattled might of the world in those terrible years of 1940 to 1942 is a miracle (applause). People speak of Dunkirk as a miracle, but it was only an episode in the greater miracle of the survival of the Commonwealth in those years. With Russia neutral, with the United States a friendly neutral, with western Europe, including France, occupied, and geared to the fullest capacity to the German war machine, with the Mediterranean virtually closed to us, with Vichy France and Italy in possession of all North Africa, with Italy in occupation of Abyssinia and threatening East Africa, with the Luftwaffe in control of the air, and the U-boat roaming the seas, our scattered group yet held the narrow gateway through which not only our future was saved but the freedom was passed on to the future of mankind (applause). In those fateful years occurred under God's mercy perhaps the greatest miracle of all history. Think of the performance of ~~that wonderful people in their little~~ island home, led by their incomparable leader, in those days, which have shed an unfailing glory not only on them but on all mankind. Think of the effort of Canada, an effort rising through those years to a grand crescendo, which has carried her at the end of the war to a foremost place, military, industrial and political, among the middle nations of the world. Think of the contributions of India, Australia and New Zealand. Think of the glory that was Malta. And do not forget South Africa. South Africa sorely divided, deeply troubled in her own mind, yet she held open the only passage that could carry our forces around Africa to the decisive theatres of war in the Mediterranean.

Mr. President, I cannot think without emotion of these young South Africans whose grandfathers fought each other in the South African war, tramping as comrades and fellow crusaders in their tens of thousands over Africa from South to North, clearing it as they went along, to take their part in the battles of the desert, and to march on through Rome and the Gothic Line to the final victories in the Valley of the Po and on the slopes of the Alps. What a group to belong to! What an example this group of ours has set the world in heroism, in comradeship, in that spirit of conciliation and magnanimity which surely points the way to that nobler human future which awaits the erring race of man! Our group has demonstrated how small human units can combine for their own protection and their own good, and so far from surrendering their own status and position can derive new increase of strength and progress and freedom from such union, while thereby also setting an example to the world of solving the larger problems of human government and eliminating the causes of human conflict. Our example is well worthy of being followed by others, if they can!

In this connection I would suggest just for a moment that the most urgent case for a regional group is Europe itself. There is no sadder case today than that of the continent of Europe, suffering materially and mentally from two world wars in one generation, the second one the most disastrous in every way in all history. The restoration of Europe, the supreme problem of the coming peace, is beyond all doubt the most urgent problem before the world. In many ways even more important and more urgent than San Francisco. With that old continent of our western civilization in decay and confusion we have a fruitful perennial source of future trouble, and even our World Peace Organization may find it a task beyond its strength. I merely mention this in passing as one of the great cases for regional grouping and consolidation which lies immediately before us.

So much for the provisions of the charter directly concerned with the prevention of war.

But besides the chapters of the charter dealing with the preservation of peace there are others dealing with our fundamental faith, outlook and principles, and with the establishment of an economic and social council embracing a wide range of human problems and interests, and with trusteeships to watch the development and problems of dependent peoples, who are, so to say, the wards of our civilization. The charter largely differs from the covenant of the League of Nations in that it emphasizes more fully these wider social and economic aspects, which yet are so closely related to the problem of security. War is often the crisis arising from social and economic diseases and maladjustments, and can then only be properly dealt with by social and economic reform. Create wholesome conditions of life and development on an international scale and the menace of war will be largely transformed. It is for this reason and from this point of view that international agencies and bodies, additional to the Assembly and Council, are to be established to improve conditions generally, and thereby strike at the roots of war. A whole network of such agencies will ultimately cover the ground under the charter and raise the general conditions of living for mankind at large.

So far the charter takes us in its treatment of the social disease of war and its prevention or cure. This is perhaps as far as the state or an international organization of states can go. It might be dangerous for them to venture further. If they can produce conditions of life and work among the nations which are fair and just as between man and man, and if they can also create agencies to act as judge and police in disputes and conflicts between the nations, they will probably have done as much as a state or states can safely undertake, and their success in these undertakings will effect a revolution in the life of mankind.

But still I remain unsatisfied with this view of war and its prevention. As the matter is of profound interest and deserves further thought I may be pardoned if in conclusion I mention what is passing in my mind.

My reflections and experience of life have led me to question the adequacy of the Marxian view that human conflicts arise solely from material and economic causes, and can be dealt with adequately on that level—merely by economic and social reform. There is something more that the human spirit wants and craves for in its search for satisfaction and peace. A house swept clean and garnished, but empty of spirit, still remains a place which even devils may enter and occupy. For instance, I fail to believe that Hitler's war—the most terrible in history—was due merely to economic causes, and not to something deeper and more sinister in human outlook and beliefs. There was the Nazi ideology, with its worship of the state, its deification of the nation as the Herrenvolk, its contempt and hatred of other peoples as slave peoples, its disregard for the dignity of the person, its persecution mania, its thirst for conquest and world domination. It was an ideology and not merely materialism. It was an ideological obsession, a madness, which can operate as disastrously in nations as in individuals. Surely this ideology was the real cause of the war, and not the Versailles "Diktaat", or the fall of the mark, or unemployment, all of which had disappeared years before the Nazi bolt was launched against the world. The Nazi ideology was in the nature of a religion, however false a religion, which was to be spread with fire and slaughter in the old style of the world's religious wars—only more so. In discussing the causes of war we cannot neglect the awful phenomenon of Nazi fanaticism and World War II.

Religious beliefs and values are therefore very relevant to the issue, and the charter very rightly emphasizes the cultural advance of the world as an antidote to war. The human soul is not in the long run satisfied with material goods. Man cannot live by bread and comfort alone. If he has no right sense of ultimate values, he will create false debased values which always end in brute force. At the heart of our human problem—as of war itself—is this issue of ultimate values, of ultimate beliefs, of religion, the recession or decay of which has been, and may well be again, the precursor of untold misfortunes to mankind. Our civilization has therefore the deepest interest in fostering and inculcating the higher cultural and spiritual values of life in their purest form. There is so much today to confuse and distract the mind, and to fill it with downright falsehood and error, or with substitute values of an artificial or synthetic character, that there is grave danger of our losing our hold on the permanent spiritual and cultural values which express the very soul of man and of our Western civilization. The great effort now being made for world peace therefore naturally links up with the call to an awakened culture and a purified and spiritual outlook on life, and both of them are essential to the saving of our civilization, if not of our race. The charter is concerned mostly with one aspect of this double quest, with the social and economic aspect; but the other religious or spiritual aspect, so closely associated with it, has an even greater and deeper significance. That great task fell beyond the scope of this conference, and must be left to other hands, but it cannot be deferred indefinitely by those who have the highest interests of our race and our civilization at heart. The quest of world peace is bound up with the quest of inner peace, which alone can satisfy the human spirit and give it lasting rest and peace. Perhaps the scientific materialism of today may find its counterpoise and sublimation in the spiritual humanism of the age to come, and thus prove only a stepping stone to the next great advance of our race, and its corollary in the banishment of war as the arbiter and judge in our human affairs.

Peace among nations can only endure in the deep purpose which derives from man's practice of freedom and justice and those other high principles which are the basis of our Christian civilization.

SPEAKING OF MONEY AND WAR

Excess profits tax
Price Control

Extracts from a series of addresses by

HON. J. L. ILSLEY,

Minister of Finance,

September 3 - 18, 1941.

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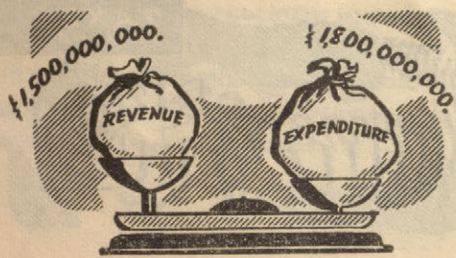
FOREWORD

Here on the home front in Canada we face a year of strenuous war production. This year we must *deliver the goods. We have most of our production equipment now — or will have it shortly. We have the labour — men and women — though we may have to take some of it away from civilian use. We have or can get the materials — and to get many of them we shall have to restrict their use for other purposes. We must make this third year a year of achievement on the economic front. But it will not be easy. We shall have difficulties, worries, and economic casualties. We shall have many problems which can be solved only by vigorous, courageous action.*

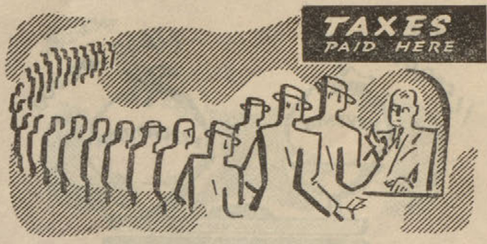
(From an address given at the Seigniory Club, P. Q., on September 18, 1941).



PAYING FOR THE WAR

Immediately following our declaration of war, the first war budget was brought down and, in that budget, we committed ourselves to the policy of financing this war on a pay-as-you-go basis as far as practicable. It has been a matter of great gratification to me personally that that principle has received almost universal acceptance by all sections of the Canadian public. Since the war began, we have, as you have good reason to know, stepped up our taxation steeply on several occasions, until now our revenues are running on a level three times as high as before the war. In the budget of last April, I estimated that our total revenues for the present fiscal year would approximate $1,400 millions. Judged by our receipts in the last two or three months, I am now inclined to raise that estimate to $1,500 million. If my new estimate of revenues is correct, these revenues will exceed the total amount of our direct war expenditures this year, and they will equal 78 per cent of our own estimated total war and non-war expenditure for the year. I cite these figures to illustrate that we are taking seriously the pay-as-you-go principle.

(From an address given at the Seigniory Club, P. Q., on September 18, 1941).



WHY SHOULD WE PAY AS WE GO?

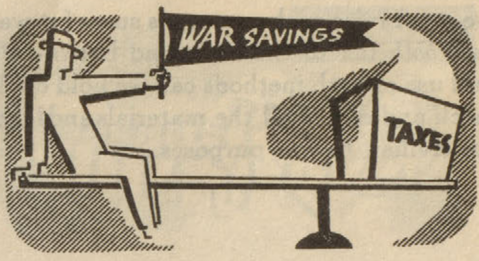
In the first place, we do not want to delude ourselves by thinking that we can escape the real costs now by borrowing. We cannot — unless we borrow from other countries — shift our burdens to them. It is now, during the war, that we must work harder, deny ourselves luxuries, reduce our average national standard of living, to meet the needs of war. It is best to recognize these facts and to reflect them in our finance by paying as much as we can of the bill once and for all.

Secondly, we want to avoid creating any more debt than necessary because the taxation needed to carry that debt after the war must to some degree discourage enterprise and initiative upon which our economic progress and prosperity will depend.

Thirdly, taxation is the fairest means of distributing the cost. By using it we can be sure that everyone is bearing at least his minimum share of the material sacrifices required during the war. It is also fairer to future generations, since the creation of more debt than necessary would mean that our children, or perhaps even their children, would have to bear an additional tax burden, in order to pay many of their own generation for something their fathers or perhaps grandfathers did during the war.

Finally we must raise such enormous sums for war purposes that we must *both* tax to the limit and borrow all we can. Only by a full use of both methods can we hold civilian expenditure in check and divert all the materials and labour that we require from civilian to war purposes.

(*From an address given at Edmonton, Alberta, on September 3, 1941*).



WHY DO WE NOT RAISE ALL THE MONEY BY TAXATION?

The amount we can raise by taxation is limited, even in wartime, and we have to spend far more than that amount if we are to achieve a maximum war effort. The limit to taxation is set by three principal considerations. In the first place, if taxation is too heavy it will discourage hard work, initiative and enterprise. Even in wartime we must rely to some degree upon economic incentives. Secondly, if taxation is too heavy it encourages carelessness and extravagance in business, whereas economy and efficiency in the use of materials and labour is vitally necessary in wartime. Finally, we cannot adjust taxation so closely to ability to pay that we can take from every man all he can spare without doing grave injustice to many. Even an income tax, for example, cannot distinguish between two men who have the same income but one of whom has a heavy mortgage on his house and illness in the family. Borrowing enables us to obtain what any man is able to save over and above his taxes.

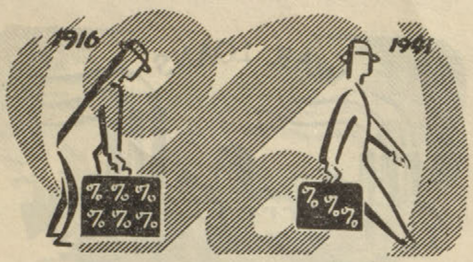
(*From an address given at Edmonton, Alberta, on September 3, 1941*).

WHY NOT PRINT MORE MONEY?

This is the modern stream-lined version of the age old question. Why not just print the money? Nothing would be easier for me, as Minister of Finance, than to be able to pick up the telephone the first morning of each month, call up Mr. Graham Towers at the Bank and just ask him to credit the Government with what we will need for the month. Unfortunately we can't do that without getting into a great deal of trouble. We should either bring about inflation or else, to prevent inflation we would be forced to take drastic and unpleasant action.

For us to borrow from the Bank of Canada to finance our expenditures, the Bank must expand the supply of money. This new money goes out into circulation and into bank reserves, where it gives rise to even more monetary expansion. While a relatively small amount of such expansion, both by the Bank of Canada and the other banks, may at times be required in order to provide the larger working balances needed when employment and production increase, the amount is strictly limited by economic conditions. The Bank of Canada, sees to it that the supply of money is properly adjusted in this way to economic requirements. If we, through the Bank of Canada, create and spend more new money than this limited amount, then the spending of these new funds is added to the existing level of expenditures, and competes with it for the available supplies, thereby forcing up prices at a time like this when supplies of very many things cannot be expanded. We would, it is true, be able to buy what we needed for war purposes, but we would get it at the cost of those who had to do without because of higher prices. If we tried to prevent prices rising when we were creating new money to pay for all or most of our war expenditures in this way, we should have to stop people spending their own money by universal rationing or other drastic regimentation. It is far fairer and better to restrict civilian expenditure to the necessary extent by taxation or by getting the public to save and lend their savings to us.

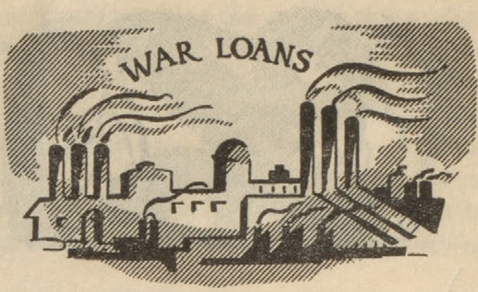
(*From an address given at Edmonton, Alberta, on September 3, 1941*).



WHY PAY INTEREST ON THE MONEY BORROWED?

We offer a fair rate of interest in order to induce people to save and to lend their savings to us. We buy or hire their savings, in effect, just as we buy or hire the services of the munitions worker or the civil servant. We pay the market price for it, just as we do for other goods or services, and that price is fair and reasonable. Indeed it is surprisingly low in relation to the enormous demand we have for savings now in comparison to pre-war conditions, and, of course, our whole conception of the scale of interest rates has changed since the days of the last war. The average rate we are paying on our borrowings in this war is only about half the effective rate paid during the last war. The average rate of interest on all our Dominion funded debt and Treasury bills has for some months now been only about 2.99% — the first time, I believe, that it has ever fallen below 3%. We could not, I believe, get anything like the amount of saving we require if we did not offer a reasonable return on it We would get some, of course; we have received seven million dollars in non-interest bearing loans as it is, from public spirited citizens, but after all we need far more than a hundred times this amount.

(*From an address given at Edmonton, Alberta, on September 3, 1941*).



SHALL WE BE ABLE TO CARRY OUR DEBT AT THE END OF THE WAR?

First I point out that we are not borrowing from some other country, to which we must make payment, but from Canadians only. In fact we are paying off our debts to Britain rapidly — paying them off before maturity in order to provide her with money to buy war supplies in this country. Our total debt is for this reason increasing far less than by the amount we are borrowing. Secondly, I call attention to the very large numbers of those who are lending to us in wartime. There were about 950,000 subscriptions to the Victory Loan, and during each of the months of May, June and July, the last three months for which I have the figures, more than a million subscriptions a month for War Savings Certificates. We shall owe the debt to ourselves — to millions of Canadians in one form or another.

Of course we shall be paying interest on the debt and we shall need to tax for that purpose, but we shall be very well able to bear those taxes. We have a rich country, with a vigorous, intelligent population. While we are now putting our full effort into the war, we are, as part of the process, building up new industries and developing new skills Our base metal producing industry, for example, is being greatly increased, and more sources of cheap power developed Our men and women are getting new training and experience in

This is something worth while.
L.

"SPIRIT IN WAR"

AN ADDRESS

by

BRIGADIER GEORGE P. VANIER,
D.S.O., M.C. and bar

before the

CANADIAN CLUB OF MONTREAL

MONDAY, NOVEMBER 30th, 1942

at the

WINDSOR HOTEL

I had thought of giving a different title to this address—"Spiritual Values in War", might have been more fitting. I very nearly sent this to your aggressive secretary who makes Canadian Club speakers toe the line under rigid, almost military discipline, but, on reflexion, I thought it wiser to call it "Spirit in War". I was afraid you might think it was going to be a sermon, and that, perhaps, you didn't want to listen to a sermon. In fact I could almost hear some of you saying "this is Monday, yesterday was Sunday—I heard a sermon then". (Perhaps some of you didn't), so I called it "Spirit in War" and I hope you won't find it a bad sermon.

It is a very particular pleasure to speak before the Canadian Club of Montreal, not only because Montreal is my home town, but because you happen to have at the present time, as president, one of the most patriotic, unselfish and biggest hearted Canadians I know, my old friend, Bill Scott. He is everybody's friend, more particularly if the other man is an underdog. I went about with him for nearly a year on recruiting work and I can tell you he is the best companion in the world.

To your speaker, Providence is kind indeed. Not only has he given me, as chairman, a happy warrior of yesterday's generation, but he places in our midst a youth who is the living embodiment of Spirit in this war, one of that band of intrepid airmen who form a fiery halo around the earth for our protection and for the destruction of our enemies. We have with us a young Canadian who bailed out of a bomber, over Northern France and who, five weeks later, turned up in Gibraltar—that's Spirit. His name, enshrined in our hearts is Bruneau Angers.

At the risk of wounding his modesty, I am going to tell Bruneau Angers, and I am going to tell you, what I think of young airmen like him. I know you will forgive me if I paraphrase part of an address which I gave some time ago, when presenting Wings to air navigators. I said to them:

"You know the glory and the beauty of living among the stars, above the clamour of petty controversy and sordid meanness. Every man worthy of the name, who cannot follow your example, envies you and the noble part you play in the designs of Providence.

"When fighting in far-off, war-clouded skies, you will be protecting those in this country who are dearest to you; you will be protecting them in such a way—no other way should satisfy a self-respecting Canadian—that they will not suffer the savage cruelty and shameful indignity with which the Nazis have branded the women and children of Europe. You have understood the Great Truth that to defend Canada in Canada means necessarily bloodshed here and misery for our people. The protection of this country is in other skies if we do not wish our skies to be aflame with enemy fire.

"Remember always that in the darkest hour on earth or aloft, you will never be alone. You will feel the warmth of the Divine Presence if you ask for it. I make bold to say that in you God is proud of His creation. Our faith in Him and in His power should be measureless when we recall there is a special Providence in the closing of a sparrow's wings. Intrepid airmen, in your travels through the skies, may God bless, guide and keep in full flight the wings you wear over your hearts."

You have referred, Mr. Chairman, in appreciative terms which moved me deeply, to my appointment in London as

Canadian Minister to the Governments of the Allied Nations which have been overrun and soiled by Hitler's vermin. Their men, women and children have suffered every outrage, have known every horror in the calendar of Nazi crime. They have felt the cold steel and the burning fire of the barbarians—can we who live in this land of plenty, this golden land, with milk and honey blest, where every creature comfort is known and taken for granted, can we appreciate what it is to suffer as these nations have suffered? We can make speeches, about it, as I am doing now, but until we feel the pangs of hunger, the agony of cold limbs, until we see the sweat of blood that comes from torture, we cannot really understand.

And for whom have they suffered if not for you and for me? They occupied, nearest the Vampire nation, the outposts of civilization. They bore the first brunt of hatred and violence; they absorbed the first shock of the most deadly war weapons ever conceived by man or devil. They may have been weak in numbers—they are weaker now because of the massacre of hostages and other innocent people—but they are great in spirit, and that is what makes the greatness of a nation. In the age-old struggle in the cause of liberty and justice, bravely they stood in the forefront of the battle—now they lie, weary and bloodstained, but not beaten. No, not beaten, for in the heart of every man, woman and child in the occupied countries—with the exception of a few miserable traitors—burns a sacred flame that no human weapon or agency can extinguish, a flame which will consume the enemy when the day of reckoning comes.

Let us pay homage to these sublime martyr-nations which have suffered so deeply in the flesh and in the soul. Let us vow to make every sacrifice on their behalf, every sacrifice of wealth, of comfort and of blood—anything else would be unworthy of us. It is indeed a great honor to have been chosen to go to them. May God make me humble in their presence, give me strength and guide me in this holy mission.

And now France takes her full place in the ranks of the martyrs. The sordid tragedy of Vichy ends and the soul of France is freed at the moment when her body is pressed to earth by Hitler. The true spirit of France burst forth in all its splendour when the captains of her ships, standing on the bridge, went down in the waters of Toulon Harbour. This was a glorious baptism which regenerated France after the shame inflicted on her by some ignoble leaders. The people of France have not changed. They are the worthy sons of valiant fathers who fought on the Marne and at

Verdun. For a time they were misled, but, now that they are united by a common bond of suffering, they will all hearken to the real voice of France, to that great Frenchman, de Gaulle. I was informed, just before I came to this luncheon, of my appointment as Canadian representative to the French National Committee, it is one of the great joys of my life.

Why do I speak to you of Spirit or of Spiritual Values in War?

Because I believe deeply and sincerely that above all the forces of matter, above all the planes and ships, and tanks and guns "spirit" as opposed to matter, is the most powerful weapon in our possession.

Because I believe that the Nazi doctrine from the very start was doomed to failure, built up as it was on a Pagan conception of life and on lies. Its teaching does not conform to the one thing which matters and the one thing which stands and will stand forever—truth. It is not possible to build on any other foundation—everything else is shifting sand.

Because I believe that we will be in a hopeless mess at the end of the war unless we shape our lives on moral standards, personal as well as national, higher than those in existence today.

Is our democracy strong enough in a spiritual sense? For years, for generations, we have heard that democracy is on trial. The fact that it has been on trial for so long is proof of its inherent strength, but it is not a guarantee that in the end, the prisoner at the bar will not be condemned. This war has brought to life the weak points of democracy, there are many and you know them as well as I. The future of democracy is in our hands now, during the war. The ultimate remedy does not lie only in the building up of purely physical material forces and armaments. It lies also, and essentially, in a more rigid observance of our duties and obligations to God, country and fellow man; it lies also in the free acceptance of all sacrifices however painful, which a firmer moral code will impose. We shall have to forego many of our personal privileges and pseudo rights.

Some are beginning to realize that Democracy, without a Divine core to reinforce it, will find it difficult, if not impossible, to weather the storm. The President of the United States, said, a short time ago: "We know that the spiritual liberties of mankind are in jeopardy—we are at war with the forces of evil abroad—we shall need all our spiritual resources to sustain us in the days to come—providentially, there is always Guidance if one knows where to look. Said the Psalmist: 'Thy Word is a lamp unto my feet, and a light unto my path.'

If we invited this Divine Guidance more often, the fog of doubt in which we live would be dissipated.

I confess that at times I have been exasperated by the view, so often expressed, in an endeavour to bolster up confidence and accelerate action, that "We may lose the war if......" I can't imagine Alexander, or Caesar, or Napoleon going about with long faces saying: "We may lose the war." And if this was supposed to be an antidote to complacency, it was a negative antidote, a soporific, a narcotic and not a stimulant. There are so many things which we can say if we are not satisfied with ourselves, if we are fearful of becoming complacent. We may say we are not doing our part, that we are shirking our duty, that we should be ashamed of ourselves, but I cannot conceive of a defeatist spineless view that we may lose the war helping in any way. Inspiration does not come from negation—it rises from a faith so strong that it cannot be mistaken for or merge into complacency. It is an active rampant faith, a faith that shatters. I have heard it referred to lately in a press article as "dynamic faith". And so that the Nazis may understand, let me call it, for their benefit, a "blitz" faith. Let us consign to limbo the "We may lose the war" attitude, and substitute dynamic action for words, dynamic faith for doubt.

Yes, we must have faith. Faith in God and in his power to help. Faith in the righteousness of our cause; faith in ourselves and in ultimate victory. The faith which moves mountains can work other miracles, and thus upset the natural orbit.

> "More things are wrought by prayer
> Than this world dreams of."

Would that we could return to the simple faith of our fathers, and that we could infuse into our daily lives belief in the power of prayer. Each one of us then would have within himself a source of Divine inspiration which Hitler in his Pagan conception of life, spurns.

There is a tendency, in some quarters, to associate the thought of spirit or prayer with weakness, as if one ceased to be a realist when praying. A great living scientist has written this; "Today, as never before, prayer is a necessity in the lives of men and nations. The lack of emphasis on the religious sense has brought the world to the edge of destruction. Our deepest source of power and perfection has been left miserably undeveloped. If the power of prayer is again released and used clearly in the lives of common men and women, there is yet hope that our prayers for a better world will be answered." Those of you who have read the Reader's Digest for November know who he is. The famous Dr. Carrel.

The power of prayer was realized in England two years ago, when a great non-denominational movement called "The sword of the spirit" was born of the threat to British freedom. Christians and Jews, clergy and laity alike, united under the banner of a veritable crusade. The Cardinal Archbishop of Westminster, the Archbishop of Canterbury and the Chief Rabbi adhered to the movement and spoke from the same platform.

They understood that the Spirit of the Sword may be adequate to kill and to destroy, but that the Sword of the Spirit is necessary if we are to retain the distinctive mark which differentiates us from the barbarian and the pagan. They understood that to the spirit of the sword with all its brutal implications of evil done and suffering to be inflicted, we must oppose the sword of the Spirit.

It is not surprising that this spiritual movement began in the United Kingdom because, in the summer of 1940, the people of those Blessed Isles proclaimed and proved that the defences of the soul are impregnable. I was in London at the time, so that my impressions and feelings are based on life. I am convinced that the salvation of England, in the darkest period of her history, rested primarily on the rock of a deep religious instinct, of a glorious awakening of the Spirit.

The salvation of England certainly did not rest on the planes and the anti-aircraft guns they had in Britian at the time. It rested on the reincarnation of all the spiritual forces which form the magnificent heritage of the British people.

Faith born of prayer leads naturally to charity, the greatest virtue of them all. And we must have charity if we hope to make a better world.

You remember the story of the lawyer who said to Jesus: "And who is my neighbour?" And Jesus answering said: "A certain man went down from Jerusalem to Jericho and fell among robbers, who also stripped him and having wounded him went away, leaving him half dead. And it chanced, that a certain priest went down the same way, and seeing him, passed by. In like manner also a Levite, when he was near the place and saw him, passed by. But a certain Samaritan, being on his journey, came near him, and seeing him, was moved with compassion. And going up to him, bound up his wounds, pouring in oil and wine, and setting him upon his own beast, brought him to an inn and took care of him."

It was on the road from Jerusalem to Jericho that the robbers stripped and wounded and left half-dead the poor traveller of the Gospel. But what of the millions who are being stripped, wounded and left half dead and dead on the blood-stained road from Rotterdam to Warsaw and Belgrade—on all the roads in tortured Europe. Is not each one of these our brother?

What is Christ to you and to me? Is He only a legend or a symbol of a page in history?

If He is more to us than this, if He lives in us, we must not, we will not, rest until these brothers of ours have been liberated.

Although my title limits me to a consideration of spirit in wartime, you will forgive me, I know, if I make a short incursion into the after war period. Frankly I am less afraid of the war than of the after war, and I believe most sincerely that spiritual factors if anything will be more essential then.

If we think that after the war we will be able to go on living in our old comfortable materialistic way, we are wrong. There is going to be a new order of things—through evolution if we are wise, through revolution otherwise.

If we do not put into practice now the teachings of Christ we shall find ourselves when hostilities have ceased, faced with the dangers which spring from selfishness, envy, greed, hatred — vices which can be national as well as personal. It will be easier to win the war than to establish a peace which will be based on justice. I share the view expressed in an article which I read recently in the Press. I quote: "It seems to me that present problems — the bitter clash of political ideologies, racial hatred, the unspeakable horrors of war and the threat to our entire civilization — force us to admit that there is no solution for the world's ills except the practical application of the simple truths that were taught to poor fishermen and Jewish peasants by one who, 1900 years ago, was crucified."

I am not sure that the war will bring us to our knees in prayer, but if it does not, the cataclysm which follows the war will surely do so.

In conclusion, let me reaffirm that I do not advocate as a means to victory, faith, prayer and charity, coupled with complacency. Heaven forbid. But I do believe profoundly, that the man who receives help from Above is better fitted to accept responsibility, better armed for the combat. The man who believes that he will live until God's appointed time has come will face danger, serene and unafraid. Julian Grenfell, killed in action in 1915, gave true expression to this feeling of serenity, when he wrote thus of the soldier in battle:

"And when the burning moment breaks,
And all things else are out of mind,
And only joy of battle takes
Him by the throat, and makes him blind,

Through joy and blindness he shall know
Not caring much to know, that still
Nor lead nor steel shall reach him, so
That it be not the destined will."

Let us begin now to associate prayer with power, faith with fire, charity with clear swift action. May these spiritual shafts shatter the clouds of doubt and fear, light our path through the dark valley of war and guide us, however cruel the road, to the Mount on which 19 centuries ago a certain Sermon was preached.

Do I hear someone say "Oh, it is all very well to speak of faith and prayer, but they are so illusive, so intangible, so unreal." Are they? What of Dunkirk? Have you given Dunkirk a thought? Did Dunkirk just happen? Are you sure it was nothing more than a coincidence that for something like 100 years weather conditions over such a long period had never been so favorable in the Channel?

Is there a man among you who is prepared to rise and say that there was nothing supernatural about Dunkirk? Many hard-boiled sailors, soldiers and airmen, who were at Dunkirk, thought Dunkirk was a miracle and were not afraid to say so in public, and I don't mind throwing in my lot with that hard-boiled crew.

There is an unseen Hand at work, in all our destinies, and when, through our own fault, we do not feel its blessed touch, let us remember Dunkirk, remember Dunkirk and lift up our hearts to God.

industrial work Our national health, I venture to say, is improving in war. Even more important, however, is that fact that this nation, under the spur of war, is recapturing some of its old fire, its dynamic spirit, which had been dampened by years of economic depression and international uncertainty. I am confident that this reawakened spirit will stay awake now for a long time and that we will not again allow economic depression to stifle it. Given these fundamental conditions we shall be able to achieve a far larger national income after the war than we have had before it. Then by keeping interest rates low, and I believe that this will be quite possible, we can carry our debt and at the same time achieve a higher standard of living for the vast majority of the people of Canada.

(From an address given at Edmonton, Alberta, on September 3, 1941).

THE RISE IN PRICES

In the summer of 1939 prices were low, abnormally low. The outbreak of war, followed by the depreciation in Canadian exchange, the disruption in established trade channels, the rise in ocean freight and insurance charges and speculative buying of commodities in the United States, brought a rapid rise in wholesale prices. There followed a levelling off process and for a year or more a period of comparative stability, at least in the general level. Five or six months ago, however, the upward movement was resumed, extending over a wide field and affecting both wholesale and retail prices. Since August 1939 the rise in the index of wholesale prices has been 26.2 per cent and the cost of living index has risen by 12.8 per cent. These may seem to be very moderate increases in all the circumstances. Certainly it is true that some increase from depressed pre-war levels was desirable. Moreover, 53 per cent of the increase in the cost of living has been due to increases in the prices of foodstuffs, and the marked increase in recent months in the prices of such farm products as livestock, meats and dairy products has resulted in a considerable alleviation of the former disparity between the price of farm products and other commodities.

(From an address given at the Seigniory Club, P. Q., on September 18, 1941).

THE GOVERNMENT AND PRICE CONTROL

We are determined to check the upward movement in prices that has been taking place. To do so we have prepared to extend and intensify our direct control over prices. Last month the powers and responsibilities of the Wartime Prices and Trade Board were greatly increased in order to make this possible. Furthermore, a direct connection was established between this Board and the Wartime Industries Control Board, made up of the Controllers, in order to ensure mutual understanding and common policies, as well as to avoid either overlapping or gaps. A few days ago the Wartime Prices and Trade Board announced a far-reaching step in the early licensing of all manufacturers and distributors of food and clothing, which is needed to carry out price control and, if necessary, rationing of these consumers goods.

I can assure you that things will not be allowed to drift. We have the basis laid now on which a successful system of price control can be built. Our financial policies have been sensible and vigorous. While they cannot do the job alone, they will do their share in holding the front against inflation. We have a fair and reasonable wage policy, a more definite policy, I think, than either Britain or the United States has foimulated. This wage policy can provide a firm and equitable basis for price stabilization. We have the agencies established and empowered to achieve price stability.

(*From an address given at the Seigniory Club, P. Q., on September 18, 1941*).

THE EXCESS PROFITS TAX

Taxes on profits have, of course, been increased very substantially. All corporate profits are now subject to a tax of at least forty per cent, including income tax and excess profits tax. Increases in corporate profits over the standard pre-war period are subject to a tax of $79\frac{1}{2}\%$ — when we take account of both income and excess profits taxes. This very heavy rate of tax in increases in profits — about the same rate as that in England, which has recently been reduced to 80% from the previous figure of 100% — ensures that if any company does increase its profits because of war conditions, the Treasury will derive nearly all the benefit.

The figures indicate very graphically the extent to which this tax has frozen profits at their level at the outbreak of the war. I noticed the other day some figures published by the Financial Post on this question. These figures indicated that after payment of taxes the profits of 280 Canadian companies had increased on an average only 2.2% in 1940 over 1939. Another recent survey made in Ottawa of the 321 corporations on which adequate information could be obtained, in the fields of manufacturing, mining, trade, power and communications, shows that with the higher volume of business in 1940, profits before the payment of taxes were increased by some 32% over their 1939 level, but the provision by these companies for income and excess profits tax payments was up by no less than

133% and consequently profits remaining after providing for tax were increased by less than 6%. It is noteworthy that much of this modest increase in net profits was due to the improved conditions in those industries which were unduly depressed in 1939.

Needless to say, when these profits are paid out as dividends they are taxed again in the hands of the recipients. Taking into consideration the excess profits tax and corporation income tax, together with the steeply progressive personal income tax, — the rates of which run up as high as 96% on income in the highest bracket — I think you will agree that this war is being financed in such a way that no great fortunes can be accumulated out of wartime profits.

(*From an address given at Edmonton, Alberta, on September 3, 1941*).

BUSINESS AND THE GOVERNMENT

I want to appeal to business leaders for co-operation in this effort we are making and shall be making to control prices. There are several ways in which you can help.

First of all, I would ask you to shun a defeatist attitude towards rising prices. Inflation is not inevitable. It can and will be prevented. It will be prevented much more easily if we all join in the effort and reject the view that resistance is useless.

Secondly, we need your active support in our savings campaigns. A rising volume of savings will not only provide the Government with the funds needed for war purposes but it will relieve the persistent upward pressure of expenditure on prices. This is its important economic purpose. In normal times — in peacetime — we do not try to discourage expenditure, we encourage it to obtain employment and if possible prosperity. But these are anything but normal times. Now we must limit expenditure. The more we can limit it by encouraging voluntary saving, the better it will be for all concerned.

Thirdly, we shall need your co-operation, your active co-operation in keeping your costs of production down. Price stability can only be achieved if costs can be held in check. In the last analysis they must be held in check by those who are running the businesses concerned. Waste of labour or materials must be eliminated — the nation cannot afford it in wartime. Luxury, extravagance or just plain carelessness in business expenditures cannot be tolerated.

Finally, I would like to emphasize that the business boom now in progress is not prosperity. The high level of employment and production, the large volume of expenditures, rising prices and wages, have many superficial similarities to good times. In fact, however, we are going through bad times, very dark days indeed. Due to the inevitable delays in getting war production up to its full level many Canadians have been able until recently to increase their standard of living. For most, that is just a lucky by-product of the early stage of the war. Before we are through this struggle we shall have to cut down and down until nearly all of us will realize very vividly the extent of the economic cost of war. We must work hard and long, but have little for ourselves to show for it. We must be content to take part of our wages and our profits in victory. We cannot afford either living as usual or business as usual until the war is over and victory achieved.

(*From an address given at the Seigniory Club, P. Q., on September 18, 1941*).

ADVICE FOR THE FUTURE

I have often been asked by provincial ministers and municipal officials to give them some constructive guidance as to what their policy should be in wartime. I have told these questioners privately, and I now give this message publicly to all those engaged in the business of government: Spend less and save more, judge each object on which you may wish to make an expenditure not by whether it is good, but rather by whether it is indispensable; support the war program to your utmost and be sure that by your expenditures you do not compete with it for scarce materials and labour; curtail expenditures now in order that you may be able to maintain a sound financial position and to give support to employment and economic activity in the days that will follow the war. That, after all, is simply the message which I have come West to give to my voluntary workers on the War Savings Committees and through them to every Canadian. SPEND LESS AND SAVE MORE.

(*From an address given at Calgary, Alberta, on September 9, 1941*).

SAVE

Issued by
The Director of Public Information
Ottawa, October 1941

Under Authority of
Hon. J. T. THORSON,
Minister of National War Services

Printed in Canada

CANADA AT WAR

A Summary of CANADA'S PART IN THE WAR

Revised to November 1st, 1941

Issued by the Director of Public Information, Ottawa, under authority of the Hon. J. T. Thorson, Minister of National War Services.

Printed in Canada

SOME SALIENT FEATURES OF CANADA'S WAR EFFORT EXPRESSED IN TERMS OF UNITED STATES POPULATION OR NATIONAL INCOME

Canada's population is about 11,500,000, the United States' about 130,000,000. It is estimated that the national income of Canada in the present fiscal year will be something less than $6,000,000,000 and that the national income of the United States will be something less than $90,000,000,000. A true picture of the war effort of any country can only be obtained when that effort is considered in relation to potential resources. For the convenience of United States readers, therefore, the following salient features of Canada's war effort are presented in round figures, in terms of United States population or national income. Figures relating to man-power are translated in terms of population, figures relating to money in terms of national income.

	Canada	In United States Terms
Number of men in active armed forces	About 344,000*	About 3,900,000
Sailors, soldiers and airmen overseas	More than 100,000	More than 1,130,000
Money spent on war (first two years)—including financial aid to Britain	$2,183,000,000	$32,745,000,000
Money being spent on war this fiscal year (April 1, 1941, to March 31, 1942)—including financial aid to Britain	$2,350,000,000	$35,250,000,000
Cost to Canada of British Commonwealth Air Training Plan (for three years)	$ 531,000,000	$ 7,965,000,000
Value of Canadian products, including war supplies and equipment, sent to Britain in first two years of war	$1,071,000,000	$16,065,000,000
Value of Canadian products to be sent to Britain during present fiscal year	$1,500,000,000	$22,500,000,000
Estimated total of taxes (Federal, Provincial and Municipal) to be collected in present fiscal year	$1,850,000,000	$27,750,000,000
Money loaned to Canadian Government by Canadian people since outbreak of war	$1,470,000,000	$22,050,000,000
Voluntary contributions to war charities since outbreak of war	$ 27,000,000	$ 405,000,000
Total value of contracts placed and commitments made by Department of Munitions and Supply on Canadian and British account	$2,600,000,000	$39,000,000,000

*See note on page 11.

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Persons who wish to be placed on a mailing list to receive this booklet monthly, should apply to the Director of Public Information, Ottawa, Canada

EXPLANATORY NOTE

This booklet is intended to provide information about the nature and extent of Canada's war effort. It is hoped that it may be of value as source material for speakers and for others who desire up-to-date information about Canada's participation in the war. It is revised monthly and contains the most recent available facts and figures.

These facts and figures are not presented in any spirit of complacency. On the contrary, they are presented on the assumption that until victory is won, conscientious Canadians will never be satisfied that they have done enough.

It is hoped that this booklet will fortify this spirit of determination. A man fights better and works harder if he knows something of what his fellow-countrymen, in their many various lines of work, are doing for the cause they have all embraced in common. He will be able to co-ordinate his own efforts intelligently with those of others, if he has some idea of the broad lines of Canada's war endeavour and if he understands the sort of effort which the Government looks to him to make.

This booklet sets out to provide briefly the basic information upon which such an understanding may be based. It has been written for Canadians and for all others who are interested in what Canada is doing.

GENERAL SUMMARY

"Our people went to war for the sake of Canada, but not for Canada alone. We went to war as well for the sake of Britain, for North American civilization which we are proud to defend, and for the sake of that humanity which is above all nations."

Prime Minister Mackenzie King in a speech to the Associated Canadian Organizations of New York City on June 17th, 1941.

"We have not begun to win this war yet; we have just succeeded in not losing it."

Hon. J. L. Ralston, Minister of National Defence, in a speech to United States editors on tour, at Ottawa on August 27th, 1941.

Canada has entered her third year of war. In September, 1939, four days after Britain began hostilities, the Canadian Parliament assembled and the Government announced that it advocated placing Canada in the war at the side of Britain and her Allies. The Dominion was completely at liberty to make war or to abstain from making war, and it was Parlianent's duty to decide whether or not to support the Government in its decision. After the proposal had been freely discussed for two days, the Government was accorded Parliament's support by a nearly unanimous division, and on the following day, September 10th, 1939, the King, at the request of the Canadian Government, declared that a state of war existed between Canada and Germany. As L. W. Brockington, the Official Recorder of Canada's War Effort, put it in a speech at Toronto on September 18th, 1941, "King George VI of England did not ask us to declare war for him; we asked King George VI of Canada to declare war for us." When Italy began hostilities on June 10th, 1940, Canada at once declared war on her.

Two years ago the Dominion was a relatively weak military power.

"The first year of war," said Hon. J. L. Ilsley, Minister of Finance, on September 18th, 1941 "was one of disaster and disillusionment. We and the other democratic nations who entered it were not fully prepared for it—no one, in fact, was fully prepared except the enemy who had been planning a campaign of conquest for many years, and had forced the German nation to bend all its energies to forging weapons of aggression. Moreover, the Allied Chiefs of Staff made the profound mistake of visualizing this war as one primarily of static defence and economic blockade. Before that fateful first year was over, we had learned what prodigious striking force the enemy had created, and how inadequate were not only our preparations for modern war, but also our military strategy. The fall of France was a major catastrophe in itself and vastly altered the character of the war, giving the enemy great strategic advantages. All the plans of the democratic nations had to be revised, indeed revolutionized.

"Canada had entered the war with decision and clear-headed courage. During this year we had to plan and organize our war effort. By its close we had many of our own forces in Britain or British waters, we had set about a far-reaching programme of military expansion, we had commenced to build a large war industry, and the Commonwealth Air Training Plan was well under way. We were all hopeful, but still conscious of the overwhelming superiority of the Nazi war machine—still fighting an uphill defensive fight and hoping for time in which to build up our offensive strength.

"The second year of war has given us more room for hope, but none for complacency. It opened with the air battle of Britain, in which those daring men of the R.A.F. saved the fortress of civilization—civilization itself. Our confidence grew with the victories over the Italians, but false optimism was soon dashed to the ground by the German successes in Jugoslavia, Greece, Africa and Crete, and gave way to searching self-criticism. In the meantime, our hopes for ultimate victory were immeasurably strengthened by the passage of the Lease-Lend Act, the increasing mobilization of the economic power of the United States on our side, and finally, that fateful decision, for whatever reason, of the Nazi war lords to attack Russia. As the second year of war ended, there was still in progress, after more than two months of amazing destruction, that gigantic battle in which perhaps eight millions of men are locked in death struggle on a 2,000-mile front from Leningrad to Odessa—a battle that will surely rank as the greatest of all history.

"For us here in Canada the second year was one of action as well. An active army of 230,000 men has been recruited and trained and much of it despatched overseas.

Our Navy has taken a vital part in the unceasing battle of the Atlantic. Our men have fought in the air over England. The Commonwealth Air Training Plan has been rushed to practically full-scale operation, far ahead of schedule. We have carried nearly to completion the building of a great new war industry—far beyond anything ever dreamed of in Canada before. We have produced large supplies of food, of raw materials and of many types of war equipment for our own forces and for Britain. We have begun to hit our stride."

Two years of war have indeed wrought significant changes in Canada. Here are some approximate figures which indicate the extent to which a nation organized for peace has mobilized its resources for war:

	Pre-War	*To-day*
Total number of men in active armed forces	11,000	About 344,000*
Percentage of national income allocated for defence	1.4%**	40%
Contracts placed and commitments made for munitions and supplies in Canada by Canadian and British Governments	$35,000,000	$2,600,000,000

*See note on page 11.

**About $64,500,000—the largest sum ever allocated for defence in Canada in peace time. During the years 1936-39 steps were taken to modernize the armed forces and to prepare measures for the defence of Canadian territory.

Reviewing the general war situation and the extent of Canada's effort to date, Mr. Ilsley expressed the point of view of the average thinking Canadian when he said on September 18th, 1941:

"We have more and more reason to believe in ultimate victory, if all of us work to achieve it—if we make the best use of our men, our materials and our intelligence. We have indeed a solid basis for confidence. But this I cannot too strongly emphasize—it would be false and dangerous optimism to think the end is near or that Victory is assured whatever we may do. Let us not delude ourselves—the road ahead is long and hard, victory has still to be won from the most powerful of enemies, and we of the British Commonwealth cannot devolve the burden that is ours upon the people of any other nation or nations."

Canada is in full agreement with Britain on plans for the conduct of the war for the immediate future. When in Britain in December, 1940, to consult with British authorities, Hon. J. L. Ralston, the Minister of National Defence, assured the British Government that "Canada has only one object—a full-out contribution with everything Canada has and as fast as she can give it." Mr. Ralston went to England in October with Maj.-Gen. H. D. G. Crerar, Chief of the Canadian General Staff, for discussions with British and Canadian leaders there.

Canada is continually adding to the strength of her overseas forces, and is prepared to have them go wherever their services may be required. Speaking at the Mansion House in London, on September 4th, 1941, Prime Minister Mackenzie King said, "You all know how eager our Canadian soldiers are for action against the enemy. I cannot make too clear that the policy of the Canadian Government is to have our troops serve in those theatres where, viewing the war as a whole, it is believed their services will count most."

Rt. Hon. Winston Churchill, Britain's Prime Minister, expressed his countrymen's appraisal of Canada's war effort when he said on the same occasion, "The war effort of Canada during this war, happily, has not so far required effusion of blood upon a large scale. But that effort, in men, in ships, aircraft, air training, in finance, in food constitutes an element in the resistance of the British Empire without which that resistance could not be successfully maintained." Rt. Hon. W. L. Mackenzie King, Canada's Prime Minister, expressed the determination of the average Canadian citizen when he said at the same time, "We have been inspired by the undaunted courage and unshaken faith with which millions of ordinary men and women have faced destruction and death. We in Canada cannot all share your dangers, but we are proud to share your burdens. We are determined to share them to the utmost of our strength."

THE ARMED FORCES

"Take up our quarrel with the foe:
To you from failing hands we throw
The torch; be yours to hold it high."

From "In Flanders Fields" written at Boulogne in 1915 by Lt.-Col. John McCrae. Lt.-Col. McCrae was born in Guelph, Ontario, went overseas with the first Canadian contingent and died in France on active service in January, 1918.

The Roll Call

Navy	About 25,000
Army	About 230,000
Air Force	About 89,000
Total on Active Service	**About 344,000**
Total Overseas	**More than 100,000**
Reserve Army	About 170,000

NOTE:—As statistics relating to the strength of the forces are of vital interest to the enemy, the above figures are all approximate.

The Navy

"I want you to remember that you can't get men and ships by just whistling for them—not if they are to be any good. They are only achieved by hard work and planning."

Rear-Admiral P. W. Nelles, Chief of the Naval Staff, in a broadcast talk on October 19th, 1941.

The Royal Canadian Navy has grown speedily, as is indicated by the following figures:

	Pre-war	*To-day*
Active service strength	1,800	About 25,000
Ships	15	300

The Navy consists chiefly of small ships—destroyers, corvettes, mine-sweepers, patrol boats, converted yachts, and a fleet of smaller craft suitable for coastal work. It has, in addition, three merchant cruisers of considerable tonnage. New craft for the Navy are continually being turned out. For example, four corvettes and four mine-sweepers were christened simultaneously at one Canadian shipyard on October 26th. A Tribal class destroyer for the Canadian Navy was launched in Britain recently, and four more are to be built—two in Canada and two in Britain.

R. C. N. personnel is the nucleus of Canada's Navy, but since the outbreak of war Volunteer Reservists have been mobilized and enlisted in increasing numbers. They now constitute the largest portion of the Navy's strength. Most of them are landsmen who for the first time are learning the craft of the sea and the lore of ships. R.C.N.R. personnel, experienced sailors, have also been enlisted by the Royal Canadian Navy, and on the Pacific Coast the Fishermen's Reserve is doing a quiet but, important job. At the outbreak of war this Reserve organized in the spring of 1939, in preparation for possible emergencies, was called immediately into service. It was composed mainly of British Columbia deep-sea fishermen, who brought with them their sturdy fishing craft for mine-sweeping and patrol work. Now they are being provided with a new type of patrol ship specially built for the Royal Canadian Navy.

Work of The Navy

Canada's sailors are manning Canadian naval ships which have taken part in the Battle of the Atlantic and in operations in almost every other theatre of naval warfare, including the Pacific and the North Sea. Canadian destroyers, which have operated on both sides of the Atlantic, average twenty to twenty-five days a month at sea. The Royal Canadian Navy has also posted its fighting men in merchant ships which bear supplies to far ports, and about 600 Canadians are serving with the Royal Navy or in Royal Naval establishments. Young Canadians with special scientific training have for some time been doing special work with the Royal Navy. Two of them have been killed in battle.

The Royal Canadian Navy has played a very important part, since the outbreak of war, in the convoying of Canadian and American supplies to Britain. Since September 16th, 1939, when the first group of convoyed ships left an eastern Canadian port, Atlantic shipping carrying a total of more than 40,000,000 tons has been convoyed by the Royal Canadian Navy, in co-operation with the Royal Navy. This has involved the most careful organization of the Naval Control Service on Canada's east coast—a factor of vital importance to the maintenance of supply lines from America to Britain. Speaking in Bermuda on September 27th, 1941, Col. Frank Knox, Secretary of the United States Navy, said that the Canadian Navy is doing "a very outstanding job" in the defence of North American sea approaches and added that it had been "a very considerable help to the whole problem of transport."

In addition to convoy work, ships of the Royal Canadian Navy have performed a variety of duties. They have captured enemy vessels, caused others to be scuttled, sunk enemy submarines, effected rescues and assisted in the evacuation of beleaguered troops.

The Navy's work has not been carried out without loss, H.M.C.S. "Fraser" was sunk on a misty night in June, 1940, during the course of operations off the coast of France. Ships were running without lights to avoid danger of enemy attack, and "Fraser" was cut in two by a much larger ship. H.M.C.S. "Restigouche" rescued most of her crew. H.M.C.S. "Margaree", on convoy duty, suffered a similar fate somewhere in the Atlantic in the autumn of 1940, and most of her crew were lost. Thirty-one Canadians were serving on H.M.S. "Jervis Bay" when she went down protecting her convoy from the guns of a German warship in November, 1940. The most recent loss suffered by the Royal Canadian Navy was the sinking of H.M.C. corvette "Levis" by enemy action, which was announced on September 27th, 1941. Because of the need for secrecy concerning naval operations, no details were disclosed by Naval Headquarters beyond the fact that 17 of her crew were lost. The Navy has lost a total of five ships and more than 400 men.

In addition to its work in British and other non-Canadian waters, the Royal Canadian Navy has successfully protected the Dominion's shores and ports. Its ships patrol Canada's coasts day and night. On the Pacific are more than 5,000 miles of mainland and island coastline over which to keep "watch and ward," and the Atlantic seaboard sets its own peculiar problems. This work has its hazards. For example, in October, 1940, storm caught the minesweeper H.M.C.S. "Bras d'Or" somewhere in the Gulf of St. Lawrence and she was lost with all hands.

Canadian naval shore establishments also play their part. In key centres naval officers carry on the complex business of naval plans and operations, linking the Dominion's activities to the world-wide operations of the Empire's naval forces and performing the multitude of exacting tasks which must be carefully executed if Canada is to play her full part in protecting the Empire's commerce.

The Army

"We have a large and constantly growing Canadian force in Britain which, individually and collectively, is the match for anything it may meet on the field of battle."

Maj.-Gen. H. D. G. Crerar, Chief of the Canadian General Staff.

The Canadian Army has expanded greatly since the outbreak of war as is indicated by the following figures:

	Pre-war	*To-day*
Active Army	4,500	About 230,000*
Reserve Army	55,000	About 170,000*

*See note on page 11.

The Army Overseas

The Canadian Active Army is a force of some 230,000 volunteers who have enlisted for service anywhere for the duration of the war and for as long thereafter as the Government may require them. About 100,000 of them are now overseas.

The Canadian Army will shortly have the greatest divisional strength in its history—a total of six divisions. During the first Great War Canada raised five divisions, but the fifth was broken up for reinforcements. Nearly all the infantry for the Sixth Division is already mobilized, and artillery, engineers, signals and other technical units are being drawn from the Reserve Army.

The Canadian Army Corps in Britain guards vital sectors. By the end of this year Canada will have in Britain four divisions, one of them armoured, a tank brigade and ancillary troops. Other Canadian soldiers are in Newfoundland, the British West Indies and Gibraltar. Until their recent removal for service elsewhere, Canadians for many months helped to garrison Iceland, where they played an important part in building the defences of that strategic island.

The First Canadian Division landed at a British port on December 17th, 1939, and was quickly followed by other troops, until, by February, 1940, there were approximately 25,000 Canadian soldiers in Britain. This number has been increasing steadily ever since.

In April, 1940, a Canadian component was detailed to take part in a frontal attack on Trondheim, Norway. This component, composed of picked units and commanded by a specially selected officer, moved off on April 18th to the port of embarkation in Scotland. However, after arrival there, the operation for which they had been detailed was cancelled, and the troops returned to camp.

In May, 1940, the First Canadian Division was selected to restore the communications of the British Expeditionary Force with the Channel Ports. On May 23rd and 24th, while the Canadian Commander, Lieut.-Gen. A. G. L. McNaughton, was carrying out a reconnaissance in France, the troops started for embarkation points. However, as a result of the reconnaissance, the War Cabinet decided that the existing military situation would have to be dealt with by the men and guns which were in France, time for moving troops with the necessary heavy equipment to the critical points not being available. The operation was accordingly cancelled.

On May 26th another proposal was made to use the Canadian troops in France. Units were entrained and ready to move to the port of embarkation, but it was decided that landing more men on the French coast would not contribute to the salvation of the B.E.F. This proposal was made by Lord Gort, Commander of the B.E.F. in France in 1940, and is referred to in his recently published despatches. Lord Gort relates that he thought it not unlikely that considerable fighting would occur during the withdrawal of troops at Dunkirk. "I had therefore asked the War Office", he writes, "whether it would be possible to send out an infantry brigade of the 1st Canadian Division so as to provide a nucleus of fresh and well-trained troops on the bridgehead position. This request was at once agreed to, and orders were given to despatch the brigade to Dunkirk on the night of 26th/27th May. These orders were, however, cancelled on 28th May".

In June, 1940, the First Canadian Division was detailed as part of the new B.E.F. which was formed after Dunkirk, in order to support the battered French Armies in the region of the Somme. However, only one infantry brigade, with some artillery and attached technical units, actually landed at Brest. These troops immediately proceeded towards the battle front, and some were at Sable-sur-Sarthe, more than 200 miles from Brest, and close to the divisional concentration area, when they received orders to retire. Thus, after less than forty-eight hours in France, these troops were necessarily withdrawn to England because of the deterioration of the general situation in France.

In September of this year Canadian, British and Norwegian forces under Canadian command effected a landing at Spitzbergen. The main purpose of the expedition was to prevent the Germans from utilizing Spitzbergen with its rich coal mines for their own war purposes. No enemy interference was encountered, and the force carried out its mission successfully.

In between such expeditions, and up to the present time, Canadian formations have occupied vital sectors in Britain's front line and acted as striking forces in reserve, ready to launch a counter-blow against any invading force that might succeed in getting through the coastal defences. Canadian units take their turn on coastal duty, work on the coast defences at many points, maintain communications, dispose of unexploded bombs, build strategic roads, and help to exploit the timber resources of the British Isles. The Canadian Corps has been kept in Britain thus far because the British Government considers it an essential factor in the defence of Britain, which is of paramount importance to the democratic cause. On September 4th, 1941, speaking at the Mansion House, London, Winston Churchill, the British Prime Minister, said of the Corps, "There they stand, and there they have stood through the whole of the critical period of the last fifteen months—at the very point where they would be the first to be hurled into a counter-stroke against an invader." In the meantime, every opportunity for increasing the Corps' efficiency and high state of training is eagerly seized upon—in preparation either for an invasion attempt by the Germans or for an attack in force on the continent, to the ultimate need for which Lt.-Gen. McNaughton referred on September 26th, 1941, when he told Canadian newspapermen visiting Britain that "there will have to be an invasion of the continent. I don't think you can bring a proud and well-organized nation to her knees with missiles alone."

The Canadian Army overseas is a powerful organization built on strictly modern lines. Its mechanized equipment of many different types and its complex array of armament, make it a very different army from the Canadian Corps of 1914-18. Planes and reconnaissance battalions of motorcycles and armoured scout cars render it sensitive. Tanks give it striking power. Its infantry units are capable of fast movement and possess fire-power for both offensive and defensive purposes. Its artillery is mobile and equipped to fight tanks and airplanes as well as to bombard enemy

CANADA'S MODERN ARMY

In a radio address on October 5th, 1941, Victor Sifton, Master-General of the Ordnance, made a statistical comparison between Canada's modern Army and the Army of 1914-18, particularly with respect to armament and transport.

This is the picture presented by Mr. Sifton's remarks:

	1914-18	*To-day*
Spent on armament and transport.............	For every $1	$5
Transport equipment of infantry division.......	4,400 horses 153 motor vehicles	No horses 3,500 motor vehicles of 160 types
Cost plus upkeep of this equipment for one year..	$2,000,000	$12,000,000
Fire power of an infantry division	Field guns Machine guns Lewis guns Trench mortars	More field guns Twice as many automatic small arms New and better mortars and many new weapons such as anti-tank guns and rifles and anti-aircraft guns
Cost plus upkeep of this armament for one year under battle conditions.	$5,000,000	$28,000,000
Cost plus upkeep of cavalry brigade for one year compared with that of tank brigade..........	$3,500,000 (Cavalry)	$32,000,000 (Tank)
Cost plus upkeep of armoured division for one year compared with that of whole Canadian Corps in 1916-17 fiscal year (under heavy fighting conditions).....	$143,000,000 (Army Corps)	$155,000,000 (Armoured Division)
Horse-power at disposal of 12,000 soldiers........	3,300 h.p. (Infantry)	394,237* h.p. (Armoured)

***As much power as is available to 700,000 people in a large city.**

positions. Its engineer units are capable of coping with the new problems which mechanization has created. Its signal arm makes full use of modern wireless equipment. The Army Service Corps and the Ordnance Corps have been mechanized and provided with modern equipment needed to supply the troops with food, gasoline, ammunition, repair facilities, etc. The Medical Corps, too, has had to adapt itself to the war of movement.

Mechanization of the Canadian Army has been reduced to statistics by Victor Sifton, Master-General of the Ordnance. In a radio speech on October 5th, 1941, Mr. Sifton said that "the scientific employment of machines . . . is the goal at which we are aiming." A tabulation of Mr. Sifton's statistics appears on page 17. In the course of his speech Mr. Sifton stated that "The 1st and 2nd Canadian divisions in England are completely equipped. In fact, there are no better equipped divisions in the British Army."

While the arming of Canadian forces overseas and the sending of supplies to the battle fronts of the world have been the first consideration of Canada's war industry, the Canadian Army at home is steadily being fully equipped. Hon. C. D. Howe, Minister of Munitions and Supply, said on September 11th, 1941, "The problem of equipment for our Canadian armed forces is one that no longer gives concern . . . We are now producing practically everything required by a fully equipped infantry division at a rate that enables us to equip a new division every six weeks." These words obtain added significance when taken in conjunction with a statement made late in September by Maj.-Gen. H. D. G. Crerar, Chief of the General Staff. Maj.-Gen. Crerar said that the object of army training in Canada is to produce formations "capable of fighting from the day they land overseas."

The Army in Canada—The Canadian "Draft"

Units of the Active Army at present in Canada guard the Dominion's coasts and vital areas. Most of these men are volunteers who are prepared to go anywhere required. Some, however, are "draftees" called up under the National Resources Mobilization Act for home defence duties.

Canada drafts men, aged 21 to 24, who have not already joined one of the forces, for full-time home defence duties with the Active Army. During their four months' period of preliminary training, "draftees" are given an opportunity to volunteer for active service wherever required with the Navy, Army or Air Force. Those who do not volunteer for such service are posted to home defence duties for as long during the period of the war as the Government sees fit. These men constitute the Canadian Active Army on Home Defence and release volunteers already on active service in Canada for overseas duty.

Compulsory military training was announced in Canada in June, 1940. In that month the National Resources Mobilization Act was passed. It gave the Canadian Government power to require "persons to place themselves, their services and their property" at the disposal of the country whenever this "may be deemed necessary or expedient for securing the public safety, the defence of Canada, the maintenance of public order, or the efficient prosecution of the war." This power, however, "may not be exercised for the purpose of requiring persons to serve in the military, naval or air forces outside of Canada or the territorial waters thereof."

The first group to be given thirty days' basic training under the authority of this act, went to camp in October, 1940. In the succeeding months about 87,000 men were so trained. About 20,000 of these joined the active forces; the rest were posted to the Reserve Army for part-time training. In February, 1941, the period of preliminary training was increased to four months; in March, the first four-months class went to camp; and shortly afterward it was announced that "draftees" would be kept indefinitely in the Army.

All single men and widowers without children, aged 19 to 45, are by law liable for military service in Canada. At present the Canadian "draft" is calling up the 21-24 age group. Provision is made for postponements in a few very special cases where it is in the public interest that they should be granted. Men not selected at their first call are still liable for service and may be called at any time. Monthly classes totalling more than 25,000 have been selected. A large number of these men have volunteered for service anywhere with the Navy, Army or Air Force.

The Canadian Reserve Army

The Canadian Reserve Army constitutes a pool of partially trained men from which volunteer reinforcements for the Active Army may be drawn. It is also to perform "an operational role in defence of Canada when required" and give "aid to the civil power in case of subversive or other disturbances." It numbers about 170,000 men; of these about 67,000 are men who have been given thirty days' compulsory military training and then posted to reserve units for part-time training. These men are now steadily being called for full-time home defence duties, unless they volunteer for overseas service. The remainder of the Reserve Army are volunteers. Members of the Reserve Army train for a specified number of hours each week, and at camp in the summer, and at the same time carry on with their civilian jobs. Because of the nature of the work which the Reserve Army is designed to perform, the age limit is now 50, compared with 45 for the Active Army.

The Air Force

"More than two years of war have brought a continuous repetition of the glorious achievements of Canadian airmen of the First Great War."

Air-Vice-Marshal L. S. Breadner,
Chief of the Air Staff.

The total personnel of the Royal Canadian Air Force is more than twenty times what it was before the outbreak of war. This is indicated by the following figures:

Pre-War Strength	*Strength To-Day*
4,500	about 89,000

On September 30th, 1941, Hon. C. G. Power, the Minister of National Defence for Air, stated, "Canadian youth have simply rushed to our recruiting offices."

The Air Force Overseas

Canadian airmen have been engaged in combat since the outbreak of war. Many had joined the R.A.F. before war broke out and others followed in late 1939 and early 1940. The first R.C.A.F. squadron arrived in Britain early in 1940; it was followed shortly afterward by two other squadrons. The flow of Canadian airmen from the British Commonwealth Air Training Plan in late 1940 and in 1941 has steadily increased the number of R.C.A.F. fliers at the battle front. R.C.A.F. fliers, after completing their operational training overseas, are posted either to the R.A.F. or to an R.C.A.F. squadron operating under R.A.F. command.

Seventeen of these squadrons are now in action. By the end of the year there will be twenty-five R.C.A.F. squadrons overseas, and the total number of trained Canadian airmen abroad will be equal to a division of infantry. One of the largest contingents of Canadian airmen ever to go overseas recently arrived in Britain. Air Minister Power has said that eventually the R.C.A.F. may constitute one third or even one half of all Empire airmen. He stated significantly on August 9th, "We are not proposing to limit ourselves."

Canadian airmen are now fighting over Britain, Europe, the Mediterranean area and Russia. For reasons of secrecy, detailed information concerning their activities is not at present available. The following facts, however, are known. The "All-Canadian" squadron of the R.A.F., formed late in 1939 of Canadian and British pilots, has had a very distinguished record. It destroyed at least thirty planes over France and the Low Countries during the Battle of France in the summer of 1940 and had the honour of being the last squadron to leave French soil. It fought over Dunkirk, and played its part in protecting the evacuation of British and Allied troops. It also fought over London during the September "blitz". In six fights it destroyed fifty-five enemy planes with a loss of only two of its own pilots. By January, 1941, it had accounted for more than one hundred enemy planes. All but one of the Canadians in the squadron have now been transferred, and its famous leader, the "legless" Squadron-Leader Douglas Bader, is reported a prisoner of war.

One of the first R.C.A.F. fighter squadrons to see action has had an equally distinguished record. It shot down

12 enemy planes in its first 19 days of action and is now credited with nearly 100 planes. It took part in the air battles over London in September, 1940, and on one day shot down 14 enemy planes.

During the past five or six months Canadian fliers have been taking part in R.A.F. daylight sweeps over Germany and the Low Countries. Canadian airmen have bombed Berlin and carried out attacks on the German warships "Gneisenau" and "Scharnhorst". Two Canadian squadrons are now assigned to night fighting duties, and others are on coastal patrol work and attached to both the fighter and bomber commands.

On October 21st, 1941, the R.C.A.F. had reported 823 as dead or missing and 75 as prisoners of war or interned.

Canadian ground crews are operating in Britain, and soon most Canadian squadrons will be serviced by Canadian mechanics. About a thousand radio technicians have for some time been assisting the R.A.F. in detecting hostile aircraft and 2,500 more such technicians will go overseas this year. A third class is now being trained in Canada.

The Air Force in Canada

R.C.A.F. planes play a vital part in western hemisphere defence. They escort convoyed ships and are on patrol duty in Canada daily and far out to sea on both coasts. Sometimes they patrol so far out on the Atlantic that they could more easily land in Ireland than at their home base. Coast defence squadrons are being steadily strengthened. They now include many airmen who have had combat experience overseas.

Aircraft of the eastern air command have had moments of more than routine activity. For example, Atlantic squadrons took part in the search for the "Bismark" and were ready to go into action, should this have been necessary.

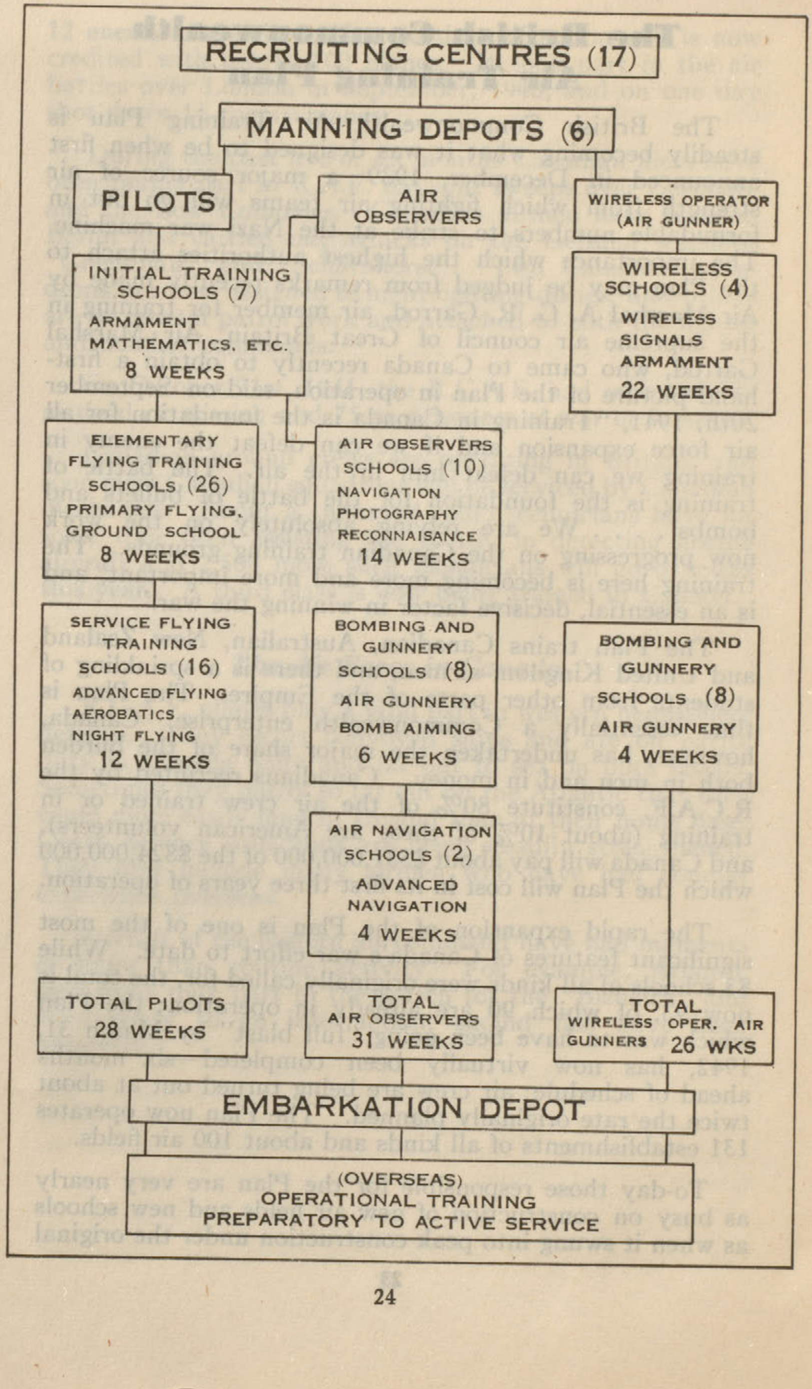
The British Commonwealth Air Training Plan

The British Commonwealth Air Training Plan is steadily becoming what it was designed to be when first announced in December, 1939—a major source of air strength from which fighting air teams will go out in formidable numbers to strike at the Nazi war machine. The importance which the highest authorities attach to the Plan may be judged from remarks recently made by Air Marshal A. G. R. Garrod, air member for training in the supreme air council of Great Britain. Air Marshal Garrod, who came to Canada recently to obtain a first-hand picture of the Plan in operation, said on September 20th, 1941, "Training in Canada is the foundation for all air force expansion and if we can defeat the enemy in training we can defeat him in the air. The battle of training is the foundation for the battle of bullets and bombs . . . . We are relying absolutely on the work now progressing on the Canadian training grounds. The training here is becoming more and more important, and is an essential, decisive factor in winning the war."

The Plan trains Canadian, Australian, New Zealand and United Kingdom airmen, and there is a sprinkling of students from other parts of the Empire. The Plan is thus essentially a Commonwealth enterprise. Canada, however, has undertaken the major share of the burden both in men and in money. Canadians recruited by the R.C.A.F. constitute 80% of the air crew trained or in training (about 10% of these are American volunteers), and Canada will pay about $531,000,000 of the $824,000,000 which the Plan will cost in its first three years of operation.

The rapid expansion of the Plan is one of the most significant features of Canada's war effort to date. While 83 schools of all kinds were originally called for, the total is now 93, of which 90 are already in operation; the Plan which was to have been going "full blast" by March 31, 1942, has now virtually been completed—six months ahead of schedule; air crew are being turned out at about twice the rate originally planned. The Plan now operates 131 establishments of all kinds and about 100 air fields.

To-day those responsible for the Plan are very nearly as busy on construction of new air fields and new schools as when it swung into peak construction under the original


RECRUITING CENTRES (17)
MANNING DEPOTS (6)
PILOTS
AIR OBSERVERS
WIRELESS OPERATOR (AIR GUNNER)
INITIAL TRAINING SCHOOLS (7)
ARMAMENT
MATHEMATICS, ETC.
8 WEEKS
WIRELESS SCHOOLS (4)
WIRELESS
SIGNALS
ARMAMENT
22 WEEKS
ELEMENTARY FLYING TRAINING SCHOOLS (26)
PRIMARY FLYING,
GROUND SCHOOL
8 WEEKS
AIR OBSERVERS SCHOOLS (10)
NAVIGATION
PHOTOGRAPHY
RECONNAISANCE
14 WEEKS
SERVICE FLYING TRAINING SCHOOLS (16)
ADVANCED FLYING
AEROBATICS
NIGHT FLYING
12 WEEKS
BOMBING AND GUNNERY SCHOOLS (8)
AIR GUNNERY
BOMB AIMING
6 WEEKS
BOMBING AND GUNNERY SCHOOLS (8)
AIR GUNNERY
4 WEEKS
AIR NAVIGATION SCHOOLS (2)
ADVANCED NAVIGATION
4 WEEKS
TOTAL PILOTS
28 WEEKS
TOTAL AIR OBSERVERS
31 WEEKS
TOTAL WIRELESS OPER. AIR GUNNERS 26 WKS
EMBARKATION DEPOT
(OVERSEAS)
OPERATIONAL TRAINING
PREPARATORY TO ACTIVE SERVICE

plan. In recent months a number of British schools have been transferred to Canada, where air space and freedom from enemy attack provide suitable conditions for training. This movement is expected to continue in the coming months until perhaps 30 or 40 British schools are operating in Canada, in addition to schools already operated by the Plan.

The table on the opposite page shows the schedule of air crew trainees from the time they enter as recruits, until, six to eight months later, they are ready to begin operational training.

Training the Forces

Schools and training centres for the forces are scattered throughout Canada. In addition, all three Services operate special technical training centres to educate men to perform the variety of highly specialized tasks which modern warfare makes necessary. Schools and universities are co-operating in this work. Air Force ground crew trade schools have trained about 25,000 men and Army trade training centres are turning out maintenance men at the rate of 20,000 a year.

The following table indicates the extent and nature of the training which the members of Canada's armed forces are receiving in centres from coast to coast:

Navy	
R.C.N.V.R. Divisions (recruiting and preliminary training of naval volunteers)	20
Training establishments	2
Technical training centres	4
Army	
Officers' training centres	2
Basic training centres	29
Advanced training centres (infantry, machine gun, small arms, artillery, engineers, signals, armoured car and tank, army service corps, medical, etc.)	28
Technical training centres, (including technical schools, etc., co-operating)	125
Air Force	
Schools for air crew (See table on opposite page)	73
Technical and other schools	17
Pre-enlistment trade training centres	18

Casualties

The following are among the casualties which had been reported in the Canadian armed forces up to late in October, 1941:

Dead or Missing (in all theatres)	2,087
Navy	403
Army	861
Air Force	823

Women's Auxiliary Services

The Department of National War Services is now intensifying recruiting of women for auxiliary service with the Army and the Air Force. The Navy has such a move under consideration. Several thousand will be needed in the next few months. Women will perform administrative duties such as office work, telephone operating and army stores duties, as well as light transport driving, cooking, messenger service and canteen work, thus releasing men for combatant duty where most needed.

Cadets

Canadian boys have opportunities to obtain elementary training which will be of use to them when the time comes for them to enlist in one of the three services.

The Sea Scouts and the Sea Cadets of Canada have branches from coast to coast. These organizations are providing boys of pre-military age with a thorough grounding in naval matters. The Sea Cadets are sponsored by the Navy League of Canada and are under the jurisdiction of Naval Services.

Secondary schools throughout the country, both public and private, operate cadet corps in which hundreds of thousands of boys learn the rudiments of soldiering.

Organization of the Air Cadet League of Canada is proceeding rapidly. Training is supervised by local Air Force commands in various parts of Canada. The course covers two years and includes basic training in subjects relating to aircraft and air fighting. Upon completion of the basic training, air cadets may specialize in certain branches of these subjects.

CANADA: ARSENAL AND STOREHOUSE

Sending Supplies to the Battlefronts

"Canadian weapons and supplies are being despatched to all the battle fronts of the world—to Britain, to the Middle East, to the Far East, to our sister Dominions, to China and to Russia."

Hon. C. D. Howe, Minister of Munitions and Supply.

In 1938 Canada ranked fourth among the exporting nations of the world, being exceeded only by the United States, Britain and Germany. To-day, in spite of the dislocations of war, the Dominion is exporting more goods than ever before in her history—about 85% more than before the war. Canada, always a storehouse of raw materials and food, is making herself as fast as she can into an arsenal as well, from which supplies go out to many parts of the world. Some idea of the extent to which Canada is becoming a source of supply for the democratic nations may be gained from the following figures. They show that Canada's exports to friendly countries have grown since the outbreak of war. Her exports to Axis countries or to countries controlled by the Axis, have, of course, ceased.

	Value of Canada's Exports in First Eight months of 1939	*Value of Canada's Exports in First Eight Months of 1941*	*Increase or Decrease*
To United Kingdom..........	$214,585,000	$449,241,000	+110%
To the rest of the British Empire....	68,138,000	135,029,000	+ 99%
To the United States	198,972,000	364,539,000	+ 83%
To China and Russia	2,257,000	5,176,000	+122%
To Germany........	7,547,000	—	— —
To Italy...........	1,907,000	—	— —
To Europe (except United Kingdom) and Russia.......	39,763,000	3,474,000	— —
To all countries.....	554,847,000	1,029,990,000	+ 85%

Canadian Exports to Britain

In the first two years of war Canada sent goods to Britain which were worth more than $1,000,000,000. They included substantial quantities of such war equipment as machine guns, anti-tank guns, anti-aircraft gun barrels, shells, small arms ammunition, explosives and chemicals, airplanes, corvettes, minesweepers, small boats, mechanized transport, and universal carriers; hundreds of thousands of tons of non-ferrous metals; enormous quantities of timber to make up for most of Britain's imports of European timber, which amounted to about 75% of her total normal supply; large quantities of pulp and pulp products; and the following foods:

Wheat	More than 300,000,000 bushels
Flour	7,000,000 barrels
Bacon and other pork products	800,000,000 pounds
Cheese	195,000,000 pounds
Eggs	15,000,000 dozen
Honey	13,000,000 pounds
Total (excluding wheat and flour and including canned goods such as concentrated milk and tomatoes and other foodstuffs)	1,830,000,000 pounds

Part of this food is really contributed by the Canadian people. Canadian governments pay about one third of the return to the producer on all cheese sold to Britain and similar steps have been taken with respect to bacon and other pork products. Also, the amount of such products available for domestic consumption has been reduced by about 25%; and such products are no longer to be exported to any country except Britain or British possessions.

During the present year, the following foodstuffs will be shipped to the United Kingdom in quantities limited only by the British demand and Canadian production: bacon and other pork products, cheese, evaporated milk, apples (fresh, dried and canned) canned tomatoes, honey, dried beans, fruits for jam, onions, dried vegetables, canned salmon, canned herring, cereal breakfast foods, wheat and flour.

In order to supply Britain with eggs, Canada has had to increase prices to her producers and also to the Canadian consumer. In the case of canned salmon, two-thirds of the entire Canadian pack has been reserved for British consumption. Practically no supplies of canned herring will be available to the Canadian public, since quantities larger than the normal pack are being reserved for Britain. The effort to meet British requirements as far as possible will result in higher prices for green vegetables and tomatoes and shorter supplies of those products for Canadian consumption. The general policy is that the Canadian people will go short in order to keep the British supplied, the rest being a matter of technique.

In the present fiscal year (ending March 31, 1942), Canada's exports to Britain will amount to about $1,500,000,000—about four times as much as in the year 1939.

"Lease-Lending" to Britain

More than three-quarters of the money Britain has so far needed to pay Canadian producers for goods exported to Britain, has been provided by the Canadian people. This amounted to more than $900,000,000 in the first two years of the war. Since December of last year there have been no gold shipments from Britain to Canada, and the Dominion will provide Britain with all the money she will need this fiscal year to pay for Canadian supplies. This will amount to at least $900,000,000.

Britain pays for a fraction of her purchases in Canada by exporting goods to the Dominion. The rest of her Canadian supplies, however, must be financed otherwise. The Dominion has provided Britain with about one third of the Canadian money she has needed by repatriating Canadian securities held in Britain; this amounts to paying debts before they fall due. Canada has supplied about two thirds by accumulating Sterling balances—in effect, lending Britain money. All this credit, like the money raised to spend on Canada's own war effort, must be provided now by the Canadian people.

Canada's Raw Material Resources

"Development of Canada's natural resources has enabled the Dominion not only to fill her own requirements for certain strategic materials but also practically all of Britain's requirements for such materials as well . . . Canada's natural resources will prove to be a winning factor in the war."

Hon. T. A. Crerar, Minister of Mines and Resources.

Canada is one of the world's major sources of strategic raw materials. She produces about 83% of the world's nickel and ranks high in the production of many other metals and minerals important in war manufacture such as aluminum, zinc, copper, cobalt, lead, platinum metals, asbestos, mica, and sulphur. There has been a steady increase in the output of most of these metals in the past twenty years. Molybdenum is available in quantity in Canada, and the Dominion has the only large commercial output of mercury in the Empire. Tungsten, antimony and manganese are being developed, and intensive search is carried out every year for further deposits of vital war minerals.

Canada now produces many times as much raw aluminum as before the war. This has involved the construction of large power-houses and dams, some of them in the heart of the Canadian wilderness. Water-power development for use in making aluminum is being approximately doubled. Other metals and minerals have also been produced in increasing quantities; total mineral production in the first eight months of this year was 18% greater than in the corresponding period of 1939. Efiective steps have been taken to restrict the use of vital war metals and minerals to essential wartime projects and to make a maximum quantity available for war purposes in the Dominion, in Britain, in the United States and in other friendly countries.

Canadian production of alloys is ten or twelve times the pre-war level. Ferro-alloys produced in Canada are increasingly in demand both at home and abroad.

Canada produces great quantities of certain kinds of timber, and has increased her output since the outbreak of war. In the first eight months of this year there were 77% more men employed in logging than in the corresponding period of 1939. Because of the heavy demands of Canada's own defence building programme, the Dominion now consumes 45% of her entire lumber output. Nevertheless, she has exported large quantities both for defence construction and for the manufacture of certain items of war equipment.

Canada's Food Resources

"The history of the first two years of the war proves that an appeal to farmers in Canada is not necessary to obtain results in production. Even without the usually necessary inducements of high returns, farmers have produced as never before."

Hon. J. G. Gardiner, Minister of Agriculture

Apart from wheat, there is no longer a surplus of most major Canadian farm products. This does not mean that production has fallen: on the contrary, it indicates an increasingly heavy demand. The major cause of this increased demand is the growing need for Canadian foodstuffs in Britain. In the past year Britain has turned more and more to Canada as the nearest source of supply of foods formerly obtained from Europe or countries far overseas. Canadian agriculture has become a war industry.

Since the beginning of the war the Dominion Department of Agriculture has taken steps to ensure maximum production of food. At the beginning of the war, the Department set up an Agricultural Supplies Board generally to direct production activity and, in collaboration with provincial authorities, to deal with other agricultural problems arising out of the war.

Independent of this Board, but working in close collaboration with it, are three Boards which purchase and forward supplies of Canadian farm products contracted for under agreements between the British Ministry of Food and the Canadian Government. These are the Bacon Board, the Dairy Products Board and the Special Products Board (responsible for eggs, fruit and vegetable products, etc.). These Boards make every effort to see that Britain gets economically all the Canadian food she needs.

An important wartime problem which the Department of Agriculture has dealt with is the surplus of wheat and the related problem of providing adequate supplies of feed for livestock at reasonable prices. As Canada has a large wheat surplus, the Government has instituted a policy of wheat acreage reduction for which a bonus is paid to the farmer if, at the same time, more coarse grains are being grown. About 3,400,000 additional acres were sown with coarse grains this year. This policy, combined with moves to reduce the price of millfeeds to the farmer and to restrict their exportation, assists livestock production and thus provides more of the foods Britain needs most—cheese, bacon, and ham. Government assistance to agriculture for all purposes in the 1941-42 crop year will total about $60,000,000.

Manufacturing War Equipment

"Canada is an arsenal of war munitions. We are manufacturing practically every weapon used in this war."

Hon. C. D. Howe, Minister of Munitions and Supply.

Two years ago Canadian industry was organized almost entirely for peace; to-day under the supervision of the Department of Munitions and Supply, a very large part of it is organized for war. The Dominion almost literally has built a war industry from the ground up. Practically every Canadian factory that can produce for war is now doing so wholly or in part, and this diversion is being continued where possible through the work of the Industry and Sub-contract Branch of the Department of Munitions and Supply. Millions of dollars have been spent by industry on plant expansion and equipment necessary for war production, and the Canadian and British Governments have authorized expenditures of about $550,000,000 for the same purposes. About 250 entirely new factories, some of which are as large as any of their kind in the British Empire, have been erected. The bulk of this latter expenditure has been designed to increase the production of shells, guns and mountings, chemicals and explosives and raw materials.

In the first year of the war the provision of plant structures and machinery constituted a serious problem towards a solution of which all concerned made a concentrated effort. Now that most of these difficulties have been overcome, Canadian industry has struck its stride and its record in war production has been impressive. Canada has now produced almost every type of war equipment which its munitions program calls for, and very substantial quantities of certain items have been turned out. The Dominion's war industry is now reaching the point of capacity production and is beginning to turn out a remarkably varied array of war equipment at high speed. The Minister of Munitions and Supply stated on September 11th, 1941, "Lord Beaverbrook, on his return to England after a visit to Canada and the United States, is reported to have said that Canada's production of war supplies compares favourably for population with any country in the world. If that be true at this time—and I have no way of knowing whether it is or not—the full output of our munitions programme, which will be largely realized in the early part of next year, should be a source of pride to our people".

Most of the war equipment now being produced in Canada has never before been manufactured in the Dominion. Referring to this development on September 18th, 1941, Finance Minister Ilsley said, "It is not too much to say that what has happened in the past year is nothing short of an industrial revolution. This has been accomplished in spite of all the difficulties in obtaining or preparing plans and specifications or in getting new machine tools, despite the need to learn or develop new skills, despite the scarcity of many materials and the inevitable dislocations of wartime. In these new or expanded plants Canadian management and Canadian labour, much of it never previously inside the four walls of an industrial plant, have already produced complicated war equipment of the highest quality at greater speed and lower cost than in the established plants of the more mature industrial countries".

The following is a list of some of the war equipment Canada is now manufacturing:

Ships

Naval Ships
- Minesweepers
- Corvettes
- Motor torpedo boats
- Patrol boats

Merchant ships
Small boats

Shipbuilding has increased tremendously in Canada. On October 9th, 1941, Hon. C. D. Howe, Minister of Munitions and Supply stated, "If our objective for 1942 is attained, we expect that in that year Canada's shipbuilding programme will equal the British annual output of cargo vessels." At the beginning of the war there were only 1,500 workers in Canadian shipyards. Now more than 20,000 workers are employed in 17 major and 58 smaller yards. To-day the shipbuilding programme, including the merchant-ship programme, and the ship repair programme involves an expenditure of more than $430,000,000.

Naval Ships

About $125,000,000 is being spent on naval vessels. Some 225 such ships have been ordered, not including small craft. A total of 120 corvettes and mine sweepers have been launched. In recent months an average of one corvette every four days has been turned out. Three "merchant cruisers" and more than thirty yachts and motor boats have been converted to naval use. Over fifty similar craft have been chartered. Patrol boats are bow being turned out. The keels of two destroyers are to be laid down in Canada. British technical experts are to be brought to Canada to assist in the construction of these vessels.

Merchant Ships

The merchant-ship building programme is now assuming very substantial proportions. It involves an outlay of $300,000,000. A total of 100 freighters of the 9,300-ton and 4,700-ton class are to be launched by the end of 1942. Two of these ships have been launched and the keels of several more have been laid down. About 95% of the material used in each ship is produced in Canada. Due to recent war expansion of engineering plants in Canada, it is no longer necessary to import such accessories as engines, propellers and fittings.

Small Boats

Deliveries are being made regularly under the $9,000,000 small-boat programme. Nearly 1,000 boats, ranging from 112-foot motor vessels to 12-foot collapsible assault boats, have been ordered and the programme is more than 50% complete. These boats are being built for the Navy, the Army and the Air Force.

Ship Repair

This very important aspect of the war programme is receiving constant attention. Additional drydocking facilities are being constructed on the Atlantic coast and additional handling facilities are being arranged at several ports. Projects under way include a semi-tidal dock, floating docks, repair piers, machine shops, boiler shops and marine railways.

Guns

- 25-pounder field guns, with equipment, trailers, and tractors
- Bofors 40 mm. anti-aircraft gun barrels
- Complete Bofors 40 mm. anti-aircraft guns and mountings
- 3.7″ anti-aircraft gun barrels
- 2″ mortars
- 3″ mortars
- Bren guns
- Browning aircraft machine guns
- Four types of naval gun mountings
- Lee-Enfield rifles
- Two types of guns for use in tanks and as anti-tank guns

Canada's gun programme calls for the manufacture of fourteen types of land and naval guns and mountings, in addition to machine guns, rifles and small arms. Canada possesses one of the largest factories in the world manufacturing artillery from scrap to complete gun, and one of the largest automatic gun plants in the world.

Ammunition

- Small arms ammunition of several types
- Shells of 14 types
- Cartridge cases
- Fuses, gaines, and primers
- 500-lb. aerial bombs
- Practice bombs
- Depth charges
- Anti-tank mines
- Rifle grenades
- Pyrotechnics of many varieties for aerial, field, naval, and practice uses
- Trench mortar bombs
- Shells, ammunition, bombs, etc. filled with Canadian-made explosives and propellants.

More than 7,000,000 Canadian shells have been turned out since the war began. They are being made at the rate of millions of rounds a year. More than 10,000,000 cartridge cases for shells have been turned out. Production of fuses, primers, explosives and other accessories keeps pace, and in the coming months increasing numbers of complete rounds will be shipped overseas.

Millions of rounds of small-arms ammunition are produced every day, and the various other types of ammunition listed above are being made in steady volume. For example, 500-pound bombs are being manufactured at the rate of 10,000 a month.

Chemicals and Explosives

- 12 types of chemicals
- 8 types of explosives

Because of the heavy demand for chemicals and explosives from North America, production facilities of

Canada's chemicals and explosives plants are being enlarged beyond the capacity originally planned. Very substantial quantities have already been shipped to Britain, and certain urgently required chemicals have been supplied to the United States and to some Dominions. The Minister of Munitions and Supply stated on October 7th, "British authorities have expressed gratification at the quantity and quality of ammunition produced in the Dominion."

Twenty of Canada's 23 chemicals and explosives plants are now producing. This year alone the total production of explosives in Canada will exceed the entire Canadian output during the whole of the first Great War.

Aircraft

12 types

The Canadian aircraft industry was of small dimensions at the beginning of the war, but since that time it has built a large number of aircraft. Since January, 1939, the number of men engaged in Canadian aircraft construction has increased from 1,600 to more than 30,000. Output during the past year has steadily increased. Production in the first six months of 1941 exceeded the total for all of 1940, and, measured in man-hours employed, an increase was noted in the third quarter of 1941.

At present Canada produces about twelve different types of plane. These include three elementary trainers, a general purpose machine, a single-engine advanced trainer, a twin-engine advanced trainer, a flying boat, an army co-operation plane, a fighter and two bombers. A medium bomber and a coastal reconnaissance amphibian are in production. It is expected that the number of types will be reduced in the near future to allow the industry to concentrate on the trainers now needed and on the service craft which have proved themselves most useful. This may mean fewer planes per week, but the actual output measured in pounds of plane components or in man-hours will continue to grow. Engines for Canadian aircraft are imported, but Canada is now producing almost all the instruments required.

The types of plane on which Canada will soon concentrate are—an elementary trainer, a single-engine advanced trainer, a twin-engine advanced trainer, a coastal reconnaissance amphibian, a bomber and a fighter.

The overhaul and repair division of the Aircraft Production Branch now supervises 29 plants scattered from Halifax to Vancouver, where it services thousands of planes. These facilities are expected to be doubled within a year.

Tanks

Cruiser tanks	Infantry tanks

The Canadian tank programme calls for the production of 1,000 cruiser and 800 infantry tanks. Since June, 1941, a considerable number of tanks has been turned out. By the end of this year it is expected that 100 Canadian tanks will have been shipped to Russia.

Vehicles

Universal carriers	Field workshops
Wireless trucks	Army mechanized transport of all types
Ambulances	

More than 150,000 army vehicles have been delivered and are in service, a large proportion of them overseas. On the average, Canada produces one army automotive unit every three minutes. These include trucks and tractors of every type required by the armed services. Practically all of the 160 different types of motor vehicle being used by the Canadian Army are being manufactured in Canada. Canadian army vehicles have been used in every engagement in which the Empire's soldiers have participated.

Among the important products of the motor industry is the universal carrier, in essence a baby tank. These efficient little machines travel at speeds up to 45 miles an hour on caterpillar tracks, manoeuvre with ease on almost any terrain, and are equipped with machine guns. A single Canadian plant turns out enough of these carriers in a day to equip a battalion, enough in 14 days to equip an infantry division.

Miscellaneous

Clothing and boots for the three services	Marine smoke floats
Personal equipment	Hospital equipment and supplies
Optical instruments	Gas decontamination suits and equipment
Military and naval instruments	Link trainers
Radios, radiolocators	Military furniture and forms
Gas masks	Fire trucks
Steel helmets	Fire hose
Parachutes	Asbestos rescue suits
Flare parachutes	Ammunition boxes
Minesweeping gear	Machine tools
Technical naval equipment	Gauges
Searchlights	Military tires
Smoke projectors	Anti-submarine gear

Articles Soon to be Produced

Boys' anti-tank rifles	Predictors for anti-aircraft guns
Naval guns of four types	Various types of secret equipment and weapons
Scout armoured cars, armoured cars	Vickers guns
Scout cars, reconnaissance cars	Sub-machine guns
Bomb throwers	

Some Typical Costs

Cargo boat	$1,750,000
Corvette	550,000
Flying boat	100,000
Cruiser tank	100,000
Hurricane fighter	45,000
25-pounder field gun	25,000
2-pounder anti-tank gun	12,500
Universal carrier	5,000
Bren Gun	325
500-pound aerial bomb	100
Depth charge	75

Scientific Research on War Weapons

"An army of scientists in Canada, Britain and other countries are at work constantly and secretly on war problems. . . . Every available man of science (in Britain) now is at work, and Britain is depending more and more upon the scientific genius of North America for her expanding war machine."

Sir Lawrence Bragg, recently Scientific Liaison Officer between Canada and Great Britain

Scientific research on war weapons is carried out by a staff of experts at the National Research Council. It maintains the closest co-operation between the fighting services, the Departments of Government, industrial institutions, universities and research laboratories in the prosecution of all scientific and technical aspects of war preparation. Some of its most important work to date has been in the fields of gauge-testing, radio research, optics, ballistics, industrial radiology, and design of electrical protective devices, acoustical equipment and instruments. It has also done important work in the field of chemical defensive methods and in the testing and preparation of war materials. Various types of research in connection with aircraft have been carried out. Problems connected with the transport and storage of food have been investigated. Medical research in connection with aviation and other war activities has been undertaken. Notable in this connection was the work of Sir Frederick Banting, whose absorbing interest from the outbreak of war until his death in a plane crash in February, 1941, was aviation medicine.

An Inventions Board was established in June, 1940, under the auspices of the National Research Council. It deals with all proposals regarding inventions received by Government departments. Research Enterprises, Limited, a Government-owned company, is manufacturing devices created by the Council. It now has orders totalling $48,000,000, and it is expected that $36,000,000 worth of these orders will have been filled by the end of 1942. The Industrial Planning and Engineering Branch of the Department of Munitions and Supply, set up in September, 1941, carries out development and design work in connection with war equipment.

The Wartime Bureau of Technical Personnel is now undertaking a survey of all persons skilled in scientific research—university graduates with post-graduate training —who may be able to assist in war research activities. All persons who may qualify are asked to communicate with the Bureau or with Professor David A. Keys of McGill University.

AID TO BRITAIN AND HER ALLIES

"All help is vital and the quicker you can give it the more help it will be."

Lord Halifax, British Ambassador to the United States

This section tells briefly of some of the miscellaneous ways in which Canada has been able to be of some assistance to Britain and her Allies in their difficult hour. It does not tell of Canada's chief part in the war—the British Commonwealth Air Training Plan, the R.C.A.F. overseas, the Royal Canadian Navy on the Atlantic, the Canadian Corps in Britain, the "lease-lending" of supplies, the building of a Canadian war industry that is now beginning to go "full blast." Those things are what most of the rest of this booklet are about. Here we have only a short collection of interesting oddments which help to round out the picture.

Quite early in the war a considerable number of British children arrived in Canada. They were followed by others until 6,000 had come to accept the invitations that had told 100,000 they were welcome if they could get across.

A considerable number of enemy prisoners of war have been brought to Canada. They have been captured in some of the many theatres of war. They are treated in accordance with an international convention governing the treatment of combatant war prisoners.

Canada has materially reduced tariffs on British imports since the outbreak of war. This helps Britain to obtain Canadian dollars.

Canada pays for the equipment and upkeep of her forces overseas. The only exception in this respect is the provision of service planes for Canadian squadrons overseas. This is looked after by Britain, as part of her contribution to the British Commonwealth Air Training Plan.

By arrangement with the Canadian Government, representatives of European nations which, though conquered, are carrying on the fight, are recruiting and training their nationals in Canada. Norwegians, Dutch, Belgians, Poles and Czechs have been given every possible facility, and some of their troops have already gone overseas.

A considerable number of Canadian ships have been made available to Britain for carrying supplies and for naval duties. British ships are repaired and supplied in Canadian ports.

Canadians have given more than $27,000,000 to war charities, large and small, since the outbreak of war. They have contributed "goods and services" besides. Women's organizations, for example, provide knitted goods and other articles of clothing in thousands every day. A very substantial portion of this money and these "goods" have already found their way to Britain, and many Canadians are there to help distribute the services where they are most needed.

The most important war charities in Canada, and those by whom by far the largest portion of money is collected and expended, are those combined in the Canadian War Services Fund, which will shortly make a new appeal for funds totalling about $17,000,000. The charities combined in the Fund are the Canadian Red Cross, the Canadian Legion, the Y.M.C.A., the Y.W.C.A., the Knights of Columbus, the Salvation Army, the Imperial Order of the Daughters of the Empire and the Navy League of Canada. The following list indicates the sort of work which these organizations have been doing for the victims of enemy bombing in Britain, for soldiers overseas, for prisoners-of-war, and for other needy persons:

Established in Britain	A military hospital About 80 recreational centres About 300 mobile canteens, etc.
Sent to Britain	Nearly 12,000,000 articles of comfort and clothing About 150 tons of same About 10,000,000 sheets of stationery More than 30,000,000 cigarettes 70,000 cases and 30 tons of food Instruments for 100 military orchestra About $500,000 in cash
Sent to British Prisoners of War	More than 350,000 parcels of food and comforts costing more than $700,000

That is a brief statistical picture of some of the work these organizations are doing overseas. It tells nothing of the movies, the educational services, the personal services provided. It tells nothing of their work in Iceland, Newfoundland—and at home, where their work among the troops is in its way as important as their activity overseas. Nor does it tell of the many other organizations collecting and sending money and comforts to Britain. The most important of these is the Queen's Canadian Fund, which has raised more than $600,000 in the past few months.

These are some of the things that patriotic Canadians are doing for Britain and her allies. A few more might be mentioned. Hundreds of "dollar-a-year men" are serving their country in key positions where their skill and experience is badly needed. Key industrial workers have ungrudgingly worked long hours; some employers have voluntarily restricted their margin of profit or even turned their profits over to the Government. Canadians, and Americans, have voluntarily donated about $2,000,000 as "free gifts" to assist the war effort. Nearly 2,500 salvage centres are collecting and turning over to war industries increasing amounts of salvable material gathered from homes, schools, etcetera. More than 10% of Canada's medical doctors are now on active service, as are a large number of nurses, many of whom are in Britain. Three hundred Canadian nurses will soon be serving in South African military hospitals by arrangement between the South African and Canadian governments. Four hundred Canadian firemen are to go to Britain soon. They will be known as the Canadian Fire Fighters' Corps. A contingent of the Veterans' Guard has been organized for overseas duty. The Canadian Red Cross recently arranged for a large shipment of medical supplies to Russia. The same organization is co-operating with the Australian Red Cross in sending parcels to Australian prisoners of war.

CANADA, THE UNITED STATES AND THE WAR

(See also pages 61-63)

"The Hyde Park Declaration is more than an extension of the Ogdensburg Agreement for hemisphere defence. It is also a joint agreement . . . for aid to Britain."

Prime Minister Mackenzie King.

Economic Co-operation

Without access to many United States products essential to war manufacture, Canada's war programme could not have progressed as far as it has to-day. Canada buys many essential war materials and machine tools in the United States, and since the outbreak of hostilities has bought them in increasing quantities. In spite of a reduction in the amount of "non-essential" commodities coming to Canada from the United States, Canada's imports from that country have increased greatly since the outbreak of war. In 1938 they were valued at $425,000,000; in 1939, in September of which year the war began, they rose to $497,000,000; and in 1940 they soared to $744,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) they are expected to reach $953,000,000, of which at least $428,000,000 will be for war purchases. At the same time it has been estimated that Canada's exports to the United States this fiscal year would run, under normal trade arrangements, to $475,000,000—which would leave Canada with a trade deficit with the United States of about $478,000,000.

The Hyde Park Declaration

The Hyde Park Declaration has established a principle which, it is expected, will reduce this deficit and assist Canada to maintain and increase her war purchases in the United States. As a result of the agreement, it is expected that Canada will be able to sell to the United States additional defence materials and some articles of war to the value of between $200,000,000 and $300,000,000. In addition, the United States is to lend-lease to Britain addition, the United States is to lend-lease to Britain materials and parts to be shipped to Canada as components in Canadian production for Britain. Canada, herself, is not obtaining supplies from the United States under the lend-lease plan, but is paying cash in American dollars for everything which she purchases in the United States on her own account.

Canadian Exports to United States Increase

Canada has increased her exports of essential raw materials to the United States in the two years since the outbreak of war. Important war metals and minerals, timber, pulpwood, pulp and new-print have been among the commodities flowing in increasing volume from the Dominion to the Republic. Since the Hyde Park Declaration was issued, arrangements have been made to increase purchases of war materials from Canada by the United States, and, in addition, certain war equipment which Canada produces in substantial quantities.

War equipment which Canada is able to export to the United States and for some of which substantial orders have already been placed, includes certain types of small arms, some guns and ammunition, certain explosives and chemicals, certain armed fighting vehicles, corvettes and mine-sweepers. There are also some types of clothing and textiles, leather, rubber and timber products and various secret devices in which Canada could probably make an important contribution if these were desired.

Canada Must Still Conserve United States Dollars

The Hyde Park Declaration, though a magnificent contribution to the common struggle in which Canada and the United States are engaged, does not remove the need for the conservation of United States dollars, as outlined on pages 60-62. The most reasonable estimate of the magnitude of the Hyde Park Declaration's effect on Canada's supply of American dollars still leaves a considerable deficit in Canada's balance of payments with the United States.

A Sound Canadian Economy Benefits Americans

Because the American and Canadian economies are very closely joined, Canada's efforts, under the stress of war, to preserve a sound financial position, have been of real benefit to Americans. Measures to safeguard the Canadian economy have protected the $4,000,000,000 which Americans have invested in Canada. Although it has been necessary to restrict the movement of capital out of Canada, Americans are allowed to withdraw, at the full official rates of exchange, all forms of current income from Canada. During the present fiscal year (April 1st, 1941, to March 31st, 1942) Canada will pay an estimated $238,000,000 in interest and dividends to United States investors. The attractiveness of Canada as a field of investment has not been impaired by the war, and millions of American dollars have been invested in the Dominion since the outbreak.

Further Significance of Hyde Park Declaration

The Hyde Park Declaration has a significance over and beyond its financial importance to Canada. The net result of the Declaration, it is expected, will be that the United States and Canada, each concentrating on the materials of war which it can produce best and most quickly, will become one strong team, working and producing according to a carefully planned programme which will ensure the most rapid possible supply of war materials to Britain and her embattled allies and the most efficient provision of defence articles for North America.

Increasing Economic Co-operation

For "Instances of Economic Co-operation", see pages 73-75 of October issue. The Material Co-ordination Committee and the Joint Economic Committees have both had several meetings in the past few months. The former collects and exchanges information on raw material supplies. The latter has discussed, among other things, shipping, priorities, civilian consumption restrictions, co-ordination of Canadian and American export controls to prevent leakages of strategic war materials, other war-time problems common to the two countries, and post-war questions.

Canada and Western Hemisphere Defence

(See also pages 13, 19-20 and 22)

When Canada went to war two years ago she took immediate steps to ensure the defence of her territory and, subsequently of key points in the western hemisphere. Since the Ogdensburg Agreement of August, 1940, these defensive measures have been co-ordinated with those undertaken by the United States and the two countries have now worked out joint plans for the defence of their part of the western hemisphere. Both Canadian coasts are constantly guarded by large concentrations of troops and by coastal and anti-aircraft guns located at strategic points, as well as by naval and air patrols operating along 2,000 miles of coast line and far out to sea. In the west Canada is building a string of staging airdromes so that military planes from both Canadian and United States centres can be moved into northern British Columbia and Alaska without delay. In the east, United States troops have replaced Canadian forces in Iceland, and they have joined Canadian troops in Newfoundland, where the two countries are building extensive defence facilities. Canada and the United States are in full agreement concerning defence measures in Greenland. Both United States and Canadian troops stand guard in the West Indies. At sea both the Canadian and the United States navies seek out marauding submarines.

Civilian defence and A. R. P. units are organized in many parts of Canada and blackout practices have been held in several cities. The Army and the Royal Canadian Mounted Police guard vital points and operate to prevent fifth column activities and sabotage. The Veterans' Guard plays an important part in this work.

Americans in the Canadian Armed Forces

A direct and striking American contribution to Canada's war effort is the arrival in Canada of American volunteers for the Canadian armed forces. About 10% of the air crew trained or in training in the R.C.A.F. are Americans and 600 Americans are acting as instructors for the Air Training Plan. Americans in the R.C.A.F. now wear a distinguishing badge "U.S.A." on the shoulder. Nearly 10,000 Americans are serving with the Canadian Army. Many of these airmen and soldiers have already gone overseas. Americans and Canadians to-day fly together in the R.A.F. and the American "Eagle" squadrons often fly with R.C.A.F. Squadrons.

THE HOME FRONT

"Unless the whole resources and total energy of the free world are thrown into the struggle, the war may drag on for years, carrying in its train famine, pestilence and horrors still undreamed of."

Prime Minister Mackenzie King.

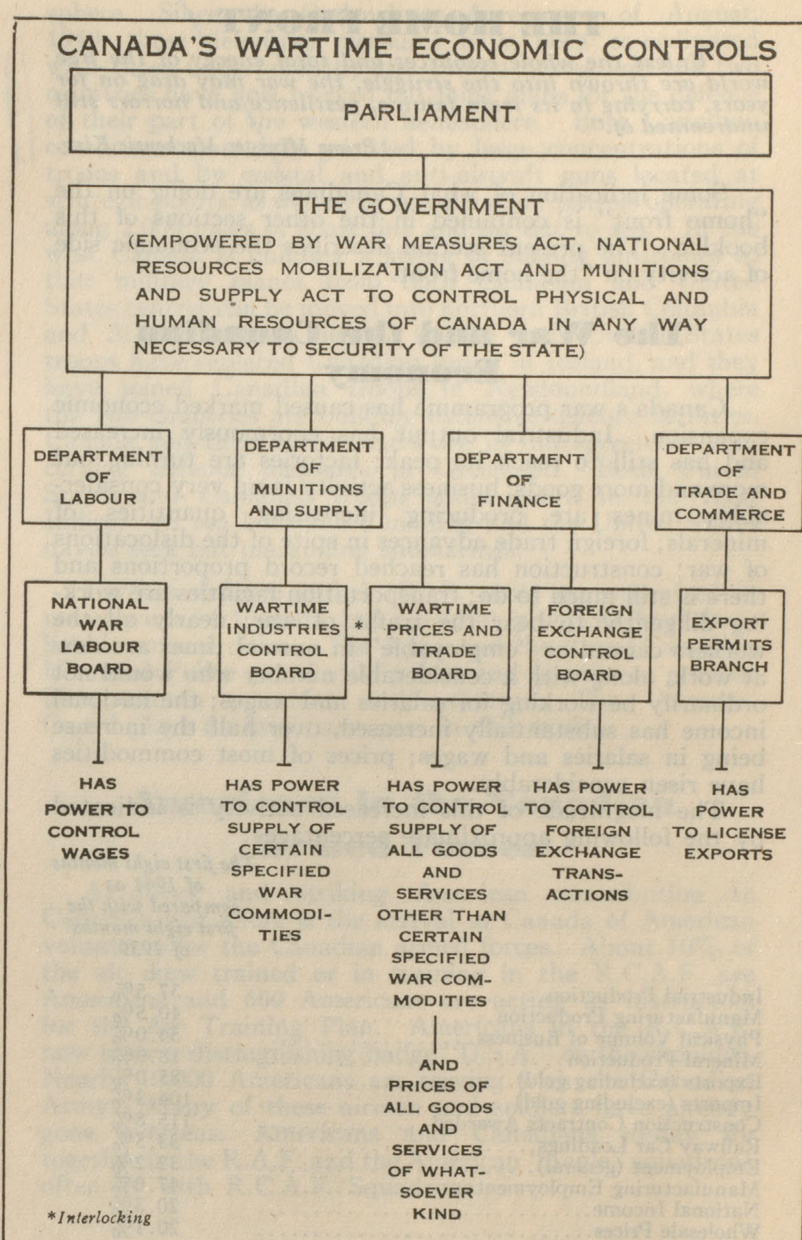
Some indication of what Canadians are doing on the "home front" is contained in the other sections of this booklet. The present section describes the economic side of activity on "the home front."

The War and the Canadian Economy

Canada's war programme has caused marked economic expansion. Industrial output has enormously increased and has still to reach its peak; factories are turning out more and more goods; business activity is up very considerably; mines are producing increasing quantities of minerals; foreign trade advances in spite of the dislocations of war; construction has reached record proportions and there is still much to do; transportation facilities are working diligently to bear the traffic of war; nearly all the workers classed as "employable" in normal times are now at work, along with a considerable number who would not ordinarily be working for salaries and wages; the national income has substantially increased, over half the increase being in salaries and wages; prices of most commodities have risen considerably.

The magnitude of this increased activity is indicated by the following approximate percentages:

	The first eight months of 1941 as compared with the first eight months of 1939 +
Industrial Production	37.5%
Manufacturing Production	40.5%
Physical Volume of Business	34.0%
Mineral Production	18.0%
Exports (excluding gold)	85.0%
Imports (excluding gold)	106.3%
Construction Contracts Awarded	115.8%
Railway Car Loadings	33.5%
Employment (general)	32.2%
Manufacturing Employment	47.0%
National Income	20.3%
Wholesale Prices	20.1%


CANADA'S WARTIME ECONOMIC CONTROLS
PARLIAMENT
THE GOVERNMENT
(EMPOWERED BY WAR MEASURES ACT, NATIONAL RESOURCES MOBILIZATION ACT AND MUNITIONS AND SUPPLY ACT TO CONTROL PHYSICAL AND HUMAN RESOURCES OF CANADA IN ANY WAY NECESSARY TO SECURITY OF THE STATE)
DEPARTMENT OF LABOUR
DEPARTMENT OF MUNITIONS AND SUPPLY
DEPARTMENT OF FINANCE
DEPARTMENT OF TRADE AND COMMERCE
NATIONAL WAR LABOUR BOARD
WARTIME INDUSTRIES CONTROL BOARD
*
WARTIME PRICES AND TRADE BOARD
FOREIGN EXCHANGE CONTROL BOARD
EXPORT PERMITS BRANCH
HAS POWER TO CONTROL WAGES
HAS POWER TO CONTROL SUPPLY OF CERTAIN SPECIFIED WAR COMMODITIES
HAS POWER TO CONTROL SUPPLY OF ALL GOODS AND SERVICES OTHER THAN CERTAIN SPECIFIED WAR COMMODITIES
AND PRICES OF ALL GOODS AND SERVICES OF WHATSOEVER KIND
HAS POWER TO CONTROL FOREIGN EXCHANGE TRANSACTIONS
HAS POWER TO LICENSE EXPORTS
*Interlocking

Economic expansion does not mean that individuals, businesses or the nation as a whole are growing rich because of the war. Business income is subject to a high minimum tax and most of any "excess" profits are taken by the Government. Wages and salaries have been stabilized at prevailing levels, and a general "ceiling" has been placed on prices. Governments are collecting three times as much in taxes as in peace time. Profiteering is "out" in this war, so far as the Canadian Government is concerned.

Moreover, with Canada's war industry now in substantial production, civilian supply of many commodities is becoming limited. Canadians are realizing to an increasing extent the need of placing their material resources at the disposal of those who can best use them for war purposes, and the Government has taken steps to accelerate this diversion, as will be seen from the following pages. R. C. Berkinshaw, Director-General of Priorities in the Department of Munitions and Supply and Chairman of the Wartime Industries Control Board has stated, "It will become necessary to effect further curtailment in consumer goods production and this will necessarily involve sacrifices on the part of all. Non-essential domestic and personal expenditures will have to be curtailed and rigid economy established in the consumption of certain lines of commodities designed for household, family or individual use." Mr. Berkinshaw also stated that rationing of consumer goods will be "largely conditioned by the effort we make now to keep waste down to an irreducible minimum."

Economic Controls

To enable the Government to take all steps necessary to ensure maximum supplies of labour, money and materials for Canada's war industry and to protect the Canadian citizen from the demoralizing effects of inflation, a comprehensive set of wartime economic controls has been set up in Canada. The diagram on the opposite page gives a picture of these controls. The following pages indicate the manner in which these controls operate and describe briefly the major steps which have been taken in each of the spheres in question.

Particularly in the early part of the war, voluntary restrictions, combined with financial measures, played a large part in harnessing the economy. (See pages 38-40 of October issue for a discussion of the reasons for this and pages 43-61 for further details of earlier measures). Such voluntary restrictions are still necessary: indeed, they are, in a sense, indispensable to the success of the comprehensive programme of control now being undertaken by the Government. Nevertheless, as Finance Minister Ilsley has put it, unless we are prepared to allow a substantial inflationary rise in prices, "we must have an effectively planned and operated set of controls which will be deliberately designed to restrict civilian consumption and prevent inflation while attaining the objectives of the war programme." In short, Canada's wartime economic problems are now so widespread that they can only be solved by control which is increasingly mandatory and general. Rising prices, heavier demand for raw materials, more acute transportation difficulties, increasing problems of labour supply—these are among the factors which, combined with the increasing magnitude of Canada's war industry, make more rigid controls necessary.

Labour

Government Labour Policy

The fundamental principles of Canada's wartime labour policy may be summarized as follows: (1) There should be no interruption of work on account of strikes or lockouts. (2) Employees should be free to organize in trade unions free from control by employers or their agents, and to negotiate with employers through their own representatives with a view to the conclusion of a collective agreement. (3) Workers should neither coerce nor intimidate any person to join their organization. (4) Fair wages, working conditions, hours of work and safeguards should be maintained. (5) Hours of work should not be unduly extended and increased output should be secured by using additional shifts. (6) Any necessary suspension of established labour conditions to speed up war production should be effected by mutual agreement and should apply only during the emergency.

Wages

No employer may increase basic wage rates unless authorized to do so by the National War Labour Board on which Government, labour and employers are represented. This permission can only be given in cases where the Board has found the wage rates to be low. The regulation applies to every employer with fifty or more employees and to every building trades employer with ten or more employees. Exceptions are employers in agriculture or fishing, and hospitals, religious, charitable or educational institutions operating on a non-profit basis.

To adjust wages to wartime price levels, it has been ordered that after February 15, 1942, every employer to whom the wage "ceiling" applies must pay a cost-of-living bonus to all employees except those above the rank of foreman. The bonus is to be adjusted every three months in order to give workers an income commensurate with the prevailing cost of living. The cost of living in Canada is now about 14.6% higher than before the war. Over 750,000 employees in Canada are already receiving the cost-of-living bonus.

This wage stabilization plan is linked to the Government's policy of controlling prices (including rents) generally, and of restricting profits. Past experience has shown that prices outstrip wages in an unrestricted wage-price rise. To fix wages, while at the same time fixing prices, is to protect the wage-earner from the harmful effects of this inflationary spiral, and, incidentally, to establish a wage "floor" as well as a wage "ceiling."

Labour Relations

Machinery for the settlement of disputes in war industries has recently established a good record. Many disputes have been settled without formal negotiation by the Government's conciliation service. Also, out of 52 disputes which have recently been referred to the Industrial Disputes Inquiry Commission (set up in July, 1941), 35 have been settled by the Commission and 8 have been referred to a Conciliation Board.

Regulations now in force discourage strikes in war industries. Disputes arising in such industries, if not otherwise settled, must be referred to a Conciliation Board. No strike action may be taken until after the report of the Conciliation Board has been released—and then only if a vote is taken under Department of Labour auspices and a majority of those eligible to vote are found to be in favour of a strike. At the present time there is not a single strike in a Canadian war industry.

Riots, disturbances of the peace or other actions likely to impede or obstruct the production or delivery of munitions of war or supplies or the construction of defence projects are, by Order-in-Council, to be prevented or suppressed, when necessary, by the calling out of the Active Army. So far there has been no need to take action under this order.

On September 13, 1941, Hon. Norman McLarty, the Minister of Labour, said, "I am convinced that the vast majority of our workers are as loyally devoted to the winning of the great cause in which we are now engaged as any other class of citizens in this country. They realize that they, by their production, are fighting in the front line of mechanized warfare."

Labour Supply

Labour supply will ultimately be the most general and difficult shortage faced by Canadian war industry. Hence labour supply problems are receiving close attention from a number of agencies—the National Labour Supply Council, the Labour Co-ordination Committee, the Wartime Bureau of Technical Personnel and the War Emergency Training Programme.

The Wartime Bureau of Technical Personnel has a register of technically trained personnel and encourages the transfer of experts from non-war to war work and the training of men for war jobs in the shops of established plants. At least five of Canada's leading industrial groups (the mining, petroleum, public utilities, textile, and pulp and paper industries) are co-operating in this latter work. The War Emergency Training Programme is training thousands of previously unskilled workers in about 100 technical and plant schools throughout the country. So far about 42,000 have been trained in technical schools; of these 24,000 are industrial workers and the rest have been trained for the armed forces. At least 40,000 workers have been trained in plant schools. About 100,000 are to be trained during the course of this year.

It is estimated that since the beginning of the war there has been an average increase of about 28,000 a month in the number of wage-earners. The number employed in durable goods industries has almost doubled. Many thousands of women are now employed in factories which manufacture shells, ammunition, guns, airplanes and other war equipment. However, only about 60% of the man and woman power that will ultimately be required to carry out

Canada's industrial war programme is now engaged in the production of munitions and war equipment. It is expected that war industries will draw increasingly on peace-time occupations during the coming months, and that more women not normally employed will be entering industrial or commercial work.

Supply

The Wartime Industries Control Board and the Wartime Prices and Trade Board exercise a joint control over the supply of all goods and services. (See page 48.) The major steps which have so far been taken by these bodies, and by other offices of the Government, to divert essential supplies to war purposes, are here indicated.

Priorities

A priorities system applies generally to raw materials and manufactured products. This helps to ensure that war supplies are produced in order of their importance, and to meet shortages or threatened shortages of goods. The informal system of priorities used in Canada has so far operated very satisfactorily and it has not been necessary to establish formal priority ratings.

Reducing Production of Durable Consumers' Goods

(See also pages 54, 61-2, 66).

Manufacturers of radios, refrigerators, stoves, vacuum cleaners, and electric washing machines are cutting their production to 75% of their 1940 output. This has been described by the Controller of Supplies as a "preliminary reduction."

A series of measures has reduced the production of passenger cars in the past six months and even fewer passenger cars are to be produced next year. Production of such cars in 1942, for sale in Canada, will be less than half the 1940 figure. In addition, the number of models will be cut about in half, and accessories reduced to a minimum.

Some idea of the extent to which essential materials will be conserved by such reductions may be gained from the following tabulation of the estimated savings to be effected in the radio industry alone:

Steel	825 tons	Corrugated cartons	250 tons
Copper	85 tons	Resin and	
Brass	30 tons	Vegetable glue	40 tons
Aluminum	15 tons	Ceramics	$1,375,000
Solid Woods	1,550,000 board feet	Ball Bearings	$1,500,000
Veneers	5,400,000 board feet	Paper tubes	$1,375,000
Plywood	105,000 square feet	Glass dials	$ 125,000
Paints, etc.	25,000 gallons	Tubes	$ 750,000

The cut in automobile production is expected to save more than 50,000 tons of materials of all kinds.

Curbing Instalment Buying

Instalment buying and instalment credit transactions have been severely curbed. Instalment purchases of a wide range of articles from radios to engagement rings, stoves to fountain pens, are now subject to drastic restrictions. The down payment must be at least one-third of the total cash price, in any case not less than ten dollars, and the balance must be paid in full within twelve months. For passenger automobiles a down payment of fifty per cent is required, and the balance is to be paid within twelve or eighteen months depending on the cash value of the sale. Payments must be made in equal instalments at intervals of not more than one month. These provisions go much further in restricting consumer credit than the regulations of the United States Federal Reserve Board. Restrictions apply to almost every article for household, sporting, motoring or personal use that is normally bought on the instalment plan.

Purchases on charge accounts are similarly restricted. If an account is in arrears, no further purchases of articles named in the Board's order may be made until the account is cleared.

Instalment credit transactions by banks and other lending institutions are similarly restricted, so that buyers are no longer allowed to make the down payment on one of the articles named in the order with money borrowed from a lending institution; nor may they arrange an extension of credit on instalment purchases by recourse to a lending institution.

Machine Tools

Designs are "frozen" on Canadian manufactures of anything from automobiles to sewing machines in which a change of model would require new tooling. The output of the Canadian machine tool industry was small before the war, but in 1940 it jumped about 800% over 1939, and steps taken this year are further increasing output. Canadian plants have been particularly active in the manufacture of machine tools for gun and shell production. Canada normally imports most of her machine tools from the United States. These imports have increased markedly since the outbreak of war, and import permits are required for privately imported machines. Machine tools can be exported only under license. The "bits and pieces" programme is increasing the number of machine tools being used for war manufacture.

Construction

Construction and repair of buildings costing more than a fixed amount can be carried out only under license and is limited almost entirely to projects essential to the prosecution of the war. The construction industry throughout the past two years has been one of the busiest in Canada. It has erected some 250 entirely new factories, enlarged old ones and built thousands of buildings for the armed forces under the $110,000,000 defence building program. Construction for the armed forces is still proceeding apace, and nearly 5,000 houses of various types are to be built for war workers. Construction is now proceeding on some 3,000 such buildings.

Transportation

Priority has been given to the movement of troops and essential war supplies by rail or water in Canada and on the sea. All Canadian merchant shipping has been placed under Government control. Manning pools to provide experienced merchant seamen at short notice will soon be established.

Electric Power

Electric power supply has been increased in certain heavily industrialized areas. Highly important in this connection are arrangements between Canada and the United States for utilization of a maximum amount of water-power at Niagara. The industrialized areas of Ontario and Quebec, where the demand for power is now extremely heavy, have been on daylight saving time since the spring of 1940.

Oil

Canada is fifth among the oil consuming countries of the world. Domestic production in Alberta has been considerably increased since the outbreak of war and large-scale exploratory work is now being carried out in that province. But at present Canada produces only about 15% of the oil she needs.

Industry and the forces make increasingly heavy demands, and imports have been reduced because tankers have been diverted to Britain. Since July 15, 1941, sale of gasoline and oil to motorists has been prohibited on Sundays and on week days between 7 p.m. and 7 a.m. Since August 25th, the amounts available to service stations have been reduced. In the past two months the cut has been about 20% of normal requirements. This action supplements an appeal for voluntary conservation, which has given results. Restrictions apply in all parts of Canada.

Coal and Coke

The Canadian coal and coke trade is required to operate under license. Canadian coal production has expended considerably since the outbreak of war, and the Dominion has imported increasingly large amounts of both anthracite and bituminous coal. Nevertheless, consumption is heavy and every effort is being made to increase supplies to a maximum.

Coke production has increased but has been largely absorbed by war industries.

Timber

Various steps have been taken to ensure the most economical and efficient use of both Canadian and imported timber. Millions of dollars have been saved by using less expensive woods for many purposes. U.S. dollars have been conserved by the substitution of Canadian for American woods in Canadian construction where possible. In many instances it has been possible to substitute wood for steel, thus saving not only steel but also American dollars Every effort has been made to increase Canadian production of hardwoods and imports of hardwoods from Empire countries. (See also page 30).

Steel and Iron

Production of steel in Canada is to-day about 65% greater than the 1935-1938 average. In the past year both iron and steel have been produced in increasing quantities. These developments may be illustrated by the following figures:

Production	*1st 9 months 1940*	*1st 9 months 1941*	*Increase %*
Steel Ingots and Castings	1,464,000 tons	1,749,000 tons	19
Pig Iron..............	839,000 tons	945,000 tons	13

Despite enlarged capacity, Canada must import substantial quantities of steel from sources outside the Dominion. Such imports must now be confined almost wholly to war requirements. Imports of iron and steel scrap have considerably increased.

Unless authorized by the Steel Controller, steel is delivered only to essential industries. Civilian consumption has been curtailed. Structural shapes have been reduced in number from 267 to 70, and rolling mill schedules must be approved by the Controller, who must also approve all orders for pig iron.

Metals

Not only has mineral (including metal) production increased since the outbreak of war; measures have also been taken to conserve for essential purposes all available supplies of metals which are in demand for defence purposes in Canada, Britain or the United States. Aluminum, nickel, zinc, copper, tin and magnesium are among the metals which are now being restricted to essential uses. (See also page 29).

The extent to which such measures are being successfully applied in the case of three key metals is indicated by the following figures:

	1940		Estimated 1941	
	Essential Use	*Non-Essential Use*	*Essential Use*	*Non-Essential Use*
	%	%	%	%
Aluminum	73	27	98	2
Nickel	60	40	85	15
Zinc	36	64	75	25

Scrap

Use of scrap in industrial manufacture has increased greatly since the outbreak of war. A Scrap Disposal Branch has now been established by the Department of Munitions and Supply. The branch will supervise the disposal of surplus or obsolete equipment and of such materials as shell turnings, gun turnings, brass and copper scrap, and other materials of all kinds created in the manufacture of munitions, as well as packing materials and other waste products.

Chemicals

Chemicals now subject to control include chlorine, glycerine, ethylene glycol (used in making non-alcoholic anti-freezes), formaldehyde, coal tar chemicals and all materials used in the plastic industry.

Miscellaneous

Use of silk, rubber and cellophane for non-essential purposes is restricted. Cork has been designated an essential commodity.

The Necessaries of Life

An adequate flow of the necessaries of life on to the Canadian market has been maintained since the outbreak of war. This has involved many measures to facilitate the distribution of such commodities as sugar, butter, tea, flour and feeds, bread, meat, canned goods, cloth and clothing, hides, leather and wool. Large supplies of these commodities have also been needed for the equipment and upkeep of the armed forces.

Controlling Prices

All goods and services sold in Canada are to be placed under a general price ceiling beginning November 17. Price control is administered by the Wartime Prices and Trade Board. In announcing the plan on October 19th, 1941, the Prime Minister described it as "an experiment hitherto untried on this continent and perhaps, having regard to its breadth and variety, hitherto untried by the will and consent of any free people anywhere."

"In the present struggle", the Prime Minister said, "we expect this year to be devoting some 40% of the national income to the prosecution of the war. . . It stands to reason that all the foods and services we are accustomed to enjoy in peacetime cannot be provided when only a little more than half our energies can be spared to provide them. Most goods and services are becoming increasingly scarce and will become scarcer still. We must face the problem of sharing what is scarce. If we let prices rise unduly, we know what will happen."

The Prime Minister pointed out that rising prices unless controlled impose an unfair hardship on those with small incomes and endanger the economic war effort by creating confusion and uncertainty in industry and trade. They also, he said, tend to produce inflation with all its disastrous wartime and post-war consequences. For all these reasons, he said, "the Government has decided that hereafter prices must be controlled more vigorously than they have been during the first two years of the war." The policy of controlling the prices of individual commodities when and where necessary which was followed during the first two years of the war, is no longer considered adequate to meet "the needs of to-day."

"The upward trend of prices," the Prime Minister said, "has become too widespread and powerful to be checked adequately by controlling the prices of a few commodities. To continue to attempt to control the rise in prices piecemeal, might only serve to augment the very evil it is desired to avoid, by occasioning through fear of the future, a precipitate rise in the prices of those commodities which are not already controlled. The problem is a general problem and it calls for general treatment. It has spread just as the war has spread."

The Prime Minister concluded, "The policy of control as it affects industry, commerce, agriculture and labour, demands a degree of restriction to which Canadians, hitherto, have been quite unaccustomed. It will demand qualities of self-discipline and self-control. It will need, as it deserves, the whole-hearted support of everyone who has the well-being of his fellow-citizens at heart . . . By its policy the Government hopes to avoid the fears, the sense of insecurity, the suffering and the profiteering which the inflation of prices inevitably brings in its train. The measures now being announced should help in the winning of the war, and, after the war, facilitate recovery and reconstruction."

The Wartime Prices and Trade Board has taken steps to place under license Canada's entire food and clothing trade. This licensing plan will provide the machinery for policing prices and for securing information necessary for the allocation of supplies. Regional licensing directors have been appointed.

More than 200,000 businesses, including department stores and country general stores, large hotels and soda bars, live-stock dealers and warehouses, are affected by this vast plan. In terms of the relative populations of Canada and the United States, this would mean the licensing of about two and a half million businesses. The only food and clothing groups exempt are the primary producers.

Controlling Foreign Exchange Transactions

(See also pages 43-45)

Canada's United States Dollar Problem

A supply of foreign exchange, particularly United States dollars, is vital to Canada's war programme. To help to ensure this supply and to perform other necessary functions, the Foreign Exchange Control Board was given the necessary powers at the beginning of the war.

Canada normally sells the Sterling resulting from her Empire trade in order to get American dollars to cover her trade deficit with the United States. But the war has made this procedure impractical. For Britain has needed most of her gold and American dollars for her own war purchases in the United States, and so has not been able to continue to convert Canadian Sterling credits into United States dollars. Moreover, since the beginning of the war, Britain has been able to settle only a fraction of her billion dollar trade deficit with Canada by transfer of gold; and since December of last year no gold has been transferred from Britain to Canada.

At the same time Canada's net deficit with the United States, on both current and capital account, has increased. In 1938, the last full year before the war, it was about $115,000,000. In the year and a half between September 15th, 1939, and March 31st, 1941, it was about $477,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) it will amount to about $467,000,000, less whatever reduction is affected under the terms of the Hyde Park Declaration.

Thus, because of greatly increased war purchases in the United States, Canada, since the beginning of the war, has been faced with a widening differential between the amount of U.S. dollars she needs and the supply she is able to command. For, under the terms of the United States Neutrality Act, Canada's vast war purchases in the United States on her own account must be paid for in cash in United States dollars. And at the same time, because of the financial burden which the war has placed on Britain, the Dominion has been unable to make up her exchange deficit with the United States in the normal peace-time manner.

Conserving United States Dollars

Foreseeing this situation, the Canadian Government took the logical step. It adopted measures to conserve the American dollars in Canadian possession and to increase that supply where possible. Canada has tried to avoid the accumulation of unliquidated obligations during the war which would only make it more difficult to do away with the control after the war. Instead, the Dominion has made every effort to meet her exchange shortages by making her own residents do without things which are not essential. Over a year ago Canada placed a special war-time tax on all imports except those paid for in Sterling. This has substantially reduced the purchase of non-essential imports. In July of 1940, Canada ceased to permit the sale of United States dollars to Canadians for pleasure travel abroad. (Canadians can visit American relatives or friends who provide the U.S. funds for the purpose, and funds are released for urgent reasons—business, education, etc.) The Government did not like to do this, but since a very substantial saving of exchange could be effected it felt that the step was necessary. Finally, about the end of 1940, Canada took the more drastic step of prohibiting the importation of a long list of non-essential consumers' goods. For certain other major items gradual reductions in imports by Canadians were decreed. Such articles include automobiles, radios, cameras, electric fixtures, household appliances and scores of similar products.

Foreign exchange provided in these and other miscellaneous ways, substantially add to the normal supply accruing from the export and tourist trades and help to provide Canada with a pool out of which she may pay for imports, service Canada's debt payable in foreign currencies and cover other necessary external disbursements. In order that Canada may continue to purchase goods in the United States on a scale commensurate with the demands of her war programme, it has been necessary to continue the methods for conserving foreign exchange outlined above, even though the Hyde Park Declaration has established a principle which, it is expected, will result in an easing of Canada's foreign exchange position.

For this reason, among others, Canada this year is especially anxious to attract American tourists to the Dominion. Americans can visit Canada and return without difficulty. They are assured of unique vacation facilities, will enjoy a 10% premium on their money and will have the satisfaction of knowing that every American dollar they spend in Canada will go back to the United States to purchase war supplies for the Canadian armed forces.

Controlling Exports

No goods may be exported to any country outside the western hemisphere (except to a part of the British Empire) without an export permit. In addition, exports of certain commodities, whether they are going to a country in this hemisphere or elsewhere, are prohibited except under license. This is done to conserve strategic materials or products.

Financial Undertakings

Wartime Financial Policy

The main lines of Canada's financial policy during the war have been, first, to pay as much as possible of the costs of war from taxation, i.e. to "pay as you go" as far as possible; secondly, to impose this increased taxation in accordance with ability to pay; thirdly, to avoid inflation; and, fourthly, to time financial action in such a way as to encourage a rapid expansion of production to the maximum, i.e. both to reduce civilian consumption and to provide the funds necessary for the war program.

War Spending

In the first two years of the war Canadians spent a total of about $2,183,000,000 on their own war effort and on aid to Britain.

Canada's total war spending in the current fiscal year (April 1st, 1941, to March 31st, 1942) has been estimated at about $2,350,000,000, the exact amount depending on as yet undeterminable factors. This is about 40 per cent of the total estimated national income of less than $6,000,000,000. It amounts to considerably more than Canada's total war expenditure during more than four years of the last Great War and represents an annual disbursement of about $200 for every man, woman and child in the Dominion.

When war expenditures are added to the ordinary expenses of all Canadian governments, federal, provincial and municipal, Canadian citizens this year will have to give up about fifty cents of every dollar earned to foot the bill. The Dominion Government alone is spending about five times as much this fiscal year as it spent in the last full fiscal year before the war.

Direct War Spending

Canada's direct war spending has increased steadily and momentously. In the first two years of the conflict the Dominion spent approximately $1,278,000,000 on her own war activities. In the period April-September of this year expenditure was more than twice as great as in the corresponding period of last year. (See table on page 67).

Since June, expenditure has been running at the rate of nearly $4,000,000 a day—about five times as fast as during the first six months of the war. It is expected that direct war expenditure in the current fiscal year (April 1st, 1941, to March 31st, 1942) will be approximately $1,450,000,000 nearly twice as much as the amount spent in the previous fiscal year.

Financial Aid to Britain

In addition to this direct expenditure on her own war requirements, Canada spent $905,000,000 in the first two years of the war to provide Britain with Canadian dollars. (See also page 29). The net amount which Canada expects to provide for this purpose in the present fiscal year, which ends on March 31st, 1942, amounts to at least $900,000,000, all the Canadian dollars Britain will need.

Taxes

(See also item on taxes on page 3.)

This fiscal year the Dominion Government is collecting about three times as much in taxes as it collected in the last full fiscal year before the war.

Pre-war taxes have been increased and new taxes imposed. The following figures indicate the increase in tax revenue since the outbreak of war.

Total Revenue from Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42, for Full Fiscal Year*
$468,271,000	$778,290,000	$1,369,310,000

Taxes on Income, Etc.

Direct taxes of all kinds will raise more than five times as much this fiscal year as they did in the last full fiscal year before the war. Income tax rates were raised in June, 1940, and again in April, 1941. The graduated rates now begin at 15%, compared with 3% before the war. Exemptions have been lowered as well. In June, 1940, a National Defence Tax was imposed on practically everyone receiving salary or wages. The rates were 2% for a married person and 3% for a single person. In July, 1941, these were raised to 5% and 7% respectively. The combined effect of these moves has been to increase the amount of tax on personal income and the number of persons paying income tax very considerably. Five times as many people as before the war now pay income taxes of all kinds, and married persons with incomes of from $3,000 to $10,000 pay from eleven to four times as much income tax as before the war.

A table showing how income tax has increased in the past year because of war is on page 71.

Immediately after the outbreak of war in September, 1939, an excess profits tax was announced. The operation of this tax, combined with increases in corporation taxes, have now advanced the minimum rate of corporation tax to 40%. This is a very much higher rate than that prevailing before the war. Increase in corporate profits over the standard pre-war rates are subject to a tax of 79½%. This is about the same rate as that now in force in Britain. This tax ensures that if any company does increase its profits because of war conditions, the Dominion Treasury will derive nearly all the benefits.

Another measure to increase direct tax revenue which has been imposed since the outbreak of war, is the levying of a Dominion Government succession duty, in addition to the succession duties already imposed by the Provinces.

In order to spread the tax load as fairly as possible through all sections of the country, an arrangement is being worked out with the Provinces which will centralize income and corporation tax collections.

The extent to which all these moves have increased direct tax revenue is indicated by the following figures.

Total Revenue from Direct Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42 for Full Fiscal Year*
$136,910,000	$274,690,000	$732,000,000

Customs and Excise Taxes

Before the war the Dominion Government secured indirect tax revenue from customs duties and a sales tax on a variety of commodities and also from excise taxes on automobiles, tires and tubes, liquor, beer and malt, wine, cigarettes, cigars, tobacco, matches and cigarette lighters, playing cards, cosmetics and toilet preparations, sugar, glucose and corn syrup, and long-distance telephone calls.

These taxes, with the exception of the sales tax, have been substantially increased since the outbreak of war. Increases in customs duties have also been effected. More than a year ago a war exchange tax was placed on a wide variety of imports, including automobiles and scores of durable consumer's goods. This tax now applies to a very wide assortment of "non-essential" imports.

In addition to increases in existing indirect taxes, new taxes have been imposed since the outbreak of war on the following—radios, cameras, phonographs, vacuum cleaners, washing machines, electric toasters and other household appliances, soft drinks, gasoline, travel fares on trains, buses and airplanes, entertainment such as movies, concerts, sports events, horse racing, etc., and race track bets.

Indirect taxes now raise about twice as much revenue as they did before the war. The following figures indicate the steady rise in indirect tax revenue in the last two years:

Total Revenue from Indirect Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42 for Full Fiscal Year*
$331,361,000	$503,600,000	$637,310,000

War Loans and Savings

Since the outbreak of war the Dominion Government has borrowed about $1,470,000,000 from the public and from domestic financial institutions other than banks. This money has been raised by the floating of three war loans and by the issue of war savings and non-interest-bearing certificates to the public. About one in every thirteen Canadians, including men, women and children, subscribed to the 1941 Victory Loan, which raised more money than the 1918 Victory Loan—Canada's largest loan during the last war. Interest on Government bonds has been held at a low rate, and there are no tax-free war bonds. Late in October, applications for war savings certificates amounted to about $94,000,000, and more than $7,000,000 had been invested in non-interest-bearing certificates. War savings certificates have a face value of from $5 to $100 and may be purchased by the accumulation of 25c war savings stamps.

The amount of bank borrowing by the Dominion Government has been cautiously limited.

The "Pay-As-You-Go" Policy

The total amount which the Federal Government will have to raise for war and ordinary purposes in the present fiscal year is estimated to be about $2,820,000,000. Of this amount taxes and non-tax revenue will provide about $1,500,000,000, in the actual fiscal year ending March 31, 1942—about $100,000,000 more than was estimated in the budget, brought down late in April, 1941.

The following table summarizes estimated revenue and expenditure in the current fiscal year in round figures:

Expenditure		%
Total	$2,820,000,000	100
Total War Expenditure	$2,350,000,000	83
Direct war	$1,450,000,000	51
For Britain	$ 900,000,000	32
Ordinary Expenditure	$ 470,000,000	17

Revenue		%
Total Needed	$2,820,000,000	100
Estimated Revenue	$1,500,000,000	53
To be met by funds borrowed from people	$1,320,000,000	47

In estimating the extent to which the Government is adhering to a "pay-as-you-go" policy, it should be remembered, however, that funds advanced by Canadians to Britain now are covered by the accumulation of Sterling balances; and repatriation, while it must be paid for now by Canadians, is not a drain on capital. Direct war and ordinary expenditures will total about $1,920,000,000; revenue will be about $1,500,000,000. On this basis, the 1941-42 budget provides for the payment of about 78% of total Federal expenditures (including ordinary disbursements and expenditure on Canada's own war programme) out of revenue. Revenue will cover expenditures on Canada's own war programme. During the first six months of the present fiscal year revenue exceeded expenditure by some $18,000,000, viz:

	April 1–Sept. 30, 1940	*April 1–Sept. 30, 1941*
Direct war expenditure	$238,000,000	$498,000,000
Total ordinary and direct war expenditure	441,000,000	678,000,000
Revenue	383,000,000	696,000,000
Excess of expenditure over revenue	58,000,000	—
Excess of revenue over expenditure	—	18,000,000

CANADA "LEND-LEASES" TO BRITAIN

During the first two years of the war, apart from British goods sent to Canada, Britain needed more than a billion dollars to cover her purchases in the Dominion.

Britain paid less than a quarter of this sum in gold, but Canada had to send more gold than this to the United States in order to fill her British orders. Canadians supplied the rest—$905,000,000.

During the present fiscal year (April 1st, 1941, to March 31st, 1942,) Canada will export goods and war equipment to Britain to the value of $1,500,000,000. Canadians will provide Britain with all the Canadian dollars she will need to finance these purchases.

The Dominion, it is clear, is not demanding "cash on the barrel-head" for her aid to Britain.

CANADA PAYS CASH FOR AMERICAN SUPPLIES

Canada has bought increasingly large amounts of war supplies in the United States. In 1939 her imports from the United States were valued at $497,000,000. In 1940 they soared to $744,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) they are expected to reach $953,000,000. Of this amount at least $428,000,000 will be spent on war supplies, some of which will be materials and parts to be manufactured in Canada for Britain. The latter are being transferred to Britain via Canada under the lend-lease plan. But Canada, herself, is not obtaining supplies under the plan. She pays cash for her own purchases in the United States.

CANADA SENDS TROOPS OVERSEAS

Canada has sent more than 100,000 volunteer soldiers, sailors and airmen overseas. By the end of this year Canada will have four army divisions, one of them armoured, and a tank brigade overseas; the number of Canadian airmen overseas will be equal to a division of infantry; and Canadian naval vessels will play, as now, an increasingly effective part in the war at sea.

CANADA DRAFTS MEN FOR HOME DEFENCE

Canada is now drafting men 21 to 24 years of age, who have not already joined one of the forces, for home defence for as long during the period of the war as the Government requires them. During their four months' basic training they are given an opportunity to volunteer for service anywhere with the Navy, Army or Air Force. Of those who have so far been drafted, a large number have volunteered. The rest are being posted to the Active Army on Home Defence for full-time service. Postponements have been granted to key workers in war industries, and in a few other cases where it was in the public interest to do so.

Thus, men aged 21 to 24 are being called for full-time service with the armed forces at home, or abroad if they volunteer for such duty. By law, all men aged 19 to 45 who were single in July, 1940, are liable to be so called.

SOME OF THE WAR'S EFFECTS ON CANADIAN CIVILIANS

They—pay three times as much in taxes as they did before the war

—have loaned the Government since the outbreak of war a sum of money equal to the total to be collected in taxes during the present fiscal year

—are voluntarily contributing millions of dollars to war charities

—face 14.6% rise in the cost of living since the outbreak of war

—have had wages and prices stabilized under general "ceilings"

—can get no new models in automobiles, radios, etc., till the end of the war, where such models require new tooling

—will have less than half as many new automobiles on the market in 1942 as in 1940

—have had domestic production of radios, washing machines, vacuum cleaners, stoves and refrigerators cut by 25%

—can now make "instalment" purchases only on very strict terms

—can get only very limited supplies for "non-essential" purposes of machine tools and of essential materials such as iron, steel, aluminum, nickel, zinc, copper, tin, rubber, silk, cellophane and certain chemicals

—cannot buy gasoline or motor oil on Sundays or between 7 p.m. and 7 a.m. on week days and have had supply of gasoline and oil for motoring cut 20%

—can erect no new building or additions costing more than a fixed amount unless they are approved as necessary

—can purchase only a few "non-essential" products from the United States, in order that war materials and equipment may be bought there in increasing quantities

—cannot get funds to travel in the United States, except for urgent reasons, cannot hold foreign exchange and cannot export capital

—have been asked to eat less of certain foods in order that more may be sent to Britain

—are being urged to save all salvable waste material and to conserve perishable foodstuffs.

HOW THE WAR HAS INCREASED INCOME TAXES IN CANADA AND THE UNITED STATES

Both Canada and the United States have greatly increased their income taxes to pay for national defence. The following table illustrates the extent to which incomes are now being taxed in these North American countries:

Tax to be Paid on This Year's Income in the United States and in Canada by a Married Couple with No Dependents.

Income	UNITED STATES Income Tax	CANADA Income Tax	CANADA Total Including National Defence Tax*
$ 1,600	$ 6.	$ 15.	$ 71.
3,000	138.	250.	355.
5,000	375.	750.	925.
10,000	1,305.	2,580.	2,930.
20,000	4,614.	7,330.	8,030.
50,000	20,439.	24,485.	26,235.
100,000	52,704.	56,895.	60,395.
500,000	345,084.	376,140.	393,640.

*Levied on total income without deductions. (See also page 64).

No. 7

CANADA AT WAR

A Summary of CANADA'S PART IN THE WAR

Revised to October 1st, 1941

THIS booklet is intended to serve as source material for speakers and for those who desire up-to-date information about Canada's participation in the war. It is revised and issued monthly and contains the most recent available facts and figures.

Further copies of the booklet may be obtained by writing to the Director of Public Information, Ottawa. Those who wish to be placed on a mailing list to receive the booklet monthly should apply to the Director.

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SOME SALIENT FEATURES OF CANADA'S WAR EFFORT EXPRESSED IN TERMS OF UNITED STATES POPULATION OR NATIONAL INCOME

Canada's population is about 11,500,000, the United States' about 130,000,000. It is estimated that the national income of Canada in the present fiscal year will be something less than $6,000,000,000 and that the national income of the United States will be something less than $90,000,000,000. A true picture of the war effort of any country can only be obtained when that effort is considered in relation to potential resources. For the convenience of United States readers, therefore, the following salient features of Canada's war effort are presented in round figures, in terms of United States population or national income. Figures relating to man-power are translated in terms of population, figures relating to money in terms of national income.

	Canada	In United States Terms
Number of men in navy	25,000	282,500
Number of men in army	230,000	2,599,000
Number of men in air force	83,000	937,900
Sailors, soldiers and airmen overseas	100,000	1,130,000
Money spent on war (first two years)—including financial aid to Britain	$2,183,000,000	$32,745,000,000
Money being spent on war this fiscal year (April 1, 1941, to March 31, 1942) — including financial aid to Britain	$2,350,000,000	$35,250,000,000
Cost to Canada of British Commonwealth Air Training Plan (for three years)	$ 531,000,000	$ 7,965,000,000
Value of Canadian products, including war supplies and equipment, sent to Britain in first two years of war	$1,071,000,000	$16,065,000,000
Value of Canadian products to be sent to Britain during present fiscal year	$1,500,000,000	$22,500,000,000
Estimated amount of Federal revenue in present fiscal year	$1,500,000,000	$22,500,000,000
Money loaned to Canadian Government by Canadian people since outbreak of war	$1,470,000,000	$22,050,000,000
Voluntary contributions to war charities since outbreak of war	$ 27,000,000	$ 405,000,000
Total value of contracts placed and commitments made by Department of Munitions and Supply on Canadian and British account	$2,400,000,000	$36,000,000,000

HOW THE WAR HAS AFFECTED TAXATION IN CANADA AND THE UNITED STATES

Both Canada and the United States have greatly increased their income tax to pay for national defence. The following table illustrates this increase:—

Tax on income paid in the United States and in Canada by a married couple with no dependents.

Income	Tax Paid on Last Year's Income		Tax Paid on This Year's Income	
	United States	Canada	United States	Canada
$	$	$	$	$
1,600	—	6.	6.	15.
3,000	31.	135.	138.	250.
5,000	110.	455.	375.	730.
10,000	528.	1,870.	1,305.	2,580.
20,000	2,336.	5,910.	4,614.	7,330.
50,000	14,128.	20,610.	20,439.	24,485.
100,000	43,476.	49,520.	52,704.	56,895.
500,000	330,156.	347,235.	345,084.	376,140.

To the figures for Canada given above should be added the Canadian National Defence tax which is 3½% for the present year for a married couple. This tax is levied on the total income without deductions. (*See also pages 64-65.*)

FOREWORD

Servitude or Freedom?

From now on, let free men everywhere face reality. Let them recognize that it is something infinitely greater than the fate of any country which they are called upon to defend; that it is the defence of freedom not of any country, not of any continent, nor, indeed, of any hemisphere, but that it is the freedom of mankind which is at issue. Mankind cannot continue long half slave and half free. A world, half slave and half free, is the position that confronts the nations to-day.

Two years of war have served not to lessen but to increase the magnitude of the conflict. Whatever the outcome in Russia may be, it should be realized that the power, the skill and the resources of the enemy are so great that the slightest relaxation of effort in any direction would be fraught with the greatest of risks for all. Let us never forget the size and the power of Germany's war machine, and that while German forces fight on distant fronts, Germany herself and the countries controlled by Germany continue to manufacture the equipment and munitions needed to effect the necessary repairs and to keep her armed forces at the highest state of efficiency.

The President of the United States, in the latest of his great pronouncements, did not hesitate to say: "It must be explained again and again to people who like to think of the United States navy as an invincible protection, that this can be true only if the British navy survives. That if the world outside the Americas falls under Axis domination, the shipbuilding facilities which the Axis powers would then possess in all of Europe, in the British Isles and in the Far East would be much greater than all the shipbuilding facilities and potentialities of all the Americas—not only greater, but two or three times greater."

I said in London that nothing in recent months had been more significant than the recognition of the deepening interdependence of the British Commonwealth and the United States. This growing sense of interdependence has arisen because, while, albeit at the sacrifice of assistance to other nations, the British Commonwealth and the United States might each for itself be able to resist invasion and conquest, each is coming to realize that neither acting alone could destroy a military machine such as Germany already possesses, and is in a position further to strengthen. Without the common action of both, the present war might well drag on for years, and the world be reduced to a condition of chaos which will make decisive victory, not to mention reconstruction, impossible.

Canada's task is to play her part in saving humanity from a descent into universal chaos. In order speedily to accomplish that task, the total effort of all free men is needed. We in Canada can make no more effective appeal to free men throughout the world than the appeal of our own example, as a people still removed from the heart of the struggle, yet putting forth our utmost effort.

How much, when it is over, may be left of what is worthwhile in the world, no one can say. That is why I believe it is vital to make a supreme effort now to convince the people of Germany that they never can hope to win. Such a supreme effort can be made only if every nation and every man, who is still free, put forth their utmost effort. "The length of the ordeal through which humanity must pass", to use words employed by President Roosevelt a night or two ago, "the extent of the wastage of human life, the chance for reconstruction, ere mankind encounters something in the nature of world chaos, all alike wait upon what it is possible for men who are still free to do here and now."

Prime Minister Mackenzie King in a Radio Address to the People of Canada on September 17th, 1941.

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GENERAL SUMMARY

"King George VI of England did not ask us to declare war for him: we asked King George VI of Canada to declare war for us."

L. W. Brockington, Official Recorder of Canada's War Effort, in a Speech at Toronto on September 18th, 1941.

"The war effort of Canada during this war, happily, has not so far required effusion of blood upon a large scale. But that effort, in men, in ships, aircraft, air training, in finance, in food constitutes an element in the resistance of the British Empire without which that resistance could not be successfully maintained."

Winston Churchill, Prime Minister of Great Britain, in an Address at the Mansion House, London, on September 4th, 1941

Canada has entered her third year of war. In September, 1939, four days after Britain began hostilities, the Canadian Parliament assembled and the Government announced that it advocated placing Canada in the war at the side of Britain and her Allies. The Dominion was completely at liberty to make war or to abstain from making war, and it was Parliament's duty to decide whether or not to support the Government in its decision. After the proposal had been freely discussed for two days, the Government was accorded Parliament's support by a nearly unanimous division, and on the following day, September 10th, 1939, the King, at the request of the Canadian Government, declared that a state of war existed between Canada and Germany. When Italy began hostilities on June 10th, 1940, Canada at once declared war on her.

Two years ago the Dominion was a relatively weak military power.

"The first year of war," said Hon. J. L. Ilsley, Minister of Finance, on September 18th, 1941, "was one of disaster and disillusionment. We and the other democratic nations who entered it were not fully prepared for it—no one, in fact, was fully prepared except the enemy who had been planning a campaign of conquest for many years, and had forced the German nation to bend all its energies to forging weapons of aggression. Moreover, the Allied Chiefs of Staff made the profound mistake of visualizing this war as one primarily of static defence and economic blockade. Before that fateful first year was over, we had learned what prodigious striking force the enemy had created, and how inadequate were not only our preparations for modern war, but also our military strategy. The fall of France was a major catastrophe in itself and vastly altered the character of the war, giving the enemy great strategic advantages. All the plans of the democratic nations had to be revised, indeed revolutionized.

"Canada had entered the war with decision and clear-headed courage. During this year we had to plan and organize our war effort. By its close we had many of our own forces in Britain or British waters, we had set about a far-reaching programme of military expansion, we had commenced to build a large war industry, and the Commonwealth Air Training Plan was well under way. We were all hopeful, but still conscious of the overwhelming superiority of the Nazi war machine—still fighting an uphill defensive fight and hoping for time in which to build up our offensive strength.

"The second year of war has given us more room for hope, but none for complacency. It opened with the air battle of Britain, in which those daring men of the R.A.F. saved the fortress of civilization—civilization itself. Our confidence grew with the victories over the Italians, but false optimism was soon dashed to the ground by the German successes in Jugoslavia, Greece, Africa and Crete, and gave way to searching self-criticism. In the meantime, our hopes for ultimate victory were immeasurably strengthened by the passage of the Lease-Lend Act, the increasing mobilization of the economic power of the United States on our side, and finally, that fateful decision, for whatever reason, of the Nazi war lords to attack Russia. As the second year of war ended, there was still in progress, after more than two months of amazing destruction, that gigantic battle in which perhaps eight millions of men are locked in death struggle on a 2,000-mile front from Leningrad to Odessa—a battle that will surely rank as the greatest of all history.

"For us here in Canada the second year was one of action as well. An active army of 230,000 men has been recruited and trained and much of it despatched overseas. Our Navy has taken a vital part in the unceasing battle of the Atlantic. Our men have fought in the air over England. The Commonwealth Air Training Plan has been rushed to practically full scale operation, far ahead of schedule. We have carried nearly to completion the building of a great new war industry—far beyond anything ever dreamed of in Canada before. We have produced large supplies of food, of raw materials and of many types of war equipment for our own forces and for Britain. We have begun to hit our stride."

Two years of war have indeed wrought significant changes in Canada. Here are some approximate figures which indicate the extent to which a nation organized for peace has mobilized its resources for war:

	September, 1939	*September, 1941*
Total number of men in active armed forces	11,000	338,000
Percentage of national income allocated for defence	1.4%*	40%
Contracts placed and commitments made for munitions and supplies in Canada by Canadian and British Governments	$35,000,000	$2,400,000,000

*About $64,500,000—the largest sum ever allocated for defence in Canada in peace time. During the years 1936-39 steps were taken to modernize the armed forces and to prepare measures for the defence of Canadian territory.

Reviewing the general war situation and the extent of Canada's effort to date, Mr. Ilsley expressed the point of view of the average thinking Canadian when he said on September 18th, 1941:

"We have more and more reason to believe in ultimate victory, if all of us work to achieve it—if we make the best use of our men, our materials and our intelligence. We have indeed a solid basis for confidence. But this I cannot too strongly emphasize—it would be false and dangerous optimism to think the end is near or that Victory is assured whatever we may do. Let us not delude ourselves—the road ahead is long and hard, victory has still to be won from the most powerful of enemies, and we of the British Commonwealth cannot devolve the burden that is ours upon the people of any other nation or nations."

Canada is in full agreement with Britain on plans for the conduct of the war for the immediate future. When in Britain in December 1940, to consult with British authorities, Hon. J. L. Ralston, the Minister of National Defence, assured the British Government that "Canada has only one subject—a full-out contribution with everything Canada has and as fast as she can give it." Canada is continually adding to the strength of her overseas forces, and is prepared to have them go wherever their services may be required. Speaking at the Mansion House in London, on September 4th, 1941, Prime Minister Mackenzie King said, "You all know how eager our Canadian soldiers are for action against the enemy. I cannot make too clear that the policy of the Canadian Government is to have our troops serve in those theatres where, viewing the war as a whole, it is believed their services will count most." And, speaking for the average Canadian citizen, he said, "We have been inspired by the undaunted courage and unshaken faith with which millions of ordinary men and women have faced destruction and death. We in Canada cannot all share your dangers, but we are proud to share your burdens. We are determined to share them to the utmost of our strength."

CANADA'S ARMED FORCES

"They are too near to be great but our children will know how and why our fate was changed and by whose hand".

From a tribute to the Canadian Corps, 1914-18, carved in the Memorial Chamber, Parliament Buildings, Ottawa.

Apart from the Reserve Army, Canada's armed forces (Navy, Army and Air Force) now number about 338,000 men. Of these over 100,000 are overseas. In addition, some Canadians are serving with British forces.

The Navy

"Seek out and engage the enemy".

Naval Standing Order.

The Royal Canadian Navy has grown speedily, as is indicated by the following figures:

	Pre-war	*To-day*
Active service strength	1,800	25,000
Ships	13	About 300

The Navy consists chiefly of small ships—destroyers, corvettes, mine-sweepers, patrol boats, converted yachts, and a fleet of smaller craft suitable for coastal work. It has, in addition, three merchant cruisers of considerable tonnage.

R. C. N. personnel is the nucleus of Canada's Navy, but since the outbreak of war Volunteer Reservists have been mobilized and enlisted in increasing numbers. They now constitute the largest proportion of the Navy's strength. Most of them are landsmen who for the first time are learning the craft of the sea and the lore of ships. R.C.N.R. personnel, experienced men from the merchant service, have also been enlisted by the Royal Canadian Navy, and on the Pacific Coast the Fishermen's Reserve is doing a quiet but important job. Some forty fishing craft with their crew have "joined up" for the duration.

Volunteers for the Royal Canadian Navy continue to be taken on at a steady rate. By March of next year its strength is expected to be at least 27,000 men and 400 ships.

Work of The Navy

Canada's sailors are manning Canadian naval ships which daily take part in the Battle of the Atlantic and in operations in almost every theatre of naval warfare. Canadian destroyers, which have operated on both sides of the Atlantic, average twenty to twenty-five days a month at sea. The Canadian Navy has played a very important part, since the outbreak of war, in the convoying of Canadian and American supplies to Britain. Since September 16th, 1939, when the first group of convoyed ships left an eastern Canadian port, Atlantic shipping carrying a total of more than 35,000,000 tons has been convoyed by the Royal Canadian Navy, in co-operation with the Royal Navy. This has involved the most careful organization of the Naval Control Service on Canada's east coast—a factor of vital importance to the maintenance of supply lines from America to Britain. Speaking in Bermuda on September 27th, 1941, Col. Frank Knox, Secretary of the United States Navy, said that the Canadian Navy is doing "a very outstanding job" in the defence of North American sea approaches and added that it had been "a very considerable help to the whole problem of transport."

In addition to convoy work, ships of the Royal Canadian Navy have performed a variety of duties. They have captured enemy vessels, caused others to be scuttled, sunk enemy submarines, effected rescues and assisted in the evacuation of beleaguered troops.

This work has not been carried out without loss. H.M.C.S. "Fraser" was sunk on a misty night in June, 1940, during the course of operations off the coast of France. Ships were running without lights to avoid danger of enemy attack, and "Fraser" was cut in two by a much larger ship. H.M.C.S. "Restigouche" rescued most of her crew. H.M.C.S. "Margaree", on convoy duty, suffered a similar fate somewhere in the Atlantic in the autumn of 1940, and most of her crew were lost. The most recent loss suffered by the Royal Canadian Navy was the sinking of H.M.C. corvette "Levis" "by enemy action", which was announced on September 27th, 1941. Because of the need for secrecy concerning naval operations, no details were disclosed by Naval Headquarters beyond the fact that 17 of her crew were lost. The Navy has lost a total of five ships.

About 600 Canadians are serving with the Royal Navy or are in training at Royal Naval establishments.

In addition to its work in British and other non-Canadian waters, the Royal Canadian Navy has successfully protected the Dominion's shores and ports. Its ships patrol Canada's coasts day and night. This work too has its hazards. For example, in October, 1940, storm caught the minesweeper "Bras d'Or" somewhere in the Gulf of St. Lawrence and she was lost with all hands.

Canadian naval shore establishments also play their part. In key centres naval officers carry on the complex business of naval plans and operations, linking the Dominion's activities to the world-wide operations of the Empire's naval forces and performing the multitude of exacting tasks which must be carefully executed if Canada is to play her full part in protecting the Empire's commerce.

The Army

"The Canadian Corps is a dagger pointed at the heart of Berlin".

Lt-Gen. A. G. L. McNaughton,
Commander of the Canadian Corps in Britain.

The Canadian Army has expanded greatly since the outbreak of war as is indicated by the following figures:

	Pre-war	*To-day*
Active Army	4,500	230,000
Reserve Army	55,000	170,000

Strength of the Canadian Active Army

The Canadian Active Army is a body of some 230,000 volunteers who have enlisted for service anywhere for the duration of the war and for as long thereafter as the Government may require them.

It will shortly have the greatest divisional strength in its history—a total of six divisions. During the first Great War Canada raised five divisions, but the fifth was broken up for reinforcements. Nearly all the infantry for the Sixth Division is already mobilized, and artillery, engineers, signals and other technical units are being drawn from the Reserve Army.

The Canadian Army is continuing to enlist volunteers.

The Canadian Active Army on Home Defence

Canada drafts single men, aged 21 to 24, who have not already joined one of the active armed forces, for full-time home defence duties with the Active Army. During their four months' period of preliminary training, "draftees" are given an opportunity to volunteer for active service wherever required with the Navy, Army or Air Force. Those who do not volunteer for such service are posted to home defence duties for as long during the duration of the war as the Government sees fit. These men constitute the Canadian Active Army on Home Defence and release volunteers already on active service in Canada for overseas duty.

Compulsory military training was announced in Canada in June, 1940. In that month the National Resources Mobilization Act was passed. It gave the Canadian Government power to require "persons to place themselves, their services and their property" at the disposal of the country whenever this "may be deemed necessary or expedient for securing the public safety, the defence of Canada, the maintenance of public order, or the efficient prosecution of the war." This power, however, "may not be exercised for the purpose of requiring persons to serve in the military, naval or air forces outside of Canada or the territorial waters thereof."

The first group to be given thirty days' basic training under the authority of this act, went to camp in October, 1940. In the succeeding months about 87,000 men were so trained. About 20,000 of these joined the active forces; the rest were posted to the Reserve Army for part-time training. In February, 1941, the period of preliminary training was increased to four months; in March, the first four-months class went to camp; and shortly afterward it was announced that "draftees" would be kept indefinitely in the Army.

All single men and widowers without children, aged 19 to 45, are by law liable for military service in Canada. At present the Canadian "draft" is calling up the 21-24 age group. Only men in first-class physical condition are selected and provision is made for postponements in a few very special cases where it is in the public interest that they should be granted. Men not selected at their first call are still liable for service and may be called at any time. To September, six monthly classes totalling about 23,000 had been selected. A large number of these men have volunteered for service anywhere with the Navy, Army or Air Force.

Strength of the Canadian Reserve Army

The Canadian Reserve Army constitutes a pool of partially trained men from which volunteer reinforcements for the Active Army may be drawn. It is also to perform "an operational role in defence of Canada when required" and give "aid to the civil power in case of subversive or other disturbances." It numbers about 170,000 men; of these about 67,000 are men who have been given thirty days' compulsory military training and then posted to reserve units for part-time training. These men are now steadily being called for full-time home defence duties, unless they volunteer for overseas service. The remainder of the Reserve Army are volunteers. Members of the Reserve Army train for a specified number of hours each week, and at camp in the summer, and at the time same carry on with their civilian jobs. Because of the nature of the work which the Reserve Army is designed to perform, the age limit is now 50, compared with 45 for the Active Army.

The Active Army in Canada

Units of the Active Army in Canada guard the Dominion's coasts and vital areas. Others are training in some sixty establishments scattered throughout the country.

While first consideration has necessarily been given to the equipping of Canadian overseas forces and to sending material to Britain, the Canadian Army at home is steadily being fully equipped.

The Army Overseas

A Canadian Army Corps, consisting of three divisions, an Army Tank Brigade and ancillary troops, and numbering scores of thousands of men, is in the British Isles. These troops guard vital sectors. Other Canadian soldiers are in Newfoundland, the British West Indies and Gibraltar. Until their recent removal for service elsewhere, Canadian troops for many months helped to garrison Iceland, where they played an important part in building the defences of that strategic island.

The First Canadian Division landed at a British port on December 17th, 1939, and was quickly followed by other troops, until, by February, 1940, there were approximately 25,000 Canadian soldiers in Britain. This number has been increasing steadily ever since.

In April, 1940, a Canadian component was detailed to take part in a frontal attack on Trondheim, Norway. This component, composed of picked units and commanded by a specially selected officer, moved off on April 18th to the port of embarkation in Scotland. However, after arrival there, the operation for which they had been detailed was cancelled, and the troops returned to camp.

In May, 1940, the First Canadian Division was selected to restore the communications of the B.E.F. with the Channel Ports. On May 23rd and 24th, while the Canadian Commander, Lieut.-Gen. A. G. L. McNaughton, was carrying out a reconnaissance in France, the troops started for embarkation points. However, as a result of the reconnaissance, the War Cabinet decided that the existing military situation would have to be dealt with by the men and guns which were in France, time for moving troops with the necessary heavy equipment to the critical points not being available. The operation was accordingly cancelled.

On May 26th another proposal was made to use the Canadian troops in France. Units were entrained and ready to move to the port of embarkation, but it was decided that landing more men on the French coast would not contribute to the salvation of the B.E.F.

In June, 1940, the First Canadian Division was detailed as part of the new B.E.F. which was formed after Dunkirk, in order to support the battered French Armies in the region of the Somme. However, only one infantry brigade, with some artillery and attached technical units, actually landed at Brest. These troops immediately proceeded towards the battle front, and some were at Sable-sur-Sarthe, more than 200 miles from Brest, and close to the divisional concentration area, when they received orders to retire. Thus, after less than forty-eight hours in France, these troops were necessarily withdrawn to England because of the deterioration of the general situation in France.

In September of this year Canadian, British and Norwegian forces under Canadian command effected a landing at Spitzbergen. The main purpose of the expedition was to prevent the Germans from utilizing Spitzbergen with its rich coal mines for their own war purposes. No enemy interference was encountered, and the force carried out its mission successfully.

In between these expeditions, and up to the present time, Canadian formations have occupied vital sectors in Britain's front line and acted as striking forces in reserve, ready to launch a counter-blow against any invading force that might succeed in getting through the coastal defences. Canadian units take their turn on coastal duty, work on the coast defences at many points, maintain communications, dispose of unexploded bombs, build strategic roads, and help to exploit the timber resources of the British Isles. The Canadian Corps has been kept in Britain thus far because the British Government considers it an essential factor in the defence of Britain, which is of paramount importance to the Empire and its Allies. On September 4th, 1941, speaking at the Mansion House, London, Winston Churchill, the British Prime Minister, said of the Corps, "There they stand, and there they have stood through the whole of the critical period of the last fifteen months—at the very point where they would be the first to be hurled into a counter-stroke against an invader." In the meantime, every opportunity for increasing the Corps' efficiency and high state of training is eagerly seized upon—in preparation either for an invasion attempt by the Germans or for an attack in force on the continent, to the ultimate need for which Lt.-Gen. McNaughton referred on September 26th, 1941, when he told Canadian newspapermen visiting Britain that "There will have to be an invasion of the continent. I don't think you can bring a proud and well-organized nation to her knees with missiles alone".

The Canadian Army overseas is a powerful organization built on strictly modern lines. Its mechanized equipment of many different types and its complex array of armament, make it a very different army from the Canadian Corps of 1914-18. Planes and reconnaissance battalions of motorcycles and armoured scout cars render it sensitive. Tanks give it striking power. Its infantry units are capable of fast movement and possess fire-power for both offensive and defensive purposes. Its artillery is mobile and equipped to fight tanks and airplanes as well as to bombard enemy positions. Its engineer units are capable of coping with the new problems which mechanization has created. Its signal arm makes full use of modern wireless equipment. The Army Service Corps and the Ordnance Corps have been mechanized and provided with modern equipment needed to supply the troops with food, gasoline, ammunition, repair facilities, etc. The Medical Corps, too, has had to adapt itself to the war of movement.

Some Canadians are serving with the British Army.

The Air Force

"Per ardua ad astra".

Royal Canadian Air Force Motto

The total personnel of the Royal Canadian Air Force is about sixteen times what it was before the outbreak of war. This is indicated by the following figures:

Pre-War Strength	*Strength To-Day*
4,500	83,000

The rate of recruiting is now being accelerated, with training capacity expanding. About 16,000 volunteers were taken on in September—an increase of approximately 24% in total personnel. On September 30th, 1941, Air Minister Power stated, "Canadian youth have simply rushed to our recruiting offices."

The Air Force Overseas

Canadian airmen have been engaged in combat since the outbreak of war. Many had joined the R.A.F. before war broke out and others followed in late 1939 and early 1940. The first R.C.A.F. squadron arrived in Britain early in 1940; it was followed shortly afterward by two other squadrons. The flow of Canadian airmen from the British Commonwealth Air Training Plan in late 1940 and in 1941 has steadily increased the number of R.C.A.F. fliers in both the R.A.F. and the R.C.A.F. overseas. That Canadian fliers have recently been reaching the battlefront in rapidly increasing numbers, is indicated by the latest casualty figures. On October 1st, 1941, 756 had been listed as dead or missing (as compared with 549 five weeks earlier), and 49 were prisoners of war or interned. The number of R.C.A.F. squadrons operating overseas is now 13. By the end of the year there will be at least 25 R.C.A.F. squadrons overseas, and the total number of trained Canadian airmen abroad will be equal to a division of infantry. Air Minister Power has said that eventually the R.C.A.F. may constitute one third or even one half of all Empire airmen. He stated significantly on August 9th, "We are not proposing to limit ourselves." Canadian airmen are now fighting over Britain, Europe, Libya, Egypt, Greece, Syria and Russia.

For reasons of secrecy, detailed information concerning the activities of Canadian airmen overseas is not at present available. The following facts, however, are known. The "All-Canadian" squadron of the R.A.F., formed late in 1939 of Canadian and British pilots, has had a very distinguished record. It destroyed at least thirty planes over France and the Low Countries during the Battle of France in the summer of 1940 and had the honour of being the last squadron to leave French soil. It fought over Dunkirk, and played its part in protecting the evacuation of British and Allied troops. It also fought over London during the September "blitz". In six fights it destroyed 55 enemy planes with a loss of only two of its own pilots. By January, 1941, it had accounted for more than 100 enemy planes. All but one of the Canadians in the squadron have now been transferred, and its leader, the famous "legless" Squadron-Leader Douglas Bader, is reported a prisoner of war.

One of the first R.C.A.F. fighter squadrons to see action has had an equally distinguished record. It shot down

12 enemy planes in its first 19 days of action and is now credited with 100 planes. It took part in the air battles over London in September, 1940, and on one day shot down 14 enemy planes.

During the past five or six months Canadian fliers have been taking part in R.A.F. daylight sweeps over Germany and the Low Countries. Canadian airmen have bombed Berlin and carried out attacks on the German warships "Gneisnau" and "Scharnhorst". Two Canadian squadrons are now assigned to night fighting duties, and others are on coastal patrol work under both the fighter and bomber commands.

Canadian ground crews are operating in Britain, and soon most Canadian squadrons will be serviced by Canadian mechanics. About a thousand radio technicians have for some time been assisting the R.A.F. in detecting hostile aircraft and 2,500 more such technicians will go overseas this year. A third class is now being trained in Canada.

The Air Force in Canada

R.C.A.F. planes play a vital part in western hemisphere defence. They escort convoyed ships and are on patrol duty in Canada daily and far out to sea on both coasts. Sometimes they patrol so far out on the Atlantic that they could more easily land in Ireland than at their home base. Coast defence squadrons are being steadily strengthened. They now include many airmen who have had combat experience overseas.

Aircraft of the coastal commands have had moments of more than routine activity. For example, Atlantic squadrons took part in the search for the "Bismarck" and were ready to go into action, should this have been necessary.

The British Commonwealth Air Training Plan

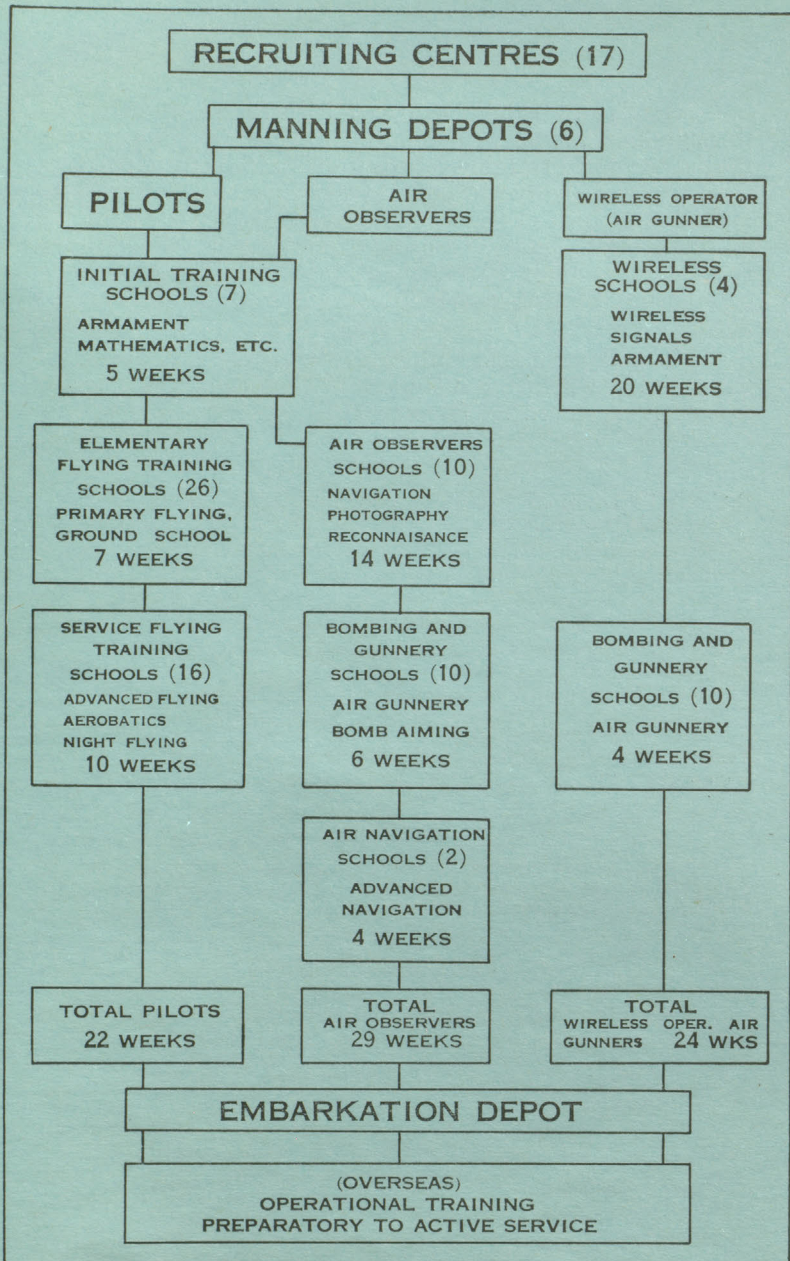
The British Commonwealth Air Training Plan is steadily becoming what is was designed to be when first announced in December, 1939—a major source of air strength from which fighting air teams will go out in formidable numbers to strike at the Nazi war machine. The importance which the highest authorities attach to the Plan may be judged from remarks recently made by Air

Marshal A. G. R. Garrod, air member for training in the supreme air council of Great Britain. Air Marshal Garrod, who came to Canada recently to obtain a first-hand picture of the Plan in operation, said on September 20th, "Training in Canada is the foundation for all air force expansion and if we can defeat the enemy in training we can defeat him in the air. The battle of training is the foundation for the battle of bullets and bombs. . . . We are relying absolutely on the work now progressing on the Canadian training grounds. The training here is becoming more and more important and is an essential, decisive factor in winning the war."

The Plan trains Canadian, Australian, New Zealand and British airmen. In the past year a considerable number of British training schools have been transferred to Canada, where air space and freedom from enemy attack provide suitable conditions for training. The Plan is thus essentially a Commonwealth enterprise. Canada, however, has undertaken the major share of the burden both in men and in money. Canadians recruited by the R.C.A.F. constitute 80% of the air crew trained or in training (about 8% of these are American volunteers), and Canada will pay about $531,000,000 of the $824,000,000 which the Plan will cost in its first three years of operation.

The rapid expansion of the Plan is one of the most significant features of Canada's war effort to date. While 83 schools of all kinds were originally called for, 93 are now in operation; the Plan which was to have been going "full blast" by March 31, 1942, has now virtually been completed—seven months ahead of schedule; air crew are being turned out at about twice the rate originally planned. The Plan now operates 131 establishments of all kinds and about 100 air fields. This, however, is only a beginning. The Plan is to be further extended. Air Minister Power announced on September 30th that the number of airdromes and schools is to be almost doubled and that the output of air crew will be increased by 25%.

The table on the opposite page shows the schedule of air crew trainees from the time they enter as recruits, until, about six months later, they are ready to begin operational training.


RECRUITING CENTRES (17)
MANNING DEPOTS (6)
PILOTS
AIR OBSERVERS
WIRELESS OPERATOR (AIR GUNNER)
INITIAL TRAINING SCHOOLS (7)
ARMAMENT
MATHEMATICS, ETC.
5 WEEKS
WIRELESS SCHOOLS (4)
WIRELESS
SIGNALS
ARMAMENT
20 WEEKS
ELEMENTARY FLYING TRAINING SCHOOLS (26)
PRIMARY FLYING, GROUND SCHOOL
7 WEEKS
AIR OBSERVERS SCHOOLS (10)
NAVIGATION
PHOTOGRAPHY
RECONNAISANCE
14 WEEKS
SERVICE FLYING TRAINING SCHOOLS (16)
ADVANCED FLYING
AEROBATICS
NIGHT FLYING
10 WEEKS
BOMBING AND GUNNERY SCHOOLS (10)
AIR GUNNERY
BOMB AIMING
6 WEEKS
BOMBING AND GUNNERY SCHOOLS (10)
AIR GUNNERY
4 WEEKS
AIR NAVIGATION SCHOOLS (2)
ADVANCED NAVIGATION
4 WEEKS
TOTAL PILOTS 22 WEEKS
TOTAL AIR OBSERVERS 29 WEEKS
TOTAL WIRELESS OPER. AIR GUNNERS 24 WKS
EMBARKATION DEPOT
(OVERSEAS)
OPERATIONAL TRAINING
PREPARATORY TO ACTIVE SERVICE

Training the Forces

Schools and training centres for the forces are scattered throughout Canada. In addition, all three Services operate special technical training centres to educate men to perform the variety of highly specialized tasks which modern warfare makes necessary. Schools and universities are co-operating in this work. Air Force ground crew trade schools have trained more than 20,000 men and Army trade training centres are turning out maintenance men at the rate of 20,000 a year.

The following table indicates the extent and nature of the training which the members of Canada's armed forces are receiving in centres from coast to coast:

Navy	
R.C.N.V.R. Divisions (recruiting and preliminary training of naval volunteers)	20
Training establishments	2
Technical Training centres	4
Army	
Officers' training centres	2
Basic training centres	29
Advanced training centres (infantry, machine gun, small arms, artillery, engineers, signals, armoured car and tank, army service corps, medical etc.)	28
Technical training centres, (including technical schools, etc., co-operating)	125
Air Force	
Air Schools (See table on page 23)	85
Technical and special training schools	8
Pre-enlistment trade training centres	16

Casualties

The following casualties in the Canadian armed forces had been reported up to September 20th, 1941:

Dead or Missing		1,553
	Navy	401
	Army	442
	Air Force	710
Wounded		346
	Navy	63
	Army	151
	Air Force	132

Women's Auxiliary Services

The Army and the Air Force are now enrolling women for auxiliary services, and the Navy has such a move under consideration. The Canadian Women's Army Corps expects to take on 2,000 women by April 1st, 1942, and the Canadian Women's Auxiliary Air Force will enlist more than 2,000 during the next six months. Women will perform administrative duties such as office work, telephone operating and army stores duties, as well as light transport driving, cooking, messenger service and canteen work, thus releasing men for active duty.

Cadets

Canadian boys have opportunities to obtain elementary training which will be of use to them when the time comes for them to enlist in one of the three services.

The Sea Scouts and the Sea Cadets of Canada have branches from coast to coast. These organizations are providing boys of pre-military age with a thorough grounding in naval matters. The Sea Cadets are sponsored by the Navy League of Canada and are under the jurisdiction of Naval Services.

Secondary schools throughout the country, both public and private, operate cadet corps in which hundreds of thousands of boys learn the rudiments of soldiering.

Organization of the Air Cadet League of Canada is proceeding rapidly. Training is supervised by local Air Force commands in various parts of Canada. The course covers two years and includes basic training in subjects relating to aircraft and air fighting. Upon completion of the basic training, air cadets may specialize in certain branches of these subjects.

AID TO BRITAIN

"Come the three corners of the world in arms,
And we shall shock them.

Shakespeare

Co-operation between Britain and Canada is extremely close. It is fostered through diplomatic and trade channels, by various boards established by both governments and by means of personal visits by officials and experts back and forth across the Atlantic. These visits are going on continually. In addition, most Canadian cabinet ministers who are concerned with the conduct of the war have been to Britain to consult with the British authorities. These include the Prime Minister, Rt. Hon. W. L. Mackenzie King; the Minister of National Defence, Hon. J. L. Ralston; the Naval Minister, Hon. Angus Macdonald; the Air Minister, Hon. C. G. Power; the Minister of Munitions and Supply, Hon. C. D. Howe; the Minister of Agriculture, Hon. J. G. Gardiner; and the Minister of Pensions and National Health, Hon. Ian Mackenzie. Hon. R. B. Hanson, leader of the Opposition, is now in Britain to obtain a first-hand view of conditions there.

Military and Scientific Co-operation

Close co-operation between Canadian and British forces is maintained by the heads of all three services in both countries. Co-ordination in matters relating to training, operations, etc., is carefully worked out and fostered by frequent visits by high ranking officers and officials of both countries. Direct liaison between Canadian and British forces overseas is maintained through the Captain Commanding Canadian Ships in the United Kingdom and through Canadian Army Headquarters and Royal Canadian Air Force Headquarters in Britain.

Canada has taken charge of a number of enemy prisoners of war, most of whom have been captured on one of the many battle fronts of the war. These prisoners are kept in internment camps and are treated in accordance with an International Convention which lays down regulations for the treatment of combatant war prisoners.

Canadian scientists are co-operating closely with British experts, and many Canadian technicians have gone to Britain. These include specialists attached to the armed forces, as well as civilian experts. It was when on his way to Britain on a mission of high military and national importance that Sir Frederick Banting, famous as the co-discoverer of insulin, lost his life in February 1941, in a plane crash in Newfoundland. Many British experts have come to Canada.

Important in this connection is the work of the National Research Council, Ottawa. Scientific research on war weapons is carried out by its staff of experts. The Council is under the supervision of the War Technical and Scientific Development Committee. Research Enterprises Limited, a Government-owned company, is manufacturing devices created by the Council. It now has orders totalling $48,000,000 and it is expected that $36,000,000 worth of these orders will have been filled by the end of 1942.

Economic Co-operation

Sending Supplies to Britain

Since the outbreak of war Canada has sent increasing quantities of supplies to Britain. This is indicated by the following table:

	Value of Canada's Exports to Britain
1939	$ 329,000,000
1940	508,000,000
1941 (first eight months)	449,000,000
Estimated present fiscal year (April 1, 1941, to March 31, 1942)	1,500,000,000

Precise figures concerning the amount of war equipment which Canada has sent to Britain are not available for reasons of secrecy. It is known, however, that supplies sent include considerable quantities of such war equipment as machine guns, two-pounder guns, anti-aircraft gun barrels, shells, small arms ammunition, explosives and chemicals, airplanes, corvettes, minesweepers, small boats, mechanized transport, and universal carriers.

Canada's exports to Britain of raw materials such as base metals and timber constitute one of her most important contributions to the Empire's war effort. Precise figures may not be given here; but it may be said that hundreds of thousands of tons of non-ferrous metals are shipped every year. Canada has exported enormous quantities of timber to Britain; for the war cut Britain off from European countries from which she got 75% of her pre-war requirements.

Canada has sent large quantities of food to Britain, as is indicated in round figures by the following table:

Some Foodstuffs Sent From Canada to Britain in the Two Years Since the Outbreak of War

Wheat	More than 300,000,000 bushels
Flour	7,000,000 barrels
Bacon and other pork products	800,000,000 pounds
Cheese	195,000,000 pounds
Eggs	15,000,000 dozen
Honey	13,000,000 pounds
Total (excluding wheat and flour and including canned goods such as concentrated milk and tomatoes and other foodstuffs)	1,830,000,000 pounds

During the coming year most of Canada's cheese (112,000,000 pounds) will go to Britain, along with two thirds of this year's salmon pack (1,200,000 cases), 30,000,000 dozen eggs, more than 120,000,000 bushels of wheat, 600,000,000 pounds of bacon and other pork products and more than 1,500,000 boxes of apples. Agreements on other items have not yet been announced.

The war has presented a real challenge to Canadian producers. Britain needs certain products in as large quantities as shipping space will allow; other products she does not want or cannot take under war conditions. Nevertheless, Canada is to-day exporting more than twice as much to Britain as she did before the war.

Financial Aid to Britain

Canadians have provided Britain with most of the Canadian dollars she has so far needed to purchase war supplies from Canadian producers; and Canadians will finance the bulk of Britain's expenditures in Canada in the coming months.

Britain pays for a fraction of her purchases in Canada by exporting goods to the Dominion. The rest of her Canadian supplies, however, must be financed otherwise. In the first two years of the war Britain needed about $1,155,000,000 to cover her purchases in Canada. Less than a quarter of this sum Britain paid Canada in gold. But it has cost Canada in the United States more gold than this to enable her to fill her British orders; and there have been no gold shipments from Britain to Canada since December, 1940.

The remaining $905,000,000 Canada herself supplied. The Dominion provides Britain with about one third of the Canadian money she needs by repatriating Canadian securities held in Britain. This amounts to paying debts before they fall due. Canada supplies the rest by accumulating Sterling balances—in effect, lending Britain money. All this credit, like the money raised to spend on Canada's own war effort, must be provided now by the Canadian people. During the present fiscal year the total required for financial aid to Britain will be at least $900,000,000.

Other Types of Economic Co-operation

The Canadian Government has co-operated closely with the British Government in order that Britain may have all the facilities she needs for war production in Canada. Not only do Canadian factories send supplies to Britain, but plants have been erected in Canada on British account to produce directly for Britain.

Co-operation with Britain in the matter of raw material supply is extremely close, and every effort is made to co-ordinate the work of the two countries, along with that of the United States, in this important phase of the war programme.

Canada has materially reduced tariffs on British imports since the outbreak of war.

Canada pays for the equipment and upkeep of her forces overseas. The only exception in this respect is the provision of service planes for Canadian squadrons overseas. This is looked after by Britain, as part of her contribution to the British Commonwealth Air Training Plan.

A considerable number of Canadian ships have been made available to Britain for carrying supplies and for naval duties.

British ships are repaired and supplied in Canadian ports.

Citizens' Voluntary Aid to Britain

Millions of dollars have been voluntarily subscribed by Canadian citizens to the Canadian Red Cross and smaller organizations for the purpose of providing money, needed articles and war equipment for Britain and for British and Allied soldiers overseas. Bombed towns have been assisted by gifts of money, with blankets, clothing, first aid equipment and other conveniences. Ambulances and mobile kitchens have been provided for the relief of the wounded and to assist A.R.P. workers. Depots of emergency supplies have been set up at key points in preparation for disasters. Several Canadian towns and cities have "adopted" certain British towns or have undertaken to assist special groups such as fire-fighters, children and congregations of bombed churches. Some organizations supply specially needed articles such as cigarettes and seeds. War planes have been provided by a large number of organizations.

The Red Cross has established a special channel for aid to British civilians—the Canadian Red Cross British Bomb Victims' Fund. The following list indicates the extent to which the Red Cross has already assisted British civilians, Allied soldiers and prisoners of war:

Sent to Britain by the Canadian Red Cross Since the Outbreak Of War

For civilians	1,200,000 articles and 2,700 cases of garments
For fire-fighters	36 mobile kitchens and $215,000
For A.R.P. work	200 ambulances
Soldiers' comforts and supplies for Canadian military hospitals in Britain and British hospitals	8,400,000 articles and 5,000,000 surgical dressings and 69,000 cases of food and tobacco
To British, Canadian, Australian and New Zealand prisoners of war	400,000 parcels costing $2.50 each and containing food and comforts.

The other major Canadian war charities—which are now joined with the Red Cross in the Canadian War Services Fund—provide similar services. These are the Salvation Army, the Canadian Legion, the Navy League of Canada, the Imperial Order of the Daughters of the Empire, the Y.M.C.A., the Y.W.C.A., and the Knights of Columbus. In addition to supplying workers to assist in providing comforts for British civilians, most of these organizations maintain canteens, hostels and service clubs for Canadian sailors, soldiers and airmen overseas and provide them with comforts and entertainment of various kinds. For example, mobile film units are circulated among the troops. The Canadian Legion's educational services offer Canadian forces courses of instruction in a wide variety of subjects, at both school and university standards. They are also instrumental in making concerts, libraries, art exhibitions, etc., available to the troops.

CANADA: ARSENAL AND STOREHOUSE

"Inventiveness and thoroughness in the supply of equipment will win this war."

Lt.-Gen. A. G. L. McNaughton

Building a War Industry

Two years ago Canadian industry was organized almost entirely for peace; to-day under the supervision of the Department of Munitions and Supply, a very large part of it is organized for war. Practically every Canadian factory that can produce for war is now doing so wholly or in part, and this diversion is being continued where possible through the work of the Industry and Sub-contract Branch of the Department of Munitions and Supply. Millions of dollars have been spent by industry on plant expansion and equipment necessary for war production, and the Canadian and British Governments have authorized expenditures of about $550,000,000 for the same purposes. This has meant not only expansion of facilities existing before the war but also the erection of scores of entirely new factories, some of which are as large as any of their kind in the British Empire.

In the first year of the war the provision of plant structures and machinery constituted a serious problem towards a solution of which all concerned made a concentrated effort. Now that most of these difficulties have been overcome, Canadian industry has struck its stride and its record in war production has been impressive. Most of the war equipment now being produced in Canada has never before been manufactured in the Dominion. Referring to this development on September 18th, 1941, Finance Minister Ilsley said, "It is not too much to say that what has happened in the past year is nothing short of an industrial revolution. This has been accomplished in spite of all the difficulties in obtaining or preparing plans and specifications or in getting new machine tools, despite the need to learn or develop new skills, despite the scarcity of many materials and the inevitable dislocations of wartime. In these new or expanded plants Canadian management and Canadian labour, much of it never previously inside the four walls of an industrial plant, have already produced complicated war equipment of the highest quality at greater speed and lower cost than in the established plants of the more mature industrial countries."

Two years ago Canada was incapable of equipping an infantry division. "Now", said Hon. C. D. Howe on September 11th, 1941, "Canada is producing practically everything required by a fully equipped infantry division at a rate that enables us to equip a new division every six weeks." Two years ago Canada imported most of what little war equipment she had. To-day Canadian war equipment to quote Mr. Howe, "is being despatched to all the battle-fronts of the world—to Britain, to the Middle East, to the Far East, to our sister Dominions, to China and to Russia."

Construction

Industrial expansion in Canada has involved tremendous construction activity; and in addition to expanding industry, the construction business has undertaken a $110,000,000 defence building programme, under which several thousand buildings and about 100 air fields have already been completed.

What construction companies in Canada have been and still are undertaking in providing buildings for industry and for the armed forces, is evident from the fact that during the first seven months of this year the number of construction contracts awarded was about 59.9% greater than the number let in the corresponding period of 1940; and construction contracts in 1940 were about 85% higher than in 1939.

Substantial progress has been made in the provision of low-cost dwellings for war workers. Wartime Housing Limited (a Government-owned company) is at present erecting nearly 4,500 houses in Halifax and in twenty-seven other crowded communities. These houses will accommodate thousands of workers and their families. This programme is steadily being extended. The accommodation is to be temporary in character and will be rented to the occupants.

Producing for War

The following is a list of the war equipment Canada is now manufacturing:

Ships

Cargo boats
Minesweepers
Corvettes
Motor torpedo boats
Patrol boats
Small boats

Guns

25-pounders
Bofors anti-aircraft guns
3.7 anti-aircraft guns
Anti-tank guns
Two-inch mortars
Three-inch mortars
Bren machine guns
Browning machine guns
Boys anti-tank rifles
Lee-Enfield rifles

Ammunition

Shells (complete)—22 types
Bullets (complete)—several types
500-pound bombs
Depth charges
Anti-tank mines
Rifle grenades

Chemicals and Explosives

Chemicals—12 types
Explosives—8 types

Planes

13 types including:
- Harvard trainers
- Avro-Anson trainers
- Hurricane fighters
- Catalina flying boats

Tanks

Cruiser tanks
Infantry tanks

Vehicles

Universal carriers
Field artillery tractors
Trucks, etc.

Miscellaneous

Uniforms, boots, etc.
Personal equipment
Bomb throwers
Instruments
Radiolocators
Gas masks
Parachutes
Minesweeping gear
Naval stores

Articles on order include naval and land guns and mountings, some of which are in production, armoured scout cars, small arms, predictors for anti-aircraft guns and certain secret weapons.

Most production figures are not available because of the need for secrecy concerning such matters in war time. The following facts, however, give some idea of the extent of Canada's war production to date.

Shipbuilding has increased tremendously in Canada. At the beginning of the war there were only 1,500 workers in Canadian shipyards. Now more than 20,000 workers are employed in 17 major and 45 smaller yards. To-day the shipbuilding programme, including the merchant-ship programme, involves an expenditure of about $320,000,000.

Of this amount about $120,000,000 is being spent on naval vessels. Some 250 such ships have been ordered, not including small craft, and over 140 have been either delivered or launched. A total of 112 corvettes and minesweepers have been launched. Three "merchant cruisers" and twenty-seven yachts have been converted to naval use. Patrol boats are now being turned out. The keels of two destroyers are to be laid down. British technical experts are to be brought to Canada to assist in the construction of these vessels.

The $200,000,000 merchant-ship building programme calls for the construction of 116 vessels of the 9,300-ton and 4,700-ton class by the end of 1942. The keels of 16 of these ships have now been laid.

Deliveries are being made regularly under the $9,000,000 small-boat programme. Nearly 1,000 boats have been ordered and the programme is more than 50% complete. It includes such craft as crash boats, aircraft tenders, bomb-loading dinghies, salvage and supply boats and various types of scows for the Air Force; harbour utility craft, motor torpedo boats, whalers, pulling boats and service dinghies for the Navy; and service boats and collapsible assault boats for the Army.

Canada's gun programme calls for the manufacture of fourteen types of land and naval guns and mountings, in addition to machine guns, rifles and small arms.

Shells, complete and ready for firing, are being turned out at the rate of millions of rounds a year, and tens of millions of rounds of small arms ammunition are being manufactured every month.

Twenty of Canada's 23 chemicals and explosives plants are now producing. This year alone the total production of explosives in Canada will exceed the entire Canadian output during the whole of the first Great War. Construction of chemicals and explosives plants is 95% complete.

The Canadian aircraft industry was of small dimensions at the beginning of the war, but since that time it has built a large number of aircraft. Since January, 1939, the number of men engaged in Canadian aircraft construction has increased from 1,600 to more than 30,000. Output in the first six months of this year exceeded the total for all of 1940.

At present Canada is producing about thirteen different types of plane at the rate of about 40 a week. It is expected that the number of types will be reduced in the near future to allow the industry to concentrate on the trainers now needed and on the service craft which have proved themselves most useful. This may mean fewer planes per week, but the actual output measured in pounds of plane components or in man-hours will continue to grow. Engines for Canadian aircraft are imported, but Canada is now producing almost all the instruments required.

The Canadian tank programme calls for the production of 1,000 cruiser and 800 infantry tanks. Since June, 1941, a considerable number of tanks has been turned out.

More than 150,000 army vehicles have been delivered and are in service, a large proportion of them overseas.

Production of alloys in Canada is now ten or twelve times as great as before the war.

Here are some typical costs in round figures:

Cargo boat	$1,750,000
Corvette	550,000
Catalina flying boat	100,000
Cruiser tank	100,000
Hurricane fighter	25,000
25-pounder gun and carriage	25,000
Bren gun	325
Depth charge	75

The total value of contracts awarded and commitments made by the Department of Munitions and Supply on Canadian and British account is now about $2,400,000,000. This includes commitments for plant expansion and equipment.

Canada is one of the world's major sources of strategic raw materials. She produces about 83% of the world's nickel and ranks high in the production of many other metals and minerals important in war manufacture such as aluminum, zinc, copper, cobalt, lead, platinum metals, asbestos, mica, gypsum and sulphur. Molybdenum is available in quantity in Canada, and the Dominion has the only large commercial output of mercury in the Empire. Tungsten, antimony and manganese are being developed, and intensive search is carried out every year for further deposits of vital war minerals. Mineral production in Canada was 10.9% greater in 1940 than in 1939, and 4% greater in the first seven months of 1941 than in the corresponding period of 1940.

Canada produces great quantities of timber, and has increased her output since the outbreak of war. In 1940 there were 29% more men employed in logging than in 1939, and in the first seven months of 1941, 31% more than in the corresponding period of 1940. Because of the heavy demands of Canada's own defence building programme, the Dominion now consumes 45% of her entire lumber output. Nevertheless, she has large quantities available for export.

Canada is one of the world's great food-producing countries. Among the food products of which she exports large quantities are wheat, flour, cheese, meat and canned goods.

THE HOME FRONT

"Our soldiers, sailors and airmen must be able to feel that they have the collective effort of the nation behind them."

Rt. Hon. Ernest Lapointe, Minister of Justice.

The War and the Canadian Economy

Canada's war programme has caused marked economic expansion. Industrial output has enormously increased and has still to reach its peak; factories are turning out more and more goods; business activity is up and is still rising; mines are producing increasing quantities of minerals; foreign trade advances in spite of the dislocations of war; construction has reached record proportions and there is still much to do; transportation facilities are working diligently to bear the traffic of war; nearly all the workers classed as "employable" in normal times are now at work, along with a considerable number who would not ordinarily be working for salaries and wages; the national income has substantially increased, over half the increase being in salaries and wages.

The magnitude of this increased activity is indicated by the following percentages:

	1940 as compared with 1939	The first seven months of 1941 as compared with the first seven months of 1940
	% Increase	% Increase
Industrial Production	23.1	13.2
Manufacturing Production	23.4	11.8
Physical Volume of Business	18.8	13.2
Mineral Production	10.9	4.0
Exports (excluding gold)	27.5	36.0
Imports (excluding gold)	44.1	32.0
Construction Contracts Awarded	84.9	59.9
Railway Car Loadings	10.9	14.5
Employment (general)	9.0	22.2
Manufacturing Employment	16.9	25.6
National Income	8.5	10.7
Wholesale Prices	9.8	5.9

Economic expansion does not mean that individuals, businesses or the nation as a whole are growing rich because of the war. On the contrary, with governments taking three times as much in taxes as in peace time, every one—from the Dominion Government down—needs to retrench in order to help pay for the war. Economic expansion is the result of the insatiable demands of war.

Moreover with Canada's war industry now in substantial production, civilian supply of many commodities is becoming limited. Canadians are realizing to an increasing extent the need of placing their material resources at the disposal of those who can best use them for war purposes, and the Government is taking steps to accelerate this diversion. R. C. Berkinshaw, Director-General of Priorities in the Department of Munitions and Supply and recently appointed chairman of the Wartime Industries Control Board, stated on August 30th, 1941, "It will become necessary to effect further curtailment in consumer goods production and this will necessarily involve sacrifices on the part of all. Non-essential domestic and personal expenditutes will have to be curtailed and rigid economy established in the consumption of certain lines of commodities designed for household, family or individual use." Mr. Berkinshaw also stated that rationing of consumer goods will be "largely conditioned by the effort we make now to keep waste down to an irreducible minimum."

At the same time, restrictions on civilian supply, greatly increased taxes and a heavy demand for war investments, are not the only burden the average Canadian must face. Prices have risen in a number of commodities, though the commodity price index is still considerably below the August, 1929, peak. In addition, certain persons have found that the war has destroyed the market for their product, limited their manufacturing scope, restricted their imports and exports, or in some other way disturbed their economic security. Such of these as are unable to turn to war work, are bearing a special burden.

Profiteering is "out" in this war, so far as the Canadian Government is concerned. Mr. King gave this assurance to Parliament during the debate on Canada's entry into the war. And that assurance was at once made good by the imposition of an excess profits tax and by the setting up of a Wartime Prices and Trade Board, which curbs those who might turn national needs into personal profits.

Economic Policy

In the early stages of the war, production for civilian purposes was in most cases able to expand very substantially along with expansion in war production. This did not interfere with the war effort, because before the war Canada had large reserves of unemployed or under-employed labour and capacity, and as war industries were only in the process of being built up, their demand for raw materials was not so heavy as to interfere seriously with ordinary production. Moreover, supplies of raw materials brought in by ocean ships were not so limited as they are to-day. Nor was the danger of an undue rise in prices as great as it now is. In order to provide war industries with an adequate supply of raw materials and at the same time to prevent an undue rise in prices, the Government pursued two related policies. On the one hand, certain formal restrictive measures to conserve raw materials and foreign exchange were taken, and from time to time specific rulings or informal agreements with industry were utilized to conserve some particular commodity; on the other hand, by taxing and borrowing heavily from the public, the Government was able to hold total civilian spending reasonably close to the pre-war level. These policies were supplemented by measures to increase domestic production and imports where possible, to regulate exports where necessary, to control prices for a time when and where the need arose, and to create an enlightened and effective public opinion. Generally, these policies were marked by a minimum reliance on over-all coercion and by a maximum reliance on constructive endeavour on the part of the Government on the one hand, and on the part of the persons involved on the other.

In recent months the situation has materially changed. Rapidly growing war industries and expanding armed forces are making increasing demands on raw material supplies; and, because of shipping conditions and the very heavy consumption of raw materials by the rapidly expanding United States defence programme, these supplies, in some instances, are more difficult to get than they formerly were. The problem to-day, as Finance Minister Ilsley stated on September 18th, 1941, "is not to *hold down* civilian consumption but to *reduce it*—in many lines to reduce it substantially or perhaps eliminate it altogether. It is obvious, therefore, that our fiscal measures will now have to be supplemented by more direct controls of production and consumption. The shortages of materials, labour, power and transport which are now developing, are in many cases so acute that no practicable scheme for reducing people's money income could be expected to curtail civilian expenditure far enough and fast enough."

More direct controls are also necessary to safeguard the price structure. Since August, 1939, the rise in the index of wholesale prices has been 26.2% and the cost-of-living index has risen by 12.8%. While this movement has been by no means alarming, considering the depressed pre-war levels of prices, particularly of farm products, the fact that the rise has been most pronounced in the past five or six months points to a danger which the Government is determined to avoid. Prevention of inflation has been a central principle of economic policy since the outbreak of war, and it is to achieve this as much as to provide war industries with the materials they need, that more direct controls are being introduced.

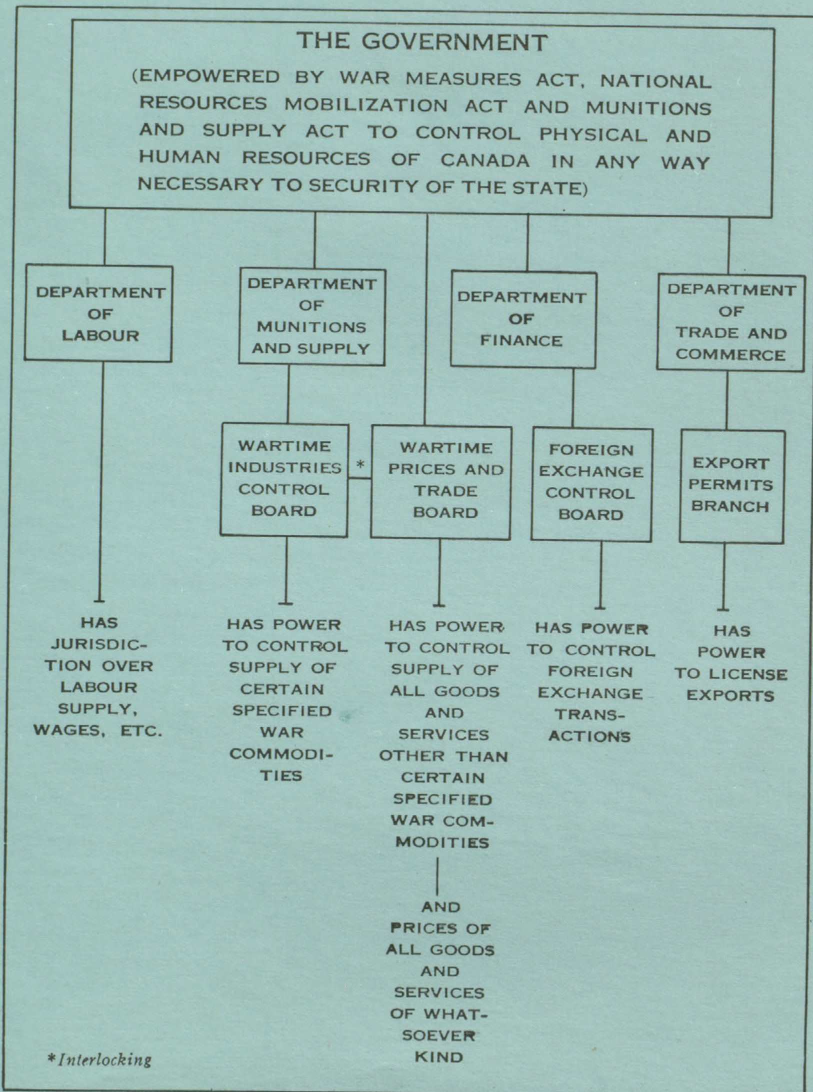
This has been put very clearly by the Minister of Finance. "The basic factor," he said on September 18th, "is the tremendous increase in private spending power in relation to the dwindling supply of commodities which can be bought for civilian use without conflicting with the war programme. If we think of our total national effort as being an 8-hour day, we are spending now perhaps about 3 hours of it in producing goods for war or doing war work of various kinds, and we are spending, say, only 5 hours producing things to be sold on the market. Yet we are still getting paid for 8 hours' labour. If we all try to spend 8 hours' pay on 5 hours' product, obviously prices will go up. That is a mathematical truism. It is the fundamental factor in the situation. It poses what is for us the fundamental problem of drawing off the surplus purchasing power of private consumers, in order (1) that it may not compete with and therefore retard the war effort; (2) that it may not give rise to all the evils of inflation which became so familiar to us during the last war; and (3) that it may be deferred in order to provide a support against deflation and a stimulus to production and employment in the post-war period when present conditions are likely to be reversed. Let us face the issue clearly. We have two alternatives. Either we must have an effectively planned and operated set of controls which will be deliberately designed to restrict civilian consumption and prevent inflation while attaining the objectives of the war programme. Or alternatively, we must allow a substantial inflationary rise in prices to take place which will automatically restrict civilian consumption and thereby enable the required materials and labour to be used for war work. I believe we are all agreed on the evils of inflation and the absolute necessity of preventing it."

"THERE is only one way to meet total war, and that is by total effort—effort not for a day, or a week or a month, but every day until victory is won."

Prime Minister Mackenzie King

Wartime Controls

The diagram below gives a picture of the set-up of Canada's wartime economic controls.



The Minister of Munitions and Supply is empowered to take any steps necessary to ensure that war industries "delivers the goods" to his satisfaction. The Wartime Industries Control Board may at any time designate a material not already controlled as subject to its control.

The Wartime Prices and Trade Board has control in the price field over all Boards of the Federal and Provincial governments, including the controls established by the Departments of Munitions and Supply, Agriculture, and Fisheries, and Provincial bodies exercising price control over such commodities as milk, fruit, vegetables, and other products and services. In practice, the effect is that all such bodies continue their former functions and present their price recommendations for concurrence to the Wartime Prices and Trade Board.

Powers of the Wartime Prices and Trade Board also include the authority to fix minimum as well as maximum prices and mark-ups, and to prohibit the purchase, sale, or supply of "any goods and services" at variance with such prices. The Board will now also have power to prescribe the terms and conditions under which any goods or services may be sold or supplied "whether on terms of deferred payment or otherwise". This reference is to the so-called "instalment-buying" plan, restriction of which would appear to be in the national interest under wartime conditions. The new regulations also give the Board complete licensing authority over manufacturers, importers, exporters, producers, jobbers, wholesalers or retailers or the suppliers of any goods or services.

The Board is given power to appoint persons to regulate the supply and distribution of goods or services and to investigate voluntarily or on complaint, costs, prices, profits, and stocks of goods and materials of any person engaged in manufacture, importation, exportation, production, storage, transportation, supply or sale of any goods or services, or any alleged or apparent offence against any regulation. The Board is given powers of a commissioner under the Inquiries Act for this purpose.

The Export Permits Branch of the Department of Trade and Commerce licenses exports of a large number of products classified as to type and destination. No product of any kind consigned to a country outside the western hemisphere—except to a part of the British Empire—may be exported without a permit. In addition, export to any country of certain products specified from time to time is subject to export permit control.

Canada's economic control set-up was established in its present form in August of this year, but some of the controls represented have been operating since the outbreak of war and others have been established from time to time in the past two years as the need arose. Some idea of the extent to which these controls, in conjunction with various other steps taken both by Government and by private business, have already succeeded in harnessing the Canadian economy for war, may be gained from the following pages (43 to 68).

Providing a Maximum Supply of Commodities Essential in War Time at Reasonable Prices

General Measures

A priorities system applying generally to raw materials and manufactured products has for some time been in effect. The step was taken to ensure that war supplies might be produced in order of their importance and to meet shortages or threatened shortages of goods arising from the ever-increasing volume of Canadian war production. By direct negotiation priorities officials have tried to avoid the formal application of priority classifications which might tend to retard rather than to expedite production. Priority certificates have been issued only when all other means of obtaining necessary production had been tried and found inadequate. Producers have been expected to meet their own production problems by direct negotiation with others. Should such negotiations fail, the Priorities Officer then took whatever steps were necessary. He could alter delivery dates, divert deliveries, ration materials or take any other action necessary to meet production needs. If these methods failed, priority ratings were assigned. Now with war industries making heavier demands, more selective priorities are expected.

Certain other general measures have been undertaken to limit the use of machine tools for non-war purposes, and to reduce non-war production which requires essential raw materials. In 1940 designs were "frozen" on Canadian manufactures of anything from automobiles to sewing machines in which a change of model would require new tooling. In April, 1941, the erection of plants, the installation of equipment and the construction or repair of buildings costing more than a fixed amount were limited to projects licensed by the Priorities Branch of the Department of Munitions and Supply. Construction in Canada is now being concentrated on completing industrial expansion, providing more structures for the armed forces and erecting low-cost housing units for war workers. A Controller of Construction has now been appointed, bringing construction under the supervision of the Wartime Industries Control Board.

The manufacture of automobiles for civilian use has been curbed by a series of measures. To prevent the setting up by importers of new assembly operations which would consume material and labour, an order was issued in the spring of 1941, ruling that if an importer was not manufacturing before December 2nd, 1940 (the date of the embargo on imported cars), he could not start manufacture and make more cars than he could import under his quota. This was followed by an order curtailing the production and sale of automobiles for the period April to December, 1941, to the extent of about 20%, compared with the like period of 1940. The control was based on the foreign currency exchange content of the individual types and models of automobiles. This has effected a decrease in the number of passenger cars being produced for sale in Canada. Official estimates indicate that the average monthly rate of production of passenger cars is steadily declining. At the same time, total automobile production, including output of war vehicles, is up very considerably.

Even fewer passenger cars are to be produced next year. Production of passenger cars in 1942, for sale in Canada, will be less tnan half the 1940 figure. This will be effected by an order recently issued which limits production to about 44% of the 1940 output. In addition, the number of models will be cut about in half, and accessories reduced to a minimum. The spring manufacturing peak will be "flattened out."

The manufacture of "white-wall" tires in Canada is now prohibited except under license. It is not proposed that any licenses will be issued, as the manufacture of such tires consumes additional zinc oxide and rubber simply for the sake of appearance.

On October 1st, 1941, manufacturers of radios, refrigerators, stoves, vacuum cleaners, and electric washing machines were ordered to cut their production of such goods to 75% of their 1940 output. This was described as a preliminary reduction."

These steps are steadily releasing skilled workers, machine tools, plant capacity and materials for war production.

Measures Applying to Specific War Commodities

Machine Tools: Machine tools, cutting tools and abrasives are basic in war production, and every effort has been made to supply war industries with as many of these tools as possible. The output of the Canadian machine tool industry was small before the war, but in 1940 it jumped about 800% over 1939, and steps taken this year are further increasing output. Canadian plants have been particularly active in the manufacture of machine tools for gun and shell production. Canada normally imports most of her machine tools from the United States. These imports have increased markedly since the outbreak of war and every effort is being made to expedite such purchases.

Electric Power: Electric power supply has been increased in certain heavily industrialized areas. Highly important in this connection is an arrangement between Canada and the United States for utilization of additional water at Niagara for power development. Most of the additional hydro-electric capacity of the Niagara plants has in this way been put to use for war purposes. The industrialized areas of Ontario and Quebec have been on daylight saving time since the spring of 1940. This has saved a considerable quantity of electric power.

Oil: Canada is fifth among the oil-consuming countries of the world but produces only 15% of the oil she needs. Domestic production in Alberta has been considerably increased since the outbreak of war but the amount is still short even of Prairie Provinces requirements. As most of Canada's imported oil is brought in by tanker and many tankers have had to be diverted to Britain to replace tonnage lost in the Battle of the Atlantic, Canada has in recent months been faced with a reduction in oil imports and a consequent diminution of oil stocks in hand.

Several steps to conserve oil have been taken since June, 1940. In that month an order was issued curtailing the establishment of further service stations throughout the Dominion. In September the sale of oil for any equipment which previously utilized other fuel was prohibited. In June, 1941, this measure was extended to include a ban on the installation of new oil-consuming equipment of any kind. From time to time steps have been taken to ensure the most efficient use of crude oil at refineries.

A further step in oil conservation—a request to Canadians to cut their consumption of oil and gasoline for ordinary civilian purposes by half—was made necessary by the supply situation outlined above and by the rapidly increasing demands for oil and gasoline by the Navy, Army, Air Force and war industries. In order to encourage this cut in consumption, the sale of gasoline and oil to motorists on Sundays, and at night (7 p.m. to 7 a.m.) on week days, has been prohibited. Credit cards may no longer be used by Canadians, though they may be used by American tourists, and a list of pointers on how to save gasoline and oil has been placed before the public.

Supplementing this move, an order was issued, effective August 25th, which sharply reduced gasoline and oil deliveries to retailers throughout Canada. The monthly amounts saleable are now 80% of the estimated normal requirements. This reduces the amounts available to automobile drivers and is, in effect, an informal system of rationing.

The new pipe-line from Portland, Maine, to Montreal is expected to relieve the oil situation to some extent, but it cannot be ready to make deliveries much before the end of the year.

Coal and Coke: Coal and coke are under the supervision of the Wartime Prices and Trade Board, and since December, 1939, the Canadian coal and coke trade has been required to operate under license. Canadian coal production has expanded considerably since the outbreak of war, and the Dominion has imported increasingly large amounts of both anthracite and bituminous coal. Although imports of anthracite from the British Isles were up to normal for a time, they have fallen off considerably in recent months; but imports of both anthracite and bituminous coal from the United States have very substantially increased, and Canadian coal supplies to-day are enormously greater than before the war. Nevertheless, consumption is heavy and every effort is being made to increase supplies to a maximum.

The supply of coke in Canada is by no means ample. In spite of an increase of about 1,000,000 tons in Canadian coke supplies during the past fiscal year, Canadians face a shortage of this fuel for civilian purposes. This has been caused by an increasingly heavy demand for coke by war and allied industries.

Steps have been taken from time to time to deal with the problem of transporting coal and coke by water and rail. A recent move in this direction was a request to Canadians to buy next winter's supply of coal early in order to avoid the usual fall rush on coal. This had to be prevented because of the enormous volume of war supplies being carried on Canadian railways.

Timber: Since early in the war the Timber Controller and the lumbering and woodworking interests have worked together to mobilize the Canadian timber trade in accordance with the Dominion's wartime economy and also to assist the British Timber Controller in securing supplies from Canada.

Enormous quantities of lumber were required during the first year of the war both here and overseas when factories, plant additions, and military, naval and air force projects were being built at great speed. The Government took steps to secure all lumber for its projects at the lowest possible prices. This was done, with the co-operation of the industry, by centralized buying. Later, the spring building programme of 1941, combined with the new needs of U.S. defence construction, created a demand for timber that amounted to boom proportions. This situation, complicated by other factors, caused rising prices. In May, 1941, therefore, the Timber Controller fixed retail prices for lumber and millwork at levels obtaining on April 1st, 1941. This did not apply to timber for export. The move has been very successful, and in spite of the fact that Canada is now consuming about 45% of her entire lumber output, prices have been maintained at a reasonable level. This has not only saved the country money but has prevented a hazardous situation from developing in the timber industry itself. In September, 1941, maximum prices for certain kinds of timber sold in certain localities in Canada were fixed.

Various other steps have been taken to ensure the most economical and efficient use of both Canadian and imported timber. Millions of dollars have been saved by using less expensive woods for many purposes. This, too, has provided Canada with American exchange by making more high-grade timber available for export. U.S. dollars have also been conserved by the substitution of Canadian for American woods in Canadian construction where possible. In many instances it has been possible to substitute wood for steel, thus saving not only steel but also American dollars. Every effort has been made to increase Canadian production of hardwoods and imports of hardwoods from Empire countries—again in order to save U.S. dollars.

Steel and Iron: Steel has been under the supervision of a Controller since June, 1940. Since that time measures have been taken to stabilize prices. Canadian production of both steel and iron has been increased by stepping up the output of existing facilities and arranging for other sources of production. This has involved expanding the facilities of many plants, at Government expense in some cases.

Production of steel in Canada is to-day about 65% greater than the 1935-1938 average, and Canada now manufactures about two thirds of present steel requirements. Iron is being produced in increasing quantities. Pig iron production in 1940 was more than 50% greater than in 1939 and in the first six months of this year the output was about 14% greater than in the corresponding period of last year. Despite enlarged capacity, Canada must import substantial quantities of steel from sources outside the Dominion. Such imports must now be confined almost wholly to war requirements. Imports of iron and steel scrap have considerably increased.

Canadian industry is assisting the war effort by salvaging increasingly large amounts of iron and steel scrap. Crop ends, trimmings, defective ingots and castings, turnings, borings, discarded rails, scrapped automobiles, freight cars and locomotives, old machines and a variety of other types of scrap, are regularly being turned over to war factories. The extent to which this scrap has been utilized since the outbreak of war is shown by a Dominion Bureau of Statistics report showing the amount of scrap iron and steel used in Canada, 1924-1940. It indicates the following advances:

	1939 over 1938 % Increase	1940 over 1939 % Increase
Scrap Iron and Steel used in Steel Furnaces....	26	72
Scrap Iron and Steel used in Iron Foundries...	9	40
Scrap Iron and Steel used in Manufacture of Ferro-Alloys........................	41	50
Scrap Iron and Steel used in Manufacture of Artificial Abrasives....................	6	60

Measures to conserve steel and iron have been taken. Other materials are being used wherever possible. Structural steel shapes have been standardized and reduced in number from 267 to 70. An informal system of priorities has been operated to ensure that essential undertakings have the steel they require. A Wartime Steel Advisory Committee has recently been appointed to protect the requirements of Canada's munitions industry. For some time all orders for pig iron have had to be approved by the Steel Controller, who approves them on the following priority basis: castings required for war work; castings required by transportation systems, mining and petroleum industries, and public utilities; castings for agricultural implements, and the pulp and paper and lumber industries; and castings not otherwise classified. Recently the use of rolled steel plate in the manufacture of cigarette containers was prohibited.

Metals, Minerals and Alloys: The following are among the important minerals which are under the supervision of the Metals Controller, who was appointed in July, 1940,—aluminum, nickel, gold, copper, zinc, cobalt, lead, molybdenum, chromium, tin, manganese, potash, tungsten, and magnesium. The first eight are available in quantity in Canada; the others have to be imported in greater or less degree to meet normal requirements.

Canadian mineral production has substantially increased since the outbreak of war.

In addition, imports of needed metals have been increased wherever possible. While exports of scarce metals are severely restricted, Canada's exports to Britain and the United States of those she produces in quantity, such as nickel and aluminum, have greatly increased.

The use of metals in Canada for non-war purposes has been curbed by agreements between the Metals Controller and industry. A variety of measures have been adopted, of which the following are important examples.

The first step in aluminum control was taken in August, 1940, when the use of aluminum for electrical conductors was banned. At the same time manufacturers of aluminum cooking utensils and foil rollers were notified that supplies of primary aluminum would not be available for those purposes. As of July 15th, 1941, control and curtailment were extended to secondary and scrap aluminum. There has as yet been no need to take any mandatory action in connection with prices for secondary or scrap aluminum. In the case of scrap, the producers and users of secondary aluminum in Canada are voluntarily adhering to the price schedule prevailing at the outbreak of war. Also, in co-operation with the Metals Controller, they have agreed to restrict the use of secondary aluminum as far as possible to essential war purposes. The use of aluminum powder is being strictly rationed for essential needs or for purposes where no substitute is practical.

The International Nickel Company of Canada is the only producer and distributor of primary nickel of Canada and prior to any official action, this company, in co-operation with the Metals Controller, took steps to exercise a measure of control in the domestic consumption of the metal.

Curtailment of domestic consumption of zinc was started in May 1941. As a first step, all exports of zinc die castings were stopped. Then representatives of all principal industries using zinc were called together by the Metals Controller and their co-operation was secured in bringing about domestic curtailment. In order to institute curtailment of zinc oxide in the rubber, paint and miscellaneous groups, thus saving zinc metal, the Metals Controller has formed a Zinc Oxide Committee which includes all principal producers and distributors of this product in Canada. This Committee meets regularly to allocate available supplies for most essential purposes.

The following table indicates the extent to which the use of aluminum, nickel and zinc is being restricted to essential undertakings:

	1940		*Estimated 1941*	
	Essential Use	*Non-Essential Use*	*Essential Use*	*Non-Essential Use*
	%	%	%	%
Aluminum	73	27	98	2
Nickel	60	40	85	15
Zinc	36	64	75	25

Copper and tin are also being carefully conserved. The use of copper for making brass and for other commercial purposes is being restricted by a quota system. The tin content of metal containers for all products except a few specified foods, has been reduced by 10%.

Chemicals: Measures to assure a maximum supply of chemicals, constituents and intermediates have been taken from time to time. In July, 1941, a Chemicals Controller was appointed to supervise this work. Chlorine and ethylene glycol (used in making non-alcoholic anti-freezes for military vehicles) are among the chemicals now being controlled. Chemicals are in heavy demand and the problem of maintaining an adequate supply is one of those being dealt with most carefully at the present time.

Shipping: In addition to undertaking a $200,000,000 merchant-ship-building programme, Canada has taken all possible steps to increase the number of ships available to Britain. This has been done in addition to carrying on her own essential water-borne trade. Besides all ocean-going merchant vessels which could be spared, a large number of Great Lakes vessels, a number of vessels of special type, such as salvage vessels, and a considerable number of tankers have been made available to Britain. Such arrangements as are possible are being made to transfer Canadian Lakes vessels to coastal work next winter, in order that coastal ships may be freed for deep-sea duties. All vessels taken in prize or requisitioned by the Canadian Government are being used to carry goods to Britain, with the exception of one which is unsuitable for such service.

Manning pools to provide groups of experienced merchant seamen at short notice will soon be established to facilitate merchant ship movements.

Canadian ship-repair facilities are being stepped up to a maximum to assure a rapid turn-around for merchant shipping and to provide quick repairs for ships of war. New drydocks are being built in important ports.

Silk: Early in August, 1941, an Order in Council was passed "freezing" all raw silk not required for the production of war materials. The move was made to conserve available supplies of silk, in view of the uncertainty of future shipments from abroad. A Government-owned company has been given control of silk supplies and matters relating thereto.

Rubber: Rubber is now subject to control. Consumption of crude rubber for domestic purposes, beginning this month, is to be reduced to 70% of the monthly average used in the year which ended May 31st last. The reduction is to be graduated and will become fully effective in February of next year.

Cork: Cork has also been placed under control.

"The Necessaries of Life": At the outbreak of war the Government took immediate steps to assure an adequate and continuous distribution of the necessaries of life at reasonable prices, and to eliminate hoarding and profiteering. The Wartime Prices and Trade Board was established and endowed with powers permitting, where necessary, an adequate control of the production and distribution of the necessaries of life. (The Board's wider powers, as described above, were assigned in August, 1941.)

During the first two years after its establishment, the Board investigated the distribution and sale of most important consumer commodities, including sugar, butter, tea, flour and feeds, bread, meat, canned goods, cod liver and other oils, cloth and clothing, hides and leather, wool, coal, and rents; and, with the help of Technical Advisers and Administrators, it endeavoured to forestall shortages wherever and whenever possible. In certain cases it was found necessary to fix prices for a time. But in most cases, the Board was able to prevent unjustified price increases by creating an enlightened and effective public opinion, and by taking all possible steps to ensure ample supplies. This work involved a great amount of detailed study and negotiation. Technical Advisers are experts in their own fields, but Administrators are chosen from outside the industry in question so that unbiased authority may be exercised.

The Board's efforts to secure enlightened and voluntary co-operation have been most outstanding in regard to prices. An interesting example of the Board's work in the price field is the administration of rent control in crowded centres. The Board "pegs" rents as of a certain date and provides both landlords and tenants with detailed information on rentals. For those who are unable to obtain satisfaction as a result of this instruction, courts operate to hear appeals. Recent advice issued to the public by the Board includes its "serve by conserving" campaign, which urges householders, hotels, restaurants, shops, etc., to make the most economical use of perishable foodstuffs, animal fats, and other foods often allowed to go to waste.

The problem of ensuring ample supplies of the necessaries of life is a very complicated one and various methods have been adopted in this matter. For example, a system of import and export licensing, combined with efforts to increase domestic production, has been used to conserve available supplies of fish livers and oils, hides and leather and wool. Again, Government purchasing, as in the cases of sugar and wool, has been carried out to assure adequate supplies at economical prices and to allow maximum co-operation with Britain in the use of shipping facilities. The problem of distribution has engaged the Board's attention and various measures to ensure the best possible transportation facilities and rates for essential products have been taken. Another task which the Board undertakes is the investigation of complaints of hoarding and profiteering. It takes corrective action where necessary.

The Board has at all times co-operated with the Food Supply and Shipping Controls in Britain. Several measures helpful to these offices have been taken since the outbreak of war.

The difficulties faced by the Board have been many. Depreciation of the Canadian dollar, disorganized shipping, tremendous increases in ocean freight rates and war insurance costs, and substantial increases in taxes on many commodities, have all affected the prices of certain essential products. Nevertheless, by careful planning and co-operation it has been possible to maintain an adequate and uninterrupted flow of the necessaries of life on to the Canadian market.

The Board's powers, as stated above, now extend to all goods and services. Its first major move since obtaining its larger function has been to take steps to place under license Canada's entire food and clothing trade—all dealers, manufacturers, processors, wholesale and retail distributors of food products, clothing, and footwear, including all restaurants and eating places. In addition, all dealers in feeds for livestock and poultry will be required to operate under license. This licensing plan will provide the machinery for policing prices and for securing information necessary for the allocation of supplies. Regional licensing offices are being established.

Supervising Agricultural Production in War Time

While prices of farm commodities are supervised by the Wartime Prices and Trade Board, the Dominion Department of Agriculture is in charge of food production in wartime. At the beginning of the war, the Department set up an Agricultural Supplies Board generally to direct production activity and to deal with other agricultural problems arising out of the war. It is the responsibility of the Agricultural Supplies Board and its collaborating provincial production committees to ensure that Canadian agriculture is conducted, during war-time, in a manner calculated to satisfy, as far as possible, the needs of Canada and of Britain for food and fibres.

The Board has acted as a central directive agency, attempting to guide production in the light of Canada's known needs and of British requirements as ascertained through constant telegraphic and, when the need arises, personal communication with the British authorities. Through special sub-committees, the Board assures supplies of fertilizers and pesticides needed in Canada; by Dominion-Provincial joint programmes production is undertaken in suitable areas of those field root and vegetable garden seeds ordinarily supplied in large measure by Europe; and by direct action, the Board controls the fibre flax industry in Canada to make sure that a maximum quantity of flax fibre and tow goes forward to the British Fibre Control, and that surplus fibre flax seed from Canada is made available to Northern Ireland.

To prevent dislocations in the agricultural industry, the Board has endeavoured to assist those branches of agriculture that, through the disappearance under war conditions of normal export outlets, have become war casualties.

Independent of the above Board, but working in close collaboration with it, are three Boards which purchase and forward supplies of Canadian farm products contracted for under agreements between the British Ministry of Food and the Canadian Government. The Bacon Board buys, stores and ships bacon and other pork products required by Britain, limiting, when necessary, supplies used in Canada in order to ensure that contract needs are met. The Dairy Products Board acts in a similar capacity with respect to Canadian cheddar cheese needed by Britain, and takes such measures as will ensure needed supplies of other dairy products for Britain or for the domestic market. A Special Products Board, established in the spring of 1941, is responsible for purchasing and shipping to Britain certain Canadian farm produce, such as eggs and fruit and vegetable products, not already being handled by the two Boards mentioned immediately above.

An important wartime problem which the Department of Agriculture has dealt with is the surplus of wheat and the related problem of providing adequate supplies of feed for livestock at reasonable prices. As Canada has a large wheat surplus, the Government has instituted a policy of wheat acreage reduction. At the same time, more coarse grains are being grown. This policy, combined with moves to reduce the price of millfeeds and restrict their exportation, assists livestock production and thus provides more of the products Britain needs in greater quantity—cheese and pork products.

The Canadian Government pays about one quarter of the return to the producer on all cheese sold to Britain. Similar steps have been taken with respect to bacon and other pork products. The amount of such products available for domestic consumption has been reduced by about 25%; Canadian citizens have been asked to cut their consumption of pork meats drastically; such products are no longer to be exported to any country except Britain or British possessions; and the Government has undertaken as in the case of cheese, to pay a substantial share of the return to the producer.

> ***"The history of the first two years of the war proves that an appeal to farmers in Canada is not necessary to obtain results in production. Even without the usually necessary inducements of high returns, farmers have produced as never before."***
>
> *Hon. J. G. Gardiner, Minister of Agriculture.*

Government, Labour and the War

Labour Supply

Labour supply will ultimately be the most general and difficult shortage faced by Canadian war industry. Hence labour supply problems are receiving close attention from a number of agencies—the National Labour Supply Council, the Labour Co-ordination Committee and the Wartime Bureau of Technical Personnel.

The latter, which has a register of technically trained personnel, also encourages the transfer of experts from non-war to war work and the training of men for war jobs in the shops of established plants. Five of Canada's leading industrial groups (the mining, petroleum, public utilities, textile, and pulp and paper industries) are co-operating in this latter work. The War Emergency Training Programme is training thousands of previously unskilled workers in about 100 technical and plant schools throughout the country. So far 41,500 have been trained in technical schools; of these 23,903 are industrial workers and the rest have been trained for the armed forces. At least 40,000 have been trained in plant schools. About 100,000 workers are to be so trained during the course of this year.

It is estimated that about half the persons employed in manufacturing in the Dominion are now engaged more or less directly on production associated with wartime needs. Many thousands of women are now employed in factories which manufacture shells, ammunition, guns, airplanes and other war equipment. However, only about 60% of the man and woman power that will ultimately be required to carry out Canada's industrial war programme is now engaged in the production of munitions and war equipment. It is expected that war industries will draw increasingly on peace-time occupations during the coming months, and that more women not normally employed will be entering industrial or commercial work.

A precautionary measure giving the Government power to protect the supply of key workmen in Canadian war industry was taken recently when an Order in Council was passed extending the provisions of a previous order preventing employers from enticing to their service persons already engaged in war production. The new order gives the Government such powers as are necessary to keep in war industry persons in certain scarce or skilled trades.

This may be done by the establishment of a system of priorities operating through employment offices. Young men in industry who wish to enlist are released from their jobs if an independent Board considers they can be spared.

Labour Relations

The Government has taken several steps since the outbreak of war to encourage good relations between management and labour and to effect a satisfactory adjustment of wages to wartime conditions.

In November, 1939, the provisions of the Industrial Disputes Investigation Act were extended to cover disputes between employers and employees engaged in war work. This means, among other things, that a strike in a war industry is illegal if called before a conciliation board brings in its finding. In June, 1940, an Order in Council was passed enunciating certain principles for the avoidance of labour unrest during the war. In December, 1940, a wartime wage policy, taking the 1926-29 level as the norm and suggesting that any increases be in the form of wartime cost-of-living bonuses, was adopted. In June, 1941, an amendment to the Industrial Disputes Investigation Act was passed. Designed to ensure that conciliation board findings will be completely impartial, it prohibits the nomination to conciliation boards of persons who have pecuniary interest in one side or the other in a dispute or who have within six months acted as lawyer or paid agent for either side in the dispute. In June also the Government set up an Industrial Disputes Inquiry Commission to deal with labour trouble in its incipient stages and to determine whether or not a conciliation board is necessary. The Government has raised the minimum wages payable by manufacturers doing war work.

Early in July 1941, in accordance with the policy laid down in December, 1940, Government made known its approval of a cost-of-living bonus for about 3,000,000 workers in Canada. The bonus is based on a rise in the cost of living above the level of August, 1939, and is calculated at the rate of $1.25 per worker per week for each five per cent rise in the cost-of-living index. The Order of December, 1940, (P.C. 7440) made provision for payment of a flat-rate bonus when it is found that the cost-of-living index of the Dominion Bureau of Statistics has risen at least five per cent and thus impaired the power to purchase basic necessities of life. The cost-of-living bonus is intended to give labour a shield against the worst consequences of rising prices, without causing further rise in wages which would likely lead to inflation. It is in line with the Government's policy of curbing price increases, controlling rents and restricting profits.

Average money wage rates are higher to-day than they have ever been in Canadian history with one exception. In 1920 wages were about 2 per cent higher than to-day; but the cost of living was nearly 50% higher. Present-day conditions also compare favourably with 1929. Wage rates are about 4 per cent higher than in 1929 and the cost of living is about 5% lower.

The work of the Industrial Disputes Inquiry Commission indicates that the cost-of-living bonus policy is being successfully applied in war industries. In seven out of eight disputes recently settled by the Commission, management and labour accepted the principle of the cost-of-living bonus. Many other employers in Canada, including the Dominion Government, are paying the cost-of-living bonus.

On July 1st, unemployment insurance came into operation in Canada. It applies to some two and one-half million workers, who, with their dependents, total nearly one half the population of the country. The Plan is administered by a commission representing the three parties who contribute to the fund from which unemployment benefits will be paid; namely, workers, employers and the State. A worker's contribution ranges from twelve to thirty-six cents a week, depending on his earnings. Amount of benefit an unemployed worker receives and the length of time he receives it, are strictly related to the length of time he has contributed to the fund and the amount of his contribution. The contributions of workers and employers, running to millions of dollars annually, are, incidentally, of real assistance to the war effort.

In recent months the Government has found it necessary to take certain specific actions in labour disputes. In April, 1941, a Hamilton steel industry was firmly dealt with. A dispute between the management and the workers was referred to a conciliation board, as is required by law. However, the management refused to accept the majority finding of the board and the workers went on strike.

Without delay the Government, invoking the powers it possesses, sent in a controller to take over management of the plant. The next morning the plant was producing and the workers were back at their jobs. A strike which subsequently occurred in the same plant in July, 1941, was ended after negotiation with the Government.

In June, 1941, strong action was taken against strikers who were impeding war production. Under authority of the Industrial Disputes Investigation Act, summonses were issued on June 12th against a number of employees of the Canadian General Electric Company in Toronto. They were charged with participation in a strike which was illegal because it occurred before the dispute had been referred to a conciliation board. Convictions were registered on July 15th and the men were fined.

A five-day shut-down which occurred late in July, 1941, in the plant of the Aluminum Company of Canada, at Arvida, Quebec, led the Government to take further precautions against actions which impede war production. Under the War Measures Act an Order in Council was passed on July 29th, the day the shut-down ended, amending the Defence of Canada Regulations so that they now give the Minister of Munitions and Supply authority to request the Minister of National Defence to call out units of the Active Army to prevent or suppress riots, disturbances of the peace or other actions likely to impede or obstruct the production or delivery of munitions of war or supplies or the construction of defence projects. The new regulation provides for action without delay. The Minister may utilize the Royal Canadian Mounted Police; or if they and municipal and provincial police are insufficient, he may call upon the Active Army. These regulations do not prevent the calling of a legal strike in Canada.

But regulations now in force discourage strikes in war industries. If a dispute arises in a war industry, the parties must first refer their dispute to a conciliation board. No strike action may be taken until after the report of the board is released—and then only if a vote is taken under Department of Labour auspices and a majority of those eligible to vote are found to be in favour of a strike.

Canada's wartime labour record compares favourably with that of both Britain and the United States. This is indicated by the following table:

	Britain	Canada	U.S.A.
Time-loss per 1,000 workers in first six months of 1940	37	67	66
Time-loss per 1,000 workers in first six months of 1941	41	54	381

One of the most serious labour "bottle-necks" Canada has encountered since the outbreak of war—the "slow-down" of production in Cape Breton coal mines—has now been eliminated. The mines went back to full production late in September. As of October 1st, there were no strikes in Canadian war industries.

Industrial Security

The Government has taken steps, through the Division of Industrial Hygiene in the Department of Pensions and National Health, to improve and preserve the health of employees in war industry. Working conditions in defence plants are closely supervised. Advice on occupational hazards and disease is circulated to employers and employees. Workmen's Compensation Boards are supplied with information concerning new occupational diseases arising out of war manufacture. Laboratory research on occupational hazards is carried out.

An Industrial Security Branch of the Department of Munitions and Supply has recently been established to assist Canadian war industries in assuring that maximum protection is provided for their plants.

Transit

A transit controller has recently been appointed by the Department of Munitions and Supply. This is a precautionary measure directed primarily at congested traffic conditions in key war centres. The new controller has complete control over transportation facilities and power to establish schedules of fares. He may regulate the parking of vehicles. He is empowered to stagger working hours to relieve transportation congestion and may order any employer to arrange or alter the hours of employment of employees in order to assure that such proportions as the controller may fix will arrive at or depart from their places of employment at such times as may be directed.

Foreign Exchange Control

Canada's United States Dollar Problem

A supply of foreign exchange, particularly United States dollars, is vital to Canada's war programme. To help to ensure this supply and to perform other necessary functions, the Foreign Exchange Control Board was given the necessary powers at the beginning of the war.

Canada normally sells the Sterling resulting from her Empire trade in order to get American dollars to cover her trade deficit with the United States. But the war has made this procedure impractical. For Britain has needed most of her gold and American dollars for her own war purchases in the United States, and so has not been able to continue to convert Canadian Sterling credits into United States dollars. Moreover, since the beginning of the war, Britain has been able to settle only a fraction of her billion dollar trade deficit with Canada by transfer of gold; and since December of last year no gold has been transferred from Britain to Canada.

At the same time Canada's net deficit with the United States, on both current and capital account, has increased. In 1938, the last full year before the war, it was about $115,000,000. In the year and a half between September 15th, 1939, and March 31st, 1941, it was about $477,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) it will amount to about $467,000,000, less whatever reduction is effected under the terms of the Hyde Park Declaration.

Thus, because of greatly increased war purchases in the United States, Canada, since the beginning of the war, has been faced with a widening differential between the amount of U.S. dollars she needs and the supply she is able to command. For, under the terms of the United States Neutrality Act, Canada's vast war purchases in the United States on her own account must be paid for in cash in United States dollars. And at the same time, because of the financial burden which the war has placed on Britain, the Dominion has been unable to make up her exchange deficit with the United States in the normal peace-time manner.

Conserving United States Dollars

Foreseeing this situation, the Canadian Government did the only thing possible. It took steps to conserve the American dollars in Canadian possession and to increase that supply where possible. Canada has tried to avoid the accumulation of unliquidated obligations during the war which would only make it more difficult to do away with the control after the war. Instead, the Dominion has made every effort to meet her exchange shortages by making her own residents do without things which are not essential. Over a year ago Canada placed a special war-time tax on all imports except those paid for in Sterling. This has substantially reduced the purchase of non-essential imports. In July of 1940, Canada ceased to permit the sale of United States dollars to Canadians for pleasure travel abroad. It was a necessary choice of buying holidays or buying war supplies from the United States. The Government did not like to do this, but since a very substantial saving of exchange could be effected, it felt that the step was necessary. Finally, about the end of 1940, Canada took the more drastic step of prohibiting the importation of a long list of non-essential consumers' goods. For certain other major items gradual reductions in imports by Canadians were decreed. Such articles include automobiles, radios, cameras, electric fixtures, household appliances and scores of similar products.

Foreign exchange provided in these and other miscellaneous ways, substantially add to the normal supply accruing from the export and tourist trades and help to provide Canada with a pool out of which she may pay for imports, service Canada's debt payable in foreing currencies and cover other necessary external disbursements. In order that Canada may continue to purchase goods in the United States on a scale commensurate with the demands of her war program, it has been necessary to continue the methods for conserving foreign exchange outlined above, even though the Hyde Park Declaration has established a principle which, it is expected, will result in an easing of Canada's foreign exchange position.

For this reason, among others, Canada this year is especially anxious to attract American tourists to the Dominion. Americans can visit Canada and return without difficulty. They are assured of unique vacation facilities, will enjoy a 10% premium on their money and will have the satisfaction of knowing that every American dollar they spend in Canada will go back to the United States to purchase war supplies for the Canadian armed forces.

Other Foreign Exchange Control Measures

The Foreign Exchange Control Board exerts other war-time controls which bring needed United States dollars to Canada. It has also taken steps to stabilize the Canadian dollar, a condition which is vital to Canadian trade, and to prevent disorderly marketing of securities or an outflow of capital from Canada—developments which usually threaten a nation engaged in war. All these measures have been indispensable to the economic stability of Canada and to the efficiency of her war effort.

FINANCIAL UNDERTAKINGS

Wartime Financial Policy

The main lines of Canada's financial policy during the war have been, first, to pay as much as possible of the costs of war from taxation; secondly, to impose this increased taxation in accordance with ability to pay; thirdly, to avoid inflation; and, fourthly, to time financial action in such a way as to encourage a rapid expansion of production to the maximum.

War Spending

In the first two years of the war Canadians spent a total of about $2,183,000,000 on their own war effort and on aid to Britain.

Canada's total war spending in the current fiscal year (April 1st, 1941, to March 31st, 1942) has been estimated to be about $2,350,000,000, the exact amount depending on as yet undeterminable factors. This is about 40 per cent of the total estimated national income of less than $6,000,000,000. It amounts to considerably more than Canada's total war expenditure during more than four years of the last Great War and represents an annual disbursement of about $200 for every man, woman and child in the Dominion.

When war expenditures are added to the ordinary expenses of all Canadian governments, federal, provincial and municipal, Canadian citizens this year will have to give up about fifty cents of every dollar earned to foot the bill. The Dominion Government alone is spending about five times as much this fiscal year as it spent in the last full fiscal year before the war.

Canada's direct war spending has increased steadily and momentously. In the first two years of the conflict the Dominion spent approximately $1,278,000,000 on her own war activities. Since June, expenditure has been running at the rate of nearly $4,000,000 a day—about five times as fast as during the first six months of the war. It is expected that direct war expenditure in the current fiscal year (April 1st, 1941, to March 31st, 1942) will be approximately $1,450,000,000—nearly twice as much as the amount spent in the previous fiscal year.

In addition to this direct expenditure on her own war requirements, Canada spent $905,000,000 in the first two years of the war to provide Britain with Canadian dollars. (See also page 28). The net amount which Canada expects to provide for this purpose in the present fiscal year, which ends on March 31st, 1942, amounts to at least $900,000,000, the bulk of the Canadian dollars Britain will need.

War Taxes

This fiscal year the Dominion Government is collecting about three times as much in taxes as it collected in the last full fiscal year before the war.

Pre-war taxes have been increased and new taxes imposed. The following figures indicate the increase in tax revenue since the outbreak of war.

Total Revenue from Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42, for Full Fiscal Year*
$468,271,000	$778,290,000	$1,369,310,000

Direct taxes of all kinds will raise more than five times as much this fiscal year as they did in the last full fiscal year before the war. Income tax rates were rised in June, 1940, and again in April, 1941. The graduated rates now begin at 15%, compared with 3% before the war. Exemptions have been lowered as well. In June, 1940, a National Defence Tax was imposed on practically everyone receiving salary or wages. The rates were 2% for a married person and 3% for a single person. In July, 1941, these were raised to 5% and 7% respectively. The combined effect of these moves has been to increase the amount of tax on personal income and the number of persons paying income tax very considerably. Five times as many people as before the war now pay income taxes of all kinds, and married persons with incomes of from $3,000 to $10,000 pay from 11 to 4 times as much income tax as before the war.

A table showing how income tax has increased in the past year because of war is on page 4.

Immediately after the outbreak of war in September, 1939, an excess profits tax was announced. The operation of this tax, combined with increases in corporation taxes, have now advanced the minimum rate of corporation tax to 40%. This is a very much higher rate than that prevailing before the war. Increase in corporate profits over the standard pre-war rates are subject to a tax of 79½%. This is about the same rate as that now in force in Britain. This tax ensures that if any company does increase its profits because of war conditions, the Dominion Treasury will derive nearly all the benefits.

Another measure to increase direct tax revenue which has been imposed since the outbreak of war, is the levying of a Dominion Government succession duty, in addition to the succession duties already imposed by the Provinces.

In order to spread the tax load as fairly as possible through all sections of the country, an arrangement is being worked out with the Provinces which will centralize income and corporation tax collections.

The extent to which all these moves have increased direct tax revenue is indicated by the following figures.

Total Revenue from Direct Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42 for Full Fiscal Year*
$136,910,000	$274,690,000	$732,000,000

Before the war the Dominion Government secured indirect tax revenue from customs duties and a sales tax on a variety of commodities and also from excise taxes on automobiles, tires and tubes, liquor, beer and malt, wine, cigarettes, cigars, tobacco, matches and cigarette lighters, playing cards, cosmetics and toilet preparations, sugar, glucose and corn syrup, and long-distance telephone calls.

These taxes, with the exception of the sales tax, have been substantially increased since the outbreak of war. Increases in customs duties have also been effected. More than a year ago a war exchange tax was placed on a wide variety of imports, including automobiles and scores of durable consumer's goods. This tax now applies to a very wide assortment of "non-essential" imports.

In addition to increases in existing indirect taxes, new taxes have been imposed since the outbreak of war on the following—radios, cameras, phonographs, vacuum cleaners, washing machines, electric toasters and other household appliances, soft drinks, gasoline, travel fares on trains, buses and airplanes, entertainment such as movies, concerts, sports events, horse racing, etc., and race track bets.

Indirect taxes now raise about twice as much revenue as they did before the war. The following figures indicate the steady rise in indirect tax revenue in the last two years:

Total Revenue from Indirect Taxes

1939-40 Fiscal Year	*Estimated for 1940-41 Fiscal Year*	*Budgeted, 1941-42 for Full Fiscal Year*
$331,361,000	$503,600,000	$637,310,000

War Loans and Savings

Since the outbreak of war the Dominion Government has borrowed about $1,470,000,000 from the public and from domestic financial institutions other than banks. This money has been raised by the floating of three war loans and by the issue of war savings and non-interest-bearing certificates to the public. The war loans have provided the Government with more than $1,200,000,000 in new money and about $171,000,000 in conversions.

All three war loans have been oversubscribed. The recent 1941 Victory Loan, nominally for $600,000,000, raised $711,000,000 in cash subscriptions. This is more than the amount invested in the 1918 Victory Loan, Canada's largest loan during the last war. Including conversions, the total raised was $807,000,000. The Government has accepted the whole of the oversubscription. The Loan was remarkable for the number of small investors who bought bonds. About one in every thirteen Canadians, including men, women and children, subscribed to the Loan. Interest on Government bonds has been held at a low rate, and there are no tax-free war bonds.

At the end of September, applications for war savings certificates amounted to about $88,000,000, and more than $7,000,000 had been invested in non-interest-bearing certificates. War savings certificates have a face value of from $5 to $100 and may be purchased by the accumulation of 25c war savings stamps.

The Government expects in the present fiscal year to receive about $200,000,000, in return for war savings certificates and in other forms of citizens' savings.

The amount of bank borrowing by the Dominion Government has been cautiously limited.

The "Pay-As-You-Go' Policy

The total amount which the Federal Government will have to raise for war and ordinary purposes in the present fiscal year is estimated to be about $2,820,000,000. Of this amount taxes and non-tax revenue will provide about $1,500,000,000, in the actual fiscal year ending March 31, 1942, about $100,000,000 more than was estimated in the budget, brought down late in April, 1941.

The following table summarizes estimated revenue and expenditure in the current fiscal year in round figures:

Expenditure		%
Total	$2,820,000,000	100
Total War Expenditure	$2,350,000,000	83
Direct war	$1,450,000,000	51
For Britain	$ 900,000,000	32
Ordinary Expenditure	$ 470,000,000	17

Revenue		%
Total Needed	$2,820,000,000	100
Estimated Revenue	$1,500,000,000	53
To be met by funds borrowed from people	$1,320,000,000	47

In estimating the extent to which the Government is adhering to a "pay-as-you-go" policy, it should be remembered, however, that funds advanced by Canadians to Britain now are covered by the accumulation of Sterling balances; and repatriation, while it must be paid for now by Canadians, is not a drain on capital. Direct war and ordinary expenditures will total about $1,920,000,000; revenue will be about $1,500,000,000. On this basis, the 1941-42 budget provides for the payment of about 78% of total federal expenditures (including ordinary disbursements and expenditure on Canada's own war programme out of revenue. Revenue will cover expenditures on Canada's own war programme.

War Economies

The War Expenditures Committee of the House of Commons, composed of members from both the Government and the Opposition sides, is charged with the duty of examining war expenditures. It has recommended several economy measures, some of which have now been carried out. The Chairman of the War Expenditures Committee has succinctly expressed the aim both of the Committee and of the Parliament it serves: "A dollar's worth of war effort for every dollar spent."

VOLUNTARY CONTRIBUTIONS AND SERVICES

(See also page 29)

Contributions

Canadians have contributed more than $27,000,000 to war charities since the outbreak of war. Of this sum many millions have provided comforts and war equipment for Britain. The Canadian War Services Fund combining the major charities devoted to the welfare of the fighting forces, will ask for about $17,000,000 more in its next campaign. These organizations, in addition to their work in Britain, provide comforts and services for the troops in Canada. A total of 2,008 organizations are now registered with the War Charities Administrator, one of whose functions is to see that no war benefit operates with an overhead of more than 25%.

Thousands of Canadians and a large number of Americans have sent nearly $2,000,000 to the Canadian Government as "free gifts" to help the war effort.

Services

Thousands of Canadians are engaged in voluntary war work. Air Raid Precautions services have been organized in many communities and thousands of Wardens are now being trained. The services of many "dollar-a-year" men have been offered to and accepted by the Government. They occupy key positions in Canada's war machine. Many scientists and technical experts have placed their skill and knowledge at the disposal of the government. More than ten per cent of the registered medical doctors in Canada are now on active service with the armed forces. Hundreds of qualified nurses are also serving with the forces and a large number are overseas. Newspapermen, university professors, and many others, both prominent and obscure, have come to the aid of their country in the ways best suited to their talents and connections. The Canadian Manufacturers' Association, the Chambers of Commerce, the Boards of Trade, and the Service Clubs, such as Rotary, Kiwanis and Lions, play their part in the war effort.

Women of Canada, in all parts of the country, in their homes, organizations, clubs and churches have devoted themselves to providing clothing and other material for the comfort of civilians and combatants in the war zones and for Canada's armed forces.

Young women's organizations have increased rapidly in number and in strength. It is estimated that more than 10,000 Canadian women now wear the uniforms of volunteer organizations. More than 1,000 women are serving with the Canadian Red Cross Transport Service. With their associated services—the nursing service and the office and food administration—they comprise the Canadian Red Cross Corps of some 3,800 members throughout the country. The Corps is affiliated with the Royal Canadian Army Medical Corps.

Canadian children are also playing their part. Junior branches of the Canadian Red Cross throughout the country have raised thousands of dollars for patriotic purposes and have sent thousands of articles overseas. Thousands of boys and girls and young women were placed on farms during the summer months to replace men who joined the armed forces. Boys and girls throughout the country have enthusiastically gathered salvable materials and purchased war savings certificates.

Canadian homes and schools are taking care of 6,000 children evacuated from Britain to Canada. It is estimated that 100,000 would have been accommodated, had circumstances allowed this.

A special nation-wide drive to obtain used aluminum articles from Canadian households takes place this month. Actually salvage of aluminum and other waste materials has been going on in many parts of Canada for more than a year. These pioneer efforts were officially recognized in April, 1941, when a National Salvage Campaign was launched by the Dominion Department of National War Services. It has now increased the number of centres taking part to over 2,400. Men, housewives, school children and farmers have been informed by leaflets, posters and press notices of how they can best help. A variety of collection methods has been adopted and extraordinary success has been achieved in many centres. Materials being salvaged include aluminum, copper, brass, and other metals, scrap iron and steel, carpets, woollens, mixed rags, bottles and glass, old tires, old shoes, bagging, string, cork, rubber, oils and fats, waste paper, newspapers and magazines. The salvage campaign is now being expanded and is receiving the support of the controllers of essential materials.

CANADA, THE UNITED STATES AND THE WAR

(See also pages 61-63)

"As Canadians, we are proud of our great and good neighbour and grateful to know, as all the world knows, that she is with us heart and soul; that her genius, her skill and her strength work against time for those who fight for freedom."

Prime Minister Mackenzie King in a speech to the Canadian Organizations of New York City, June 17th, 1941.

Economic Co-operation

Without access to many United States products essential to war manufacture, Canada's war programme could not have progressed as far as it has to-day. Canada buys many essential war materials and machine tools in the United States, and since the outbreak of hostilities has bought them in increasing quantities. In spite of a reduction in the amount of "non-essential" commodities coming to Canada from the United States, Canada's imports from that country have increased greatly since the outbreak of war. In 1938 they were valued at $425,000,000; in 1939, in September of which year the war began, they rose to $497,000,000; and in 1940 they soared to $744,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) they are expected to reach $953,000,000, of which at least $428,000,000 will be for war purchases. At the same time it has been estimated that Canada's exports to the

United States this fiscal year would run, under normal trade arrangements, to $475,000,000—which would leave Canada with a trade deficit with the United States of about $478,000,000.

The Hyde Park Declaration

The Hyde Park Declaration has established a principle which, it is expected, will reduce this deficit and assist Canada to maintain and increase her war purchases in the United States. As a result of the agreement, it is expected that Canada will be able to sell to the United States additional defence materials and some articles of war to the value of between $200,000,000 and $300,000,000 during the twelve months ending April next year. In addition, the United States is to lend-lease to Britain materials and parts to be shipped to Canada as components in Canadian production for Britain. Canada, herself, is not obtaining supplies from the United States under the lend-lease plan, but is paying cash in American dollars for everything which she purchases in the United States on her own account.

Canadian Exports to United States Increase

Canada has increased her exports of essential raw materials to the United States in the two years since the outbreak of war. Nickel, aluminum, other non-ferrous metals, non-metallic minerals, timber, pulpwood, pulp and news-print have been among the commodities flowing in increasing volume from the Dominion to the Republic. Since the Hyde Park Declaration was issued, arrangements have been made to increase purchases of war materials from Canada by the United States, and, in addition, certain war equipment which Canada produces in substantial quantities.

War equipment which Canada is able to export to the United States includes certain types of small arms, some guns and ammunition, certain explosives and chemicals, certain armed fighting vehicles, corvettes and minesweepers, aluminum and other metals and materials. There are also some types of clothing and textiles, leather, rubber and timber products and various secret devices in which Canada could probably make an important contribution if these were desired.

Canada Must Still Conserve United States Dollars

The Hyde Park Declaration, though a magnificent contribution to the common struggle in which Canada and the United States are engaged, does not remove the need for the conservation of United States dollars, as outlined on pages 61-63. The most reasonable estimate of the magnitude of the Hyde Park Declaration's effect on Canada's supply of American dollars still leaves a considerable deficit in Canada's balance of payments with the United States.

Because of this situation the Canadian Government has reluctantly decided not to release funds for travel in the United States by Canadians for other than business, health, educational or other urgent reasons. As heretofore, of course, any Canadian can visit American relatives or friends who provide the United States funds for the purpose.

A Sound Canadian Economy Benefits Americans

Because the American and Canadian economies are very closely joined, Canada's efforts, under the stress of war, to preserve a sound financial position, have been of real benefit to Americans. Measures to safeguard the Canadian economy have protected the $4,000,000,000 which Americans have invested in Canada. Although it has been necessary to restrict the movement of capital out of Canada, Americans are allowed to withdraw, at the full official rates of exchange, all forms of current income from Canada. During the present fiscal year (April 1st, 1941, to March 31st, 1942) Canada will pay an estimated $238,000,000 in interest and dividends to United States investors. The attractiveness of Canada as a field of investment has not been impaired by the war, and millions of American dollars have been invested in the Dominion since the outbreak.

Further Significance of Hyde Park Declaration

The Hyde Park Declaration has a significance over and beyond its financial importance to Canada. The net result of the Declaration, it is expected, will be that the United States and Canada, each concentrating on the materials of war which it can produce best and most quickly, will become one strong team, working and producing according to a carefully planned programme which will ensure the most rapid possible supply of war materials to Britain and her embattled allies and the most efficient provision of defence articles for North America.

Discussions on Economic Co-operation

The Material Co-ordination Committee of the United States and Canada has been appointed and has had several meetings. It consists of two United States and two Canadian representatives, all government officials and experts in their fields, whose task is to collect and exchange information on raw material supplies of the United States and Canada, in order that all sources may be made known to those responsible for war production.

Canada and the United States have established joint committees of inquiry to "explore the possibility of a greater degree of economic co-operation" between the two countries. The committees, which are known as the Joint Economic Committees, "have been instructed to study and to report to their respective governments on the possibilities of: (1) effecting a more economic, more efficient and more co-ordinated utilization of the combined resources of the two countries in the production of defence requirements (to the extent that this is not now being done); and (2) reducing the probable post-war economic dislocation consequent upon the changes which the economy in each country is presently undergoing. The Committees have met both in Washington and in Ottawa and discussed, among other matters, arrangements to increase Canada's exports of war equipment to the United States, shipping, priorities, civilian consumption restrictions, other war-time problems common to the two countries, and post-war questions.

The close attention which the problem of integration is receiving from these committees and from other officials, augurs well for the success of a continental supply policy.

Instances of Economic Co-operation

One instance of this integration is the setting up of an informal joint committee of Canada and the United States to assure that facilities and supplies are used to the best possible advantage to meet the present heavy demands for chemicals and explosives.

The United States and Canada have co-operated in several specific measures which are advantageous to the defence of this continent and to Canada's war effort. In November, 1940, the Canadian and American governments arrived at an understanding which allows the construction of armed naval vessels on the Great Lakes. This allows both Canadian and American shipyards in this area to throw the full weight of their productive capacity into naval work. The construction of armed naval vessels on the Great Lakes had been virtually prohibited by the Rush-Bagot Agreement of 1817.

In March, 1941, representatives of the United States and Canadian Governments signed an agreement to construct the St. Lawrence waterway. The agreement is subject to the approval of the United States Congress and of the Canadian Parliament. If the waterway is undertaken, it will provide both the United States and Canada with large supplies of additional water-power for defence industries and will make possible the construction of large ships in Great Lakes yards.

Canada is co-operating with the United States in using a maximum of water-power at Niagara for defence purposes. By exchange of notes on May 20th, 1941, between the Canadian Minister to the United States and the Secretary of State of the United States, arrangements were made for the immediate utilization of additional water at Niagara for power development. In this manner, most of the additional Hydro electric capacity of the Niagara plants was put to work for defence purposes and it was made possible to increase the production of vital war materials for both countries and also for Britain. The agreement embodied in this exchange is of a temporary character and is subject to important restrictions.

During 1941 the Canadian Shipping Board has been able to make a few ships available to assist in the movement of American ore on the Great Lakes. This has been done when it has been possible to spare ships from the Canadian Great Lakes fleet, which, already reduced by the transfer of a large number of vessels to British services, is fully engaged in a number of ways. It is carrying ore and coal for Canada's own defence industries, moving grain for export to Britain and carrying certain other important commodities largely or entirely dependent upon water transportation by reason of the fact that no railway facilities serve production centres.

Various steps in respect to shipping taken from time to time by the United States Government have been of great assistance to Canada's economic war effort. One of these is the United States Ship Warrant Scheme recently introduced whereby all vessels touching United States ports are required to have a ship warrant issued by the United States Maritime Commission. Before receiving a ship warrant the owners of a vessel are required to give the Commission certain undertakings as to the employment of their vessels. This will greatly strengthen the similar control which is already in effect throughout the British Commonwealth and which is designed to ensure that all shipping contributes as effectively as possible to the common defence effort.

Canada and Western Hemisphere Defence

"Remoteness from the immediate scene of conflict has ceased to be a safeguard for men and nations that cherish their freedom."

Prime Minister Mackenzie King.

"The war is approaching the brink of the western hemisphere itself. It is coming very close to home."

President Roosevelt.

When Canada went to war two years ago she took immediate steps to ensure the defence of her territory and, subsequently, of key points in the western hemisphere. Since the Ogdensburg Agreement of August, 1940, these defensive measures have been co-ordinated with those undertaken by the United States and the two countries have now worked out joint plans for the defence of their part of the western hemisphere. Both Canadian coasts are constantly guarded by large concentrations of troops and by coastal and anti-aircraft guns located at strategic points, as well as by naval and air patrols operating along 2,000 miles of coast line and far out to sea. In the west Canada is building a string of staging airdromes to that military planes from both Canadian and United States centres can be moved into northern British Columbia and Alaska without delay. In the east, United States troops have replaced Canadian forces in Iceland, and they have joined Canadian troops in Newfoundland where the two countries are building extensive defence facilities. Canada and the United States are in full agreement concerning defence measures in Greenland. Both United States and Canadian troops stand guard in the West Indies. At sea both the Canadian and United States navies are on guard against marauding submarines.

Civilian defence and A. R. P. units are organized in many parts of Canada and blackout practices have been held in several cities. The Army and the Royal Canadian Mounted Police guard vital points and operate to prevent fifth column activities and sabotage.

Americans in the Canadian Armed Forces

A direct and striking American contribution to Canada's war effort is the arrival in Canada of American volunteers for the Canadian armed forces. About 8% of the air crew trained or in training in the R.C.A.F. are Americans and 600 American fliers are acting as instructors for the Air Training Plan. Americans in the R.C.A.F. now wear a distinguishing badge "U.S.A." on the shoulder. Nearly 10,000 Americans are serving with the Canadian Army. Many of these airmen and soldiers have already gone overseas. Americans and Canadians to-day fly together in the R.A.F. and the American "Eagle" squadrons often fly with R.C.A.F. Squadrons.

While the Canadian Government has made no effort to enlist United States citizens, it has ruled for the convenience of those who come to Canada to volunteer, that persons who, by taking the usual oath of allegiance to the British Crown, would thereby lose their nationality, do not have to do so if they wish to enlist in Canada and are otherwise acceptable to the Canadian authorities.

CANADA "LEND-LEASES" TO BRITAIN

During the first two years of the war, apart from British goods sent to Canada, Britain needed more than a billion dollars to cover her purchases in the Dominion.

Britain paid less than a quarter of this sum in gold, but Canada had to send more gold than this to the United States in order to fill her British orders. Canadians supplied the rest—$905,000,000.

During the present fiscal year (April 1st, 1941, to March 31st, 1942,) Canada will export goods and war equipment to Britain to the value of $1,500,000,000. Canadians will provide Britain with the bulk of this money.

The Dominion, it is clear, is not demanding "cash on the barrel-head" for her aid to Britain.

CANADA PAYS CASH FOR AMERICAN SUPPLIES

Canada has bought increasingly large amounts of war supplies in the United States. In 1939 her imports from the United States were valued at $497,000,000. In 1940 they soared to $744,000,000. In the present fiscal year (April 1st, 1941, to March 31st, 1942) they are expected to reach $953,000,000. Of this amount at least $428,000,000 will be spent on war supplies, some of which will be materials and parts to be manufactured in Canada for Britain. The latter are being transferred to Britain under the lend-lease plan via Canada. But Canada, herself, is not obtaining supplies under the plan. She pays cash for her own purchases in the United States.

CANADA SENDS TROOPS OVERSEAS

Canada has sent more than 100,000 volunteer soldiers, sailors and airmen overseas. By the end of this year Canada will have four army divisions, one of them armoured, and a tank brigade overseas; the number of Canadian airmen overseas will be equal to a division of infantry; and Canadian naval vessels will play, as now, an increasingly effective part in the war at sea.

CANADA DRAFTS MEN FOR HOME DEFENCE

Canada is now drafting single men 21 to 24 years of age for home defence for as long during the duration of the war as the Government requires them. During their period of four months' basic training they are given an opportunity to volunteer for service anywhere with the Navy, Army or Air Force. Of those who have so far been drafted, a large number have volunteered. The rest are being posted to the Active Army on Home Defence for full-time service. Postponements have been granted to key workers in war industries, and in a few other cases where it was in the public interest to do so.

Thus, single men aged 21 to 24 are being called for full-time service with the armed forces at home, or abroad if they volunteer for such duty. By law, all single men aged 19 to 45 are liable to be so called.

SOME OF THE WAR'S EFFECTS ON CANADIAN CIVILIANS

They—pay three times as much in taxes as they did before the war

—have loaned the Government since the outbreak of war a sum of money equal to the total to be collected in taxes during the present fiscal year

—are voluntarily contributing millions of dollars to war charities

—face 12.8% rise in the cost of living since the outbreak of war

—can get no new models in automobiles, radios, etc., till the end of the war

—will have less than half as many new automobiles on the market in 1942

—have had domestic production of radios, washing machines, vacuum cleaners, stoves and refrigerators cut by 25%

—can get only very limited supplies for "non-essential" purposes of machine tools and of essential materials such as iron, steel, aluminum, nickel, zinc, copper, tin, rubber, silk, cork and certain chemicals.

—cannot buy gasoline or motor oil on Sundays or between 7 p.m. and 7.a.m. on week days

—can erect no new building or additions costing more than a fixed amount unless they are approved as necessary

—can purchase only a few "non-essential" products from the United States, in order that war materials and equipment may be brought there in increasing quantities

—cannot get funds to travel in the United States, except for urgent reasons

—cannot hold foreign exchange

—cannot export capital

—have been asked to eat less of certain foods in order that more may be sent to Britain

—are being urged to save all salvable waste material and to conserve perishable foodstuffs.

Outbreak of war

GENERAL SUMMARY

Canada went to war with Germany on September 10, 1939, in accordance with a free vote of a free parliament. The Dominion was completely at liberty to make war or to abstain from making war. Canada's prompt and uncompelled decision was given as soon after the outbreak as Parliament could be called together. Britain went to war on September 3, 1939. On September 7 the Canadian Parliament assembled and three days later Canada declared war on Germany. When Italy began hostilities on June 10, 1940, Canada at once declared war on her.

Although at the outbreak of war in September, 1939, the Dominion was a relatively weak military power, in the ensuing twenty-three months she has built a war machine, the actual and potential strength of which is very considerable. During the years 1936-39 action was taken to modernize and expand the Canadian armed forces and to prepare measures for the defence of Canadian territory. The 1939 estimates provided about $64,500,000 for the three Services: Navy, Army and Air Force. This was by far the largest sum ever allocated in Canada for defence in time of peace. Nevertheless these pre-war steps were limited by a peace-time budget. Canada went to war with armed forces whose size was insignificant in comparison with those of European nations and with her industrial plant operating almost entirely on a peace-time basis.

Since the beginning of the war the Dominion has diverted more and more of her resources, both human and material, into her war effort. In 1941-42 Canada will spend about 40 per cent of the national income for war. Approximately three hundred thousand Canadians are serving in the active armed forces of the Dominion abroad and at home. They have been enlisted on a voluntary basis for the duration and will go wherever required. The population of the United States is more than ten times that of Canada. The roll-call of the Canadian Navy, Army and Air Force, in terms of the population of the United States, is equivalent to an armed strength of well over three million men. This does not take into account the Canadian Reserve Army for home defence. On the industrial front

Canada's manufacturing capacity is now largely occupied with the production of war materials.

Canada is in full agreement with Great Britain on plans for the conduct of the war for the immediate future. The Canadian Government has assured the British Government that Canada has only one object—a full-out contribution with everything Canada has and as fast as she can give it. Canada is continually adding to the strength of her overseas forces, and is prepared to have them go wherever their services may count for most.

CANADA IN THE THEATRES OF WAR

Canada, as an active belligerent, has sent sailors, soldiers, airmen, and naval units to the British Isles and to other strategic parts of the world. Nearly 90,000 Canadian sailors, soldiers and airmen are now overseas.

The Navy

Canada's sailors are manning Canadian warships which daily take part in the Battle of the Atlantic and in operations in British waters. Others patrol many parts of the seven seas. Canadian destroyers average twenty to twenty-five days a month at sea. Since the outbreak of war, the Royal Canadian Navy has captured several enemy vessels and caused others to be scuttled. It has destroyed enemy submarines, effected rescues and assisted in the evacuation of beleagured troops. A Canadian vessel rescued from France the British Ambassador, the South African Minister and the Canadian Minister. H.M.C.S. St. Laurent rescued 850 survivors of the "Arandora Star" in about two hours. Many Canadians serving with the Royal Navy received citations for demolition work during the evacuation of France. Atlantic shipping carrying a total of more than twenty-seven million tons has been convoyed by the Royal Canadian Navy, in co-operation with the Royal Navy. Hundreds of Canadians are serving with the Royal Navy, are on loan to the Royal Navy for temporary service or are training in Royal Navy establishments.

The Army

An army corps of two divisions, comprising, with ancillary troops, scores of thousands of men, has been in the British Isles for a considerable time. They guard vital formerly leader of the Conservative party in Canada, was recently sent to Britain to make an intensive study of the work of these organizations.

Also helpful in maintaining the morale of Canadian troops overseas are the Canadian Legion Educational Services. They provide Canadian soldiers with sources of instruction covering a wide variety of non-military subjects, and thousands of Canadians in Britain are taking advantage of these courses.

Outstanding service is being rendered along these lines by J. B. Bickersteth, Warden of Hart House in the University of Toronto, and now attached to Canadian Military Headquarters in Britain. He helps to provide Canadian troops with concerts, art exhibitions, libraries, and a variety of other cultural pursuits which are proving extremely popular.

Canadian organizations in Britain are also assisting in this work. Canada Clubs in London, Glasgow, Bristol and other centres provide Canadian troops with hospitality when on leave. The London Association of Canadian Ex-Service men, and its branches, and Canadian pensioners of the last war resident in Britain, the Masons' Canada Lodge, and similar groups, also play their part in helping Canadians to spend their leave pleasantly and profitably. A large number of Canadian artists and entertainers put on regular programs for the troops over the B.B.C. A hostel and service club for Canadian nurses in England has been organized.

HOME DEFENCE AND SECURITY

Since the outbreak of war Canada has taken steps greatly to strengthen the defence of her coasts and other strategic areas. The Canadian sections of both North American coasts are guarded by naval and air patrols, coastal and anti-aircraft guns and large concentrations of troops. Strategic air bases have been built throughout the Dominion. Canada is spending $20,000,000 this year on additional air bases of strategic importance, including a string of air fields designed to give military planes access to Alaska. Troops guard vital points throughout the country. The Veterans' Guard plays an important part in this work. In many areas local authorities have organized Civilian Defence and Air Raid Precautions units. Blackout practices have been held in several cities.

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Under the Defence of Canada Regulations all possible precautions are taken against sabotage and fifth column activity. The Royal Canadian Mounted Police, under the direction of the Federal Department of Justice, are in charge of this work.

THE NAVY

(See also page 4.)

The Royal Canadian Navy went into action the moment that Canada declared war. Since, in addition to the work it has done in British and other non-Canadian waters, it has successfully protected the Dominion's shores and ports.

The Navy has grown speedily. At the outbreak of war its strength was about 3,600 men and it had 13 ships of all kinds. To-day its mobilized strength is more than 20,000 men and it musters more than 200 vessels—including 13 destroyers, three armed merchant cruisers, a number of corvettes and minesweepers and a large fleet of smaller craft suitable for patrol and anti-submarine work. By March, 1942, the strength of the Royal Canadian Navy is expected to be about 27,000 men and more than 400 ships.

The Navy has listed 336 men killed, 20 missing, 39 who died and 63 wounded. (July 25, 1941).

THE ARMY

(See also page 4.)

The Canadian Army (Active and Reserve)

The Canadian Army has expanded greatly since the outbreak of war. In September, 1939, the Dominion had a Permanent Force of some 4,500 and a Non-Permanent Active Militia, which corresponded to the National Guard in the United States, of about 55,000—approximately 60,000 men in all. Now the Canadian Army (Active and Reserve) comprises about 390,000 men.

The Canadian Army (Active)

The Canadian Active Army is a body of some 220,000 volunteers who have enlisted for service anywhere for the duration of the war and for as long thereafter as the Government may require them. Scores of thousands are now overseas, and the rest are training or on duty in Canada while awaiting movement elsewhere.

CANADA'S WAR RECORD

Revised to November 1, 1941

Going to War

"Our people went to war for the sake of Canada, but not for Canada alone. We went to war as well for the sake of Britain, for North American civilization which we are proud to defend, and for the sake of that humanity which is above all nations."

Prime Minister Mackenzie King

Canada entered the war after full and free debate and entirely of her own volition on September 10, 1939.

Fighting Men

"Take up our quarrel with the foe:
To you from failing hands we throw
The torch; be yours to hold it high."

From "In Flanders Fields."

Sailors, soldiers and airmen overseas	**More than 100,000**
Total voluntarily enlisted for service anywhere	**About 344,000**
Navy	About 25,000
Army	About 230,000
Air Force	About 89,000

Reserve Army (given part-time training and liable to be called out for home defence)... About 170,000

NOTE:—As statistics relating to the strength of the forces are of vital interest to the enemy, the above figures are all approximate.

Dead or Missing (late October, 1941)	**2,087**
Navy	403
Army	861
Air Force	823

The total population of Canada is less than 12,000,000. Canada's 344,000 enlisted for service anywhere would be equivalent, in terms of population, to a strength of about 3,900,000 in the armed forces of the United States.

Canada drafts men aged 21 to 24, who have not joined one of the active armed forces, for full-time home defence duties with the Active Army.

At Sea

"The Canadian Navy is doing a very outstanding job . . . It has been a very considerable help to the whole problem of transport."

Col. Frank Knox, Secretary of the United States Navy

The Royal Canadian Navy has been in action since the outbreak of war, protecting the Dominion's coasts, convoying Canadian and American supplies out of port and on the Atlantic, working in the waters around the British Isles, in the Pacific and in other parts of the seven seas.

The Navy has assisted in convoying ships carrying more than 35,000,000 tons of supplies, sunk enemy submarines, effected rescues at sea, captured several enemy vessels and caused others to be scuttled. It has lost five ships and more than 400 men.

Canada's sailors man more than 300 vessels—merchant cruisers, destroyers, corvettes, minesweepers, converted yachts, and patrol craft.

On Land

"We have a large and constantly growing Canadian Corps in Britain which, individually and collectively, is the match for anything it may meet on the field of battle."

Major-General H. D. G. Crerar, Chief of the Canadian General Staff

Canadian troops have been in Britain since the arrival of the First Division in December, 1939. Soon there will be four divisions (one of them armoured) and a tank brigade overseas. With auxiliary troops, Canadian soldiers in Britain already number scores of thousands of men.

The Canadian Corps in Britain, apart from occasional expeditions, has occupied vital sectors in Britain's front line and acted as a striking force in reserve. On September 4, 1941, Winston Churchill, the British Prime Minister, said of the Canadian Corps, "There they stand, and there they have stood through the whole of the critical period of the last fifteen months—at the very point where they would be the first to be hurled into a counter-stroke against an invader."

Nearly 10,000 American volunteers are serving in the Canadian Army.

In the Air

"More than two years of war have brought a continuous repetition of the glorious achievements of Canadian airmen in the First Great War."

Air Vice-Marshal L. S. Breadner,
Chief of the Canadian Air Staff

Canadian airmen have been engaged in combat since the outbreak of war. Many had joined the R.A.F. before war broke out. Since early in 1940, R.C.A.F. squadrons have been operating in Britain, and for more then a year the output of the Air Training Plan has been swelling the ranks of Canadians in both the R.A.F. and the R.C.A.F. overseas.

Canadian airmen are now fighting over Britain, over Europe, in the Mediterranean area and over Russia. They have shot down considerably more than 200 enemy planes. Sixteen R.C.A.F. squadrons are now organized overseas. Some of them are on bomber, coastal, fighter or night-fighting duties. By the end of this year the number of trained Canadian airmen abroad will be equal to a division of infantry. A total of 823 have been reported as dead or missing by the R.C.A.F.

The British Commonwealth Air Training Plan, first announced in December, 1939, has expanded very rapidly to keep pace with the urgent demands of the war. The Plan has now virtually been completed—seven months ahead of schedule. Airmen are being turned out at about twice the rate originally planned. The Plan now operates 131 establishments of all kinds and about 100 air fields. The

R.C.A.F. provides 80% of the pilots, gunners and observers being trained under the Plan. Of these about 10% are American volunteers.

In addition, in the past year a considerable number of R.A.F. schools have been transferred to Canada. This movement will continue until perhaps 30 or 40 R.A.F. schools are operating in Canada. Construction for these schools is proceeding at a pace comparable to that when building for the original plan was at its peak.

Canada: Arsenal and Storehouse

"Canadian weapons and supplies are being despatched to all the battle fronts of the world—to Britain, to the Middle East, to the Far East, to our sister Dominions, to China and to Russia."

Hon. C. D. Howe, Minister of Munitions and Supply

Two years ago Canada was incapable of equipping an infantry division; today she can do it in six weeks. Two years ago the Dominion imported most of what little war equipment she had; today she exports war equipment and supplies to every battlefront in the world.

The following is a list of some of the war equipment and supplies which Canada produces:

SHIPS

Cargo boats
Minesweepers
Corvettes
Motor torpedo boats
Patrol boats
Small boats

GUNS

25-pounder field guns, with equipment, trailers and tractors.
Bofors 40 mm anti-aircraft gun barrels
Complete Bofors 40 mm anti-aircraft guns and mountings
3.7" anti-aircraft gun barrels
Two types of tank and anti-tank gun
2" mortars
3" mortars
Bren guns
Browning aircraft machine guns
Four types of naval gun mountings
Lee-Enfield rifles

AMMUNITION

Small arms ammunition of several types
Shells of 14 types
Cartridge cases
Fuses, gaines and primers
500-lb. aerial bombs
Practice bombs
Depth charges
Anti-tank mines
Rifle grenades
Pyrotechnics of many varieties for aerial, field, naval and practice uses
Trench mortar bombs
Shells, ammunition bombs, etc. filled with Canadian-made explosives and propellants

CHEMICALS AND EXPLOSIVES

12 types of chemicals
8 types of explosives

AIRCRAFT

12 types, including 7 training and 5 service planes

TANKS

Cruiser tanks
Infantry tanks

VEHICLES

Universal Carriers
Wireless trucks
Ambulances
Field workshops
Army mechanized transport of all types

MISCELLANEOUS

Clothing and boots for the three services
Personal equipment
Optical instruments
Military and naval instruments
Radios, radidocators
Gas masks
Steel helmets
Parachutes
Flare parachutes
Minesweeping gear
Technical naval equipment
Searchlights
Smoke projectors
Marine smokefloats
Hospital equipment and supplies
Gas decontamination suits and equipment
Link trainers
Military furniture and forms
Fire trucks
Fire hose
Asbestos rescue suits
Ammunition boxes
Machine tools
Gauges
Military tires
Anti-submarine gear

RAW MATERIALS

Timber
Nickel
Aluminum
Lead
Copper
Zinc
Asbestos
Mica
Other metals and minerals
Alloys

FOODSTUFFS

Wheat
Flour
Meat
Cheese
Eggs
Canned goods

Aid to Britain

"All help is vital and the quicker you can give it the more help it will be."

Lord Halifax,
British Ambassador to the United States

Canada, as Britain's ally, has sent more than 100,000 soldiers, sailors and airmen overseas. These troops are equipped and maintained at the Dominion's expense, with the exception of service craft for the Air Force, which are provided by Britain as part of her contribution to the Air Training Plan.

Most of the equipment and supplies already sent from Canada to Britain have been "lease-lent" by the Canadian people. In the present fiscal year Canada will send $1,500,000,000 worth of supplies to Britain. Canadians will provide all the money Britain will need to pay for these supplies.

To help Britain to "deliver the goods" to Canada, the Dominion has materially reduced tariffs on imports from Britain. Canada has put tankers and other ships at Britain's disposal. British ships are repaired and supplied in Canadian ports. Canada has taken charge of a considerable number of prisoners of war. More than 6,000 British children have been given homes in Canada for the duration. Canadian homes are prepared to accommodate at least 100,000.

Canadian citizens have voluntarily contributed more than $27,000,000 to war charities. A large part of this sum has been used to provide money and comforts for the victims of enemy bombing in Britain, for Canadian troops overseas, and to purchase planes and other war equipment. Blankets, clothing, food, mobile kitchens, hospitals, first aid supplies, blood serum, ambulances and prisoners-of-war parcels have been provided.

Canada, the United States and the War

"The Hyde Park Declaration is more than an extension of the Ogdensburg Agreement for hemisphere defence. It is also a joint agreement . . . for aid to Britain."

Prime Minister Mackenzie King

Canada and the United States are co-operating in the production of war materials for the nations actively resisting aggression and for the defence of this hemisphere. Since going to war Canada has bought increasingly large quantities of war supplies from the United States. In the present fiscal year her total imports from the United States will be about twice as great as in 1938. At the same time the United States has increased her purchases of certain Canadian materials vital to defence. Since Hyde Park Declaration of April, 1941, this interchange of defence supplies has been increased. Each country is now concentrating on the production of the defence articles it is geared to produce best and most quickly. Canada is not obtaining supplies under the lend-lease plan. She pays cash for purchases in the United States on her own account.

When Canada went to war two years ago she took immediate steps to ensure the defence of her territory and, subsequently of key points in the western hemisphere. Since the Ogdensburg Agreement of August, 1940, these defensive measures have been co-ordinated with those undertaken by the United States and the two countries have now worked out joint plans for the defence of their part of the western hemisphere. Both Canadian coasts are constantly guarded by large concentrations of troops and by coastal and anti-aircraft guns located at strategic points, as well as by naval and air patrols operating along 2,000 miles of coast line and far out to sea. In the west Canada is building a string of staging airdromes so that military planes from both Canadian and United States centres can be moved into northern British Columbia and Alaska without delay. In the east, United States troops have replaced Canadian forces in Iceland, and they have joined Canadian troops in Newfoundland, where the two countries are building extensive defence facilities. Canada and the United States are in full agreement concerning defence measures in Greenland. Both United States and Canadian troops stand guard in the West Indies. At sea both the Canadian and the United States navies seek out marauding submarines.

The Home Front

"Unless the whole resources and total energy of the free world are thrown into the struggle, the war may drag on for years, carrying in its train famine, pestilence and horrors still undreamed of."

Prime Minister Mackenzie King

Canadians now pay three times as much in taxes as they did before the war. Five times as many people pay income taxes, which have been sharply raised, and taxes on goods and services have been increased and extended to cover a wide variety of commodities from soft drinks to travel fares. Business income is subject to a minimum tax of 40%, and 79½% of all "excess profits" are taken by the Government.

Since the outbreak of war Canadians have loaned the Government nearly $1,500,000,000 in return for war bonds and savings certificates. In terms of the relative national incomes of Canada and the United States, this sum is the equivalent of about $23,000,000,000.

This fiscal year the Canadian Government is spending about $2,350,000,000 for war—a sum which would be equivalent to an expenditure in the United States of about $35,000,000,000 for defence and lend-lease aid to Britain in a single year. Forty cents out of every dollar earned in Canada is required to support the war.

The cost of living in Canada is nearly 14% higher than at the outbreak of war. To arrest this trend the Government has taken steps to place the prices of all goods and services under a price ceiling, and wages have been stabilized at prevailing levels.

Many materials are very difficult to get for purposes not connected with the war effort. Among these are iron, steel, aluminum, nickel, zinc, copper, tin, silk and rubber. Supply of non-essential durable goods is limited. New models are "taboo". Passenger automobile production is being cut in half. Output of stoves, refrigerators, radios, vacuum cleaners and washing machines is down to 75% of 1940 production. Such articles are no longer imported from the United States. Instalment purchases of a wide range of articles from furniture to engagement rings can be made only on very strict terms.

Gasoline cannot be purchased on Sundays or between 7 p.m. and 7 a.m. on week days.

Canadians cannot get funds to travel in the United States, cannot hold foreign exchange and cannot export capital. The chief purpose of these moves is to enable the Dominion to buy large quantities of war supplies in the United States.

This leaflet is a condensed version of a booklet entitled "Canada at War". Both are revised and issued monthly. Copies of either may be obtained by writing to the Director of Public Information, Ottawa, Canada.

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Printed in Canada

THE SPIRIT OF ENGLAND

AN ADDRESS

by

The Most Reverend CYRIL F. GARBETT

Archbishop of York, Metropolitan and Primate of England

before the

CANADIAN CLUB OF MONTREAL

MONDAY, MAY 8th, 1944

at the

WINDSOR HOTEL

I am most grateful to you for the welcome which you have just given me. I had hoped to be able to give utterance in a sentence or two of French my own sentiments towards your country, but my courage fails me as I recognize the limitations of my pronunciation of a beautiful language, and I came to the conclusion that if I read that sentence which the Mayor has so kindly read for me, long after my address had been completely forgotten people would still be telling one another of the remarkable and unique pronunciation of the Archbishop of York.

So now in the language with which I am much more familiar I go on to speak of the spirit of England in the fifth year of the war.

If you went to England today you would at once notice various changes since your last visit. You would see that many of the windows of the houses are broken, that many of the houses are scarred, that many of the houses are blackened with fire; that here and there are standing ruined churches and ruined halls; you would find occasionally whole streets which have been cleared away, and in their places great tanks of water, waiting for another emergency. You would experience the blackout, a blackout which is observed most strictly in every part of the country, and which is most depressing in its effect. With all my heart I hope that by next winter the blackout may be unnecessary.

You would also notice the lack of motorcars. It is almost impossible, in parts of London, to get a taxicab, and a private car is a very rare sight. Only those who are using it on quite definite business are allowed to obtain petrol. You would also find that many homes have been gravely affected by the war. You would find father and son are on active service and mother and daughter working in various factories or in one of the services for women.

You would find the rationing severe. I shall find it a great contrast when I return to Great Britain in the near future. I dread the moment when I shall stand on my weighing machine, for it will show a considerable increase in weight. But although rationing has been severe in Great Britain, our health as a nation has certainly improved, and undoubtedly the figures of many middle-aged people have greatly improved as a result of this.

We are naturally feeling the strain of war. When you are living month by month within a few minutes by air of a deadly and powerful enemy you are bound to feel the strain. At any moment an attack may be launched. We always have to be on the alert. Week by week, the Home Guard is drilling, prepared to hold any invader until the regulars come up to expel him. We are on the alert night by night in case of an attack from the air. It is not to be wondered at that people in Great Britain are feeling tired. But there is no hesitation in the minds of any about the clear duty which lies in front of them. The nation is absolutely determined to go on fighting until the Nazis are utterly smashed, and when the Nazi is smashed we shall go on fighting until the Japanese are equally broken, down to the ground.

In 1940, after Dunkirk, we went through a very difficult time. Most of our friends, the neutrals, thought that we were defeated and that it was only a question of time, a few weeks or months, before Great Britain would be occupied by the enemy. But I can tell you that whatever the neutral thought then, we in England never had any thought of defeat. The idea of defeat never entered our minds, and any statesmen who then had spoken of defeat or even of its possibility, would have been removed within a few hours.

Throughout Great Britain there is remarkable unity in this determination. There is no spirit of emotionalism, there is no spirit of flag-waving, there is no spirit of hatred, but there is an unshakeable resolve—a resolve as strong as cold steel—that we will see this matter through and that never again will Germany or Japan break so cruelly the peace of mankind. There is no difference of opinion on this. The political parties are as one. The different religions, Church of England, Roman Catholic, Nonconformist, are all as one in this matter, and all are completely joined together in their determination to see this war through to the end.

There is hardly any Pacifism in England today. Of course we have the Quakers, but we honor them—they have always been consistently pacifist, and the great majority of them are taking part in works of compassion often bringing them into great danger. But nevertheless, it is true to say, with that one notable exception, there is no pacifism in Britain today. We love peace, we long for peace, but we know there is something greater than peace and that is justice, and therefore the peace-loving people of Great Britain, and the peace loving people of the Dominions throughout the British Commonwealth, are united in the resolve to see this matter right through.

And we are helped in Great Britain by the fact that we have a leader in whom we have complete confidence. It has sometimes been said that when Great Britain is in deadly peril a war leader appears. That certainly has been the case in this war. I shall never forget Mr. Winston Churchill's speech just after Dunkirk, when he declared that we would "fight on the beaches, we would fight in the lanes, we would fight in the fields, but we would never give way" and what he said then was the expression of the resolve of the nation, and that is a resolve which has never wavered and never will waver.

Well, that is the spirit of Great Britain today as far as the war is concerned. But I don't want you to think that all out thoughts are centred solely on the war. We are also looking forward to the future. We are looking forward to the New Order, both at home and in the relationship between the various nations. The spirit of England is full of hope today for a better and juster social order at home. This does not mean any revolution. We are not a revolutionary people, and there is no party in Great Britain which desires revolution. But all parties are agreed that there must be considerable social and economic changes, and the great mass of the people of Great Britain are keenly insistent that these changes should take place.

The nature of most of these changes has been well expressed by the Prime Minister when he said that after the war we must see that there is food for all, work for all, and homes for all. Before the war there was a great deal of malnutrition, expecially in our great cities. We have learned through the war that malnutrition can be abolished, through the wise and fair distribution of food, and we are resolved to see that all, even the poorest, have their fair share of the food of the nation.

And then, before the war, there were many slums. A great campaign against the slums and for the provision of new housing had been carried on. It has been carried on with great and marked success, but the war came and practically all building was suspended. Large numbers of houses, tens of thousands of them, have been destroyed by the blitz. Many houses have deteriorated through the impossibility of receiving the necessary repairs. It will be essential that very large numbers of houses are built and plans are already being prepared for the building of those houses, so that there may be decent homes for all.

And we also recognize that political freedom by itself is not sufficient. There must be economic freedom, and that economic freedom must be expressed by a determination that all men have the opportunity to work. One of the scandals of the years before the was war the way in which in Great Britain there were large areas where for year after year there were men eager for work and capable of doing good work and who were unable to find it. And so the nation has resolved that industry in the future shall be so planned and so controlled that work is found for all.

And then in addition there is the call for social security, that when a man is temporarily out of work he shall not find himself on the verge of want and destitution. So the government has accepted in principle the recommendations in Sir William Beveridge's famous report, and these recommendations will gradually be worked out and applied. And here again the country as a whole is eager that those recommendations should be carried into effect, and at this moment the first great instalment of social reform is being carried through in the shape of a most comprehensive Education Bill. This Bill will be a great advance on anything we have had in the past. It has gone through the House of Commons, it is probably by now in the House of Lords, and before long the Bill will receive the Royal Assent, and our education system in England will be on a firmer and sounder basis, so that no one will be debarred by poverty or by the social position of his parents from receiving the best education which the country can afford.

But the spirit of the nation also recognizes that we shall not make any of these social reforms unless there is peace in the world. Now I don't know what is the case in your own country, but in Great Britain, for a very long time, foreign politics were regarded as the preserve of a few specialists. But ever since Munich there has been a growing interest in foreign politics among the great mass of the people. And it is now recognized that we shall neither have the money nor the time for these social reforms if we are threatened at any moment with a war which will again call forth all our energies. So we are facing the future with a determination that there shall be security from war.

Now we have come to see—we have been taught this by a very stern teacher—that peace will not be preserved merely by rhetorical speeches, the pious resolutions of peace societies and by acts and treaties. We bemused ourselves, I am speaking quite frankly, we bemused ourselves, the democracies, before the war by uttering noble phrases about peace. I was as bad an offender as anyone. We all talked about the beauty and splendour of peace, but we were not prepared to face the hard facts of the situation, that within a few hundred miles there were aggressive nations arming to the teeth, and we were not prepared for the sacrifices which might avert war.

When you come down to the hard facts, war will not be averted by wishful thinking and rhetorical speaking. In an imperfect world, war can only be averted by those who are prepared to make great sacrifices for freedom. War can only be averted in an imperfect world by the right use of force.

Now there is a good deal of misunderstanding about force. Some people speak as if there was something which was necessarily evil in force. Force is only evil if it is used for evil purposes. Force can be used and often is used for good purposes. For instance in any country, in any peaceful country, there are laws of the land. But those laws have behind them if necessary the authority of force. The more certain it is that the breaker of the law will be arrested and punished, the less likely it is that there will be any breach of the law.

What is true in domestic affairs is also true of the relationship between nations. If a nation knew that the force brought against it would be quite overwhelming should it break the peace of the world, that nation would hesitate once, twice, and thrice before it plunged the world into war. I have no doubt that we should have had a far greater hope of preserving the peace of mankind if Great Britain and the United States and the whole of the British Commonwealth had been armed more efficiently before the war, and had made it plain that these great democracies would use their force if need be against wilful breakers of the peace.

I am saying this as one who loves peace. I love peace. I am passionately convinced that peace is in accordance with God's will, but in the world as it is today we must be prepared to keep peace if need be by the use, the right use, of force.

But that of course, by itself, is not enough. There must be some machinery for the revision of treaties. Treaties are sometimes unjust, treaties sometimes become obsolete. The treaty which at one time was quite fair becomes harsh in the course of time. Usually the treaty then turns to the advantage of one nation and to the disadvantage of another. Unless that treaty can be revised by some peaceful means, either the injustice will be perpetuated or war will be used as an instrument in the attempt to change the treaty. Therefore some machinery will have to be devised by which a treaty can be revised in the future. And also, at the same time, there must be some method whereby the peace-loving nations may combine together to suppress, to defeat the ambitious self-willed nation which, for its own interest, refuses to accept revision and prefers to plunge the world into war.

Now I am no statesman, and I am not able to set before you any detailed scheme as to how this is to be effected. I envy the people who can turn out blueprints every week explaining exactly how all the affairs of the world can quite easily be settled. I am unable to do that, but as far as I can go in my thinking, I have reached this point: I believe that the immediate peace of the world—by immediate I mean for two or three generations to come—will depend on the close co-operation between the three great Allies. It should begin by co-operation between the members of the British Commonwealth—the closer the British Commonwealth draws together the greater will our influence be in the world. We in Great Britain will never forget the way in which you, the entire nation here, instantly, unitedly stood by our side in our moment of greatest danger when we went to war with Germany. If it is known that the British Commonwealth will stand together—I am not discussing the machinery—will stand closely together, it will have an enormous influence on the affairs of the world.

And then we wish to remain in the closest co-operation with that great freedom-loving democracy, the United States. They have been drawn into world affairs by the war. They have been fighting side by side with the British Commonwealth for the same great ideals, and we pray and hope that that co-operation may continue long after the guns have ceased firing.

And then I am also quite convinced that there will be no permanent peace unless Russia co-operates with the two great democracies. I recognize fully the difficulty—that there are differences between the two great democracies and Russia. But Russia is a country which has a wonderful future before it. I am going to speak more about Russia tonight and must not trespass on what I shall say there, but Russia is a young nation, Russia has done magnificently in this war, and for the future happiness of the human race we must do our utmost to co-operate with that great and staunch country.

Now I have just one word to say in conclusion. In the next few days we shall be entering upon the most bitter and decisive stage of the struggle with Germany. At any hour now the second front or the second fronts, if I may use such a phrase, will be open. It is not going to be an easy business breaking through the ramparts of the Citadel of Europe. It is going to cause very great sacrifices, it is going to be a long and arduous business. We must be ready to endure through thick and thin; to endure the days of hardship and disappointment as well as the days of victory.

We know, we are confident, that with God's help, victory will come, but we pray that for the sake of mankind, that victory may come soon. But whether victory comes soon or comes later, we shall persevere until it is complete, and then when victory has come, as a memorial to those who have laid down their lives for their country and for the cause of freedom, we shall build a memorial, not of marble or stone or metals, but a New Order, a new International Order, in which all the nations will have freedom and in which every nation, even the smallest nation, will be given the fullest opportunity to make its own special contribution to the building up and the strengthening of the great fellowship of the nations of mankind.

SPEECH OF

LEONARD W. BROCKINGTON

K.C., LL.D.

Canadian delegate to the American Bar Association.

Delivered at the Annual Dinner of the Association at Philadelphia on Thursday, September the 12th

EDITOR'S FOREWORD

WHEN the great speeches of this particular period come to be assessed, we believe that outstanding among Canada's contributions will be the address recently delivered by Leonard W. Brockington, K.C., LL.D., before the American Bar Association at its annual dinner in Philadelphia.

We feel honoured that a Canadian, speaking to members of the Bar of a neighbouring and friendly nation, and to a wide invisible audience who heard him on the radio, should have so represented us.

Those who hold that oratory died with a generation that is past, and that nobility of diction no longer matches nobility of thought, must revise their opinion when they read this speech, so happily conceived, so eloquently expressed. It is, of course, much more than mere oratory. With one of the most significant topics of our times as his inspiration, Mr. Brockington rose to the occasion with an address profoundly moving to the heart as well as the mind. The speech was delivered extempore, but happily it has been preserved by stenographic notes, of which we have been able to obtain a transcript:

From time to time Ronalds Sales Promotion Division has presented material of interest, supplemental to the *Monthly Digest*. Because it is our conviction that such a speech as Mr. Brockington's should be made as widely available as possible, we are giving it here for the benefit of our friends.

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SPEECH OF
LEONARD W. BROCKINGTON
K.C., LL.D.

PHILADELPHIA, SEPTEMBER 12, 1940

MR. PRESIDENT, LADIES AND GENTLEMEN:

I have a friend in Canada who is sometimes received (as I have been tonight) with more cordiality than he thinks he deserves and is sometimes introduced with a promise that is greater than his performance. He has a habit of meeting that emergency by relating an experience which he says he once had. As I have heard recently of many other people who had the same experience I am forced to the conclusion that I have yet another friend who relies "upon his imagination for his facts and upon his memory for his wit." (*Laughter.*) The experience to which he referred was this: He was once walking in the State of Virginia when he came to a coloured community where there was a little church. On the church there was a sign which said in large letters, "Annual Strawberry Festival." Underneath in small letters was written, "On account of the depression, prunes will be served." (*Laughter.*)

I need not labour the moral of that story nor tell you of the sinking and shrinking feeling of one who was introduced as though he were Michael Angelo but is deeply conscious of the fact that he is only Mickey Mouse. (*Laughter.*)

I am deeply grateful for your courtesy in asking me to be your guest on this memorable occasion. I want to thank you also on behalf of the President of the Canadian Bar Association, Mr. D. L. MacCarthy, whose presence at this head table fortifies me beyond measure. Some of you may be pleased to learn that Mr. MacCarthy belongs to the Irish Macs. They are different from that other branch of the family, of whom it was once said by a bewildered gentleman, that he never really understood what was meant by "The meek shall inherit the earth" until he realized that "Meek" was the plural of "Mac." (*Laughter.*)

Mr. MacCarthy is here as a pattern of international goodwill and a paragon of political neutrality. He is really on a Bar President's holiday. In other words, he is engaged in knocking all the conventions out of somebody else's convention. He is doing it very successfully, and I am delighted to have him at this table with me.

It is very significant that at this time, in this place, in this country, two Canadians should be standing in this company. It is to me (and I hope to you) a grand comforting thought that two Canadian lawyers should meet with this great assembly of American lawyers for the reaffirmation of an old faith under the benediction of ancient charities. It is particularly fitting that we Canadians should be meeting with you in America, in this place, when the blasphemies of the world are daily growing louder and its miseries are being heaped heavier and higher. It is an inspiration to stand in this kindly City of Friends, in this sanctuary of liberty. For in this place wise men once resolutely determined that disciplined liberty should go forth into this land under the influence of the Sermon on the Mount, they knowing that if those things departed from them there would be an end of truth and mercy and of goodness. In this city they resolved that for them and their children and their children's children freedom should not be a fugitive memory in the hearts of old men in the chimney corner, but the very life-blood of the youth of the land they loved. Here was born a great nation which Oliver Wendell Holmes says, "Not by aggression but by the naked fact of its existence is an eternal danger and an unsleeping threat to every government that founds itself upon anything else than the consent of the governed." (*Applause.*)

In this city tonight I am proudly happy because I believe that the day will come when your own Liberty Bell, with a tongue that yet speaks after its age-long silence, will join the peal of the Carillon at Ottawa, and the deep implacable tones of Big Ben, to ring the knell of tyranny. (*Loud Applause.*) Here I stand deep in the hope of mankind, and today "amid the heartbreak in the heart of things" I can hear across your river one of the grandest of all American voices, the voice of Walt Whitman, bidding the world remember, "When all life and all the souls of men and women are discharged from any part of the earth then only will the instinct of liberty go from that part of the earth." Exhorting his fellow countrymen to heed what he calls the faithful American lesson, he speaks in words triumphant, in accents unafraid, "Liberty relies upon itself, invites no one, promises nothing, sits in calmness and light, is positive and composed, and knows no discouragement—the battle rages with many a loud alarm and frequent advance and retreat; the enemy triumphs; the prison, the handcuff, the iron necklace, the anklet, the scaffold, the garrote do their work. The cause is asleep, the strong men's throats are choked with their own blood, the young men drop their eyelashes toward the ground as they pass by. And has liberty gone out of that place? No, never! When liberty goes it is not the first thing to go, nor the second, nor the third. It waits for all the rest to go: it is the last." (*Applause.*)

Ladies and Gentlemen, the echo of that voice resounds in many places other than Philadelphia.

Yes! I am proud to be in this company. But there is a vacant chair rarely before empty in your long and honourable history. I miss one man as you miss him, and as we in Canada would have missed him had we met in convention this year. I refer to the representative of the Bar of England. I don't know who he would have been: he may have been one of those strange Englishmen of whom a Frenchman once said, that the average Englishman is like a poker; he possesses all the poker's rigidity but lacks its occasional warmth. (*Laughter.*) He probably would have been a Scotsman, but whoever he was, this we know about him: he would have been full of deep unspoken certainties, he would have been imperturbable, he would have probably cheered us up, and of all the children of the tempest he would have been the least shaken or the most unshaken.

Now, I don't know what the country he represents means to you. To some of you perhaps she may be an alien and sinister power. I hope she is not. To many of you who listen, she may bring back memories of the oppression and the injustice and the tyranny of her rulers (but never of her people) in the days that are gone. But whatever have been her failings, whatever her shortcomings, whatever her sins, whatever her iniquities, if you like, they will be pardoned when her warfare is accomplished. To some of you, perhaps, she is the paradox of the poet and the adventurer, of the merchant and the crusader, of the eccentric and the formalist, of age and youth, of heresy and orthodoxy, of courage and of mercy. To some of you she may just be a memory of a lovely countryside where order stands rooted in green disorder; of meadows shining in the rain, of bluebells in the woodland, of ancient Gothic churches standing out like truth itself against an English sky.

To me she is the mother of freedom and of free nations.

Freedom was not a North American invention. The patents were taken out years ago by resolute and strong-willed Englishmen. You made it fierce, untamable, and living. Today in England I hear the echo of the praise of your own Emerson telling how in the turmoil and tribulation she has a pulse like a cannon, and always sees more clearly when the skies are dark. I see her burdened with the honour and honoured with the burden "of the stewardship of humanity" (*Applause*), I marvel at the courage and the wistful optimism that are born of her fields, her lanes, her hills and her valleys. I wonder if you remember a lovely passage in Mary Webb's *Precious*

File

PRELUDE TO VICTORY

II nd War

President Franklin D. Roosevelt
speaks to the world from
Charlottesville, Va.,
June 10th, 1940.

Compliments of

LINK-BELT LIMITED

On the evening of June 10th, after one of the darkest days of this war, there came from the President of the United States a message to the world, which carried him to one of the peaks of his greatness, and may well take its place in history. Inescapably, you thrilled to the sentiments he voiced, and to all they implied.

To be instrumental in placing a copy of President Roosevelt's address in your hands, in more permanent form, is a privilege which I regard very highly. There are many Canadians, like myself, who have come from the United States to Canada, who have become Canadians in thought, word and deed, and who are proud to see the direction in which the President of the country of our birth is leading his people.

In these days when we earnestly and devoutly raise our hearts in a dual prayer "Vive la France" and "God Save the King", we take heart from the sincere and inspiring words of the head of the Government of our great neighbors, believing that more tangible and practical evidences of their sympathy are not far distant.

TORONTO,

JUNE 12TH, 1940.

President Newcomb, my friends of the University of Virginia:

I notice by the program that I am asked to address the classes of 1940. I avail myself of that privilege, but I also take this very happy occasion to speak to many other classes—classes that have graduated through all the years, classes that are still in the period of study, classes not alone of the schools of learning of the nation, but classes that have come up through the great schools of experience. In other words, a cross-section, a cross-section just as you who graduate today are a cross-section of the nation as a whole.

Every generation of young men and women in America has questions to ask the world. Most of the time they are the simple but nevertheless difficult questions—questions of work to do, opportunities to find, ambitions to satisfy.

But every now and again in the history of the republic a different kind of question presents itself—a question that asks, not about the future of an individual or even of a generation, but about the future of the country, the future of the American people.

There was such a time at the beginning of our history as a nation. Young people asked themselves in those days what lay ahead, not for themselves, but for the new United States.

There is such a time again today. Again today the young men and young women of America ask themselves with earnestness and with deep concern this same question: "What is to become of the country we know?"

Now they ask it with even greater anxiety than before. They ask, not only what the future holds for this republic, but what the future holds for all peoples and all nations that have been living under democratic forms of government—under the free institutions of a free people.

It is understandable to all of us, I think, that they should ask this question. They read the words of those who are telling them that the ideal of individual liberty, the ideal of free franchise, the ideal of peace through justice is a decadent ideal.

They read the word and hear the boast of those who say that a belief in force—force directed by self-chosen leaders—is the new and vigorous system which will overrun the earth. They have seen the ascendancy of this philosophy of force in nation after nation where free institutions and individual liberties were once maintained.

It is natural and understandable that the younger generation should first ask itself what the extension of the philosophy of force to all the world would lead to ultimately. We see today, for example, in stark reality some of the consequences of what we call the machine age.

Where control of machines has been retained in the hands of mankind as a whole, untotaled benefits have accrued to mankind. For mankind was then the master: The machine was the servant.

But in this new system of force the mastery of the machine is not in the hands of mankind. It is in the control of infinitely small groups of individuals who rule without a single one of the democratic sanctions that we have known.

The machine in the hands of irresponsible conquerors becomes the master; mankind is not only the servant, it is, too the victim. Such mastery abandons with deliberate contempt all of the moral values to which even this young country for more than 300 years has been accustomed and dedicated.

Perception of danger to our institutions may come slowly or it may come with a rush and shock as it has to the people of the United States in the past few months. This perception of danger—danger in a world-wide arena—has come to us clearly and overwhelmingly. We perceive the peril in this world-wide arena—an arena, an arena that may become so narrow that only the Americas will retain the ancient faiths.

Some indeed still hold to the now somewhat obvious delusion that we of the United States can safely permit the United States to become a lone island, a lone island in a world dominated by the philosophy of force.

Such an island may be the dream of those who still talk and vote as isolationists. Such an island represents to me and to the overwhelming majority of Americans today a helpless nightmare, the helpless nightmare of a people without freedom. Yes, the nightmare of a people lodged in prison, handcuffed, hungry, and fed through the bars from day to day by the contemptuous, unpitying masters of other continents.

It is natural also that we should ask ourselves how now we can prevent the building of that prison and the placing of ourselves in the midst of it.

Let us not hesitate—all of us—to proclaim certain truths. Overwhelmingly we, as a nation, and this applies to all other American nations, we are convinced that military and naval victory for the gods of force and hate would endanger the institutions of democracy in the Western World—and that equally, therefore, the whole of our sympathies lie with those nations that are giving their life blood in combat against those forces.

The people and government of the United States have seen with the utmost regret and with grave disquiet the decision of the Italian Government to engage in the hostilities now raging in Europe.

More than three months ago the chief of the Italian Government sent me word that because of the determination of Italy to limit, so far as might be possible, the spread of the European conflict, more than two hundred million of people in the region of the Mediterranean had been enabled to escape the suffering and the devastation of war.

I informed the chief of the Italian Government that this desire on the part of Italy to prevent the war from spreading met with full sympathy and response on the part of the Government and the people of the United States, and I expressed the earnest hope of this government and of this people that this policy on the part of Italy might be continued. I made it clear that in the opinion of the government of the United States any extension of hostilities in the region of the Mediterranean might result in the still greater enlargement of the scene of the conflict, and that no one could foretell how much greater the theatre of the war eventually might become.

Again, upon a subsequent occasion, not so far ago, recognizing that certain aspirations of Italy might form the basis of discussions between the powers most specifically concerned, I offered, in a message addressed to the chief of the Italian Government, to send to the Governments of France and of Great Britain such specific indications of the desires of Italy to obtain readjustments with regard to her position as the chief of the Italian Government might desire to transmit through me.

While making it clear that the government of the United States in such an event could not and would not assume responsibility for the nature of the proposals submitted nor for agreements which might thereafter be reached, I proposed that if Italy would refrain from entering the war I would be willing to ask assurances from the other powers concerned that they would faithfully execute any agreement so reached, and that Italy's voice in any future peace conference would have the same authority as if Italy had actually taken part in the war as a belligerent.

Unfortuntely, to the regret of all of us, and to the regret of humanity, the chief of the Italian Government was unwilling to accept the procedure suggested, and he has made no counter-proposal. This government directed its efforts to doing what it could to work for the preservation of peace in the Mediterranean area, and it likewise expressed its willingness to endeavor to cooperate with the government of Italy when the appropriate occasion arose for the creation of a more stable world order, through the reduction of armaments and through the construction of a more liberal international economic system which would assure to all powers equality of opportunity in the world markets and in the securing of raw materials on equal terms.

I have likewise, of course, felt it necessary in my communications to Signor Mussolini to express the concern of the government of the

United States because of the fact that any extension of the war in the region of the Mediterranean would inevitably result in great prejudice to the ways of life and government and to the trade and commerce of all the American republics.

The government of Italy has now chosen to preserve what it terms its "freedom of action" and to fulfill what it states are its promises to Germany. In so doing it has manifested disregard for the rights and security of other nations, disregard for the lives of the peoples of those nations which are directly threatened by the spread of this war; and has evidenced its unwillingness to find the means through pacific negotiations for the satisfaction of what it believes are its legitimate aspirations.

On this 10th day of June, 1940, the hand that held the dagger has struck it into the back of its neighbor.

On this 10th day of June, 1940, in this university, founded by the first great American teacher of democracy, we send forth our prayers and our hopes to those beyond the seas who are maintaining with magnificent valor their battle for freedom.

In our unity, in our American unity, we will pursue two obvious and simultaneous courses; we will extend to the opponents of force the material resources of this nation and, at the same time, we will harness and speed up the use of those resources in order that we ourselves in the Americas may have equipment and training equal to the task of any emergency and every defense.

All roads leading to the accomplishment of these objectives must be kept clear of obstructions. We will not slow down or detour. Signs and signals call for speed—full speed ahead.

Yes, it is right that each new generation should ask questions. But in recent months the principal question has been somewhat simplified. Once more the future of the nation and the future of the American people is at stake.

We need not and we will not, in any way, abandon our continuing efforts to make democracy work within our borders. Yes, we still insist on the need for vast improvement in our own social and economic life.

But that, that is a component part of national defense itself.

The program unfolds swiftly and into that program will fit the responsibility and the opportunity of every man and woman in the land to preserve our heritage in days of peril.

I call for effort, courage, sacrifice, devotion. Granting the love of freedom, all of these are possible.

And the love of freedom is still fierce, still steady in the nation today.

Bane. It speaks about an English yeoman. "Kester never said 'winter,' he always said 'summer's sleeping.' He never said 'caterpillars,' he always said, 'there's butterflies as is to be on my cabbages,' and there was never a bud small enough nor sad-coloured enough that Kester did not see within it the beginning of the blow."

I see England today true to herself, "While the loud blasts that tear the skies serve but to root her native oak." I believe she knows, and will know, neither age nor weariness, nor defeat, and in this City of Liberty, will you permit me to salute her, not in my own words but on the lips of an American woman who wrote twenty-five years ago with prophetic vein, words that might have been written this very afternoon:

Shatter her beauteous breast ye may;
The spirit of England none can slay!
Dash the bomb on the dome of Paul's—
Deem ye the fame of the Admiral falls?
Pry the stone from the chancel floor,—
Dream ye that Shakespeare shall live no more?
Where is the Giant shot that kills
Wordsworth walking the old green hills?
Trample the red rose on the ground,—
Keats is beauty while earth spins round!
Bind her, grind her, burn her with fire,
Cast her ashes into the sea,—
She shall escape, she shall aspire,
She shall arise to make men free:
She shall arise in a sacred scorn,
Lighting the lives that are yet unborn;
Spirit supernal, Splendour eternal,

ENGLAND! *

(*Loud Applause*).

Ladies and Gentlemen, I shall be glad to take to the brotherhood to which I belong in Canada the message that

*From Helen Gray Cone's wonderful poem, "Chant of Love for England" this brotherhood in this city has so generously applauded the words of that American woman.

It is always an inspiration to be in a meeting of lawyers and to recall the great men of the past, the great statutes of the past, the great cases of the past and the great laws of the past, which have formed the very tapestry of our pattern of freedom. The Charter of Liberty, the Magna Charta, the Habeas Corpus Act, the Bill of Rights, the Declaration of Independence; they are the milestones of human progress. The words of Erskine, of Lincoln, of Jefferson, of Andrew Hamilton—they are the voices of human emancipation. For the Law in its majesty and its real grandeur is never on the side of oppression or of violence or of unfaith or murder. In its noblest moods it stands in compassion by the side of the Man with the Hoe, in the cell of the persecuted and by the funeral pyre of the martyr. It stands wherever a man holds his head erect and speaks the truth that is within him. It stands wherever great souls and minds fight against bigotry and darkness. For the law is the language of freedom and of free men.

It is a truism that your democracy and ours were built upon the harmony of the Greek concept of liberty and the Roman concept of law. That thing, wrought in primeval strength, is perhaps the greatest gift that the English-speaking peoples have given to the world, as long as we remember, always that without law there can be no liberty and without liberty there can be no law. That gift has been transmuted by the American people into the most scared of all rights—and I think you have done it with an inspiration, a perseverance and a vision above all others—the rights of plain, ordinary simple men and women.

Mr. Lloyd George said the other day that the freedom for which we fight was the right of the Czech to dance around his maypole and the right of every Welshman with a song on his lips or in his heart, to awaken the echoes of his native valley. That is a simple truth and I believe its acceptance can be interpreted as your divine gift to mankind.

John Buchan, Lord Tweedsmuir, Governor-General of Canada, much loving and much loved, in a chapter of his autobiography just published, which he calls *My America* and which he dedicates with a remarkable insight and deep affection to your nation, says these words: "The American civilization has two main characteristics. The first is that the ordinary man believes in himself and in his ability, along with his fellows, to govern his country. It is when a people loses its self-confidence that it surrenders its soul to a dictator or oligarchy. In Mr. Walter Lippman's tremendous metaphor it welcomes manacles to prevent its hands shaking.

"The second is the belief, which is fundamental also in Christianity, of the worth of every human soul—the worth, not the equality—and this partly honest emotion and partly a reasoned principle that something can be made out of anybody if you look for it, or in canonical words, that ultimately there is nothing common or unclean."

Ladies and Gentlemen, I rejoice to be a Canadian speaking to Americans today. There is so much that I would like to tell you and so much for which my fellow-citizens would like me to thank you. In Canada we have built much as you have built. We have raised our nation as you have raised yours as a living and eternal protest against the abominable doctrine of racialism. We have fashioned a democracy where everybody can contribute to the common good. We have believed in giving, as far as we can, an opportunity to every man to find some of the beauty behind "the dross and the darkness." We have gloried too in the exaltation of little things.

"*I come in the little things*
Saith the Lord
Not in the rush of morning wings
Of majesty. But I have set my feet
Amidst the delicate and bladed wheat
That spring triumphant in the furrowed sod."

Our romantic history has been almost without blemish or stain. We have never been guilty of aggression. We cherish no hates, we seek no revenges, we pursue no aggrandizement. We have worked for peace and we have sacrificed for peace. When we have had to fight to defend our liberties, we have marched forward with loyalty and courage, enduring to the end. In this war we have never spoken to the United States officially or semi-officially, directly or indirectly, any word that would ask you to say or do anything in this crisis other than what you of your own untramelled will wish to do or say. The people of Canada have neither dishonoured your democracy nor our good neighbourhood. (*Loud Applause.*)

We feel, of course, that we speak the same eternal verities as you do, with the same accent. We passionately desire your goodwill because you are the keepers of the world's conscience; and if we had not your goodwill we would think there was something wrong about our own conduct. We have believed, perhaps, that the crash of events speaks more loudly than any cataract of words, however brilliant they may be, from however high a place they may fall. But last and in the secret place of our own hearts, we have always known that true liberty needs no lobby in the United States of America. (*Loud Applause.*) That is really why we have never spoken to you.

A few weeks ago the idealism of our two peoples met the realism of our two governments. They met in a pact between your country and mine by which you agree to defend us in certain eventualities and we agree to defend you. We came not as a suppliant but as a partner. To that marriage of realism and idealism we bring, with the approval of every class of our citizens, all the strength and responsibility which we gave, a strength and responsibility perhaps beyond our numbers. We do not think that your Declaration of Independence will be weakened by this Declaration of Inter-dependence between us and you. We do not think that the British North America Act or the Statute of Westminster, or what our Prime Minister calls our "tried and traditional loyalties" will be impaired by the Ogdensburg agreement. But we know one thing. Living side by side together, in friendship and respect, we have reaped what we have sown; for we have sown and we have reaped in a land that has been tilled by goodwill and watered by the rains of conciliation and reconciliation. (*Applause.*)

My American friends! Through the darkness there will some day shine a great light. Soon "the brute and boisterous force of violent men" will be broken and a new world will arise on the ruins of this troubled earth which savagery has made hideous. It will be our duty and yours to help to remould it. When that bright day dawns I trust that your land and our land will both speak in the words of the unknown prophet of that race which has borne more than its share of human suffering:

> "*Bind up the broken-hearted*
> *Proclaim liberty to the captives,*
> *Open the prison to them that are bound.*"

Deep in hope, a humble citizen of the land of your neighbours, I wish you farewell in this shrine of liberty. As your guest I thank my most cordial and gracious hosts. As a lawyer I salute you, my brothers, the moulders of liberty, its eloquent spokesmen, its untiring defenders. As a Canadian, I thank you for the generosity of your American hearts. As a man, I bid you to join with me in the exultation of a great Englishman who, knowing you for what you are, reverently thanked God that Liberty is still an Eagle whose Glory is gazing at the Sun. (*Loud and Sustained Applause.*)

It is rather interesting to note that the beautiful poem, "A Chant of Love for England," an extract from which is quoted on page 7, was written in 1915 by Miss Cone in direct answer to the "Hymn of Hate" which was so popular in Germany during the last war

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Something good to take on –
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City Under Siege

Tribute about the everyday
Britisher

An Address by

RUDOLPH JOHN BERLIS

Montreal

1940

(The publication of this address is made possible through the courtesy of a friend)

City Under Siege

"There was a little city, and few men within it; and there came a great king against it and besieged it, and built great bulwarks against it: Now there was found in it a poor wise man, and he by his wisdom delivered the city; yet no man remembered the same poor man."

—*Ecclesiastes 9: 14, 15.*

It is apparent from our text that the short, short story as it appears in certain of our magazines is not a modern invention. Here is such a story, only a few sentences in length, which is well over two thousand years old. Tucked away in one of the less popular books of the Bible, it has all but escaped us. Yet with a few broad strokes of his pen the author has suggested a theme which is as contemporary as tonight's radio news-cast.

The author of the Book of Ecclesiastes was a learned and erudite man,—a philosopher. He had drunk deep of the cup of life's experience, but had laid it aside embittered and disillusioned. To him, life was essentially futile and meaningless,—to be interpreted in cynical and sardonic terms. He complained; "I returned and saw under the sun that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding . . . but time and chance happeneth to them all. All is vanity." This, to him, was the conclusion of the whole matter. But by some strange irony, the book eventually came into the hands of a priestly ghost-writer,—the ancient equivalent of our present-day government censor. The priest was appalled by the conclusions of the scholar. Worried by so pessimistic a philosophy, he determined to amend it. He protested; "Life is not vain. I have seen wisdom under the sun and it seemed great to me." And then he recounted the story of the little city,—the city under siege.

The name of that city,—its history and destiny,—we shall never know. But at one time in its career it faced disaster. A certain war-lord marched against it, raised lofty bulwarks, and set about reducing it by siege and direct attack. The city-rulers were thrown into a panic. Their resources seemed as nothing against those of the enemy. Fear and foreboding began to rise like a tidal-wave,—threatening to engulf them. Then it was,—at this most crucial moment,—that there came forward this poor wise man. He suggested a simple but effective plan of resistance. In desperation, the city-fathers acted upon his advice. They put the plan into action and,—possibly to their surprise,—it worked! The city was saved, and when the dust of the invading army had died away, the people of that city awoke to realize that they owed their freedom to a man so humble that they didn't even know his name. And this was the conclusion of the ghost-writer: "Life is not vain so long as the plain man retains this unexpected spark of genius. Life is not meaningless so long as God uses the common man as the channel for his power and purpose."

But of course it is not this obscure city of antiquity in which I am primarily interested. This lost city of the past means nothing to me except in so far as it mirrors the plight of another, a greater city in our day,—the fortress city of Britain. This little Kingdom, so precious, so well-beloved,—this Island set in a silver sea,—faces a tyrant more deadly than any known to the ancient world. He has set up bulwarks in the mountains and fjords of Norway,—other bulwarks in the erstwhile pleasant meadows of Denmark, Holland and Belgium,—and still other bulwarks on the coast of violated France. From the land of the midnight sun to the storm-lashed cliffs of Biscay he hurls his might against this little city,—this world in miniature,—this tiny shrine of all that is best and beautiful in human life. But in Britain there lives a poor wise man. You'll find him everywhere, —for his name is Legion. You'll find him in picturesque thatched-roof villages and mighty urban centers; you'll find him in the straths and glens of Scotland and in the gardens of Kent; you'll find him in the gracious homes of noblemen and the crowded tenements of the humble,—this poor wise man. He's poor,—because no man has wealth in Britain today. But he's wise,—with a subtle, stalwart wisdom which all the ingenuity of the aggressor cannot conquer.

Let us explore the elements which are caught up and focussed in this wisdom.

I.

FIRST of all, the plain man in Britain is fortified by an imperious sense of duty. This, I take it, is the basis of his wisdom. From the Nursery to the Grave he lives under a stern sense of moral obligation,—to his school, his country, his fellowmen, and his God. This is one reason for the remarkable unity of British life. The humblest tenant-farmer feels a sense of definite obligation to the Lord of the Manor; but the Lord is no less bound, in his turn, by obligations to his tenants. It has been pointed out that in this matter of moral responsibility there is an interesting contrast between the American and the Englishman. The American seems to be interested in laws,—a veritable flood of laws. But his English cousin is interested not so much in laws as in Law itself,—that remarkable distillation of custom and practice which represents his code of life. He spends the days of his years in an atmosphere of moral obligation. And when he says, "I ought,"—there can be no further appeal.

There is, of course, nothing sensational or ostentatious about the word "duty". And yet it has been the guiding-star of all great English heroes from Alfred the Great to Winston Churchill. It found its classic expression in the celebrated words of Lord Nelson: "England expects every man to do his duty." Latterly, it has found its most moving expression in the heroism of young aviators and seamen who, doing their duty in the face of overwhelming odds, have driven back the enemy in confusion.

It is, I think, significant that the British Race has never gone in for lofty or theatrical designs. It has never produced a Tamerlaine, an Alexander, a Caesar, a Napoleon, or a Hitler. But it has produced something far more durable. Down through the years, the British race has produced a quality of superb manliness,—fortified by a sense of duty,—which has disturbed and ultimately defeated the braggard war-lords of history. In this present conflict, I have no doubt that the British will wear down their enemies,—because nothing on Earth or in Hell can dissuade them from doing what they deem to be their Duty. It is the basis of a formidable wisdom.

II.

THERE is a second element in the wisdom of the plain man in Britain. He is fortified by a high sense of destiny. He's extremely quiet about it. He's not given to boasting in grandiose terms about his country's historic mission. He leaves that to less reticent peoples. But it's there all the same,—this solemn faith in Britain's necessary role in the world's future. The plain man knows instinctively that Britain is not simply an Empire. Rather, she is a community of thought,—a way of life,— a conception of Man in his Universe,—and these qualities are struggling for the right to survive in a singularly angry world. Professor Santayana once said, "Never since the heroic days of Greece has the world had such a sweet, just, boyish Master. It will be a black day for the human race if scientific blackguards, conspirators, churls, fanatics manage to supplant him." Striking words those,—especially when we remember that Santayana was not a Britisher. His is an objective tribute to the British way of life.

The possible alternatives to British rule are not pleasant to contemplate. Which will you choose? The refined sadism of Imperial Japan? The neo-Roman slavery and sensualism of Fascist Italy? The Teutonic barbarism of Nazi Germany? The crushing Slavic steam-roller of Soviet Russia? Such possibilities are not attractive. Over against these, the plain man pins his faith in the high destiny of Britain. She alone is left to ensure Justice for the weak and helpless; to offer freedom to captives; to open the eyes of those who are blinded by lying propaganda; she alone is left to set up a Pax Britannica in lieu of the Empire of slave-states envisaged by Messrs. Stalin, Mussolini, and Hitler. For the sake of this, Britain's historic destiny, the plain man will sacrifice his wealth, his personal ambitions, even life itself, —but he will not give up his faith in Britain's future. This too is wisdom.

III.

THERE is a final element in the wisdom of the British plain man. He is under-girded and over-arched by a sense of divinity. Again,—the average Britisher does not wear his religion on his sleeve. But in his heart there is a dream of God and Goodness which all the forces of organized Evil are powerless to shatter. With Robert Louis Stevenson he exclaims: "I believe in the ultimate decency of things. Even if I awoke in Hell, I would still believe in it." The plain man will fight to his last breath,—but in his heart there remains a strange peace and tranquillity,—because he has left the final issue with God.

In the days of Oliver Cromwell, the British Ambassador to the Hague, Bulstrode Whitelocke, was tossing on his bed one night, unable to sleep for anxiety about his country. An old servant, lying in the same room, addressed him:

"Sir," he whispered, "May I ask a question?"

"Certainly," replied the Ambassador.

"Sir, did God govern the world well before you came into it?"

"Undoubtedly."

"And will He govern the world well when you have gone out of it?"

"Undoubtedly."

"Then, sir, can you not trust Him to govern the world well while you are in it?"

There was no reply, but the harassed Ambassador turned on his side and fell asleep. That faithful servant was, of course, the poor wise man of Britain with his faith in the ultimate moral sovereignty of God.

The most significant book on religion ever to be written by an Englishman is "Pilgrim's Progress" by John Bunyan. Towards the end of the book, Hopeful starts to cross the Dark River. It is an awesome experience. The waters are deep and treacherous,—the current swift. But there in mid-stream,—with fearful shadows all about,—Hopeful calls back in ringing tones to his friend on the shore: "Be of good cheer, my brother. I have felt the bottom and it is sound." That is a true picture of the British character in every age. Today, though the swirling waters of this latest Dark River beat about him, the plain man from Britain calls back to us, "Be of good cheer, my brothers. I have felt the bottom and it is sound."

In this latter time, there is a small island. A mighty tyrant has come against it, and besieged it, and built great bulwarks against it. But in this island there is a multitude of poor wise men. By their wisdom and courage one day they will deliver the island from the enemy. And their names,—their names are known only unto God.

January 22nd, 1946, Chateau Laurier · Ottawa

The Department of Munitions and Supply

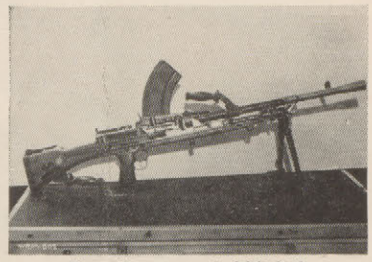

A TRIBUTE
TO A GREAT SHOW
AND A WONDERFUL CAST
To-night, the curtain goes down on a great show. In its 2,362 days of continuous performance, it rang up greater production records, covered more centers, and involved more actors than any show in our history. In all, it grossed more than 10½ billion dollars.
I am proud, indeed, that it was my privilege to be Ringmaster. Our production demanded matchless daring, speedy action, endless patience, high endurance, and skilful timing . . . all the qualities that make for great performance. Like all good troupers, you never let us down. You were an all-star cast in an all-star show.
Gentlemen, I thank you for a superb production.

Menu

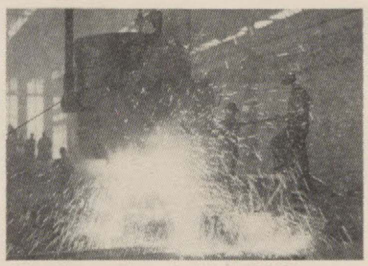
- Supreme of Fruit
- Consomme Fermiere
- Roast Imperial Capon (Cranberry Sauce)
- Green Peas and Carrots
- Risollee Potatoes
- Ice Cream Chateau
- Assorted Cakes
- Coffee

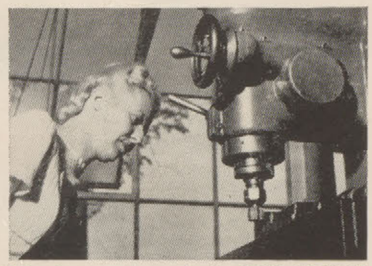
CANDID SHOTS FROM CA


Cartridge cases, 135,426,617


Small arms, 1,686,348

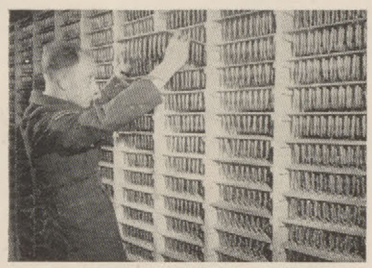

Naval vessels, 543


Steel produced, 16,975,347 tons


Machs. and equip't, $801,000,000

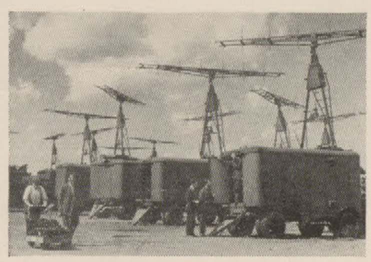

Lumber, 28,358,000,000 ft.


Aircraft, 16,414


S.A. amm., 4,628,100,000 rds.


Base metals, 7,250,564 tons

R.R. locos and cars (export), 3139

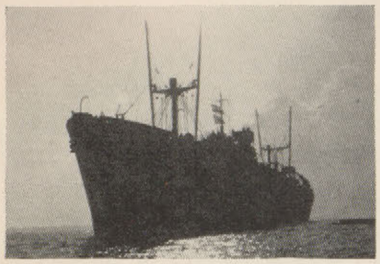

Commun. equip't, $398,000,000

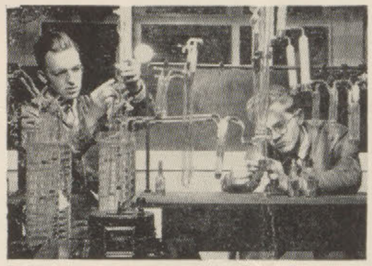

Tires, 13,704,563

300

STARRING MORE THAN

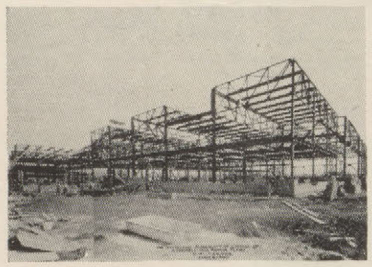
CANADA'S BIGGEST SHOW

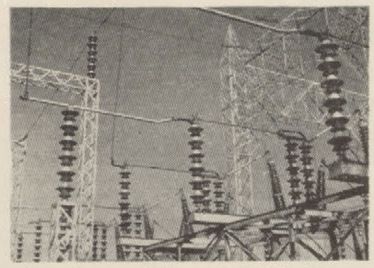

Cargo ships, 392

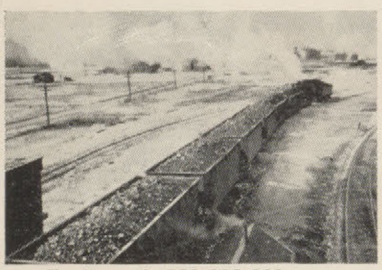

Chemicals, expl., 2,097,770 tons


Fighting vehicles, 50,761

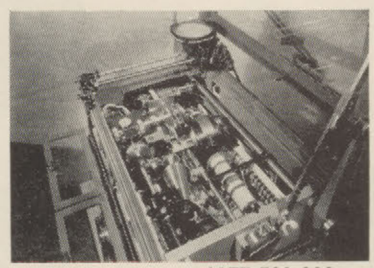

Military vehicles, 792,676


Construction, $1,180,000,000

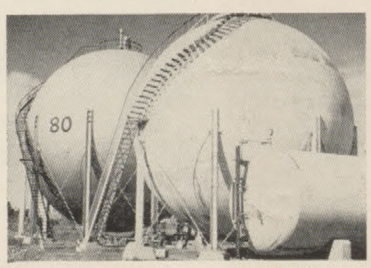

kw. hrs. produced, 220 billion


Coal used, 253,006,000 tons

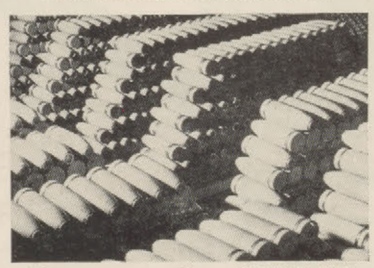

Houses, 27,638 units

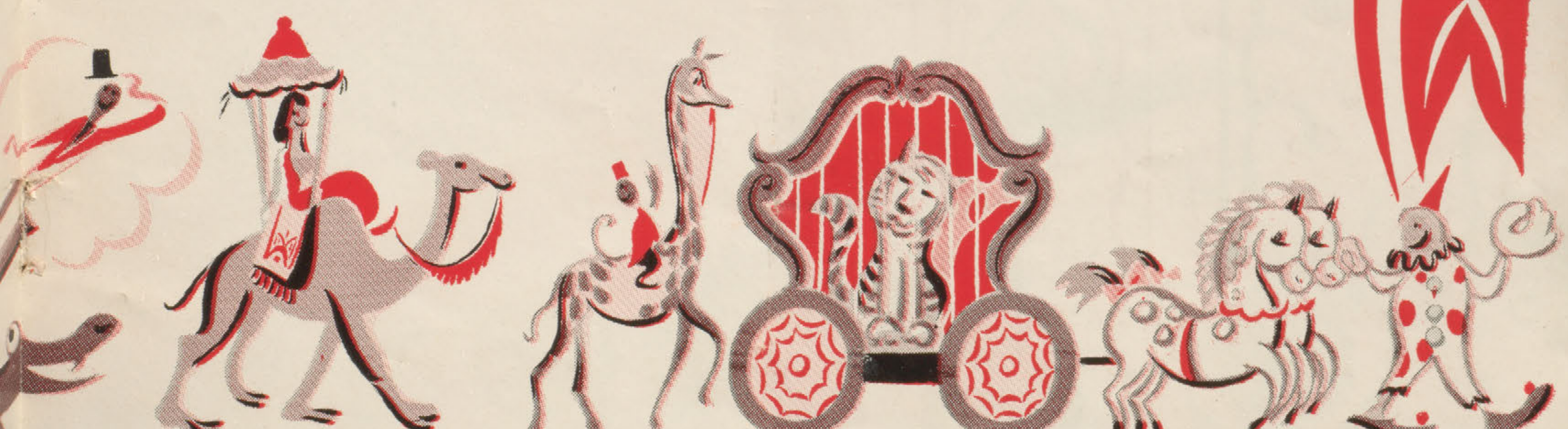

Instruments, $177,500,000


Complete gun units, 50,000



Oil and gen. stores, $1,638,000,000


Heavy projectiles, 110,000,000



A MILLION CANADIANS


HIGHLIGHTS OF THE BIG SHOW
LAUNCH TODAY 1,000TH VESSEL BUILT IN WAR
The 1,000th ship built in Canada since the war began will be launched here today in a ceremony which officially will open the Seventh Victory Loan.
Mrs. C. D. Howe, wife of the
Canadian Mosquito Makes Ocean Record
MONTREAL, Oct. 24.—(CP)—A Canadian-built Mosquito fighter-bomber today made the first non-stop Atlantic crossing of a Mosquito aircraft from Gander, Nfld., to the United Kingdom.
Mosquito KB492, just off the production line in Canada, flew from Gander to Prestwick, Scot land—2,200 statute miles—in hours, 44 minutes to establ trans-Atlantic Mosquito with an average ground spee of 322 miles an hour.
100,000,000th Shell Made
CHERRIER, Que., Sept. 9 — (CP)— On a platform backed with flags of the United Nations and ringed with a variety of Canadian-made bombs and shells, Munitions Minister C. D. Howe received here yesterday from munition workers a replica of the 100,000,000th heavy projectile made in Canada since the start of the war.
The actual 100,000,000th shell stuffed with pamphlets in
ada First in Radar F
pite Lack of Bluepri
TREAL, Dec. 3.—(CP)— an engineers, guided only ale photographs, produced equipment three months of plants which had the nal blueprints as a guide, G. Sheils, Deputy Minister of the nitions Department, disclosed ay.
Mr. Sheils, in an address to e Montreal Canadian Club, reviewed Canada's war production record and placed new light on the Dominion's top performance in the radar field.
More Effective Than A Bomb.
Radar did more than even the atomic bomb to win the war. For some time after the United States had entered the war Canadian-built radar equipment guarded approaches to the vital Panama Canal and to other important North American points.
Other Canadian-made sets made possible the North African landing, helped smash the Italian Navy, watch over the Atlantic Mediterranean and the battle of Germany.
Canadian radar back to 1938 Department
but in its timeless ity.
"Time and again wrote the delivery time and again Ca them", he said.
That success he attrib only to those who had in the Munitions Departm to the manufacturers and men across Canada who sponded to seemingly imp tasks to fill an urgent need.
and by 1940 Britain turne North America for additional duction.
A group of British experts sent to the United States to range for production and route they paused in Canada, bu they told Canadian engineers they could not spare their blueprints.
"Our engineers were not easily daunted", said Mr. Sheils. "With nothing but scale photographs to work from they told us they could produce radar—and they did.
"To their everlasting credit and to the credit of the workmen who co-operated so whole-heartedly in the project, the Crown company, Research Enterprises Ltd. at Leaside, Ont, without the original blueprints, turned out its first radar set three months ahead of the
BUILDING IS ASTONISHING
(Continued from Page 1, Column 2.)
shipping in the world than there was in 1939."
Britain must continue to serve the world with a large and efficient mercantile marine and, paying tribute to the men of the merchant navy, Noel-Baker said they were the key to security against defeat
Canada Leads In Explosives
Canada's chemical and explosives program — commenced in 1940 to supply the needs of the British Empire and as a reserve in the event that England had been mbed out by Germany—"has pplied every one of the Allied ns with some forms of explo-
J. R. Donald, O.B.E., Director General of the Chemical and Explosives production branch of the Department of Munitions and Supplies, said today. He was speaking at a lunch of the Canadian Credit Men's Trust Association, Ltd., in the Queen's Hotel.
Outlining new explosive techniques of world importance developed by the Government-owned Canadian industry, Mr. Donald said the Government has spent $150,000,000 in new plants
"Late in

Frank Ryan

Stewart Jackson

RESERVED FOR AUTOGRAPHS OF THE STARS AND THEIR GUESTS

E. Winslow Spragge

C. Grundy

W.E.P. DeRoche

J. de N. Kennedy

G.M. Davies

Stirling Parks

The Engineering Institute of Canada

Incorporated 1887
as
The Canadian Society of Civil Engineers

THE MANUFACTURE OF MUNITIONS IN CANADA

BY

H. H. VAUGHAN, M.E.I.C.

PRESIDENTIAL ADDRESS

ANNUAL MEETING, OTTAWA, FEB. 10TH,
1919

The Manufacture of Munitions in Canada

By

H. H. Vaughan, M.E.I.C.

Presidential Address

Annual Meeting, Ottawa, Feb. 10th, 1919

H. H. VAUGHAN, M.E.I.C.
PRESIDENT, ENGINEERING INSTITUTE OF CANADA,
1918

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THE MANUFACTURE OF MUNITIONS IN CANADA

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H. H. VAUGHAN, M.E.I.C.

PRESIDENTIAL ADDRESS

ANNUAL MEETING, OTTAWA, FEB. 10TH, 1919

WHEN the war commenced in August, 1914, Canadian Industries were suffering from a period of severe depression. Certain undertakings that were already under way were being completed but practically no new enterprises ~~were being projected~~, the volume of business was small and values of all securities had fallen. This condition was, no doubt, principally due to the world-wide disturbance caused by Germany's decision to bring on a state of war in that year, ~~but it was intensified in our case by the extraordinary amount of railroad construction in several preceding years, the great expansion which had taken place in our manufacturing capacity and~~ on account of the general reaction following a period of great development. there were

During the opening months of the war, the sentiment regarding business conditions was decidedly pessimistic. The immediate prospect was one involving a complete suspension of all development work, a great demand for money in Europe and consequent stringency here and a practical stagnation in all our industries during hostilities. Few foresaw the length to which such a war could possibly extend with the corresponding demand for our natural products and I believe we can safely say that none foresaw our manufacturing capacity would not only be fully utilized but enormously increased to provide for the requirements of the Allies. ?

The first aid offered by Canada to the British Government was naturally military and munition workers can claim no recognition in comparison with the magnificent contribution she has made in furnishing the troops that have served with such immortal credit to their country and have so nobly succeeded in establishing the freedom of the world. That is to-day a matter of record and history. Our Institute must, however, be eternally proud of those achievements of its membership in this terrible war, 960 have enlisted, of whom 943 were officers before the war ended. 75 have been killed or have died of wounds and 116 decorations have been gained. This constitutes a testimony to the loyalty and ability of the engineering profession to which it can point with honorable pride.

Second only to the help Canada rendered to the cause of the Allies in men was her contribution in the manufacture of munitions, a line of work in which the results that have been obtained were certainly not anticipated when the war commenced. From without, Canada would appear as a country whose wealth lay in her wheat fields, her mines and her forests and whose manufacturing wealth was simply incidental to her local requirements, and it is strange to realize that such a country with her comparatively small population should, for a considerable period, have furnished over fifteen per cent of the total disbursements of the British Ministry of Munitions.

Without any desire to disparage the achievements of the Canadian Manufacturers, it must, however, be recognized that they enjoyed certain latent advantages which were not initially recognized. A lengthy period of prosperity had produced a large number of men who were used to attacking difficulties and overcoming them. A reasonably good supply of labor was available and, on account of the dullness in business in the United States, skilled assistance was readily obtained. Last, and probably most important, was the close connection Canadians enjoyed with the United States machinery manufacturers, which enabled them to obtain promptly information as to the machinery required and quick delivery when it was ordered. These advantages were not, however, appreciated when the work was commenced and in no way detract from the initiative that was displayed by those who acted as the pioneers in the work.

The starting point of munition work in Canada came from a request received by General Hughes, Minister of Militia, from the British Government asking if he would place some contracts on their behalf in the United States and a further enquiry for 100,000 15-pounder and 100,000 18-pounder shrapnel shells, empty, which was a greater quantity than could be produced in the Dominion Arsenals in any reasonable time. General Hughes was anxious that the shells should be manufactured in Canada and requested Colonel Greville Harston, Inspector General of Arms and Ammunition, and Lt.-Col. F. D. Lafferty, Superintendent of the Dominion Arsenal to get in touch with manufacturers whom they thought could undertake the work. As a result, on the 2nd of September, 1914, Colonel A. Bertram of J. Bertram and Sons, Geo. W. Watts of the Canadian General Electric Company, Mr. E. S. Winslow of the Ingersoll Rand Drill Company, Alex. Goldie of the Goldie McCulloch Company, E. Carnegie of the Electric Steel and Metals Company and Colonel Harkom were called to Ottawa to meet General Hughes. At that meeting the nature of the work and the inspection requirements were fully discussed and, while some doubt was expressed, the meeting agreed with General Bertram and assured the Minister that the work could be done in Canada.

At a subsequent meeting held on September 8th at the Dominion Arsenal, the Minister intimated that it was not considered desirable for the Government itself to undertake the work, but suggested that a Committee of manufacturers should act as the Contractor and appointed Colonel

Bertram, Geo. W. Watts and Thos. Cantley as that Committee, whose appointment was confirmed by cable by the British War Office. Colonel Bertram was elected to act as Chairman of the Committee and it was subsequently enlarged by the addition of E. Carnegie as another manufacturer, Colonel Greville Harston, Lt.-Col. F. D. Lafferty and General Benson, Master General of Ordnance. About two weeks later, Mr. David Carnegie was appointed by the Minister as Ordnance Advisor.

This group of men constituted the original Shell Committee and, while the work they undertook was small, compared with our present views of magnitude, it was of vital importance not only for the future of Canada, but to the conduct of the war. They had as assets the assurance of the Minister that he would stand back of them, although, technically speaking, they were individually responsible as contracting parties for the fulfillment of their undertaking with the British Government, and the fact that, at the little Dominion Arsenal at Quebec, shrapnel shells had been forged and completely finished, apart from the fuse, cartridge cases made and fixed ammunition produced, all, however, in small quantities and under adverse conditions. They had as liabilities the absolute unfamiliarity of Canadian manufacturers with Ordnance requirements, the unwillingness of the majority of manufacturers to undertake the work, except as a patriotic duty, specifications and inspection requirements which presented opportunities for unlimited trouble and expense, and a number of minor difficulties which would have to be investigated and overcome before the manufacture could proceed smoothly. The great asset they possessed however was the knowledge and experience at the Quebec Arsenal.

Many have, no doubt, visited this Arsenal before war was thought of and smiled at the conditions under which the work was performed, but this Arsenal was actually producing ammunition, it knew how such work had to be done, the methods and the d fficulties, and it is safe to say that, while shells would have been produced in Canada had no Arsenal been in existence, they could not possibly have been produced as quickly or as economically if it had been necessary to visit the munition plants in the United States or gradually discover the proper way with the assistance of information from England. To Colonel F. D. Lafferty, the Superintendent, all Munition Manufacturers owe a deep debt of gratitude. No trouble was too great for him to go to, any information he possessed was available, any assistance he could render was offered freely; he simply placed himself and his entire staff at the service of every manufacturer to help in every way in the production of the munitions which he knew were so seriously needed.

In view of the numerous firms that have so successfully manufactured munitions, there is a tendency to consider it a comparatively easy kind of work. There is a certain degree of truth in this view, in the sense that, once all the difficulties attendant to any particular line of work have been mastered by a group of manufacturers, who are willing to freely impart their knowledge and experience to others engaging in the same work, the balance of the ability necessary is largely of an executive character. Without, however, desiring to unduly exaggerate the difficulties that at first confronted the Shell Committee, their task was by no means easy. Their first inquiry was for a quantity of empty shrapnel shells and it may not be out of place to mention that an empty shrapnel contains everything but the bursting charge and pellets. The Committee began by dissecting an 18-pounder shrapnel shell, and obtained from the Quebec Arsenal their manufacturing cost for each component part. Estimates were made of the cost of producing them in quantities and of machining and assembling the shell and a price at which the Committee could undertake to supply 200,000 shells was cabled to the War Office in London. This resulted in two orders being placed, one for 100,000 empty 15-pounder shrapnel and the other for 100,000 empty 18-pounder shrapnel, both of which were received on September 22nd, 1914.

The first stage in this shell is a blank of steel Fig.1; this blank is pierced on a forging press to form the forging from which the shell is machined. During the machining process, the shell is heat treated to put the steel in the required condition, the disc is inserted and the end of the shell nosed in. The shell is completed by the assembly of the powder cup, ignition tube, bullets and socket, and the final machining required after the assembling. Fig. 2.

The steel required the first consideration. This is required to conform to quite a rigid specification, which does not define the chemical composition but the physical requirements after heat treatment. The first difficulty experienced by the Committee was the specification that this steel should be acid open hearth. There was only one acid furnace in Canada and that was of small capacity and it was, therefore, practically imperative to induce the authorities to accept basic steel. Col. Thos. Cantley obtained the suitable analysis from some acid steel in the possession of the Arsenal, made up a heat of basic steel to correspond with it and rolled it into bars. These were forged at the Arsenal, made up into shells and tested with satisfactory results. Colonel Carnegie went to England with two of the shells and word came back that basic steel that met the balance of the specifications would be accepted. I have no doubt that the authorities were realizing by that time that if they wanted shells they would have to accept basic steel, but this does not detract from the importance of the concession that the experiment justified, a concession that made the entire steel making capacity of the country available for munition work.

The permission to use basic steel did not conclude the steel makers' difficulties by any means. He still had to determine the exact quality of steel that would comply with the balance of the specifications which, during the first four months, gave him considerable trouble. Experience developed that a minimum about 0.42 per cent of carbon was necessary in order to meet the physical requirements but many failures occurred before the steel makers obtained sufficient experience to ascertain the exact grade required. The Nova Scotia Steel Company took the pioneer part in this work and were unsparing in their efforts to produce the proper steel as rapidly as possible, and they deserve great credit for their patriotic enterprise.

After the steel was secured, it next had to be converted into forgings. This work was handled in a small way at the Arsenal, but many difficulties were experienced by the firms who undertook to execute it on a manufacturing basis. Again the Nova Scotia Steel Company was one of the pioneers and the Canada Forge Company also took the work up energetically and rendered good service in obtaining successful production. An interesting example of the universal desire to assist in the work was afforded when the Nova Scotia Steel Company, who commenced forging on one of their large hydraulic presses, Fig. 3. required additional capacity. The Canadian Pacific designed, made the patterns and castings, and constructed and shipped complete four 250-ton presses with 45-inch stroke Fig. 5. and one 300-ton press with 36-inch stroke Fig. 4. the first one in twenty days from the time the order was originally discussed and the last one ten days later.

The machining of the first order for 18-pounder shells was distributed amongst ten firms and that for 15-pounder amongst five firms who, in addition to actually performing the machining and heat treatment, were required to assemble the various components into a complete shell that would satisfy the War Office Inspection. The actual machining was not particularly difficult as the limits of accuracy are not close. There are, however, a number of different dimensions to be gauged, each with a definite tolerance, while in certain cases the maximum tolerance could not be used on all of several different dimensions. It was interesting to witness the difficulties experienced by men, who regarded the accuracy specified as comparatively easy, when they were required to produce a piece to pass a number of different gauges in the hands of an inspection staff that cared nothing about a thing being "almost right." There were also a number of practical points that required experience but in all such things the Quebec Arsenal was an invaluable guide. The usual procedure was to visit the Arsenal, ascertain exactly how to do the work, come back, get into difficulties and go back to the Arsenal to find out what the trouble was. On the whole, given a proper forging, the machining troubles on shrapnel were comparatively slight. One firm did nose in a perfectly good lot of shells before inserting the disc, which cannot be entered after nosing, and several melted the bullets by overheating the resin, but the only real trouble occurred in the heat treatment.

At the time this work was commenced, heat treatment was only a theory in the majority of plants. In a few automobile and tool making shops, heat treating equipment was in use but even in those shops it was exceptional to require results of the exactitude demanded for a shell. It was specified that the heat number should be marked on each forging and stamped on the shell machined from it. The shells from each heat were grouped together and a test shell selected by the Inspector from each heat. Test pieces from this shell must give a tensile strength not less than 56 tons per square inch, an elastic limit not less than 36 tons per square inch

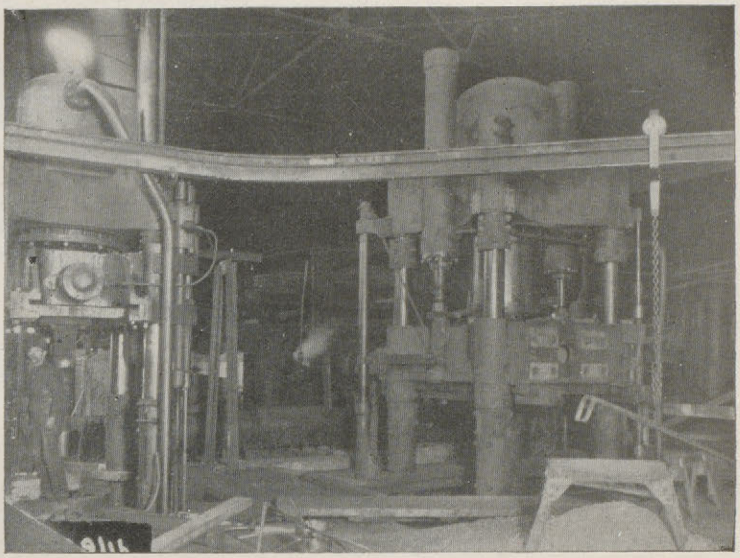


Fig. 3. Nova Scotia Steel Co. Forging Plant.

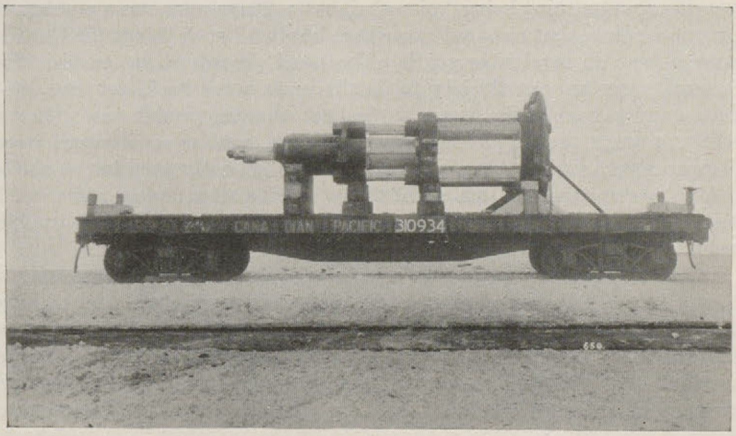


Fig. 4. C.P.R., 300 ton Hyd. Press.

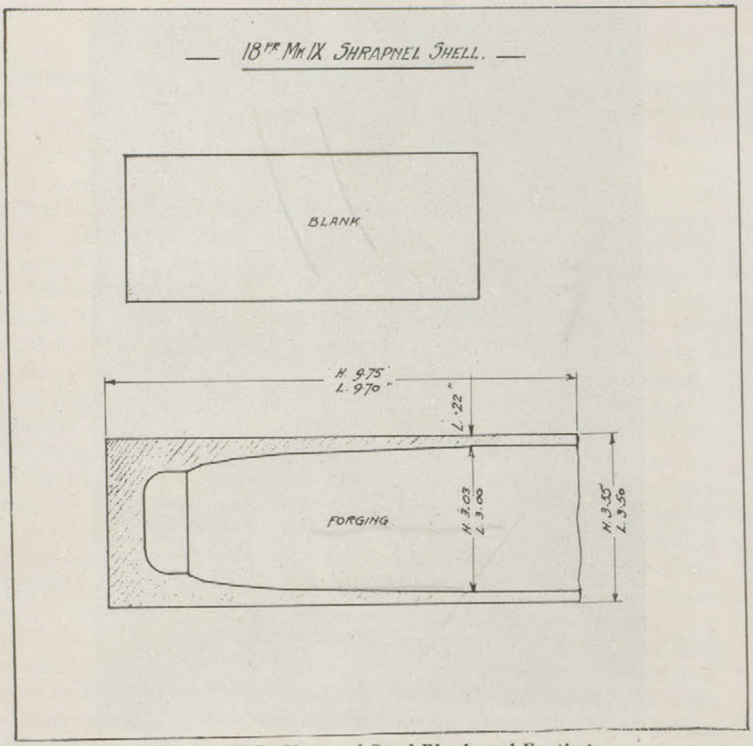


Fig. 1. 18 Pr Shrapnel Steel Blank and Forging.

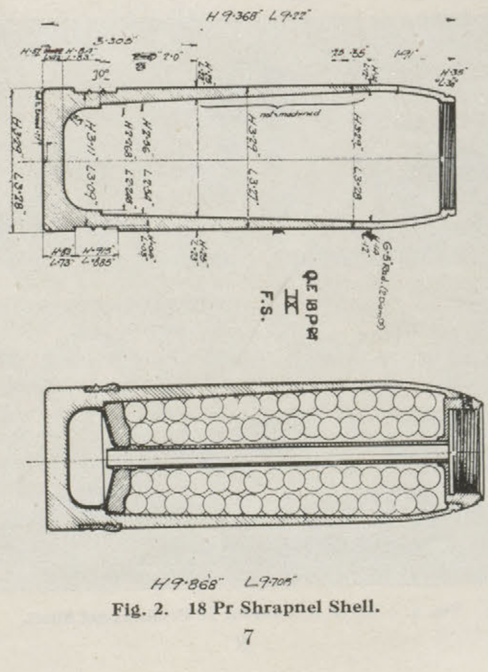


Fig. 2. 18 Pr Shrapnel Shell.

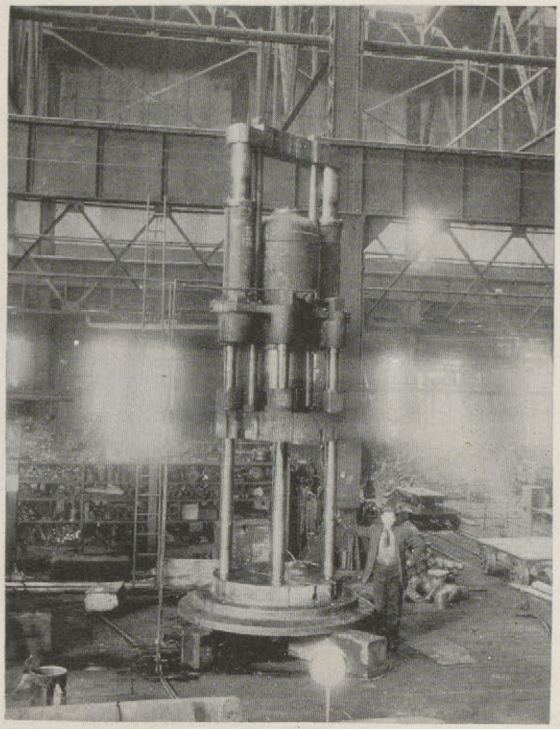


Fig. 5. C.P.R. 250 Ton Hyd. Press.

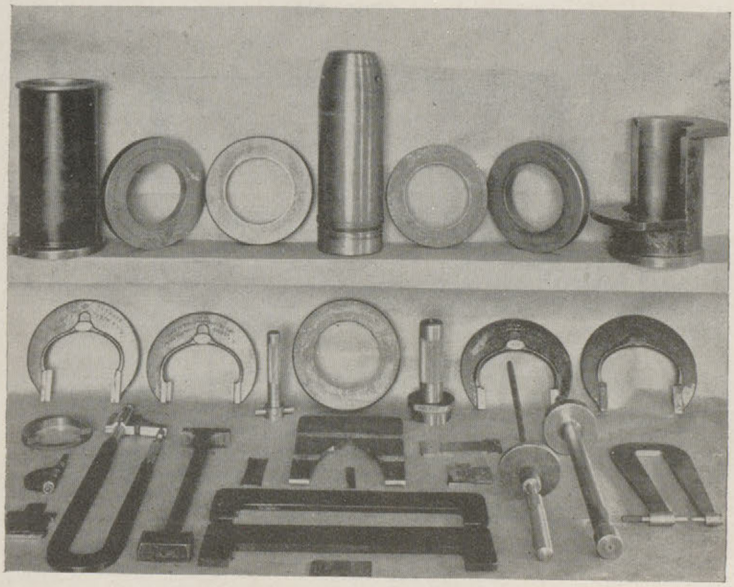


Fig. 6. Set of Gauges for 18 Pr Shrapnel Shell.

and an elongation of not less than 8% on two inches. These qualities can only be obtained with steel of the proper composition heated in a certain way. This results practically in the shells being quenched in oil from a temperature only slightly higher than the critical point and drawn back if necessary. To do this, however, the correct design of heating furnace must be used, the temperature must be accurately regulated by a pyrometer, the oil must be maintained at the proper temperature, the shell tested for hardness after quenching and, if drawing back is required, the shell must be re-heated to the proper temperature. Excellent service was rendered in working out the details of this process by Mr. W. A. Peterson, then Shop Engineer for the Canadian Pacific and Mr. E. S. Winslow of the Rand Company, the latter being, I believe the first man to introduce into regular use the magnetic detector to determine the point of critical temperature of the steel.

In many cases it was found impossible to obtain the required physical qualities from the steel furnished and in other cases re-treatment was necessary. While this work was finally developed into a manufacturing system, in the initial stages it was one of the most troublesome problems that confronted the manufacturers, although it has certainly accomplished an incidental benefit in the education of our workshops in the science of heat treatment.

The machiner, while responsible for assembling the components into a complete shell and for its acceptance by the Inspection Department, was relieved of their manufacture. This constituted one of the first and most important decisions of the Shell Committee and laid the foundation for the enormous output that was subsequently obtained. The components consisted of the powder cup, the disc, the pellet tube, the bullets, the resin, the grub screw and the socket and plug, and the powder cup was about the only one in which some little difficulty was not encountered in the manufacture. The disc, which is made by drop forging or stamping, is of steel of similar quality to the shell and must conform to physical requirements which, while less rigid than those for the shell, still required careful handling or a simple form of heat treatment to meet them. It was partially machined and had to pass its own set of gauges to be accepted. Fig. 7. The bullets were made by a machine specially constructed for that purpose and are of a mixture of lead and antimony. The pellet tube and socket are of brass, of specified quality, and required to meet physical tests, which cannot be uniformly obtained with cast brass and consequently the tube must be of extruded or drawn material and the socket forged or stamped. There is no great difficulty in meeting the requirements, but special equipment is employed in each case, there are details in the manufacture which had to be investigated to obtain the correct results and each piece must pass the War Office Inspection both as to dimensions and quality. Had contracts been let for the manufacture of the shell complete, the difficulties of the work would have been greatly increased and only those firms possessing a competent technical staff and strong financial backing could have undertaken it. Each firm would also have been obliged to purchase

Assembling part

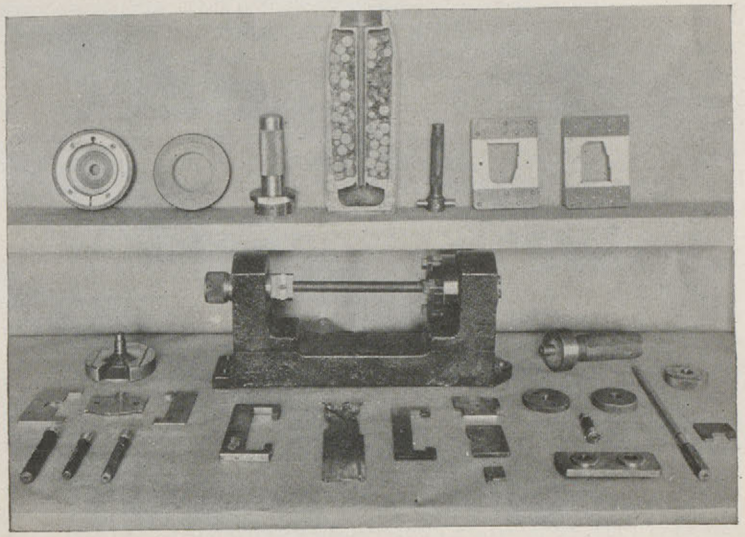


Fig. 7. Set of Gauges for Component Parts of 18 Pr Shrapnel Shell.

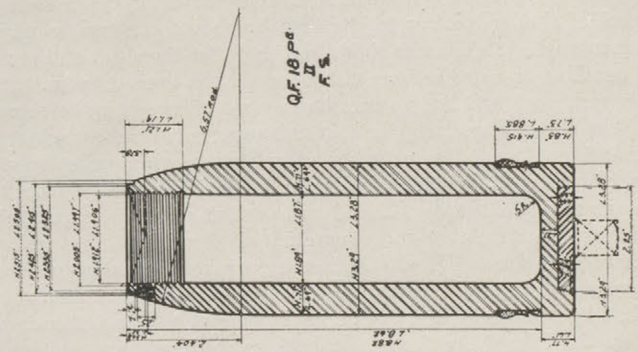


Fig. 8. 18 Pr High Explosive Shell.

part of their components and, as they would each have asked for quotations from a number of sub-contractors, the volume of inquiries would have been greatly increased and created a fictitious demand for materials and correspondingly enhanced prices. By dividing the original order amongst a few leading manufacturers, the Shell Committee could have relieved themselves of all trouble and anxiety and transferred the difficulties to the other fellow but they had confidence in the capacity of the country to produce munitions and the vision to realize that this capacity would be wanted. The principle of the arrangement they adopted, that of the subdivision of work, was old, and we have become so accustomed to this method that I doubt if we at all realize the importance of the step taken by the Shell Committee when they introduced this system, its comparative novelty and the foresight they exercised in its adoption. It entailed the independent purchase by a central body of each firm's product, the allotment of that product to other firms to perform a succeeding operation on the material or assemble it with other parts, such firms having no connection with each other, but each being individually responsible to the Shell Committee. The scheme is so manifestly efficient that we are apt to overlook its importance and its influence in rapidly obtaining production, which proved such a vital factor within the next few months. It was certainly an entirely new step in the manufacture of munitions and was not contemplated either in the specifications or the War Office system of inspection.

In so far as certain requirements were specified in the steel as rolled, the War Office could inspect the steel for those requirements at the Mill, but, if additional requirements were specified after the steel was forged or machined, the War Office could accept no responsibility for the steel meeting those requirements until presented to them in the specified state. They also could not accept any responsibility for a forging, for instance, being of the proper dimensions to permit of machining into an acceptable shell, nor were the correct dimensions for that forging determined. As any one manufacturer's product might be shipped to any of the firms engaged on a succeeding operation, the Shell Committee instituted their own system of inspection, which was carried out by the Canadian Inspection and Testing Laboratory and established the dimensions for the components which were produced in an uncompleted state. This enabled them to accept the work of any manufacturer and pay him promptly, placing all allocation of responsibility between the manufacturer and the Committee instead of between one manufacturer and another.

Like many other apparently simple things, the scheme of sub-dividing munition work is not so simple as it looks, and when it is considered that the Shell Committee had to design and obtain the gauges for the component inspection, place the contracts, attend to the shipping, financing and accounting and that they furnished the various manufacturers with master gauges and organized a staff for assisting in technical matters, the apparently easy business of letting contracts for shell manufacture is evidently a task of considerable magnitude.

While all of the work I have described was not undertaken in connection with the original order I have discussed it at some length in an attempt to portray something that I do not believe is properly appreciated, the magnitude of the original venture undertaken by the Shell Committee, the amount of hard earnest work it required and the ability with which it was executed. The whole development of munition work in Canada grew from the satisfactory execution of these preliminary orders and General Sir Alexander Bertram and his confreres deserve the greatest credit and recognition for their success.

As quickly as the Shell Committee felt assured that Canadian Manufacturers could and would undertake the work, the Minister of Militia, General Hughes, cabled Lord Kitchener pointing out that large contracts could be taken. This resulted in orders being placed on December 4th for 400,000 additional 18-pounder empty shrapnel shells and for 200,000 18-pounder fixed ammunition complete without fuse. These additional orders were justified by the rapid and satisfactory production obtained by the Canadian Manufacturers. In spite of the initial delays, which unavoidably occurred in getting the work started, deliveries were made on the first order, which was formally received 22nd September, 1914, in the month of December in that year, in which 3294 shells were shipped. This was followed by 32,961 in January and 48,264 in February and the entire order was completed well within the promised time.

As the production increased, greater confidence was felt, at the War Office, in Canada's ability to produce munitions and other orders followed until in April, 1915, the first really large order was placed for 5,000,000 rounds, divided into equal quantities of 18-pounder shrapnel, 18-pounder high explosive and 4.5-inch howitzer fixed ammunition complete.

The 18-pounder high explosive shell was Fig. 8. a new type introduced on account of the lack of effectiveness of shrapnel when used against entrenchments or wire. It is made from a plain blank, the bore being drilled out from the solid. This was the first shell made here in which a base plate was used to prevent the flash from the explosion of the propellant penetrating through any piping or seams in the base of the shell and exploding the charge. This base plate gave little trouble on the 18-pounder shell, but it was the source of endless grief on the larger shells subsequently manufactured, on which it was also employed. It was originally screwed into the base and riveted over and, although the design was subsequently changed and the threading done away with, it was responsible for the introduction of thread milling, a process up to that time very little used in Canadian Plants, which has since come into almost universal use.

The 4.5-inch high explosive shell Fig. 10 was of a different type to either of the 18-pounder. It is made from a forging like the shrapnel but is completely finish bored. It is nosed in after boring, but this operation is considerably more difficult than on the shrapnel as the shell has to be heated in a particular way to obtain the correct form after nosing, the form and material of the nosing die required lengthy experimenting with before they were properly determined and a press of about 250 tons capacity

Fig. 9. Canada Car & Foundry Shell Forging Plant.

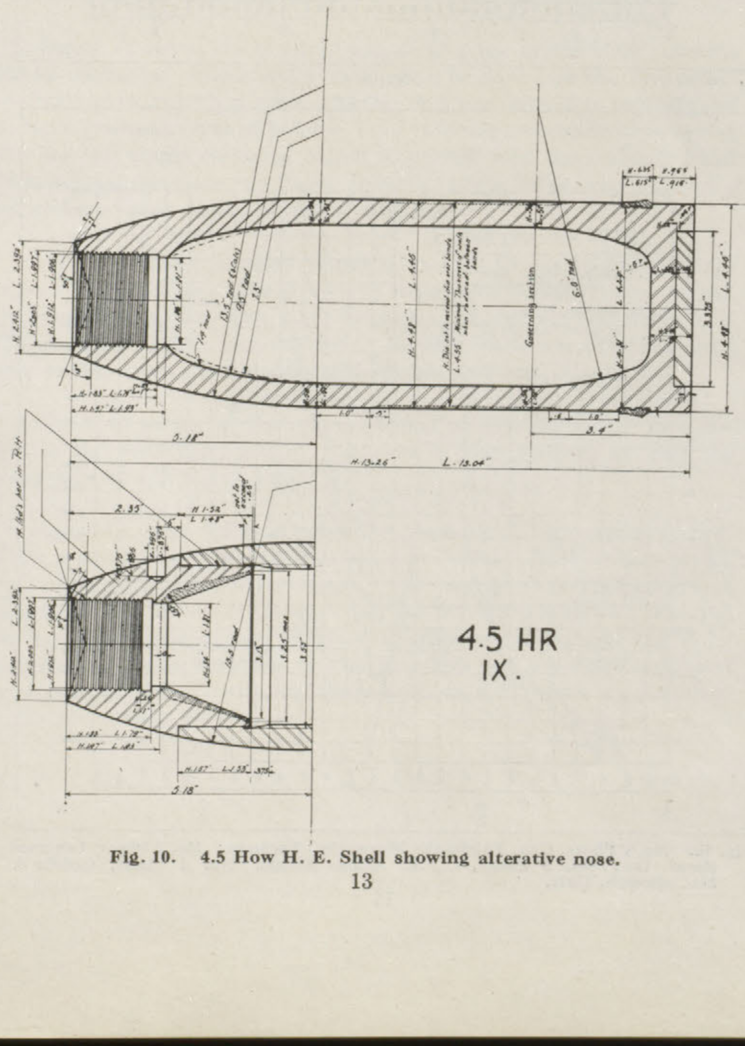


Fig. 10. 4.5 How H. E. Shell showing alterative nose.

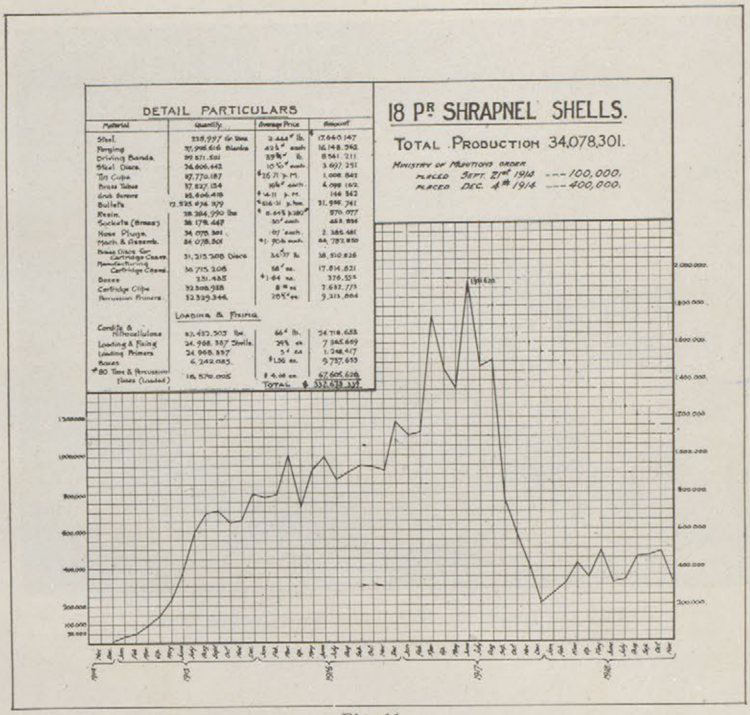


Fig. 11.

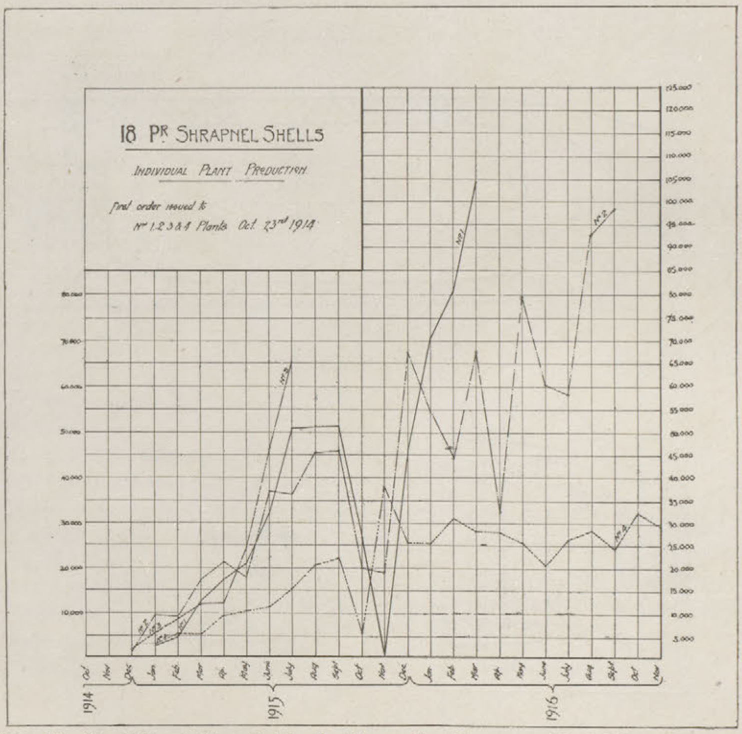


Fig. 12. No. 1 Plant, Can. Fairbanks Morse Co., Toronto. No. 2 Plant, Ingersol Rand Co., No. 3 Plant, C.P.R. Angus Shops. No. 4 Plant, Goldie & McCullough, Galt.

was required. After the shell was nosed it was necessary to machine it inside near the nose, or " internal profile " it, as it was called, to remove the irregularities caused by the nosing and obtain a sufficiently smooth contour. This is not a difficult shell to make; in fact, I should call it the easiest of the larger high explosives but, as it was the first of this type to be made, quite a lot of difficulties had to be overcome before it was produced successfully.

I have already referred to the rapidity with which production was obtained in Canada and I have prepared diagrams showing the output by months of the three shells I have described. These diagrams show the output on all orders and not only the earlier ones mentioned, but they are especially interesting in connection with the earlier stages of the industry. Figure 11 shows the output of 18-pounder shrapnel and you will note the delivery mentioned in December, 1914, and the rapid increase that took place in the succeeding periods. As the war went on, the total output varied with the requirements but the maximum was obtained in June, 1917, when 1,931,620 18-pounder shrapnel were produced and, in all, 34,078,301 of this shell were made.

Figure 12 shows the monthly output of a few of the large concerns during the earlier periods and is interesting to show how the production was built up in individual cases. As this shell was the first to be made and its rapid production was so notable, I am violating no confidence in saying that the two plants obtaining output so quickly were the Ingersoll Rand Company and the Canadian Pacific Railway, Angus Shops, who practically ran neck and neck during the first few months.

Figure 14 shows the total output by months for the 18-pounder high explosive shell. This shell was urgently required at the time it was ordered, but comparatively few were made later on until near the end of the war. The maximum output was obtained in January, 1916, when 608,355 shells were produced and, in all, 5,682,834 of this shell were made.

Figure 15 shows some of the individual outputs during the first few months and as delivery was to commence in May you will see that the promises were fairly well kept.

Figure 18 shows the total output for the 4.5-inch high explosive shell. While deliveries on this shell were specified in May, 1915, it was hardly anticipated that they could be made. The diagram shows, however, that considering the novelty of the work and the difficulties to be overcome and the fact that, in practically all cases, entirely new equipment had to be installed, the results were most creditable. This shell was extensively used up to the summer of 1918, but the output required varied considerably.

The drop in July and August, 1916, was caused by the more stringent inspection requirements put into effect at that time, but in the summer of 1917, the demand was reduced and, although there were occasional periods in which the shops were worked to capacity, their output was, as a rule, regulated by the demand. The maximum output was in June, 1917, when 636,394 shells were produced and in all 12,607,091 of this shell were made.

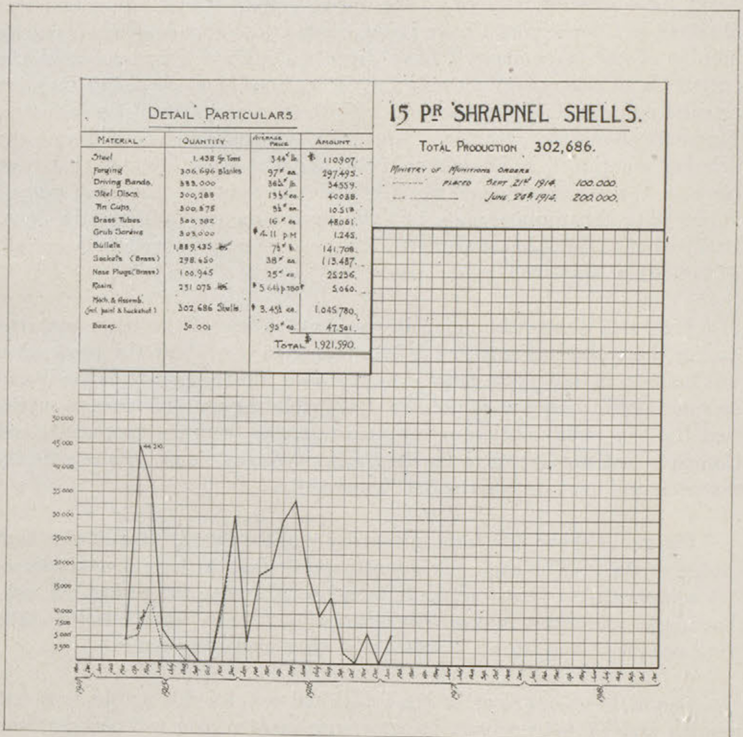


Fig. 13. 15 Pr Shrapnel Shell production showing total production by full lines and that of Electric Steel & Metals Co., Welland by dotted line.

Figure 19 shows some of the individual outputs during the earlier periods and demonstrates, I consider, that production was rapidly obtained.

I have discussed the output of the shells themselves as though they constituted the entire contract executed by the Shell Committee but, when they obtained the first order for fixed ammunition and the larger orders that followed, they assumed a far more complicated undertaking.

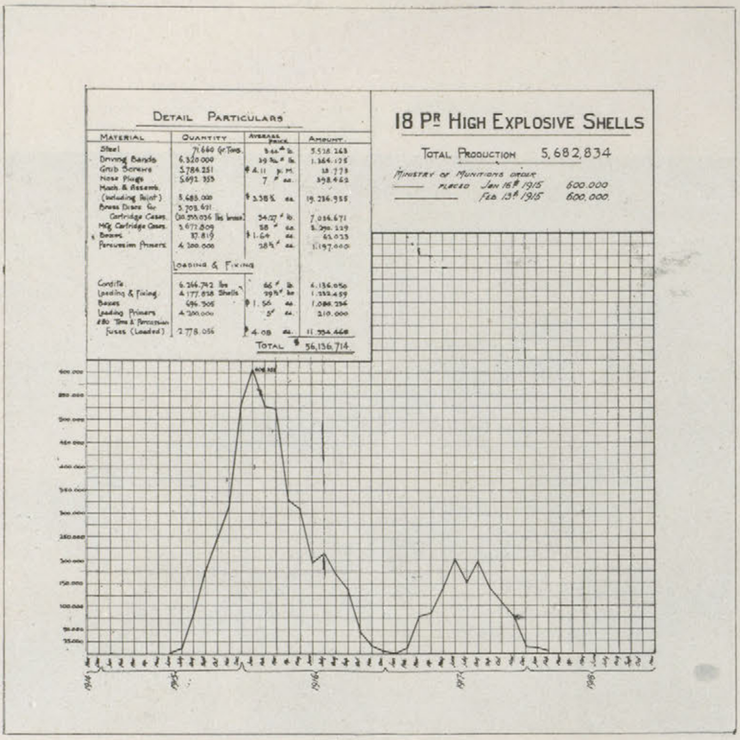


Fig. 14.

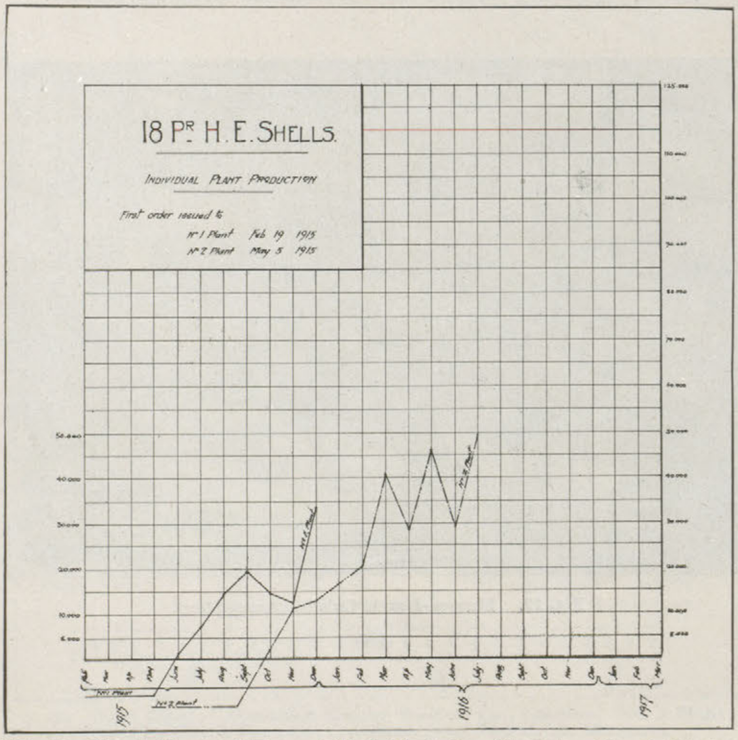


Fig. 15. No. 1 Plant — Universal Tool Steel Co., Toronto. No. 2 Plant — Vancouver Engineering Work, Vancouver.

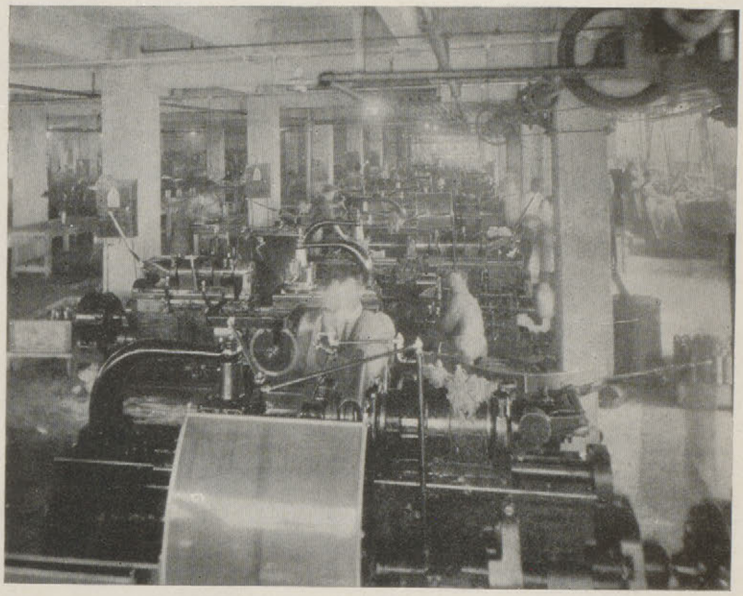


Fig. 16. Machining Shrapnel Shells at Dominion Bridge Co., Lachine.

Fig. 17. Massey-Harris Co's Shrapnel Shop.

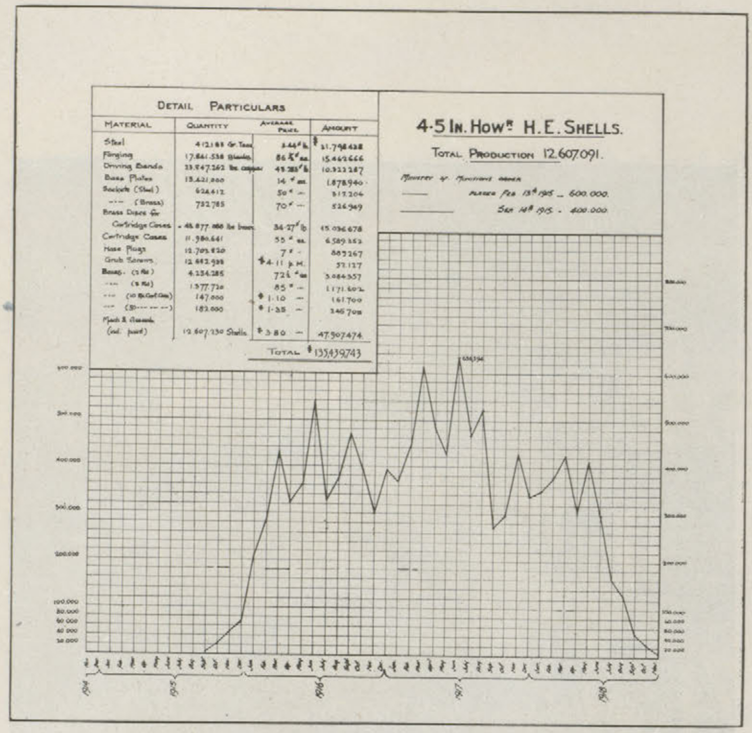


Fig. 18.

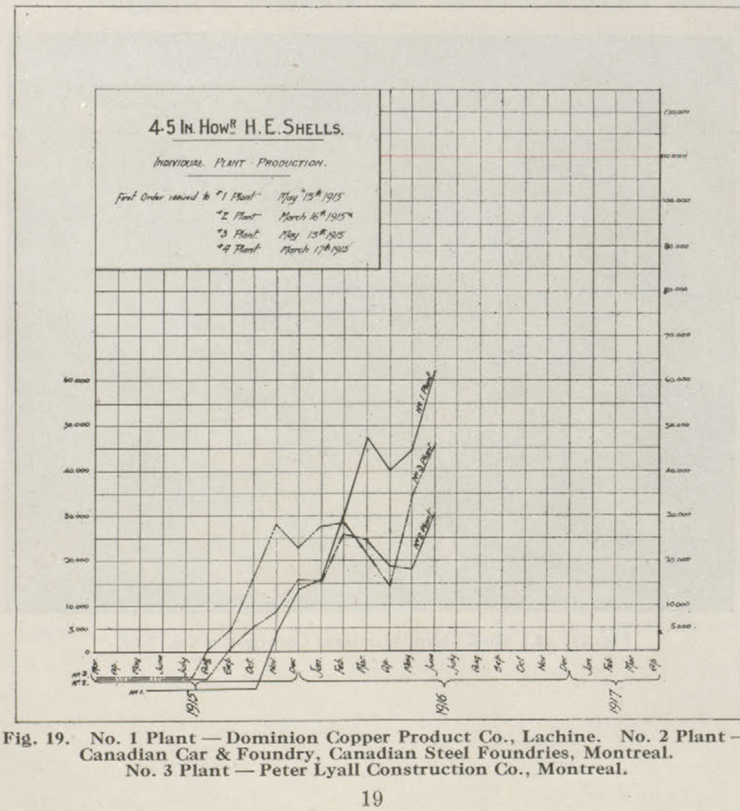


Fig. 19. No. 1 Plant — Dominion Copper Product Co., Lachine. No. 2 Plant — Canadian Car & Foundry, Canadian Steel Foundries, Montreal. No. 3 Plant — Peter Lyall Construction Co., Montreal.

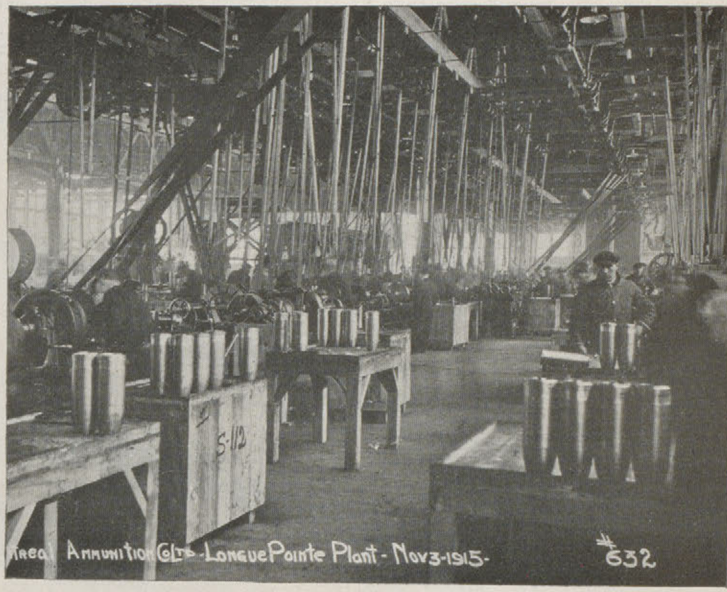


Fig. 20. 4.5 Shell Shop, Montreal Ammunition Co., Limited.

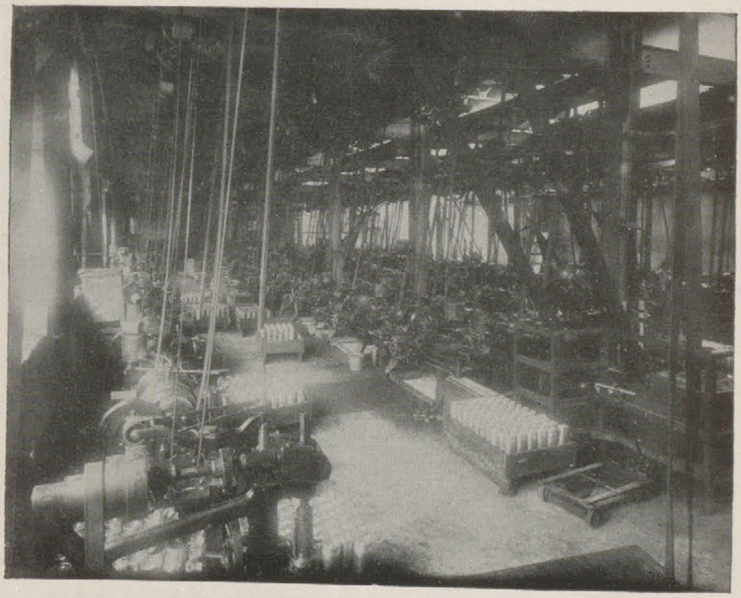


Fig. 21. 4.5 Shell Shop, Montreal Locomotive Co., Ltd.

A round of fixed ammunition, see page 59, without fuse includes, in addition to the shell, the cartridge case, the primer and the propellant and each of these components involved its own assortment of investigations, difficulties and failures before its manufacture was reduced to a science.

In the case of the 18-pounder fixed ammunition, both shrapnel and high explosive, the rounds had to be assembled at a loading plant and placed in ammunition boxes ready for direct shipment to France. In the case of 4.5-inch high explosive shells the shell, cartridge case and propellant were shipped separately, but a cartridge clip was furnished to hold the propellant in the case. The shipment of 18-pounder fixed ammunition involved the erection of loading plants to which the various components could be shipped, including buildings for storing the propellant and the machinery for assembling the completed rounds.

The primer, Fig. 22 although comparatively small, is quite a difficult article to manufacture. The tolerances are small and it must be accurately to gauge. This was one of the earliest articles requiring a high grade of workmanship and, in spite of the gauging, it was found impracticable at first to secure interchangeability among the parts made by different firms. These parts are assembled when the detonator is inserted and the primer loaded with powder and many troubles were experienced at the loading plants before the necessary quality of workmanship was obtained.

The manufacture of cartridge cases was an entirely novel problem. The Mark I, 18-pounder case, had been made in small quantities at the Quebec Arsenal, but its production in large quantities would evidently require a different class of machinery and a modification of the methods used. The order for the 200,000 cases required for the first fixed ammunition was placed with the Canadian Cartridge Company, who proceeded to immediately install a completely new equipment. While this was being constructed, an urgent call came for additional cases and the Canadian Pacific undertook to make on its car department bulldozers and other ordinary machinery. Figs. 25 to 27. Col. Lafferty lent the tools from the Arsenal to the Angus Shops to test the practicability of the scheme and, on this being demonstrated, some 800-ton hydraulic heading presses were designed and constructed in about five weeks. Figs 28 and 29. Cases were actually produced within three months and on this makeshift equipment the first cases were commercially produced, the first howitzer case was made and two million cases were completed before the plant was turned back to its regular output. In the meantime further orders were received and the work distributed among other firms, all of whom installed elaborate equipment.

I doubt very much if anyone had much more trouble than the earlier case manufacturers. One difficulty was the change made from the Mark I to the Mark II case. The case made at the Arsenal and at the Angus shops was the Mark I, on which the Mark II was an improvement. The Mark I case presented no unusual difficulty. Both at the Arsenal and at Angus, it was made with a satisfactory internal finish and passed the proof

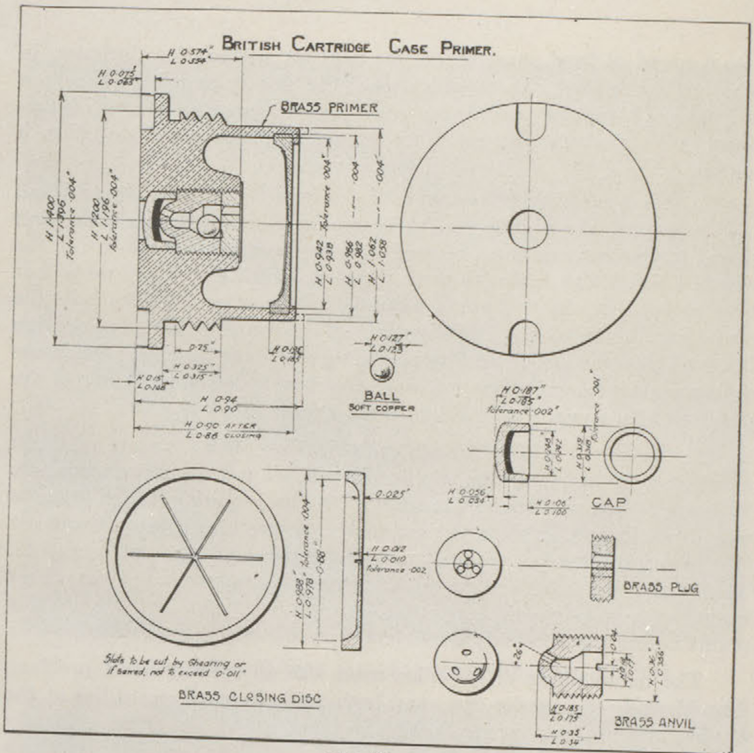


Fig. 22.

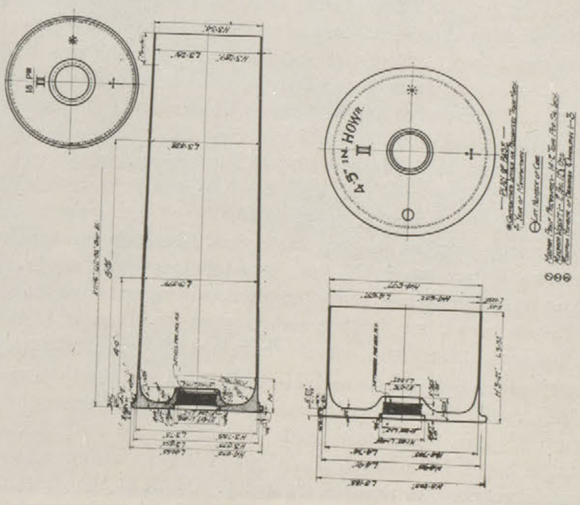


Fig. 23. 18 Pr. British Cartridge Case.
4.5 In. How R. Cartridge Case.

test. In undertaking to make the Mark II case, no special trouble was anticipated, but it was found that not only was it most difficult to obtain an acceptable finish, but that, when this was accomplished, the cases were liable to fail in the firing test. One firm, after producing 4,900 accepted cases, lost 28,000 through rejection at the proof test, which required a complete investigation of the difficulty, and a revision of the methods employed. This was not an isolated example. Each firm that went ahead in an endeavour to obtain their output had more or less trouble of the same kind. Later experience developed the correct method of making the Mark II case successfully, but a slight change in the design was quite generally made, which greatly reduced the difficulty. An inspection of cases made by various English manufacturers, which were sent over for rectification, showed a similar change in almost every instance, so that our early troubles and delays were really justifiable. Other serious troubles developed from the machinery breaking down as its total capacity was approached. It takes a pressure of about 900 tons to form the head on an 18-pounder case and, while the presses furnished for this work would probably have stood up reasonably well if the work had been intermittent, they were not constructed to stand this pressure being applied six or eight thousand times daily and had no reserve strength if it were increased by a heading post that was too high or if a punch were brought down in the wrong position. Fig. 30 shows a breakdown of one of the Montreal Ammunition Co's Hyd. Presses. The result was a great education in the design and the factor of safety required for this class of work and an exhaustive experience not only in the fatigue of the material, but in the fatigue of the superintendent.

Like any other new industry, there were a number of minor problems, simple and obvious in their solution once they were thoroughly understood, which entailed experiment and delay when delay meant the holding up of the output of ammunition. These were gradually overcome and the output of the cartridge cases from the Canadian plants was most satisfactory. The record was obtained by the Canadian Cartridge Company, who, in October, 1917, actually produced one million cases. The Montreal Ammunition Company was a good second with 797,000 cases in the month of November. Both these Companies made almost identical records in certain output. Both machined over 1,000 cases in a shift on lathes sold to machine 250. Both headed over 10,000 cases in 24 hours on one header when other machines were broken down and both obtained extraordinary service from their men when the cases were urgently required. In the winter of 1915-16, when howitzer cases were so badly needed, the men at the Ammunition Company for three months worked in two shifts 11¼ hours per day each, Sundays, Christmas and New Year's Day, which showed very forcibly the interest they had in the work. In addition to the two firms mentioned, six others were engaged in this work, who all produced successfully.

Diagrams 31 and 32 show the total monthly output and confirms what I have stated about the early delays but it shows that, once the work was

Fig. 24. Operations in the Manufacture of Cartridge Case.

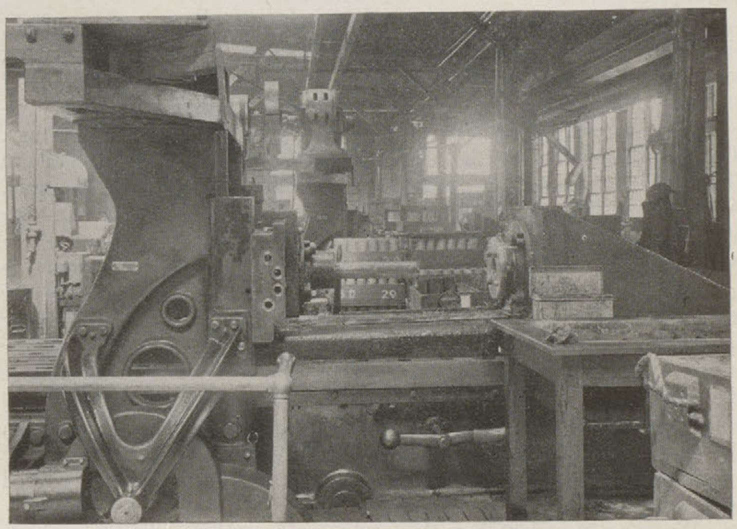


Fig. 25. Frog Planer equipped for drawing Cases.

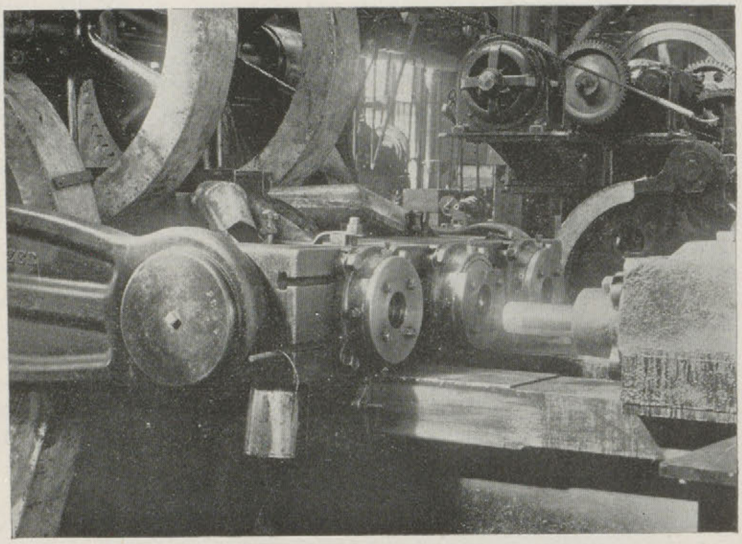


Fig. 26. Bulldozer equipped for drawing cases.

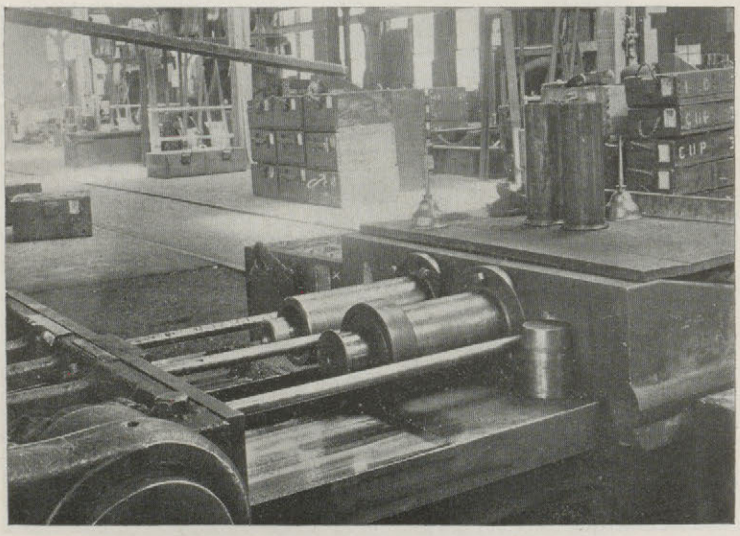


Fig. 27. Bulldozer equipped for tapering cases.

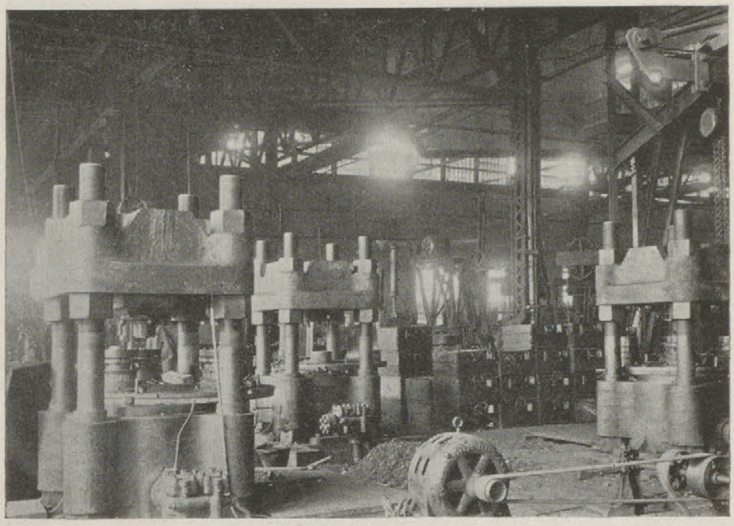


Fig. 28. 800-Ton Hyd. Presses at Angus Shops, C.P.R.

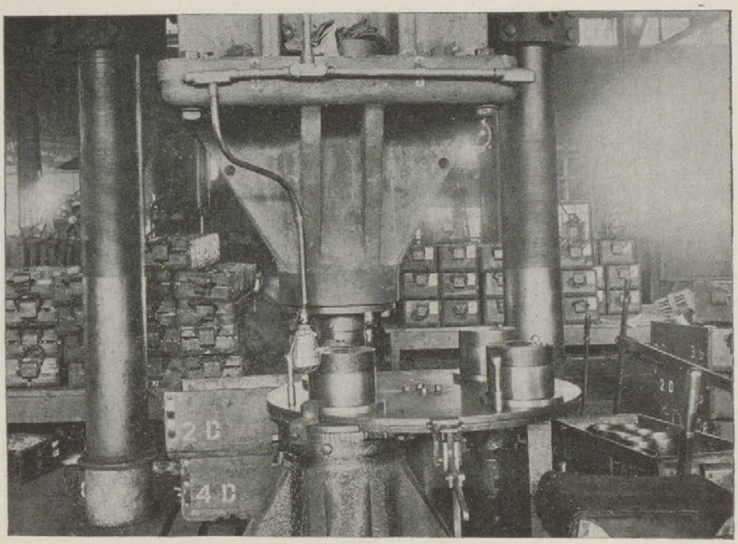


Fig. 29. Revolving Platen of 400-Ton Hyd. Press, C.P.R.

fairly started, the output grew at a rapid rate. The maximum output of 18-pounder cases, 1,893,000, was obtained in June, 1917, and that of 4.5″ cases, 824,000, in December, 1916, but both these cases were made in the same plants, and the maximum combined output was 2,560,000, obtained in December 1916, or over two and a half million in a month. The total number of 18-pounder cases produced was 34,715,208 and of 4.5″ cases, 11,980,641, or a combined total of 46,695,849, to which may be added 600,000 cases ordered by the Board for the Belgian Government, making a grand total of over 47,000,000 cases.

Diagrams 33 and 34 show some of the individual outputs during the first few months and you will notice that in Diagram 33, line No. 1 delivery commenced in three months from the date of the order and in the case of line C, which refers to a firm installing an entirely new plant, deliveries were made in four months.

I have devoted more time to the cartridge case than its importance perhaps justifies, but it was interesting on account of its being handled by comparatively few firms and the extraordinary rates of production that were obtained when it is considered that it was an absolutely novel class of manufacture.

Fig. 30. Breakdown of 900-Ton Hyd. Press Heading 4.5 in. Cartridge Cases.

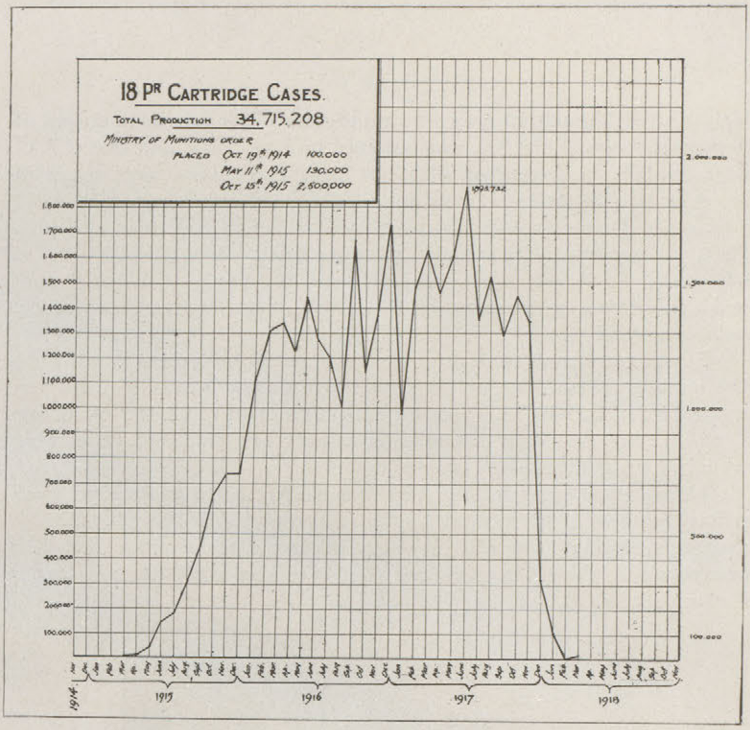

18 PR CARTRIDGE CASES.
TOTAL PRODUCTION 34,715,208
MINISTRY OF MUNITIONS ORDER
PLACED OCT 19th 1914 100,000
MAY 11th 1915 130,000
OCT 15th 1915 2,500,000
1914
1915
1916
1917
1918

Fig. 31.

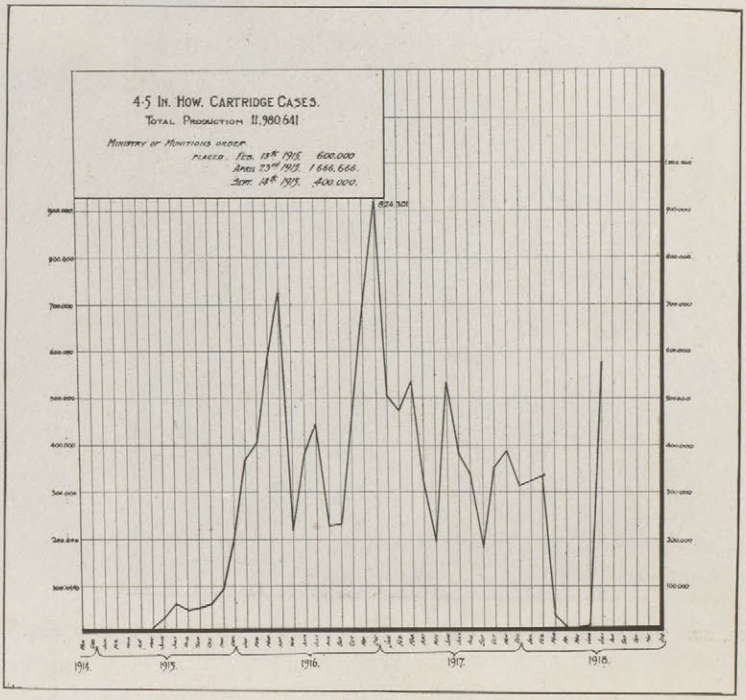

4·5 IN. HOW. CARTRIDGE CASES.
TOTAL PRODUCTION 11,980,641
MINISTRY OF MUNITIONS ORDER
PLACED. FEB. 13th 1915. 600,000
APRIL 23rd 1915. 1,666,666.
SEPT. 14th 1915. 400,000.
1914.
1915.
1916.
1917.
1918.

Fig. 32.

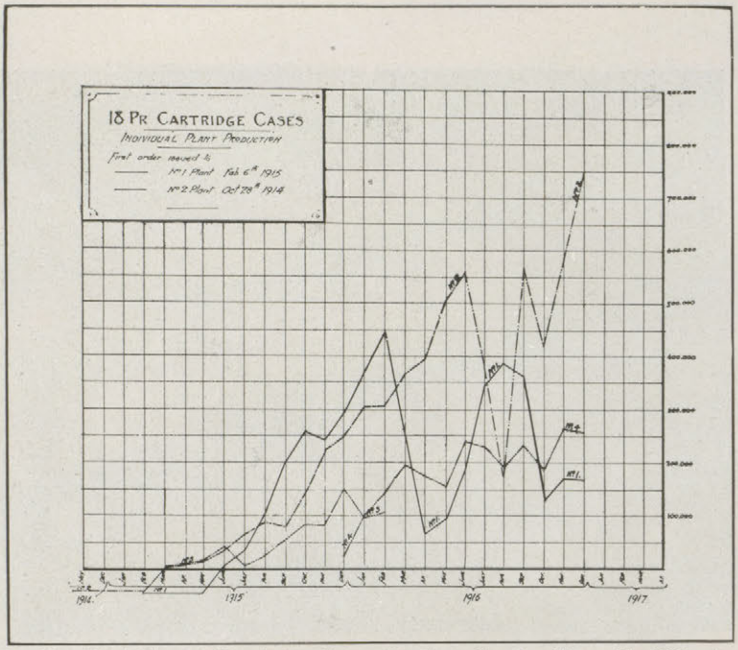


Fig. 33. No. 1 Plant — Dominion Copper Products Co., Lachine. No. 2 Plant — Can. Cartridge Co. No. 3 Plant — Angus Shops C.P.R. No. 4 Plant — Montreal Locomotive Co.

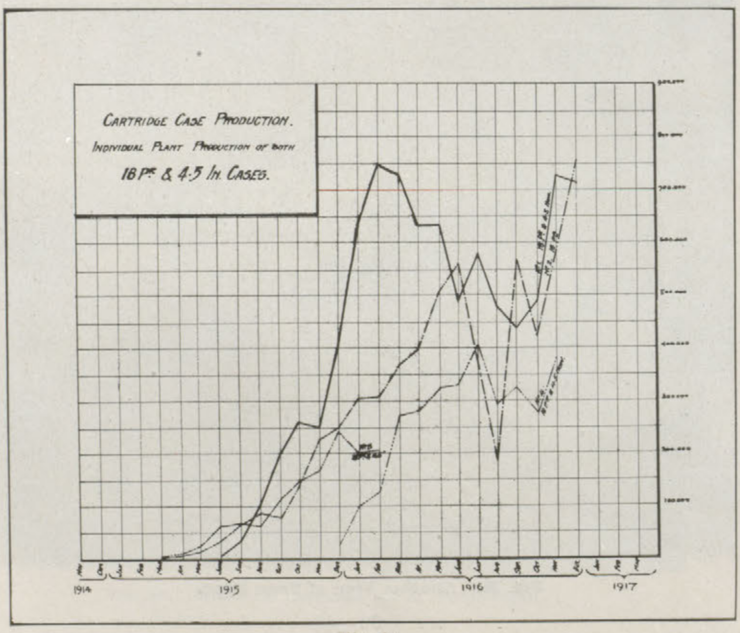


Fig. 34

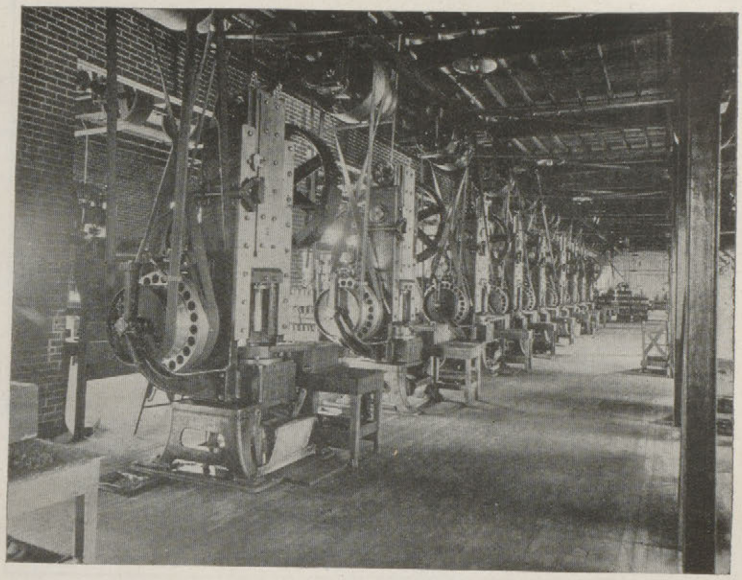


Fig. 35. Canadian Cartridge Co., Press Dept.

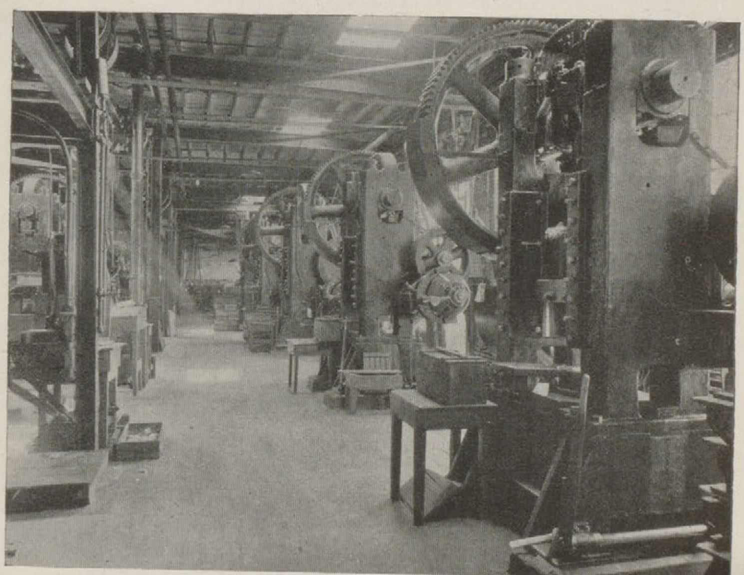


Fig. 36. Another View of Press Dept.

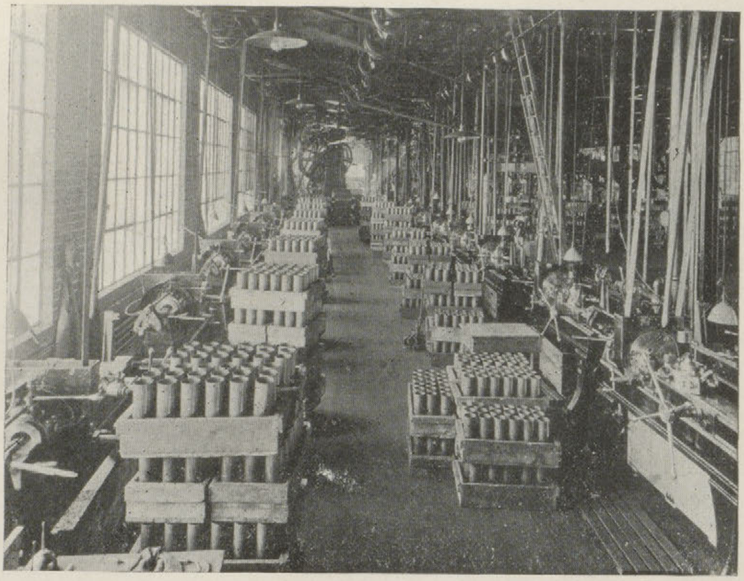


Fig. 37. Canadian Cartridge Co., Finishing Dept.

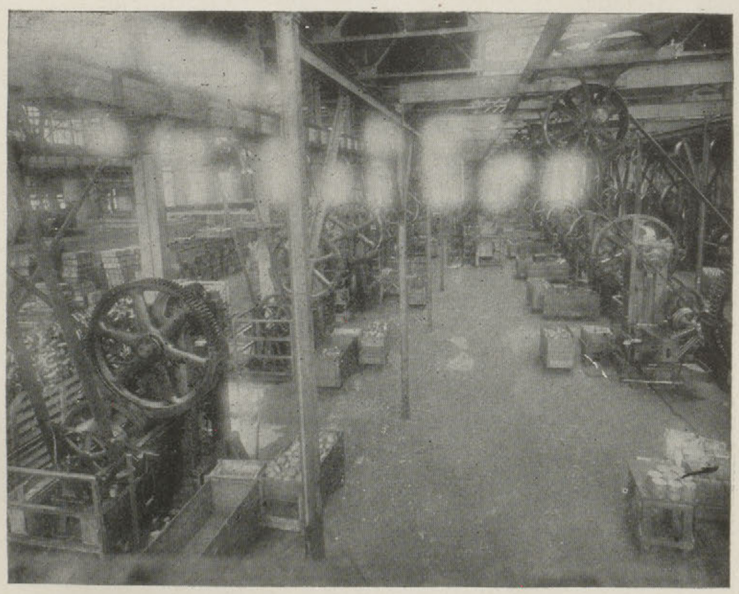


Fig. 38. Montreal Locomotive Co., Press Dept.

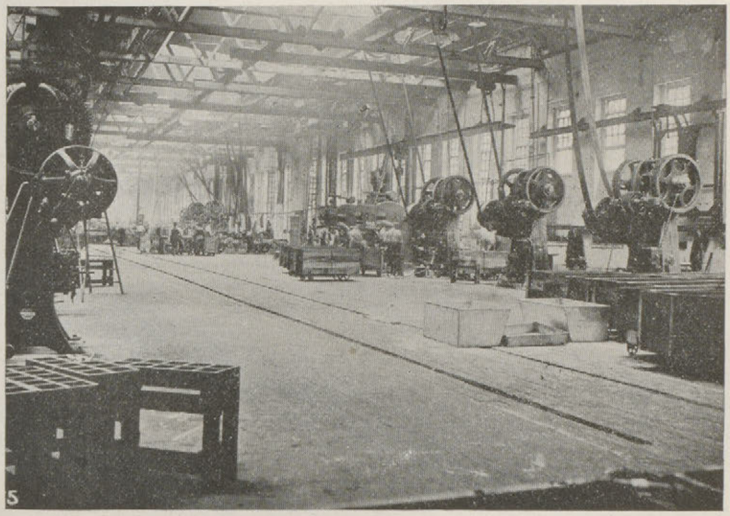


Fig. 39. Montreal Ammunition Co., Ltd., Press Dept.

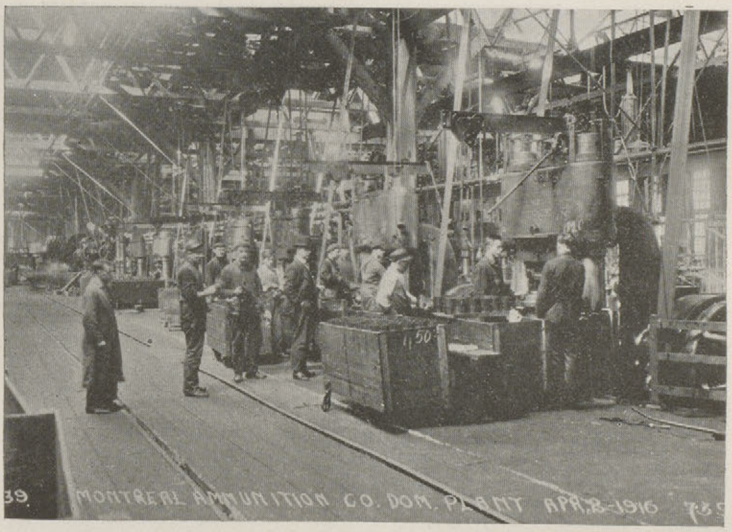


Fig. 40. View showing battery of 1200-Ton and 900-Ton Heading Presses.

A really more difficult problem, from a technical view-point, was the production of the cordite required as a propellant. This explosive has been used by the British Government since 1889, and had been manufactured by the Canadian Explosives Company at Beloeil in small quantities for the rifle ammunition required by the Militia Department. It is made from a mixture of Gun Cotton and Nitro-glycerine, both of which must pass rigid tests as to the quality, and a mineral jelly. The Gun Cotton and Nitro-glycerine are first mixed together, then kneaded with a solvent of Acetone and Alcohol and the mineral jelly added to form a dough. This dough is extruded through dies, under pressure of about 3,000 lbs. per square inch, in the form of cords, from which the material gets its name. The cordite is then dried to remove the solvent, inspected and divided into batches, each batch being tested in a gun to determine its ballistic properties, a test that involves a complicated determination of pressure and velocities, which are also dependent on the temperature and humidity at the time. The whole process is a highly scientific one from start to finish. It involves great danger and extraordinary precautions are required, on account of the extreme sensitiveness and inflammability of the material, to avoid explosion and accidents and to safeguard the lives of those engaged. This work was undertaken by the Canadian Explosives Company, who completed an extension to their plant at Beloeil in April, 1915, of 300,000 lbs. per month capacity. Another plant was commenced in March, 1915, at Nobel, which, in September of the same year, reached its maximum capacity of 1,500,000 lbs. per month. Later on, a second plant at Nobel was completed in August, 1917, with a capacity of two million pounds per month, and these plants, together with those subsequently erected by the Board, turned out over fifty-four million pounds of cordite and forty-eight million pounds of nitro cellulose during the course of the war. The same firm also erected a loading plant at Vaudreuil early in 1915, in which the ammunition was loaded and assembled, which attained a maxiumm output of 22,000 rounds per 10-hour day, and erected a similar plant at Nobel, with about the same capacity, which was in operation from October, 1915, to August, 1916. They also assembled about 15,000,000 primers at Vaudreuil and in all this work it is a pleasure to be able to report that the quality of their product has compared most favorably with that furnished by any other country.

With the exception of some forgings purchased in the United States, the only parts of the shells so far contracted for that were not entirely made in Canada were the copper driving bands and the brass discs from which the cartridge cases were drawn. A proportion of the discs were made by Brown's Copper and Brass Rolling Mills, but their capacity was not sufficient for the entire requirements and the copper and spelter used by them were purchased from the States. While large quantities of both copper and zinc were mined in Canada, no refineries were in existence to produce these metals in a suitable condition for use and we were entirely dependent on the United States for our requirements. Some uncertainty also existed

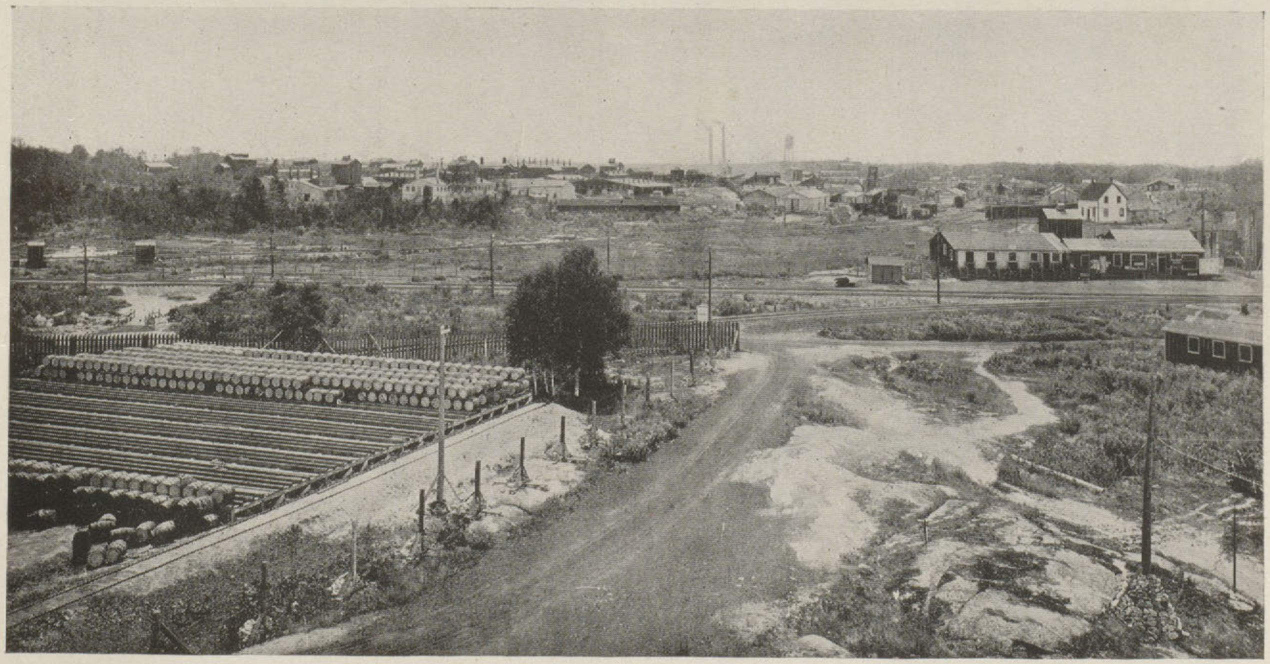


Fig. 41. Canadian Explosive Co's., old plant.

in the early part of 1915 as to what position that country might take regarding the exportation of such materials for war purposes. A Commission was formed consisting of Colonel D. Carnegie, Dr. A. G. W. Wilson and Dr. A. Stansfield, who recommended a contract entered into with the Consolidated Mining and Smelting Company of Canada, Limited, under which they installed electrolytic refineries at Trail for both copper and zinc. In this undertaking they were entirely successful and obtained productions of 500 tons of copper and 1,500 tons of zinc per month, both being of excellent quality and perfectly satisfactory for making cartridge brass. The Committee also made a contract with the Dominion Copper Products Company to install the machinery and equipment for making cartridge brass discs and copper bands. Figs 42 and 43 show two views of the plant. With the additional capacity later provided for, this contract required an output of 800,000 discs and 500 tons of copper bands per month. This output was exceeded and, through this arrangement, there were produced in Canada over ten million discs, weighing 35,000,000 lbs. and 19,000,000 bands, weighing 23,000,000 pounds, which would otherwise have been purchased abroad. This plant also installed copper melting furnaces with a capacity of 35 tons of copper per day, in which over 10,000 tons of the scrap resulting from the turning of the copper driving bands has been refined and converted back into new bands or ingot copper with a corresponding saving in expense.

A similar initiation of a new industry was accomplished in connection with the manufacture of trinitro-toluene. When Col. Carnegie was in England, in December, 1914, he was asked by Lord Moulton, Chairman of the Explosives Committee, what coke oven capacity was available in Canada for the production of toluol. The matter was investigated and it was found that the Dominion Coal Co. was coking 750,000 tons annually, which would enable them to produce 15,000 to 20,000 gallons of toluol per month. It was estimated that the necessary plant could be completed in six months. Mr. Plummer, the President of the Company, interested himself actively in the project and obtained the valuable assistance of Mr. Edison in the construction of the Toluol plant while the Canadian Explossives Company were concurrently erecting a plant at Beloeil for the manufacture of trinitro-toluene, or T.N.T., from the toluol with a capacity of 675,000 lbs. per month. The first T.N.T. was actually produced on May 23rd, slightly under four months from the time the undertaking was commenced. This industry, producing the high explosive which became almost exclusively used towards the latter periods of the war, attained very large proportions. Other plants for the production of toluol were installed, one at Toronto Chemical Company, and the Canadian Explosives Company erected a T.N.T. plant at Shand, B.C., with a capacity of 1,250,000 lbs. per month and the Imperial Munitions Board one at Trenton with a capacity of 1,200,000 lbs. per month, the total quantity produced being over 55,000,000 pounds.

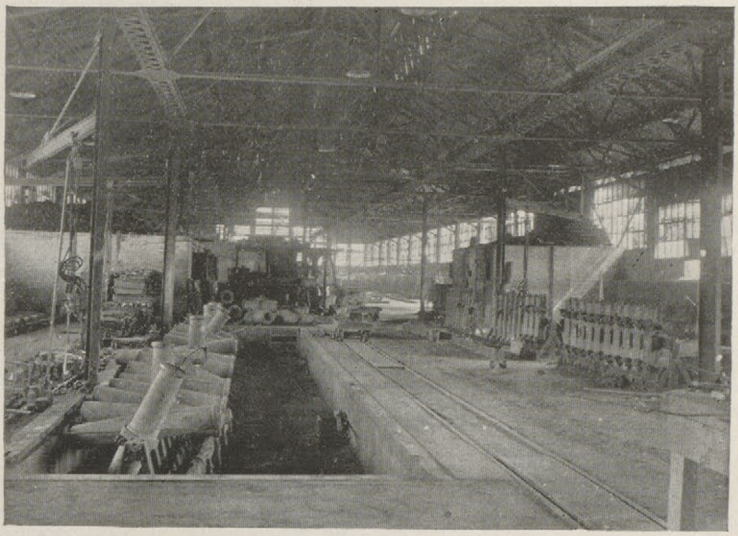


Fig. 42. Dominion Copper Products Co., Ltd., Cast House

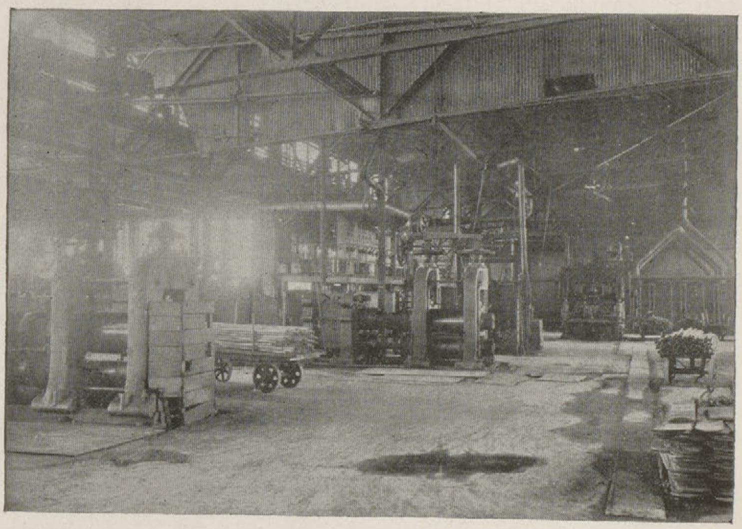


Fig. 43. Dominion Copper Products Co., Ltd., Rolling Mill.

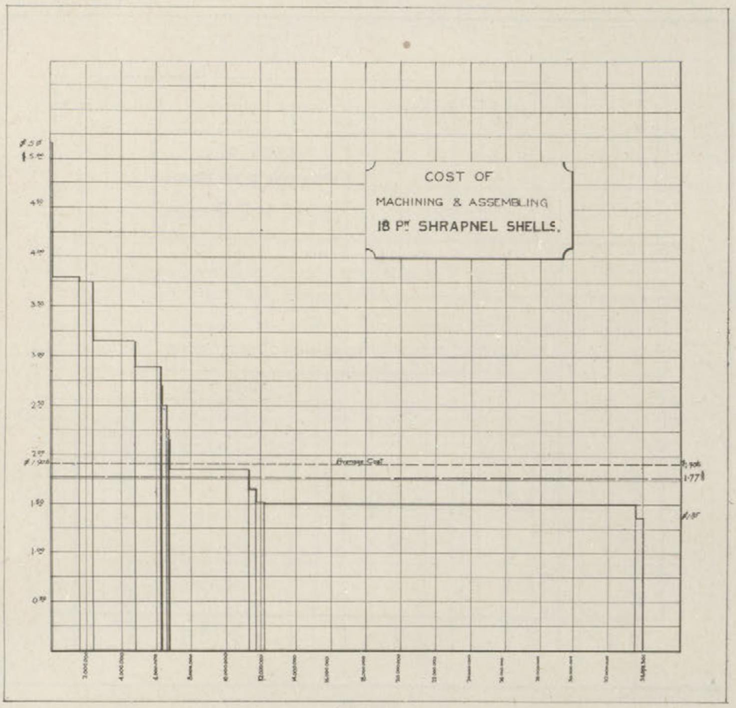
A number of other contracts were let, such as the one for five million fuses and those for small arms ammunition and a quantity of other materials, but the work I have described may fairly be considered as the accomplishment of the original Shell Committee and it constitutes an achievement for which I sincerely believe they deserve the gratitude of every Canadian, both for the employment it afforded to our people at home and the assistance it rendered to our Armies overseas. The energy displayed by the Canadian Manufacturers enabled shipments of shells to be made at a time when they were seriously needed, a vital factor during the dangerous periods in 1915 when both the British troops and our own were so terribly short of ammunition, and I have been creditably informed, although I cannot absolutely vouch for the statement, that the first shells supplied by any firm that had not previously produced them were from Canadian workshops.

I do not wish to pose as claiming any credit for the Shell Committee that has not been accorded them but I do not believe that the difficulties of the work they undertook or the ability with which they carried it out is generally recognized. They made their mistakes, but these were of minor consequence compared to their success in establishing a great industry in a wonderfully short time. One point I wish to refer to, about which I consider there is considerable misapprehension, is in connection with the prices they paid for the work which are popularly thought to have been high. There were only three methods in which it could have been handled —by the Government furnishing the money for the plant and paying the Contractor for the output, by letting the work on a " cost plus " basis or by letting the work at a price which would enable the contractor to pay for his plant provided he successfully completed his contract. The last was the one adopted as, apart from any other consideration, the War Office insisted that the manufacturer must both assume the entire responsibility and finance the project. The other plans have both been employed in the last year or two, but they depend for successful results on the interest and patriotism of the manufacturer while the last one put him in a position where he must make good, or lose not only what profit he may have estimated he could make on his contract, but the money he has invested in his plant. To justify a man taking work under these conditions, that involved the completion of a contract for a novel class of product in large quantities by a definite date, liberal prices were a necessity to enable him to spend money freely to obtain his output and increase his plant without regard to cost, looking only at the main question of fulfilling the specified deliveries. This is just what occurred. The Munitions Manufacturer, in the early days, aimed at one thing only and that was output and this is shown in the results he obtained. It is true that the work was carried out as a commercial proposition and every manufacturer had to aim at a commercial success, for the people that would invest their money in a munition enterprise with the expectation of losing it, when they could satisfy their patriotism by purchasing a government loan with an assured return, were scarce and hard to find. At the same time most of those engaged in munition work, both owners and operators had friends or relations at the front and put an energy and interest into their work which had never been approached in ordinary experience. The money was well spent and subsequent events have proved that the policy adopted not only got results quickly, but got them cheaply and probably more cheaply than they could have been obtained in any other way.

Figure 44 shows the prices for each order of shrapnel shells and the upper horizontal line shows the average price. The lower horizontal line shows the average price paid less an estimated allowance for the cost of the machining capacity required for the maximum output divided by the total number of shells made. A plant for machining 1,000 shrapnel per day costs about $75,000.00, so that for 60,000 per day the investment is $4,500,000.00. Dividing this by 34,000,000 (the number of shells made) the cost of plant averages 13c. per shell so that the average price, exclusive of plant, is $1.77, or very slightly over the price reached after two years' experience. This figure for the cost of the plant is quite conservative and does not include buildings or starting and experimental expense, which amounted to from 50 to 100 % of the plant cost in the case of the small shells and from 20 to 50% for the larger.

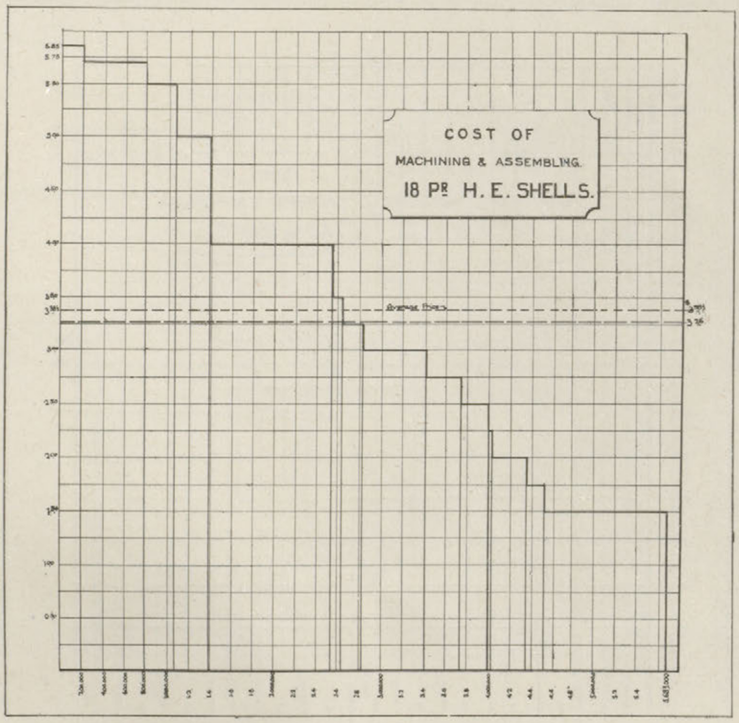
Figures 45 to 50 give the same information for various sizes of shell and you will note that the prices at the commencement of the order, in which the cost of the plant is included, show a very similar relation to the price finally arrived at and these prices on the later types of shells were established after considerable experience had been gained in actual manufacturing costs, while the Shell Committee were dependent entirely on estimates. I believe these figures show conclusively the good judgment which, on the whole, the Committee exercised in the letting of contracts, and, when you realize that the prices they submitted were accepted and approved by the War Office, that they technically undertook the responsibility for the execution of these contracts at the prices so determined and that they returned to the War Office $34,000,000 out of a total of $340,000,000 which they were authorized to spend, I think you must agree with any praise and recognition I have been able to render them.

During the summer of 1915, Mr. D. A. Thomas, afterwards Lord Rhondda, visited Canada and investigated our capacity for producing an increased quantity of munitions. He was agreeably surprised at the progress that had been made here and the manner in which the work was conducted. As a result, the Ministry of Munitions, which in England had taken over from the War Office the work of providing the supply of munitions, decided to considerably increase the amount ordered in Canada and, in doing so, naturally thought it advisable to supersede the Shell Committee, which was actually a small group of manufacturers, neither incorporated nor chartered, by a branch of their own organization. Mr. L. Hichens and the Hon. R. H. Brand were sent over and, on the 1st December, 1915, Mr. (afterwards Sir) Joseph W. Flavelle, Mr. (afterwards Sir) Charles B.



COST OF
MACHINING & ASSEMBLING
18 P^T SHRAPNEL SHELLS.

Fig. 44.



COST OF
MACHINING & ASSEMBLING.
18 P^R H. E. SHELLS.

Fig. 45.

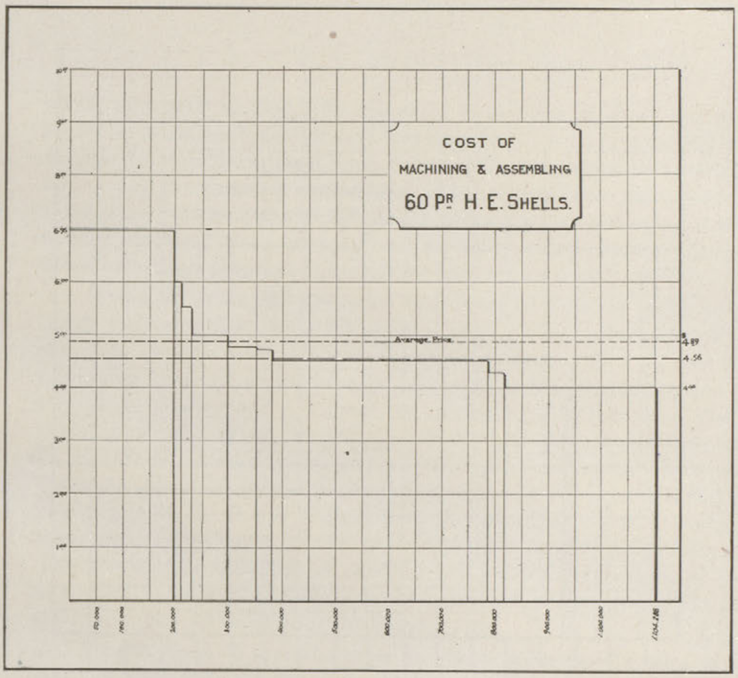

COST OF
MACHINING & ASSEMBLING
60 Pr. H. E. SHELLS.
Average Price

Fig. 46.

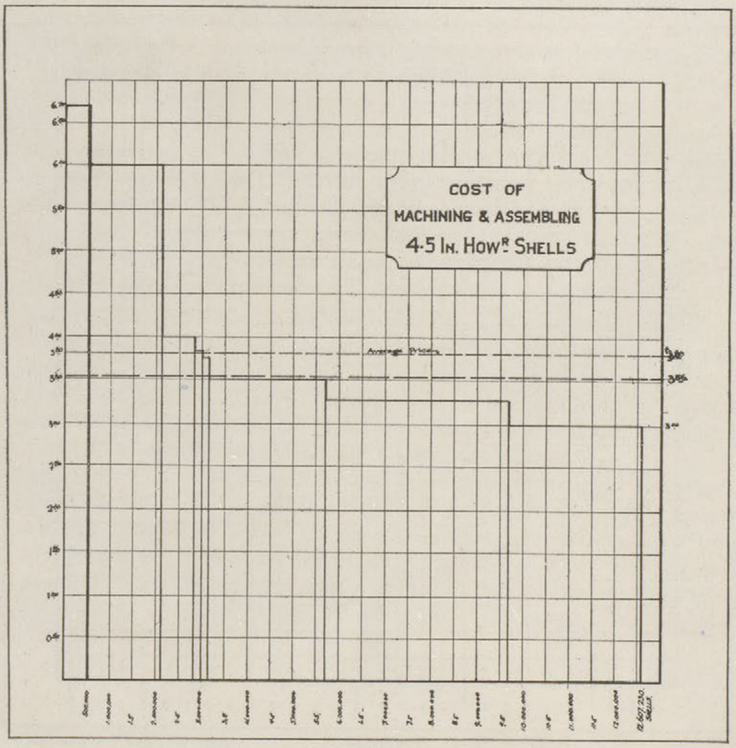

COST OF
MACHINING & ASSEMBLING
4·5 IN. HOWR. SHELLS
Average Prices

Fig. 47.

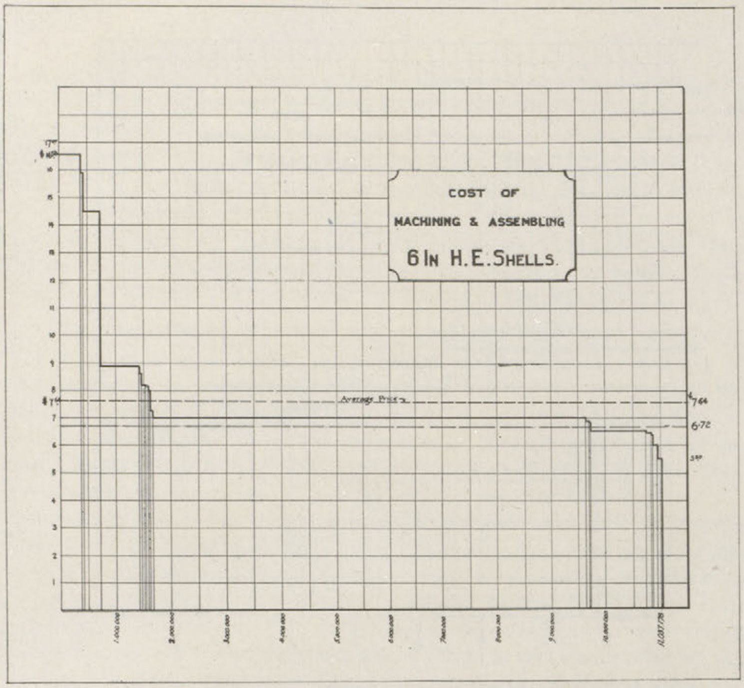

COST OF
MACHINING & ASSEMBLING
6 IN H.E. SHELLS.
Average Price
7.64
6.72
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
7,000,000
8,000,000
9,000,000
10,000,000
11,037,178

Fig. 48.

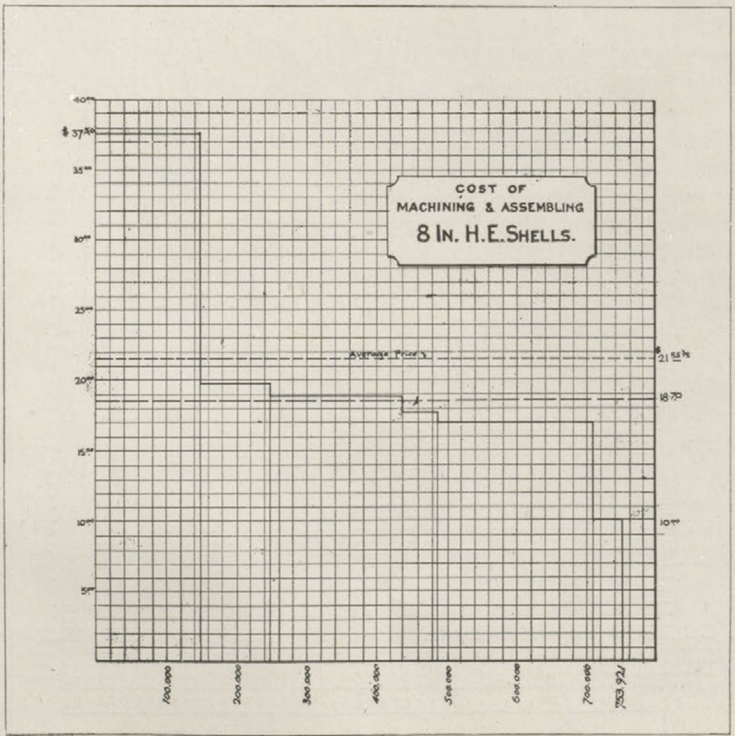

COST OF
MACHINING & ASSEMBLING
8 IN. H.E. SHELLS.
$ 37.50
35.00
30.00
25.00
20.00
15.00
10.00
5.00
Average Price
18.70
10.00
100,000
200,000
300,000
400,000
500,000
600,000
700,000
753,921

Fig. 49.

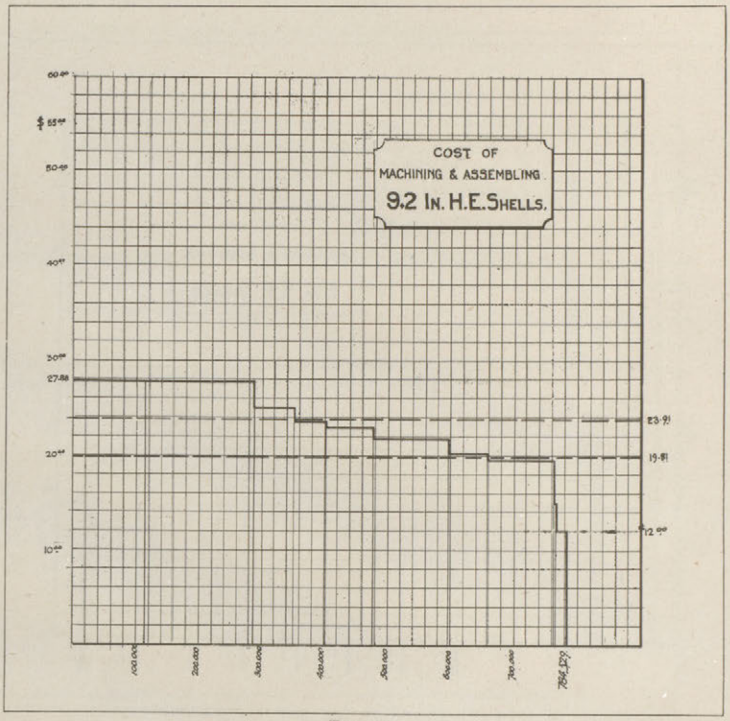

COST OF
MACHINING & ASSEMBLING
9.2 IN. H.E. SHELLS.
23·91
19·81

Fig. 50.

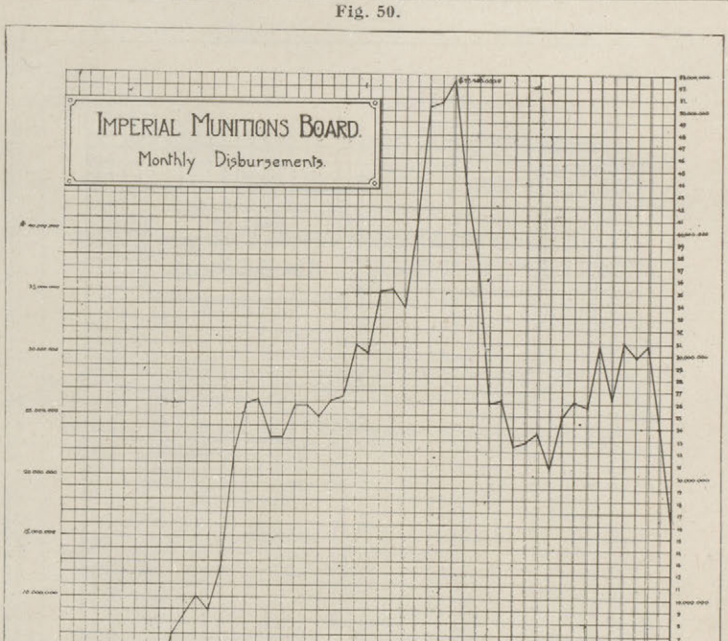

IMPERIAL MUNITIONS BOARD.
Monthly Disbursements.
1914
1916
1917

Fig. 51.

Gordon, Colonel D. Carnegie, Mr. F. Perry, Mr. J. A. Vaillancourt, Mr. G. H. Dawson and Mr. E. R. Wood were appointed as the members of the Imperial Munitions Board of Canada with Mr. E. Fitzgerald as Purchasing Agent. The Hon. R. H. Brand and Colonel (afterwards Brig.-Gen.), W. E. Edwards were added to the board later. Sir Joseph Flavelle was the Chairman of the Board and, on Sir Charles Gordon leaving it to join the British War Mission at Washington as Vice-Chairman, Mr. Fitzgerald was appointed Assistant to the Chairman and Mr. A. G. Woodhouse assumed charge of the Purchasing Department.

The appointment of the Board placed the munitions industry in Canada on a rational basis. As a branch of the Imperial Ministry of Munitions, orders could be placed that would utilize the resources of the country to the best advantage and render its capacity available for the service of the Empire. The increasing volume of work undertaken by the Shell Committee had far outgrown their organization and, in fact, they would have been severely criticized had they attempted to develop any such staff as the Board found necessary to, properly supervise their transactions. The Munitions Board, with the authority vested in it by the Ministry, was in a position to build up an organ'zation commensurable with the magnitude of their operations on sound business lines, which they proceeded to do at once. The advantages of this arrangement were amply justified in the next three years and this, I think, is best exemplified by the value of the orders which were placed through the Board in that time.

Figure 51 shows the monthly disbursements of the Shell Committee and the Board during the war and demonstrates vividly that, while the shell Committee laid the foundation for the work, the organization of the Board carried it to the successful conclusion that so fully engaged our capacity.

Prior to the formation of the Board, the Shell Committee had placed orders for a 60-pounder H.E. shell Fig. 52 which was very similar to the 4.5-inch, being simply a little larger in every way. This shell introduced no special difficulties that had not already been encountered in the 4.5-inch but, as a matter of record, I have prepared Figures 54 and 55 showing the monthly output and that obtained from individual firms. As the diagram shows, the output was quite irregular which was chiefly caused by the difficulty in obtaining the forgings. New equipment for machining had to be obtained but few delays were experienced on this account and the production of the shell as a whole was comparatively easy and the quantities required were not large.

The next shell for which orders were placed was the 6-inch H.E., which subsequently became one of our principal products. Negotiations for its manufacture had been carried out in the summer of 1915 and a number of firms had laid out plants and obtained options for their machinery. Definite orders were, however, delayed pending the formation of the Board with the result that, when they were finally placed, machinery was more difficult

OMISSION.—In the statement of the names of the members of the Imperial Munitions Board the name of Brig.-Gen. Sir Alex. Bertram, Vice-Chairman of the Board, was omitted.

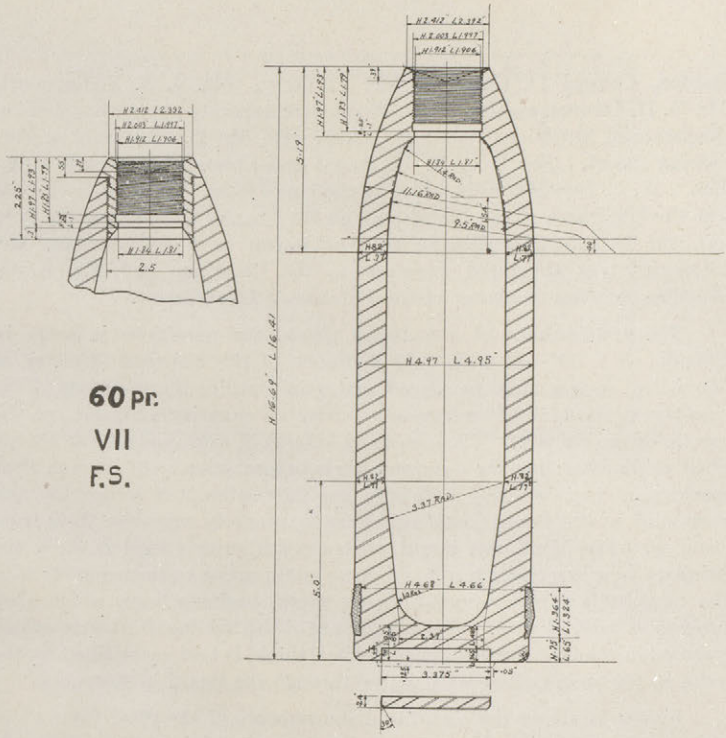


Fig. 52.

Fig. 53. Reproduced from British Official Photo.

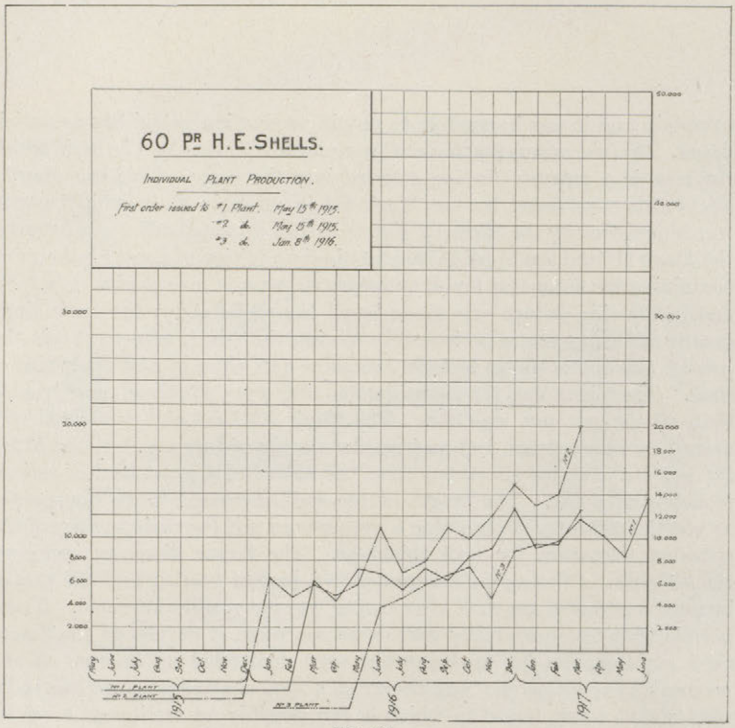
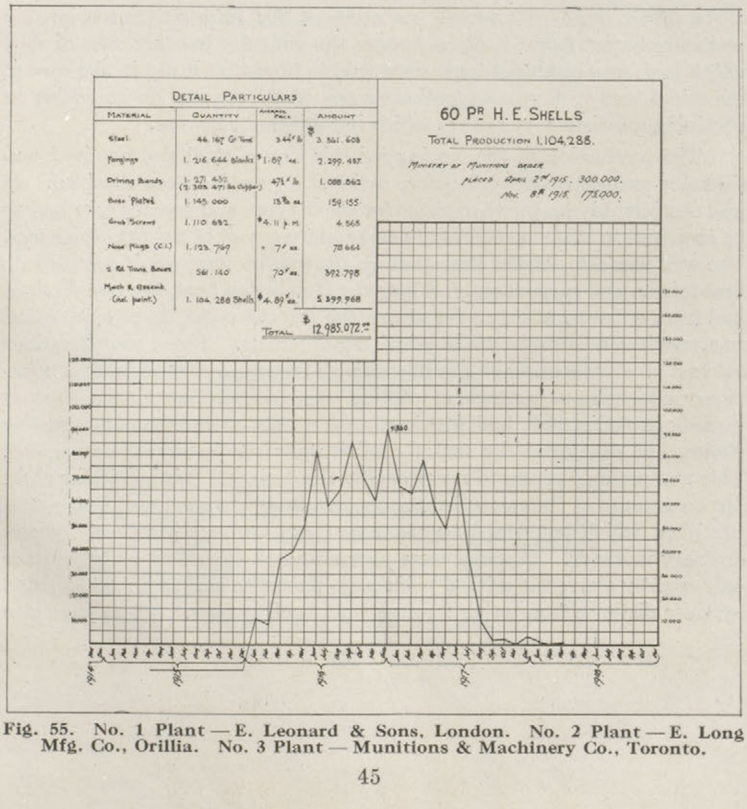


Fig. 54.



MATERIAL	QUANTITY	AVERAGE PRICE	AMOUNT
Steel	46.167 Gr. Tons	3 4/4¢ lb.	$ 3.561.608
Forgings	1.216.644 Blanks	$ 1.89 ea.	2.299.487
Driving Bands	1.271.432 (2.303.471 lbs Copper)	47 1/4¢ lb.	1.088.862
Base Plates	1.145.000	13 9/10 ea.	159.155
Grub Screws	1.110.682	$ 4.11 p. M.	4.565
Nose Plugs (C.I.)	1.123.769	" 7¢ ea.	78.664
2 Pd. Trans. Boxes	561.140	70¢ ea.	392.798
Mach. & Assemb. (incl. paint.)	1.104.288 Shells	$ 4.89¢ ea.	5.399.968
		TOTAL	$ 12.985.072.00

Fig. 55. No. 1 Plant — E. Leonard & Sons, London. No. 2 Plant — E. Long Mfg. Co., Orillia. No. 3 Plant — Munitions & Machinery Co., Toronto.

to obtain and it was impossible to obtain production as quickly as anticipated. The first orders for this shell were for the Mark XVI Fig. 57, in which the nose is a separate forging screwed into the body. This was shortly afterwards superseded by the Mark III, a nosed-in shell, which was in turn superseded by the Mark IX Fig. 56. The principal difference between the Mark III and the Mark IV consists in the addition of a seat for the gaine containing the detonator found necessary to ensure the explosion of T.N.T. and, while this change was made in all the shells about the same time, greater difficulty was experienced in forging the 6-inch nose to obtain the correct amount of metal to form the gaine seat than in any other size of shell. The 6-inch shell for a considerable time gave, I believe, more trouble than all the rest put together. The Mark XVI difficulties were chiefly caused by inexperience and an irregular supply of forgings, but the Mark III and its modified successors were the source of a great deal of serious trouble and delay. The length of the shell increased to an unexpected extent the difficulty of obtaining a proper bore and the maintenance of the specified tolerances for wall thickness. The larger diameter increased the difficulty of fitting the baseplates to a perfect bearing and the proper internal contour of the shell after nosing was not readily obtained. These peculiarities had been fairly well overcome when it developed that more rigid requirements for workmanship were demanded on account of the premature explosions that had occurred, a type of accident so serious in its results that every factor to which it can possibly be attributed must be most carefully avoided, Fig. 53 gives an idea of the result of this in a 4.5-in. How. gun. While the requirement for improved workmanship was entirely justifiable, it did not cause the difficulty in other sizes of shell which had been produced for a considerable time that it did in the case of the 6-inch and it deserves mention as one of the reasons for the delay in obtaining a satisfactory output which indubitably occurred.

The production of the forging for this size of shell also required considerable experimental work before satisfactory results were obtained. It was considerably longer than those for other types and greater care had to be exercised to avoid eccentricity and produce a wall of uniform thickness. The wall was also thicker than that on the smaller forgings, it retained its heat longer, and consequently, if forged at too high a heat, the metal might cool from a temperature so far above the critical point that its condition was unsuitable to meet the physical requirements. These considerations led to a great education on the microscopic structure of steel and its behaviour under various methods of cooling, that not only introduced into our workshops terms that had previously been only understood in scientific circles, but developed the art of cooling metals to a remarkable extent. This was not only rendered necessary by the design of this particular shell, but on account of the careful treatment required by a good deal of the steel furnished which could not be made to meet the specifications by any ordinary methods. Forgings were normalized or heated to a temperature only slightly above the critical point and allowed to cool at a rate adjusted by their distance from other forgings on a cooling floor. There were also

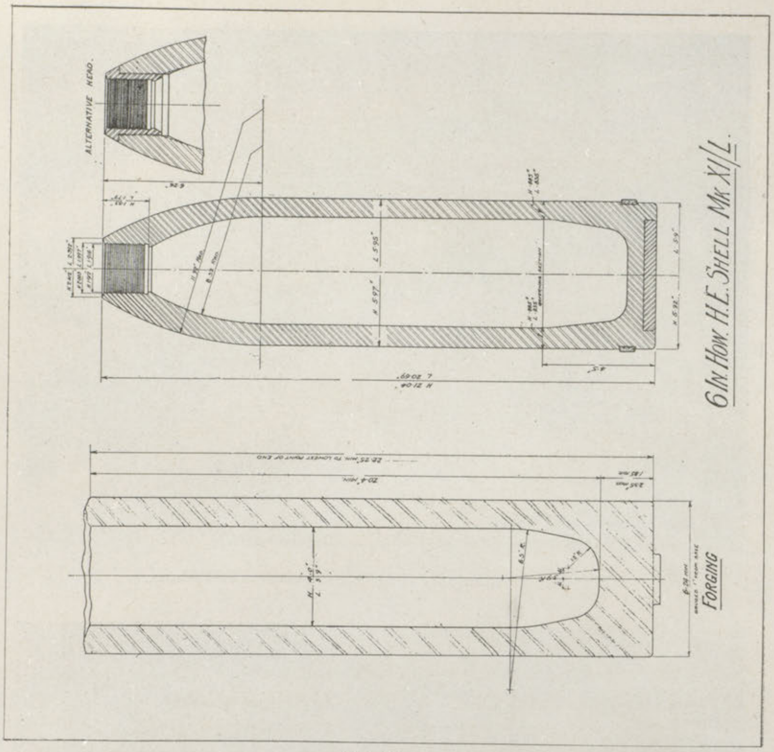


Fig. 56.

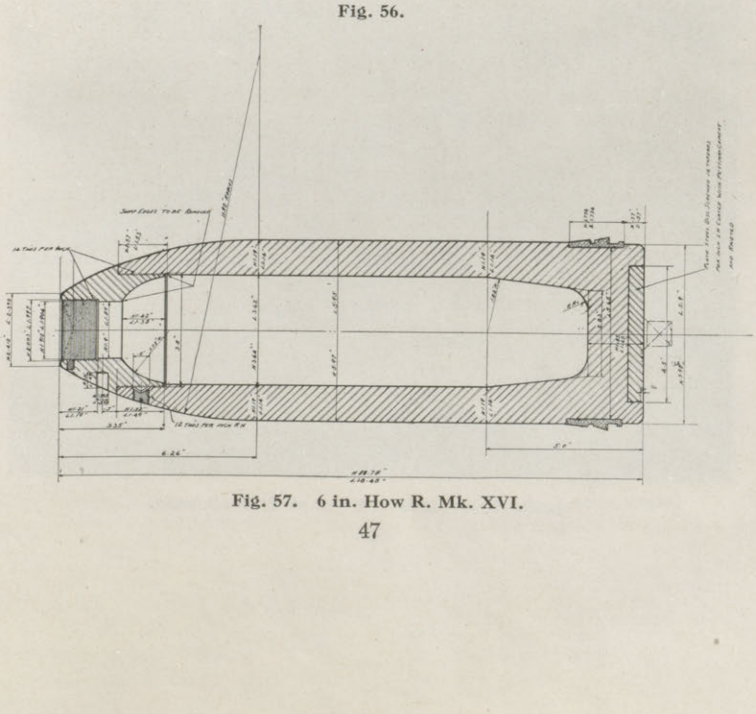


Fig. 57. 6 in. How R. Mk. XVI.

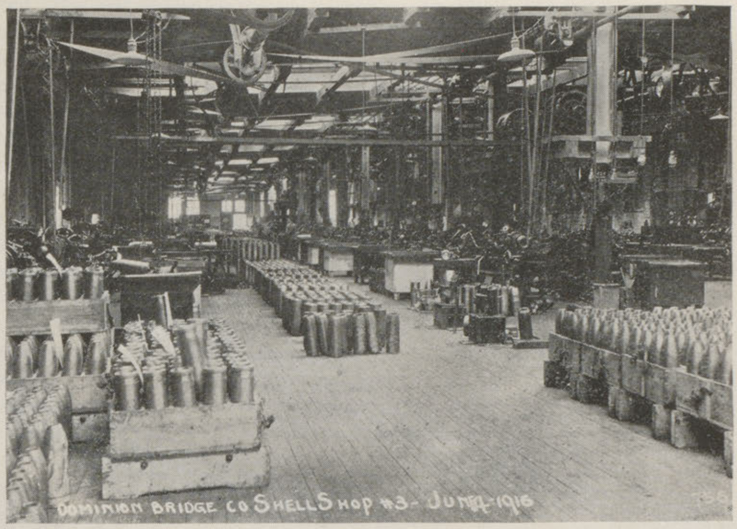


Fig. 58. Dominion Bridge Co's., 60 Pr Shell Shop.

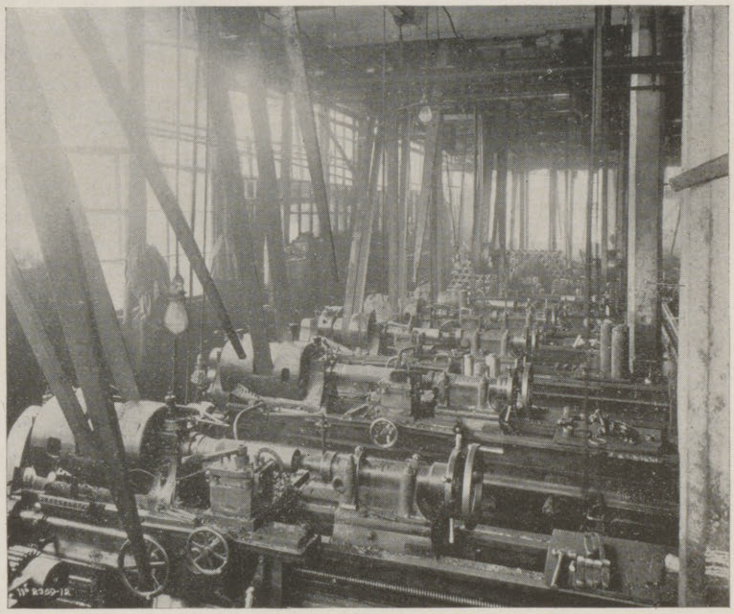


Fig. 59. Peter Lyall & Co's., 60 Pr Shell Shop.

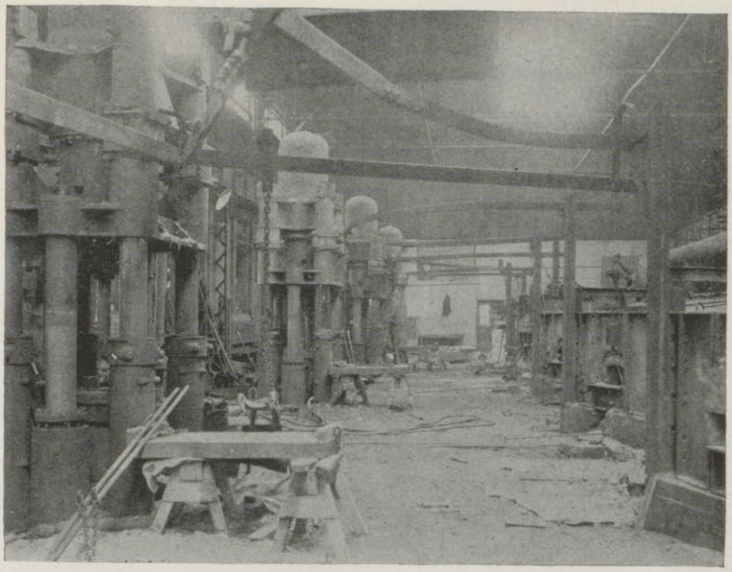


Fig. 60. 6 inch Shell Forging Plant.

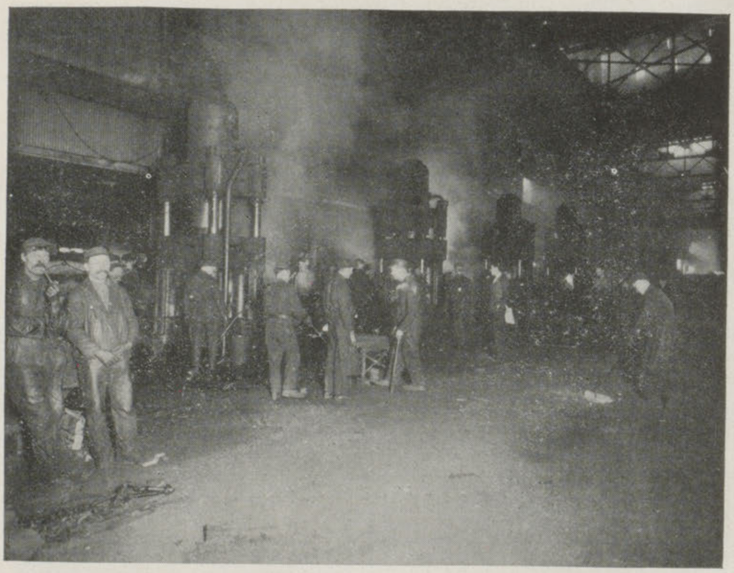


Fig. 61. Canada Car & Foundry, Forg Dept., Forging 6 inch Shells.

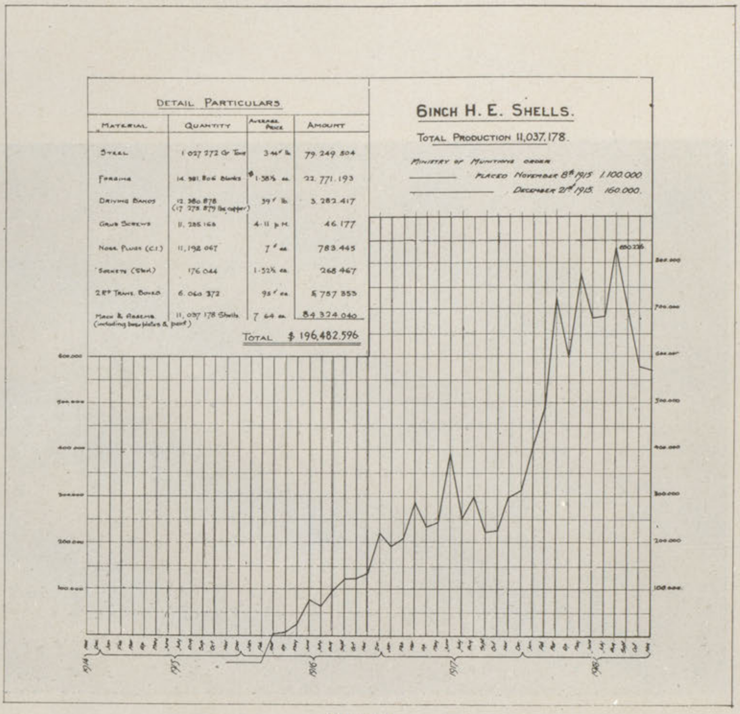


Fig. 62.

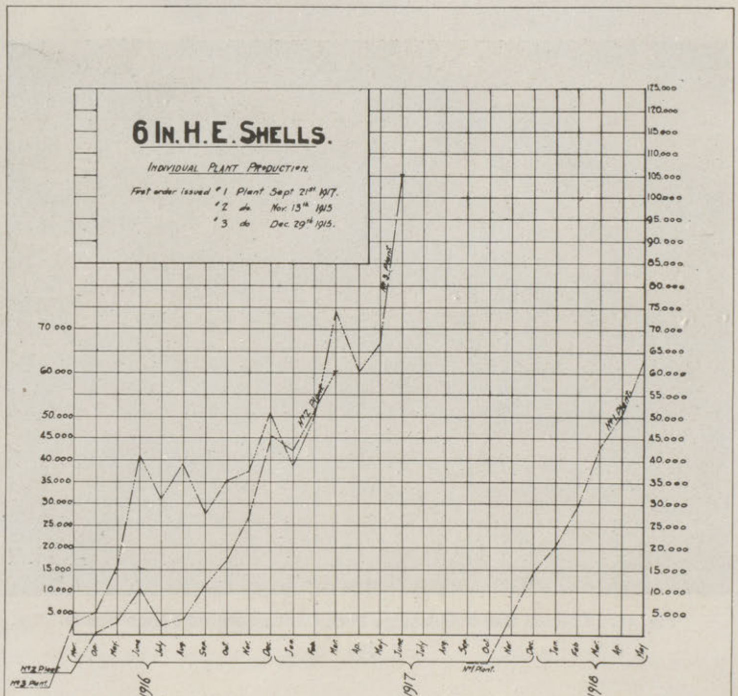


Fig. 63. No. 1 Plant — Leaside Munitions. No. 2 Plant — Peter Lyall Construction Co. No. 3 Plant — Montreal Locomotive Co.

Fig. 64. Montreal Locomotive Co's., 6 in. Shell Shop.

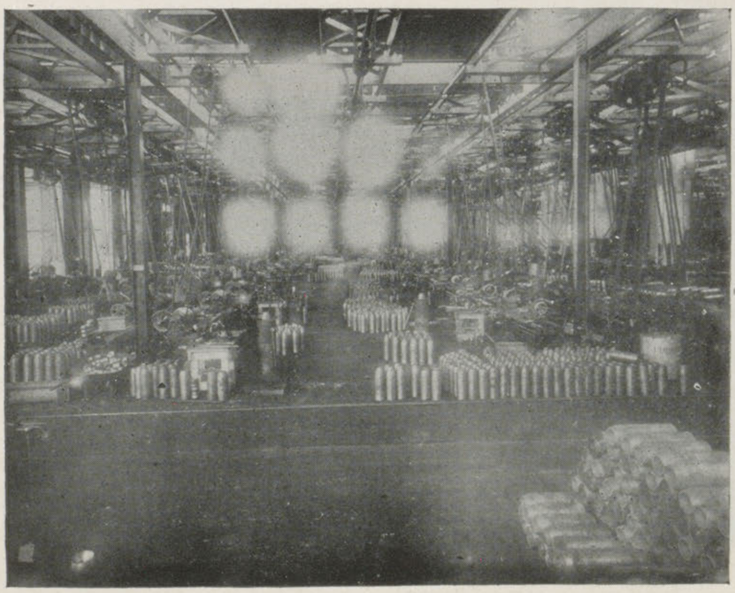


Fig 65. Montreal Locomotive, 4.5 Shell Shop.

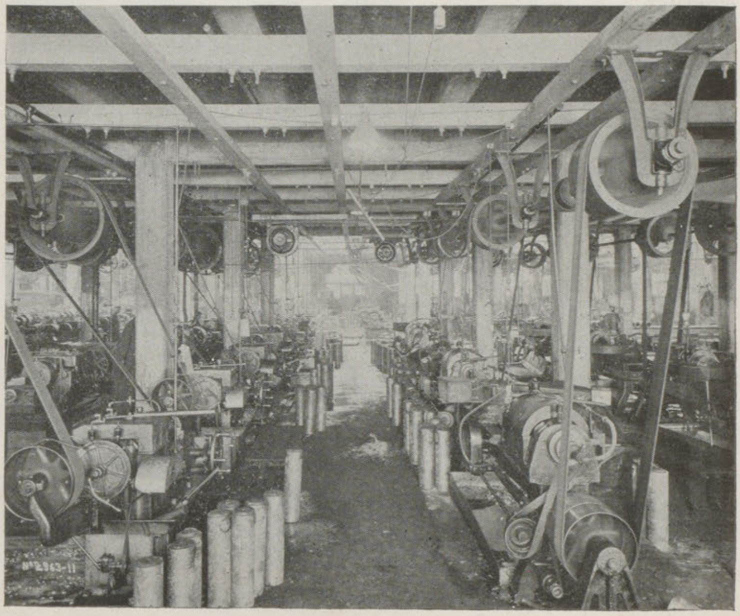


Fig. 66. Peter Lyall & Co's., 6 in. Shell Shop, Westmount Plant.

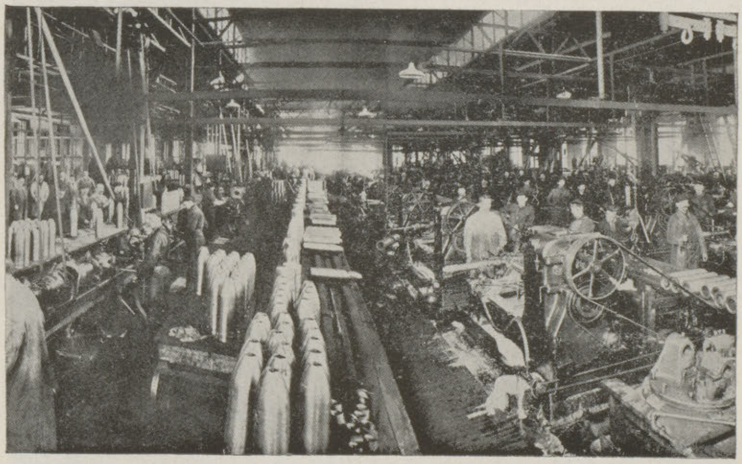


Fig. 67. Steel & Radiator Co's., 6 in. Shell Shop, King Street Plant.

air-cooled, first by high pressure air, under a process introduced by Mr. Sandberg, and subsequently by a process using low pressure air in which advantage was taken of the fact that the transfer of heat varies with the speed at which the current of air passes over the surface of the hot body, which enabled a fan blast passing through a special apparatus to control the rate of cooling to any desired extent. Such methods were actual advances over anything previously employed and in some plants the metallurgist would actually determine from the composition of the steel the spacing between the forgings in special cooling sheds that would best obtain the desired physical qualities.

When the various plants concerned did, however, overcome these troubles, the production grew rapidly and the value of the output of 6-inch shells was greater than that of any other size. The total output is shown by Figure 62, while Figure 63 shows the output for some of the individual firms during the earlier period which is very creditable when it is considered that new plants had to be installed in every case.

The next sizes of shells undertaken by the Board were the 8-inch and the 9.2-inch, which are practically alike in design, but entirely different to any of those previously described. The body of the shell is forged to the finished shape and a plug or adapter is screwed into the bottom of the shell to form the base. These shells were considerably larger than any of the earlier sizes, the 8-inch shell Fig. 68 weighing 200 lbs. and the 9.2-shell Fig. 69, 290 lbs., compared with 100 lbs. for the 6-inch. Entirely new plants for both forging and machining were required and in one case, that of the Canada Cement Company, a new steel making plant was installed as well. While these shells appear more difficult to produce than some of the smaller sizes, experience showed that, with a sufficiently heavy class of machinery, their manufacture could be quickly reduced to a satisfactory basis. The firms engaged on this work undoubtedly handled it with great ability and the results were correspondingly good. Figure 70 shows the total output, and Figure 71 that of some individual firms for 8-inch shells, and Figure 72 and Figure 73 the corresponding output for the 9.2-inch. The quantity of 8-inch shells was limited by the requirements and the maximum output of 9.2-inch shells in the early part of 1917 was reduced on account of lack of orders, but, when the size of this shell is considered, the installation of the plant and the development of such an output is evidently a piece of work of great importance.

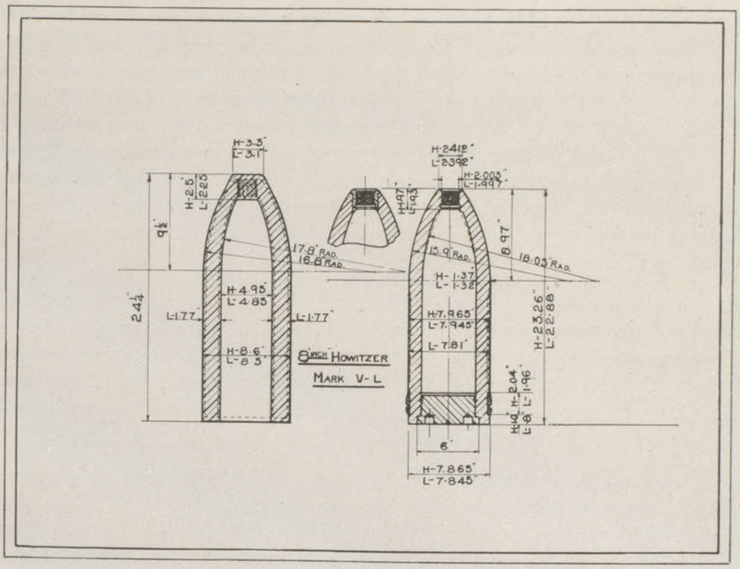


Fig. 68.

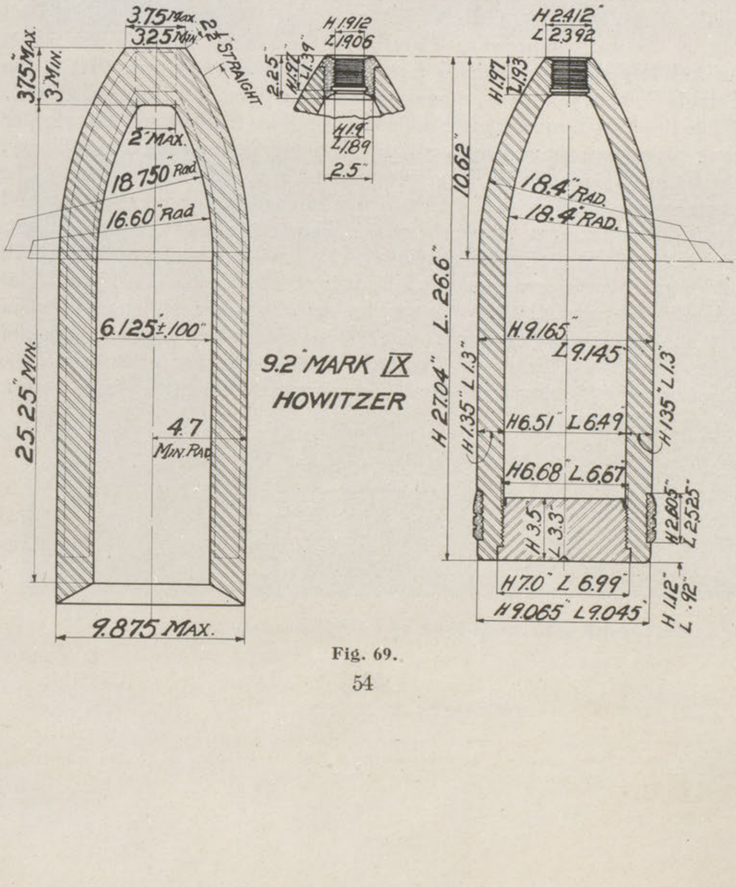


Fig. 69.

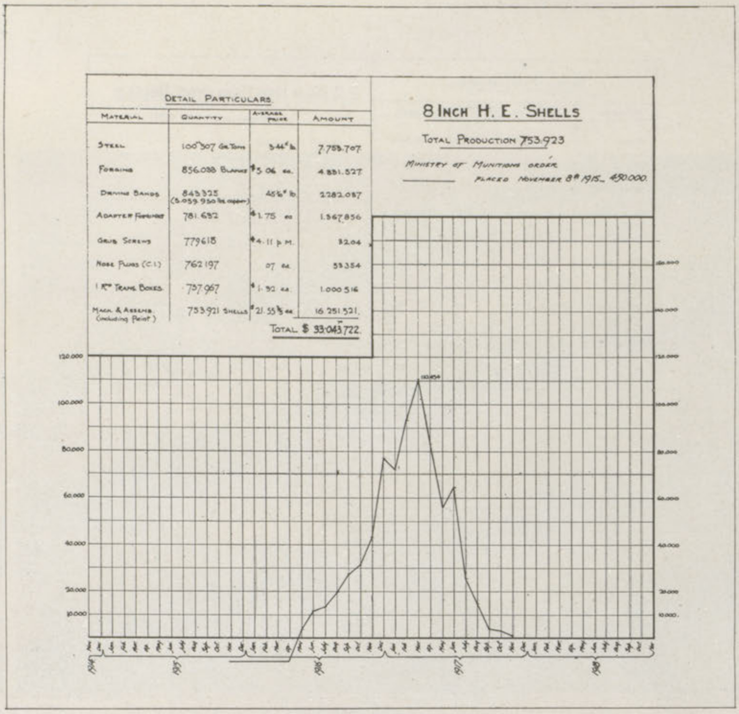


Fig. 70.

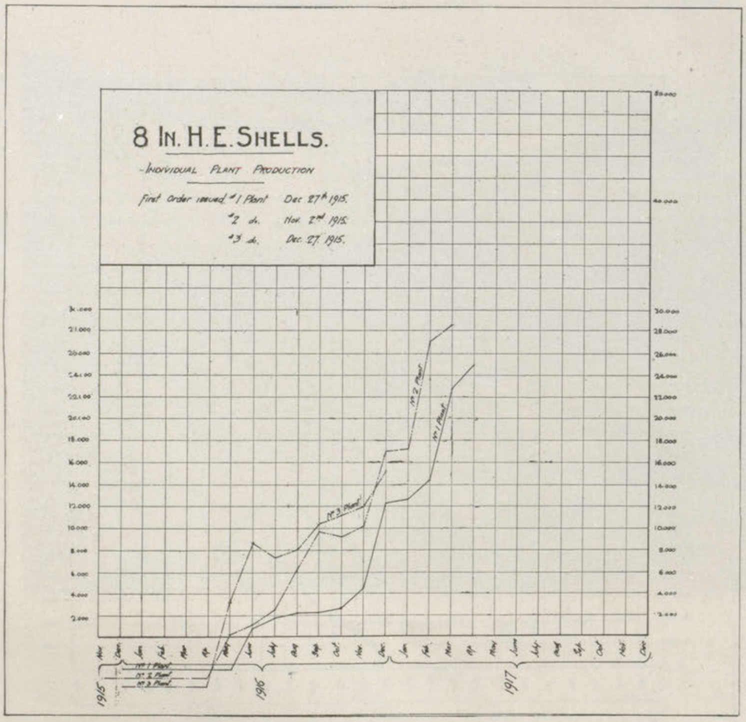


Fig. 71. No. 1 Plant — Can. Fairbanks Morse Co., Toronto. No. 2 Plant — Can. Ingersol Rand Co., Sherbrooke. No. 3 Plant — Universal Tool Steel Co., Toronto.

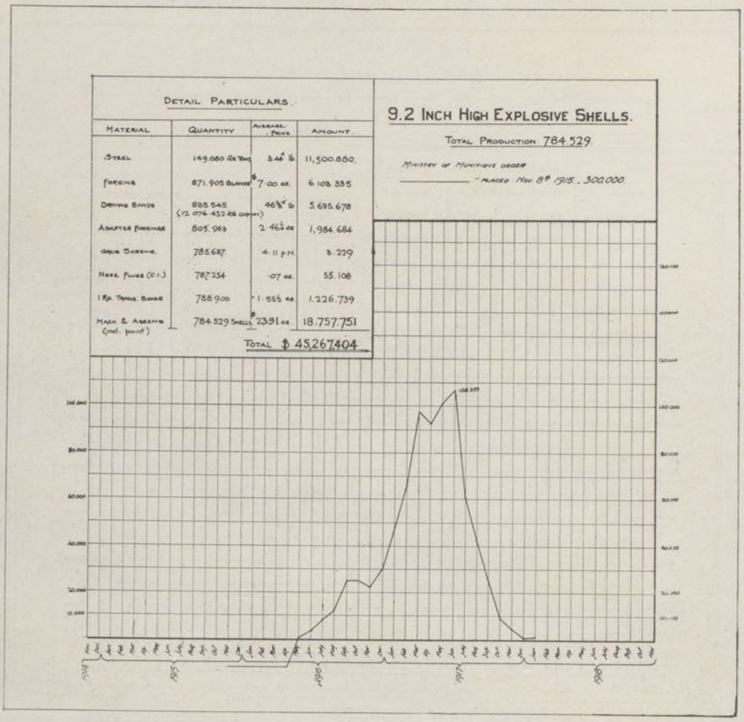


Fig. 72.

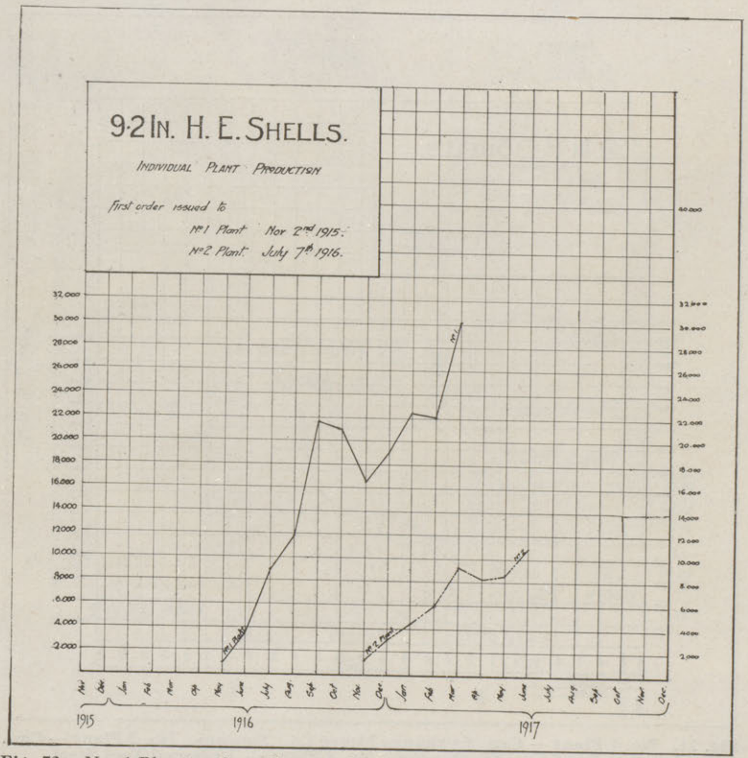


Fig. 73. No. 1 Plant — Can. Cement Co., Montreal, No. 2 Plant — Fisher Motor Co., Orilia.

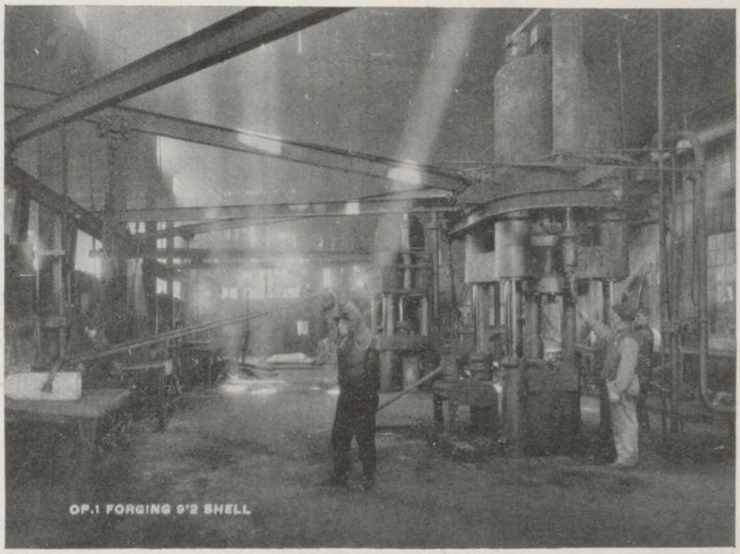


Fig. 74. Forging 9.2 inch shells.

Fig. 75. 9.2 inch shell forgings in storage yard.

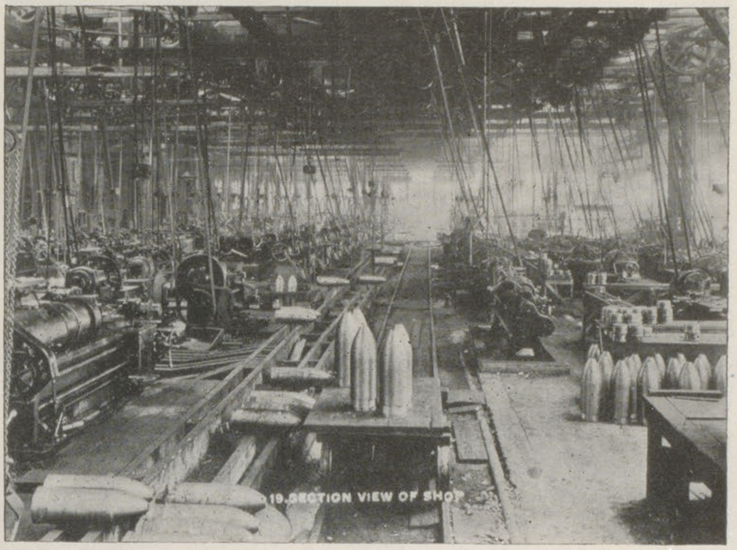


Fig. 76. 9.2 inch shell shop, St. Lawrence Bridge Company.

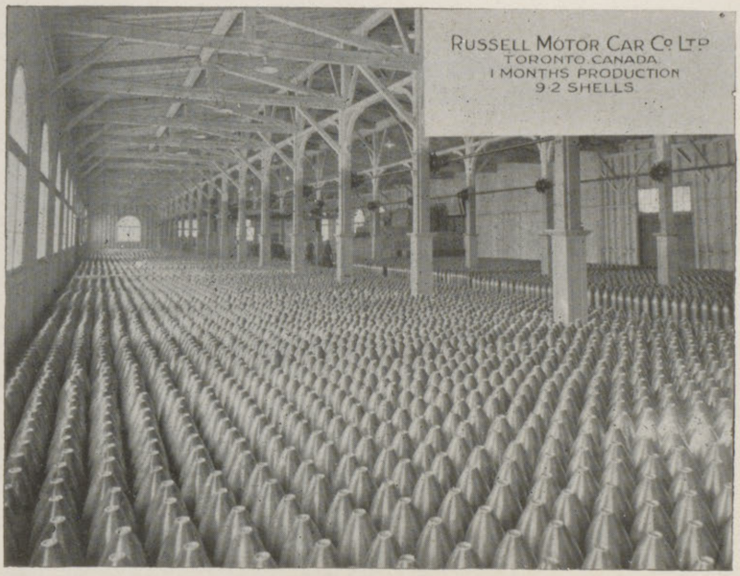
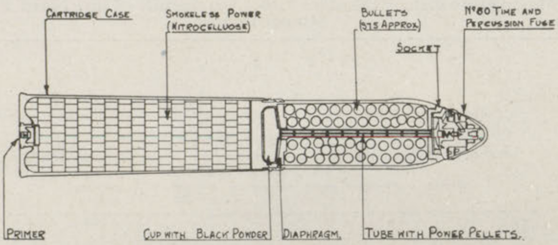


Fig. 77.

While I have discussed the orders for certain sizes of shells as being placed either by the Shell Committee or the Board, it must, however, be clear from the diagrams I have shown that the Board also continued to develop the production of all sizes and varieties of ammunition, in many cases in greatly increased quantities. One interesting feature of the output is shown in Figures 78 and 79, which gives the production of 18-pounder fixed ammunition For a considerable period this averaged 350,000 round per week, most of which was shipped direct to France ready for immediate use in the guns. Another fact that indicates the quantity of munitions produced is that during 1917 Canada manufactured 55 per cent of the 18-pounder shrapnel, 42 per cent of the 4.5-inch, 27 per cent of the 6-inch, 20 per cent of the 60-pounder, 15 per cent of the 8-inch and 16 per cent of the 9.2-inch shells obtained by the British Government, a fact which is remarkable when the enormous production in Great Britain and her extensive purchases in the United States are considered.



The BRITISH 18PR SHRAPNEL SHELL

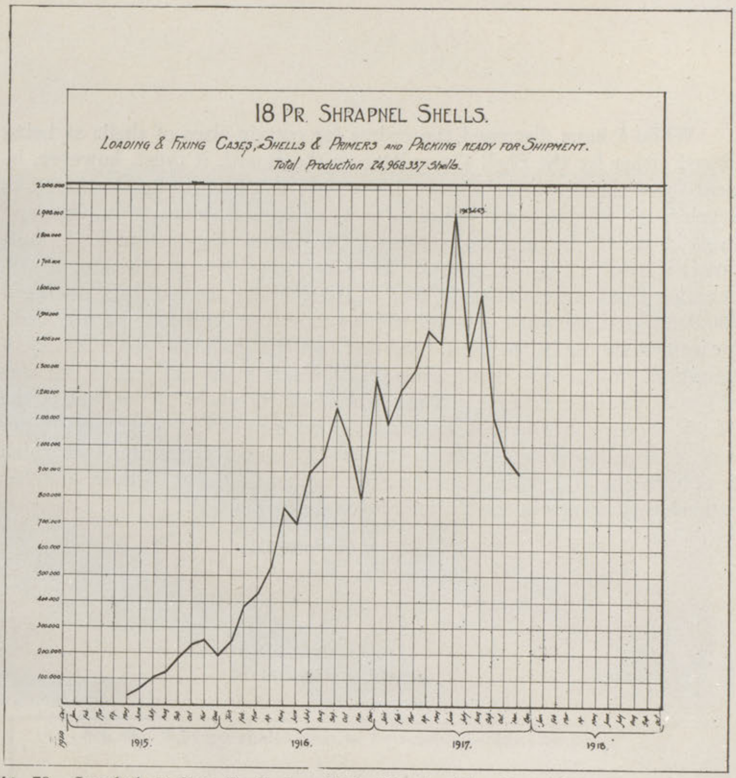


Fig. 78. Loaded at Can. Explosives Ltd., Vaudreuil. Can. Nitro Products Co., Mount Dennis.

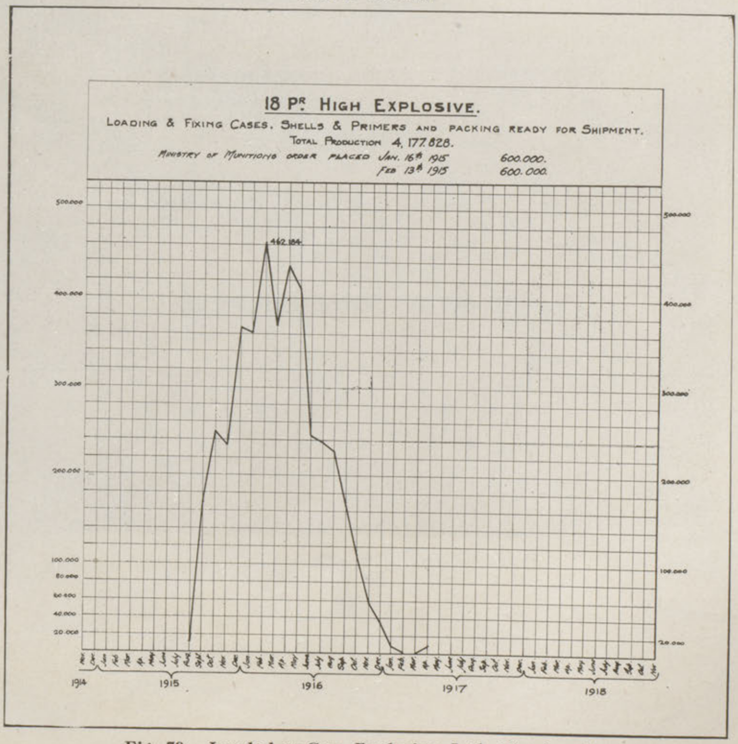
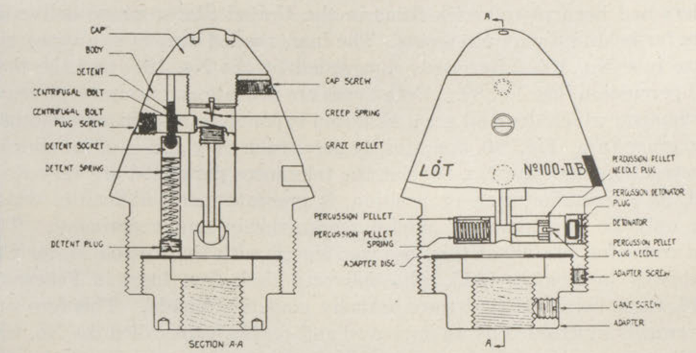


Fig. 79. Loaded at Can. Explosives Ltd., Vaudreuil.

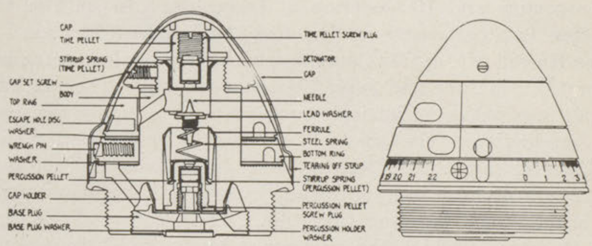
Up to the end of 1915, no fuses had been produced in Canada although orders had been placed with firms in the United States whose deliveries were far behind the requirements. The fuses needed were of two types, the graze fuse No. 100 (afterwards superseded by the No. 101) and the time and percussion fuse No. 80. Both types are delicate and accurate pieces of mechanism which demand great skill and experience in their manufacture. The graze fuse, Fig. 80, operates by percussion only and is of far simpler construction than the No. 80, but the tolerances permitted are very close and, as a manufacturing proposition, it presents many difficulties which can only be overcome by careful workmanship and experiment. The first order for 500,000 of this fuse was placed with the Russell Motor Car Company in August, 1915, who delivered their first fuses in February, 1916, these being the first fuses actually made in Canada. This fuse was afterwards superseded by an improved and simpler type called the No. 101, which was produced in large quantities, the total number made by the Russell Company and other firms who engaged in the work being 9,829,898.

The time and percussion fuse, Fig. 81, is more difficult to produce than the No. 100. It is far more complicated as it contains 52 separate parts and the tolerances permitted are still closer, in some cases the allowance being only half of one thousandth of an inch. The inspection of this fuse is most elaborate, which is well illustrated by Fig. 83, which shows the 162 gauges which are used. Probably a comparison of the relative difficulty of making this fuse and the No. 100 is best illustrated by the experience of the Russell Company that for every 100 operatives engaged in producing the No. 100 fuse, 28 Company Inspectors and 5 Government Inspectors are required, while for the No. 80 fuse the corresponding figures are 50 Company Inspectors and 10 Government Inspectors. In spite of these difficulties, time fuse parts were produced by the Northern Electric Company and the Russell Motor Car Company, with whom orders were placed in December 1915, in June and July, 1916, respectively. The machining of the No. 80 fuse, while an intricate proposition, is actually the easiest part of its production. The greatest technical difficulty occurs in its loading and assembling. This fuse can be set to explode the shell at any time up to 22 seconds after leaving the gun by setting a graduated ring on the outside of the fuse to the correct position. The accuracy of this timing depends on the rate at which the gunpowder burns, which is packed in grooves in the face of the timing rings, and as it is of vital importance to control the time and, consequently, the range at which the shell bursts, the degree of accuracy demanded is very great. From every lot of 4,000 fuses 1% are taken for a " rest test " or a test in the factory. The fuse is set to burn 22 seconds and all fuses must be accurate within 0.4 seconds. The result is automatically recorded on a chronograph which can be read to one twentieth of a second. Other fuses are then tested by actual firing, in which the absolute timing of a fuse is not as important as the uniformity of timing of any lot. With fuses set at 16 seconds, the difference between



The BRITISH CRAZE FUZE
Nº 100

Fig. 80.



The BRITISH TIME AND PERCUSSION FUZE
Nº 80

Fig. 81.

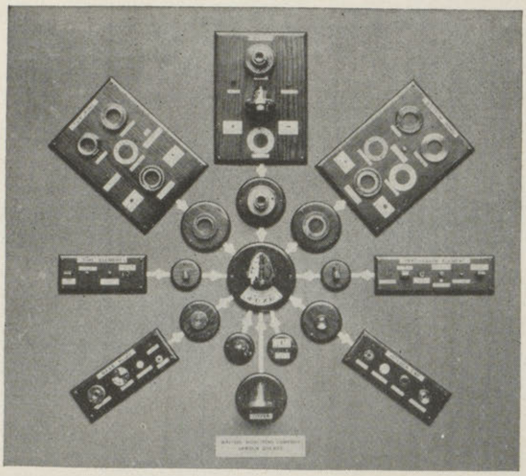


Fig. 82.

the fastest and slowest fuse in any lot must not exceed 6/10ths of a second, while with fuses set at 11 seconds the average variation from the mean must not exceed 0.12 seconds, the latter being the most important requirement.

When it is considered that the rate of burning of the powder varies with its grade, the humidity of the air, the barometric pressure and the temperature, that it is packed in the grooves under a pressure of 68,000 lbs. per square inch and that any variation in the form or accuracy of the groove has its effect the problem of loading and assembling was evidently one of great importance. After careful consideration the Board decided to erect its own plant for this purpose and enlisted the services of the Northern Electric Company to supervise its construction and operation. This plant, The British Munitions Company, was built in Montreal and operated by Mr. Hathaway, General Superintendent of the Northern Electric Company, who carried out his difficult task with the greatest success. The order to organize the Company was given on December 29th, 1915, the contracts for the buildings were let on Feb. 7th, 1916, and the first fuse was loaded, assembled and passed on June 17th. Mr. Hathaway had the advantage of the experience of the American Locomotive Company, who had been successfully handling this work on a direct contract with the British Government but this does not detract from the merit of this remarkable accomplishment. The plant is a model of its kind and shows most careful and scientific planning in its arrangements. It was organized for a capacity of 15,000 fuses per day and instructions were given in October, 1916, to enlarge it to 45,000 per day. It was not operated at this capacity, but over 40,000 fuses were assembled in one day in June, 1917, and in July 768,000 were assembled, an average of over 30,000 per day. The plant is the largest of its kind in the Empire and its operation, without any serious failure and without a single serious accident, is a noteworthy achievement. (Figs 86 to 90.)

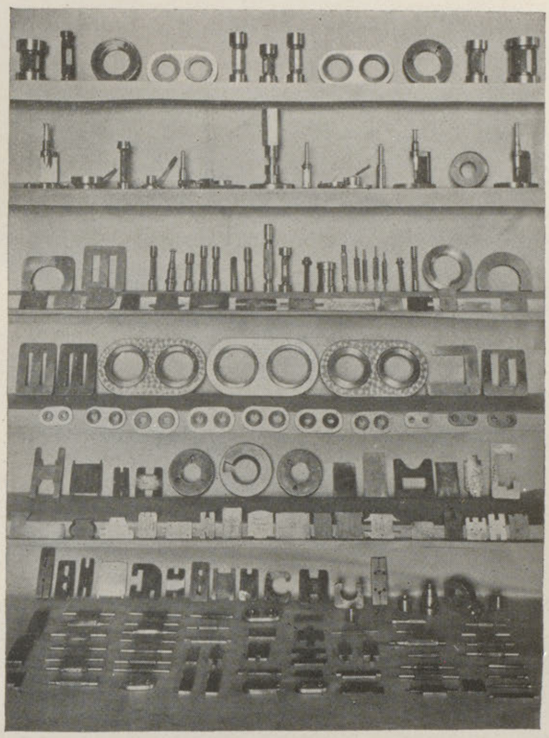


Fig. 83. Gauges Reqd for No. 80 Fuse.

Fig. 84. 250,000 Fuses awaiting shipment.

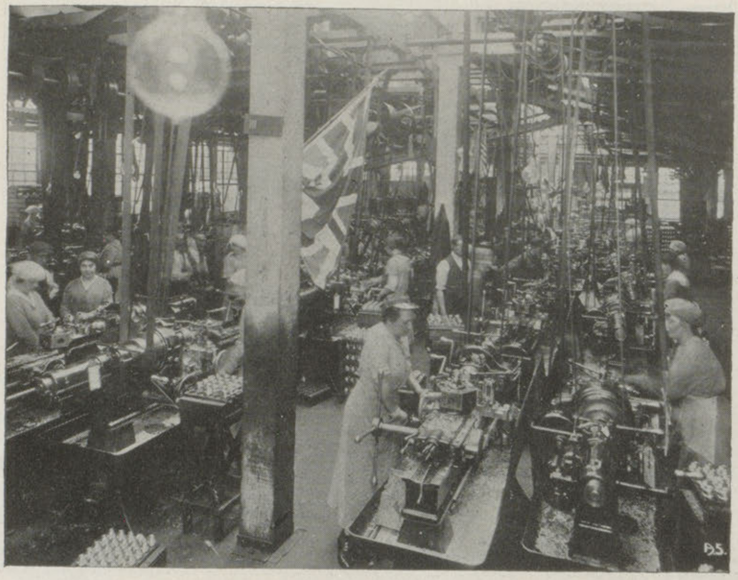


Fig. 85. Russel Motor Co., Machining Fuses.

Fig. 86 Russel Motor Co., Finishing Dept.

Fig. 87. British Munitions Co., Govt. Inspection Dept.

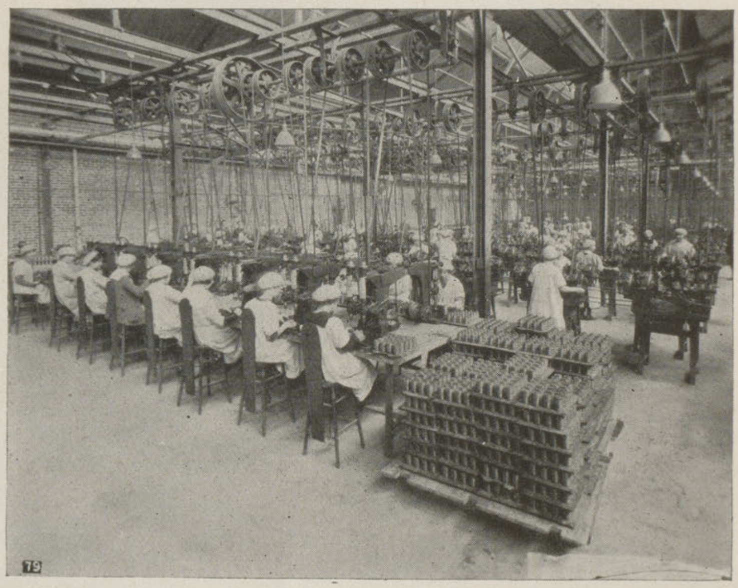


Fig. 88. British Munitions Co., Routing Dept.

Fig. 89. British Munitions Co., Soldering.

Fig. 90. British Munitions Co., Loading Dept.

During 1917 and 1918, the Board carried out on an extended scale the plan of installing its own plants for certain of its requirements, and converted or erected four large plants for explosive materials and one for steel making and forging.

British Acetones at Toronto was installed to manufacture Acetone and Butyl Alcohol by a process consisting of the conversion of corn by certain bacteria. The adjoining distilleries belonging to Messrs. Gooderham & Worts, and the General Distilling Company, were loaned to the British Government, free of cost, for this purpose. It was originally estimated that the plant would produce 300 tons of Acetone per annum and double that quantity of Butyl.

The process was so successful that plant was extended until latterly it was producing approximately 7½ tons of Acetone daily. As a result of experiments made by the staff a process was evolved whereby the Butyl Alcohol was converted, by catalytic action, into Methyl Ethyl Ketone, and, as this was proved to be a good substitute for Acetone in the manufacture of Cordite, a plant for this conversion was erected costing in the neighbourhood of $600,000. Methyl Ethyl Ketone was successfully produced at the plant before the Armistice was signed. The total cost of structural alterations, including the erection of the Methyl Ethyl Ketone Plant was approximately One Million Dollars, and from the commencement of operations 5,580,360 lbs. of Acetone and approximately 12,000,000 lbs. of Butyl Alcohol were produced.

British Chemical Company at Trenton was installed to produce the necessary Pyro Cotton for the manufacture of Nitro-cellulose Powder at the British Explosive Plant at Renfrew instead of purchasing it in the United States. This also involved the erection of a 60-ton Chamber Sulphuric Acid Unit and a plant to produce Nitric Acid. The plant was authorized and ground broken early in December, 1916. The construction work had hardly started when instructions were received to erect a T.N.T. Plant and Nitrocellulose Powder lines. This, of necessity, entailed the erection of a further Pyro Cotton Unit, another 60-ton Chamber Sulphuric Acid Plant and doubling the Nitric Acid Units. In May, 1917, six months after breaking ground, 450,000 pounds of Pyro Cotton and 380,000 pounds of T.N.T. were produced whilst the production of Nitrocellulose Powder began in July of that year.

The total expenditure on the Trenton Plant was approximately $5,000,000 and it produced 14,212,665 lbs. of Nitrocellulose powder and 13,980,000 lbs. of T.N.T.

British Explosives at Renfrew was leased from the O'Brien Munitions in December, 1916. The first shipment of Nitrocellulose was made on January 27th, 1917, and the total production from this plant amounted to 16,268,046 lbs.

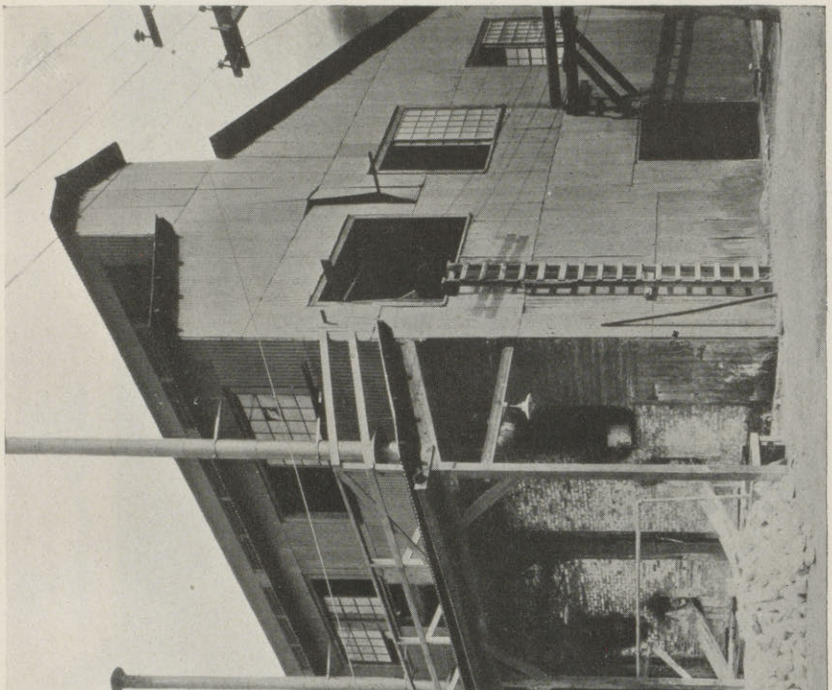


Fig. 91.

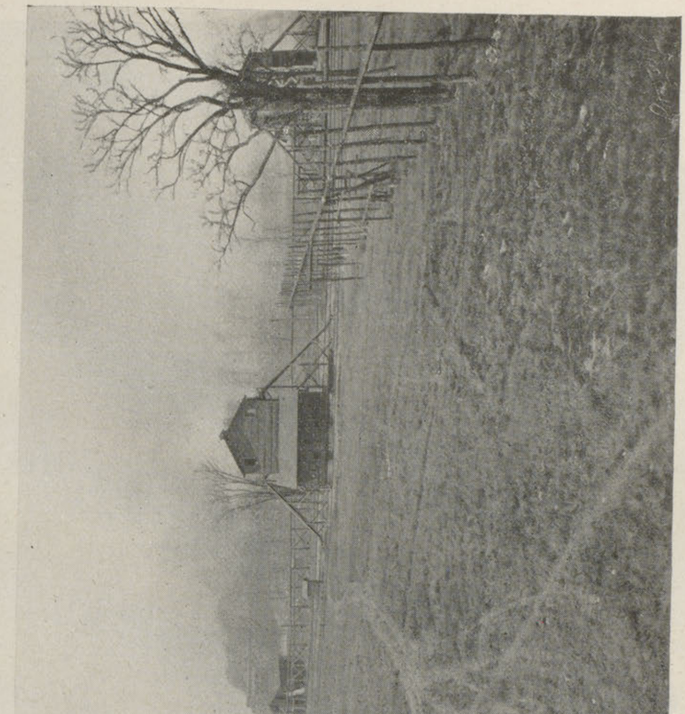


Fig. 92. Views of British Chemical Plant at Trenton.

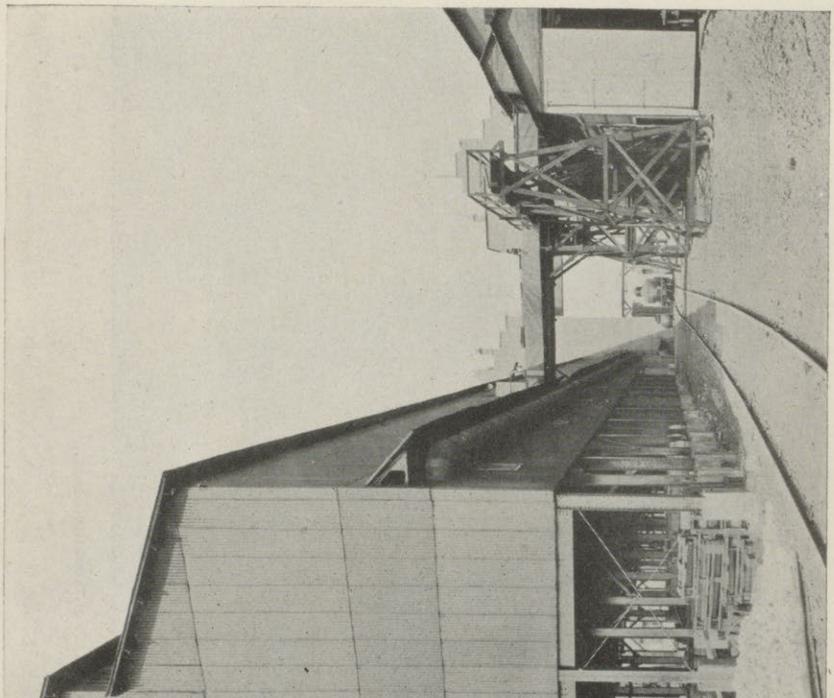


Fig. 93.

Fig. 94. British Chemical Co's., Trenton Plant.

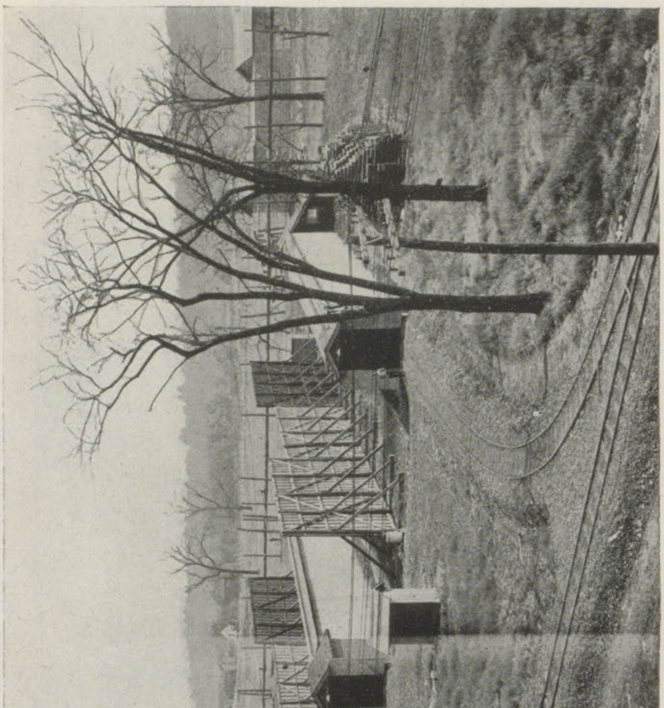


Fig. 95.

Fig. 96. British Chemical Co's., Trenton Plant.

British Cordite Company at Nobel was erected and operated as a National Plant under a contract with Canadian Explosives Limited. The plant cost in the neighbourhood of $3,500,000. The production of Cordite commenced in August, 1917, and the total production of Cordite from the plant was 21,687,900 pounds. The plant was designed for 2,000,000 pounds per month, but owing to a change in the Ministry's programme, due to over-production, the output was limited to the lowest limit commensurate with economic production.

The British Forgings at Toronto was constructed at an expenditure of approximately $2,500,000, primarily with the purpose of utilizing the large amounts of steel turnings accruing from the machining of shells, etc., which at the time were a drug on the market. This plant, which is the largest Electric Steel plant in the world, consists of 10-six ton Herault Electric Furnaces, having an average capacity of 350 tons of steel ingots per day and two forging plants each with a capacity of 5000 six-inch forgings per day. Ground was broken for the erection of this plant in December, 1916, the first heat of steel was poured in June, 1917, and the total production was 99,808 tons of steel and 2,916,047 forgings.

Reference has been made, throughout this address, to the inspection to which the various shells and components were subjected and the Inspection Department in charge of the work was a formidable organization. It was originally under the direction of Colonel (afterwards Brigadier-General) Greville-Harston, a member of the original Shell Committee and, after the formation of the Imperial Munitions Board, under Major (now Lieut.-Col.) G. Ogilvie, formerly of Colonel Harston's staff. These officers rendered considerable assistance to the manufacturers during their early difficulties, but the attitude in general of the Inspection Department was that a certain grade of work was required and that it could and must be attained. There is no doubt of this attitude being the correct one in the inspection of munitions and that it was responsible for the satisfactory quality of the shells made here. The chief difficulty that the Inspection Department, and consequently the manufacturers, suffered from was that of obtaining a sufficient number of competent inspectors and most of the troubles pertaining to inspection arose from this cause.

When the department was re-organized in 1916, as the Department of Inspection for Canada of the Imperial Ministry of Munitions under Colonel (afterwards Brig.-Gen'l) W. E. Edwards, this situation was, apart from a considerable increase in the expert staff, greatly bettered by the establishment of training schools for examiners, which also led to uniformity of inspection throughout the various plants and a decided improvement in every respect. The amount of work handled by this Department is not generally realized although its importance is easily understood. They were absolutely responsible for the acceptance or the rejection of the raw materials, such as steel, brass, etc., supplied by the Board, as well as of any component or complete item of ammunition presented to them and the staff

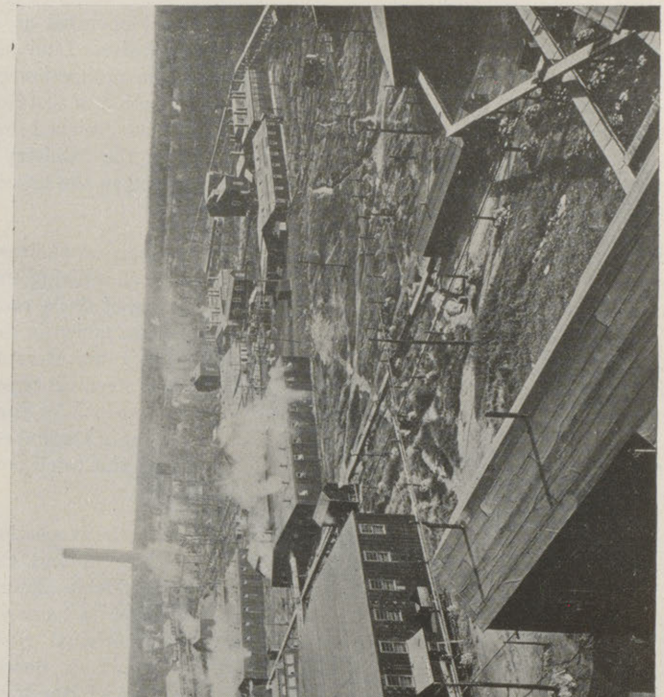


Fig. 97.

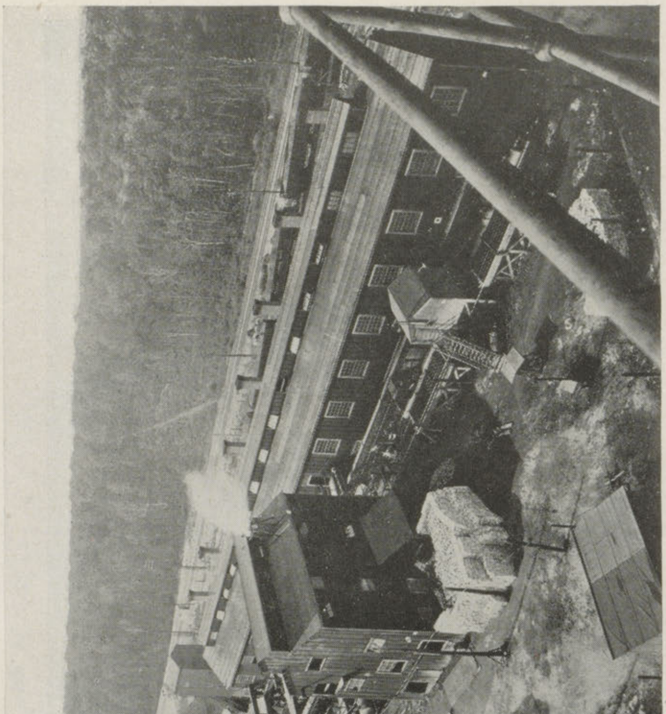


Fig. 98. Views of British Cordite Co's. Plant.

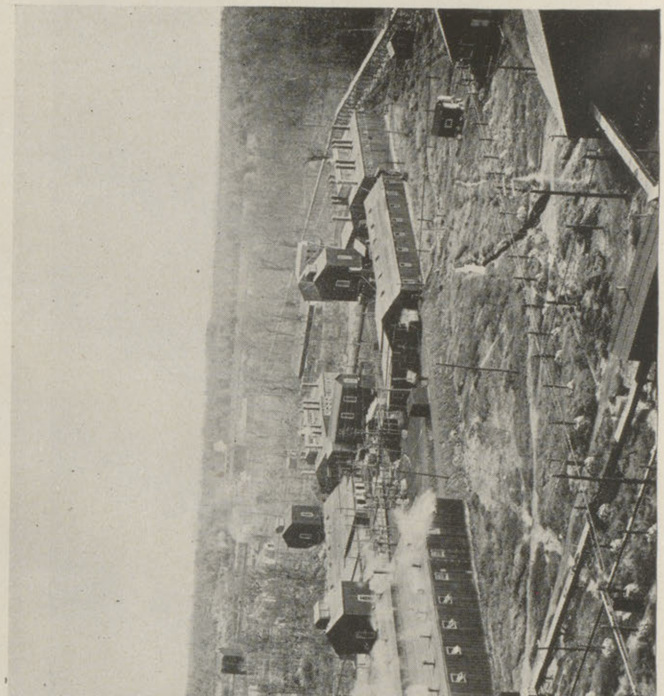


Fig. 99.

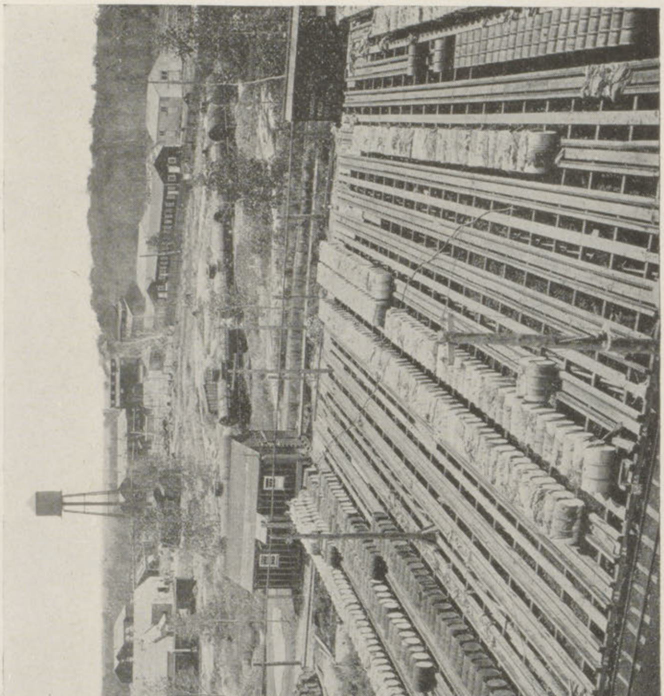


Fig. 100. British Cordite Co.

Fig. 103. British Forgings, Toronto.

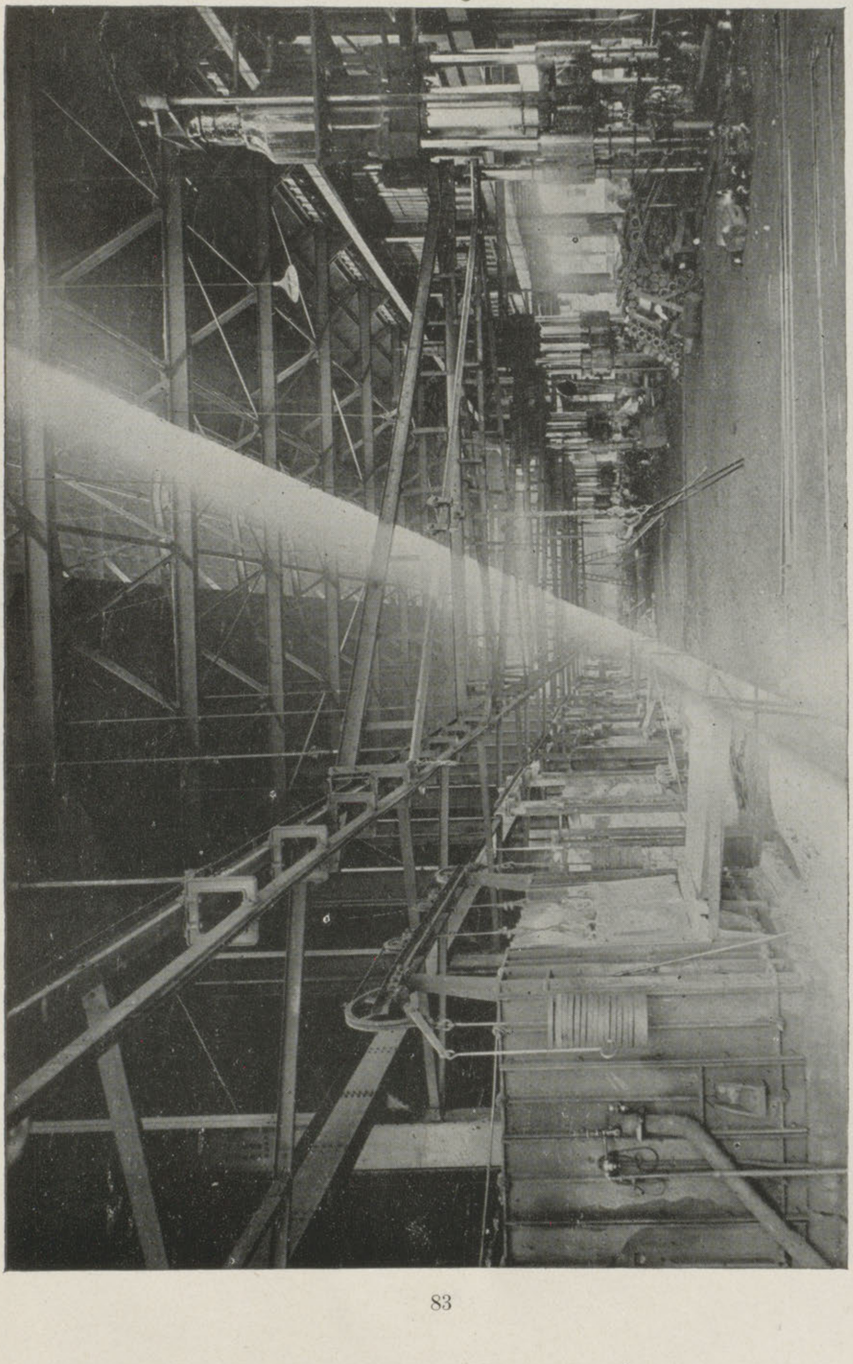


Fig. 104. British Forgings, Furnaces and Presses.

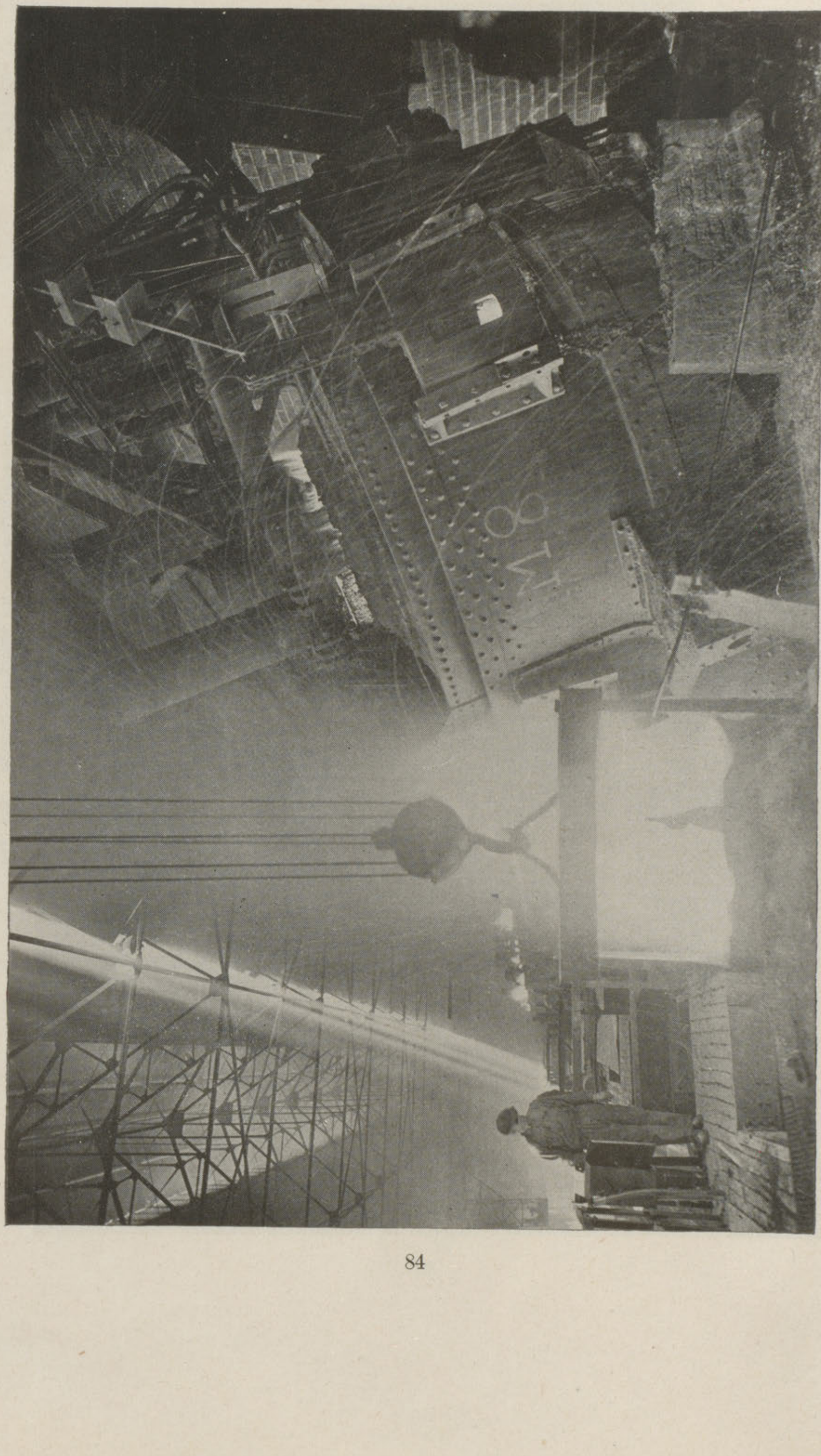


Fig. 105. Electric Furnace, British Forgings, Toronto.

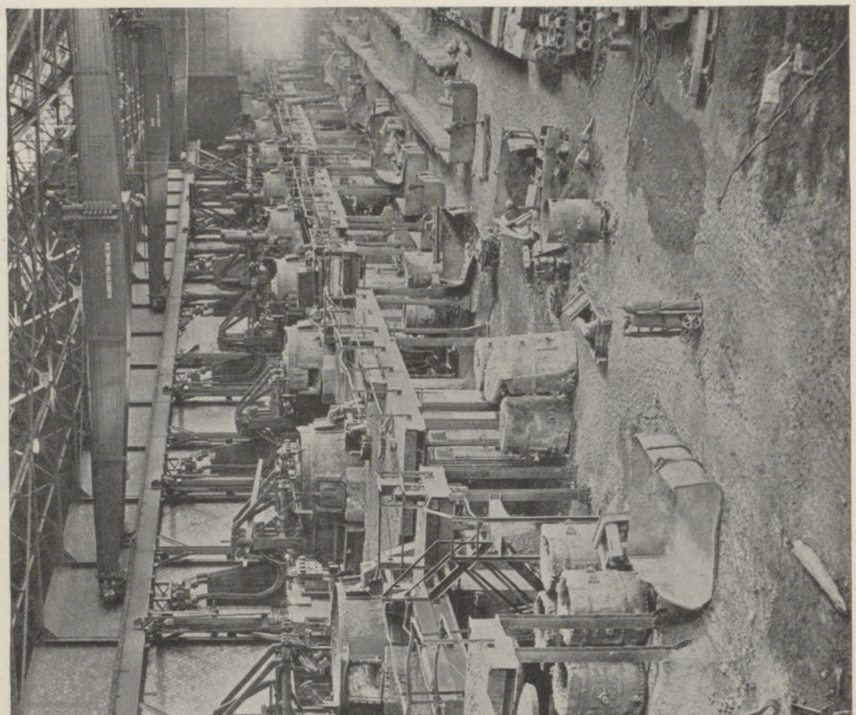


Fig. 106. British Forgings, Toronto. Electric Furnaces.

amounted in the middle of 1917 to as many as 8,072 persons. Of these 130 were senior or directing staff, mainly civil or mechanical engineers, and of the remainder at least 600 were either engineers by profession or highly skilled technical men. The balance included some 550 clerical staff and over 2,000 women examiners, chiefly on fuses and the like.

One of the Inspection Divisions in which we are specially interested was that of Gauges and Standards, organized in 1916, under Captain R. J. Durley, one of our past Councillors. This Division purchased the gauges for the Inspection Department, inspected them, repaired them and, in many cases, manufactured those of special character while their travelling staff assisted the District Gauge Examiners in checking up their standard gauges. They also were responsible for ensuring the correspondence of the gauges used in Canada with those used in England, to avoid any possibility of rejection of work re-inspected there. This necessitated the use and, in many cases, the design and construction of delicate measuring apparatus, as the accuracy of the new gauges is required to be from ten to twenty times that of the piece to be measured and the tolerance allowed does not in certain cases exceed one-ten thousandth of an inch. This Division also designed a large number of the various gauges used, and employed from forty to fifty tool makers on gauge repair and special work Fig. 107. It spent over $3,000,000 in the purchase of inspection gauges and, in 1917, made over 200,000 separate examinations of gauges in use and purchased. It is a good example of one of the ramifications of the munitions industry of which little is known and appreciated.

Fig. 107. I.M.B. Gauge Inspection Office, Ottawa.

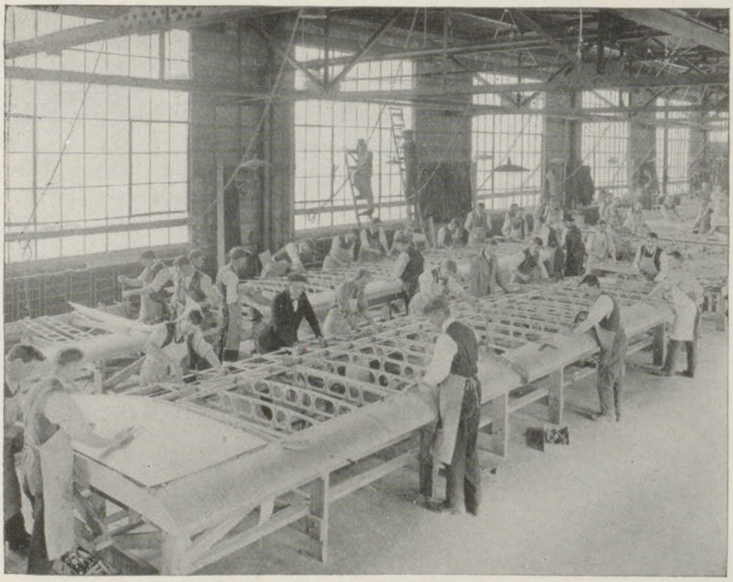


Fig. 108. Can. Aeroplanes Ltd., Wing Making.

While not strictly included under the head of Munition work, I feel that this record would not be complete without a reference to the plant of the Canadian Aeroplanes Limited, which was also constructed under the supervision of the Board at Toronto. This work was placed in charge of Sir Frank Bailie and attained a capacity of 300 machines per month, the total number completed being 2,921 aeroplanes and 30 F-5 flying boats. Practically all parts of the planes are constructed at this plant, with the exception of the engine and, when working to capacity, 2,150 employees are engaged. In addition to this plant, the Board also undertook the work of securing the ground, erecting the buildings and furnishing the equipment for the various flying camps of the Royal Air Force at Camp Borden, Moren Heights, Leaside, Camp Mohawk and Beamsville, at which so many Canadians were trained for air service.

Other activities of the Board not actually connected with munition work were the construction of forty-four steel and forty-six wooden steamships at a total cost of over $68,000,000, the purchase of over 4,000 tons of ferro silica, of 23,000,000 feet of aeroplane spruce and fir and various other requirements of the Imperial Government. Their principal work, however, was the production of munitions and in this the grand result was over 67,000,000 shells at a total cost of 1,200 million dollars, the output of over 450 different firms and 250,000 employees. These shells required two million tons of steel, 18,000 tons of copper, 25,000 tons of spelter and 138,000 tons of lead, to say nothing of the 27 million dollars worth of shell boxes and numerous other materials which it would be wearisome to recapitulate.

The Canadian achievements in munition production may not have approached those of France and England, but in comparison with anything accomplished in our previous history I believe we can justifiably be proud of them as a great piece of work which was well and honorably done. I cannot express this better than by concluding this address with the cables sent to the Chairman of the Imperial Munitions Board by Mr. Lloyd George and Mr. Winston Churchill.

Mr. Lloyd George cabled:—

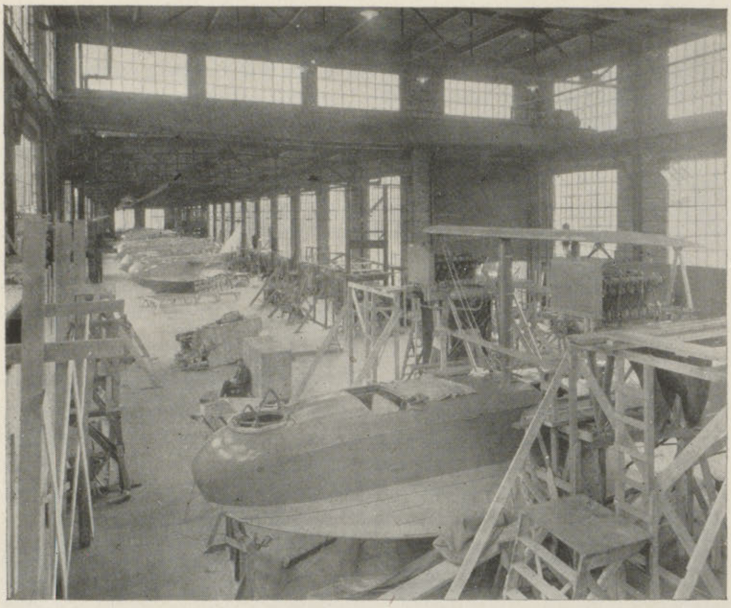


Fig. 109. Can. Aeroplanes Ltd., Flying boats with two Liberty Motors on one in foreground.

Fig. 110. Can. Aeroplanes Ltd., Final Assembly.

" Now that hostilities have ceased, I am anxious to send you, on behalf of myself and my colleagues in the War Cabinet, our congratulations on the great work of the Imperial Munitions Board for three years, which has been of such signal assistance to the British Empire and to the Allied Cause. It is a great and varied achievement for your Board, not only to have produced so great an output of munitions, representing no small proportion of the shells used by the British Armies, but also they have built over three hundred and fifty thousand tons of shipping for the Ministry of Shipping, to have assisted in so great a degree the Royal Air Force in Canada to have developed the great output of aeroplane timber which has been essential for our Air Service.

"As the Board was appointed by me when I was Minister of Munitions, it is particularly pleasurable to me to recognize the success, efficiency and value of its work and to thank you and, through you, your staff, the Canadian manufacturers and the great army of workers who have so splendidly assisted you, for the great service so rendered."
Mr. Winston Churchill cabled:—

"As the Armistice with Germany has now been concluded I wish, as Minister of Munitions, to congratulate you and, through you, all your staff on the splendid work of the Imperial Munitions Board during the last three years.

" You have carried through a work of the greatest magnitude with uniform success and efficiency, and I wish to pay my personal tribute to the great ability, energy and organizing power you, as Chairman, have shown.

" Canada's remarkable output of munitions has played a large part in the munitioning of the British Armies and will remain a testimony to the high value in that great struggle of the work of the Board and of all those, whether manufacturers or work people, who have shared the burden with you."

These cables record in eloquent terms the appreciation by men, who were in a position to know the facts, of the results obtained by Canada in the manufacture of munitions.

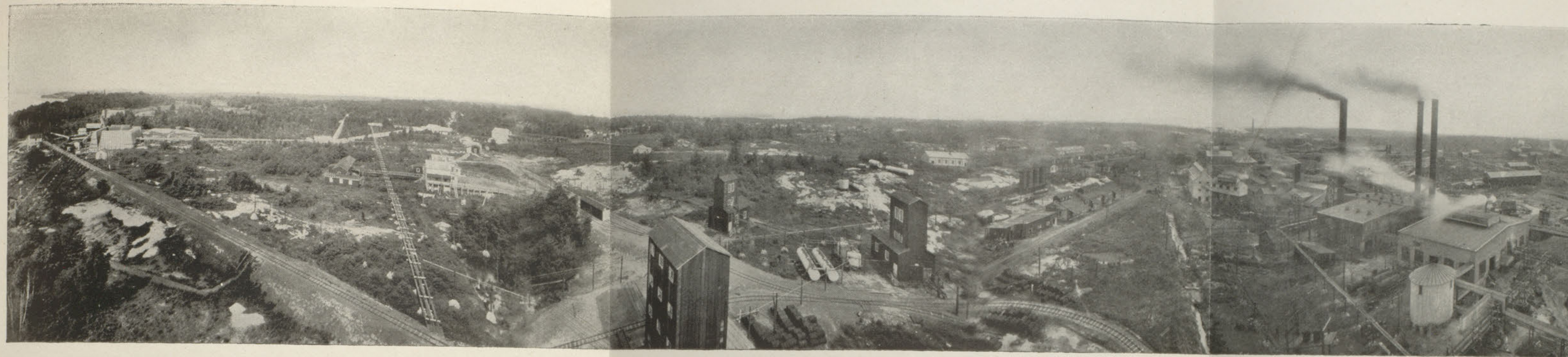


Fig. 101. CANADIAN EXPLOSIVE CO., NOBEL PLANT.

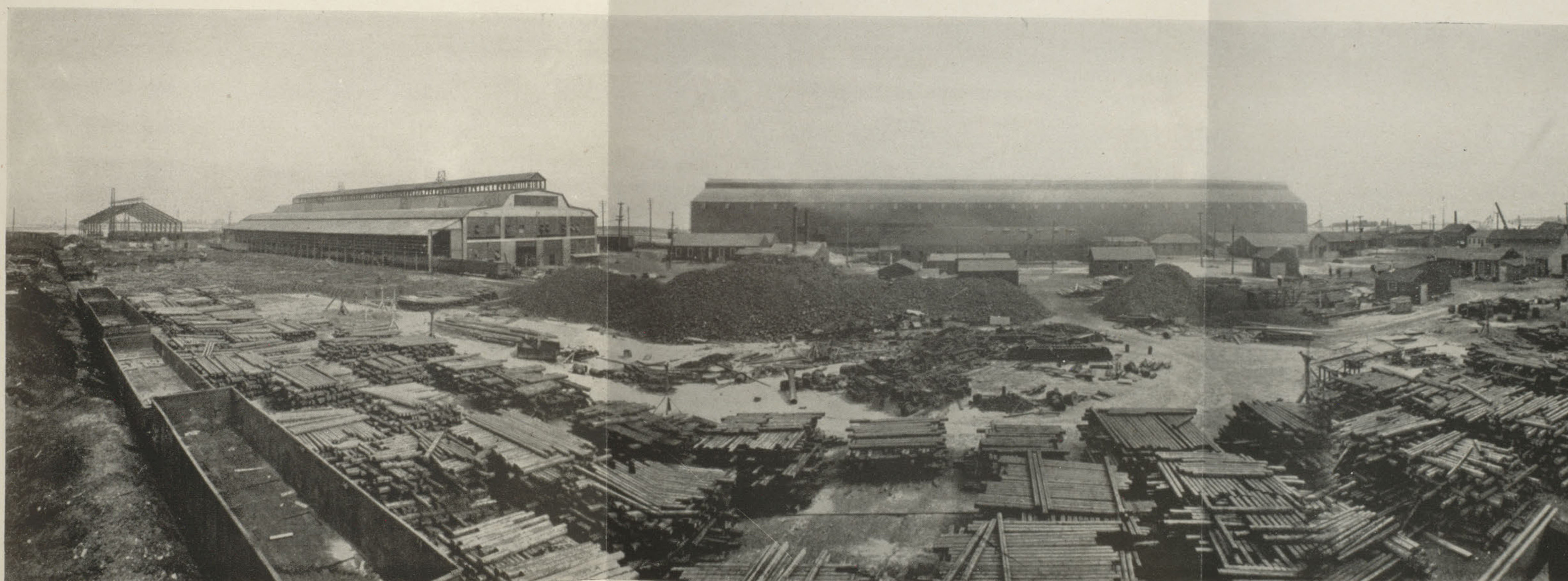


Fig. 102. PANORAMIC VIEWS OF BRITISH FORGINGS, TORONTO.

Shrapnel *and* Shrapnel Manufacture

Reprinted *from*

MACHINERY

April, 1915

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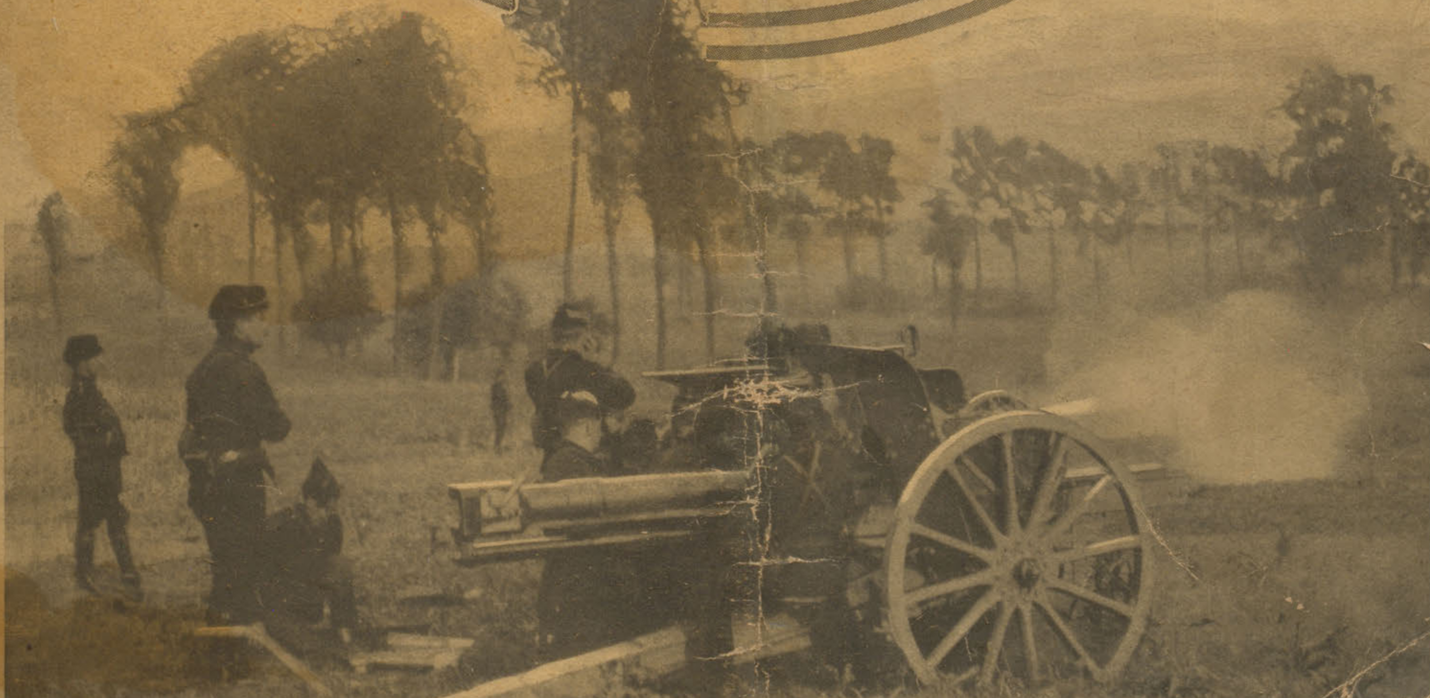

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MACHINERY for
April, 1915

Shrapnel and Shrapnel Manufacture

Historical Sketch of the Development and Methods of Manufacture

by
Douglas T. Hamilton

IN NAVAL, coast defense and artillery operations, several types of explosive shells are used; the chief ones are: the armor-piercing shell, made to pierce armor plate before exploding; shells exploded by means of a timing fuse; shells exploded by either a timing or percussion fuse; and shells exploded by percussion only. Each different shell has some definite function to fulfill, and is designed for that purpose. For field or artillery operations, the shrapnel and lyddite are the two principal types used. Of these, shrapnel is the most prominent, because of its enormous destructive power and its interesting mechanical construction.

Early Development of Shrapnel

The shrapnel shell was invented in 1784 by Lieut. Henry Shrapnel, and was adopted by the British Government in 1808. As is shown at *A* in Fig. 2, the first shell was spherical in shape and the powder or explosive charge was mixed with the bullets. Although this type of shell was an improvement over the grape and canister previously used, its action was not altogether satisfactory, as the shell, on bursting, projected the bullets in all directions and there was also a liability of premature explosion. In order to overcome the defects mentioned, Col. Boxer (R. A.) separated the bullets from the bursting charge by a sheet iron diaphragm, as shown at *B* in Fig. 2. This shell was called a diaphragm shell to differentiate it from the first shell of this type.

In the shell made by Col. Boxer, the lead bullets were hardened by the addition of antimony, and as the bursting charge was small, the shell was weakened by cutting four grooves extending from the fuse hole to the opposite side of the shell. Shells of spherical shape were first fired out of plain bored guns, and upon the advent of the rifled gun it was necessary to add a circular base, which was made of wood and covered with sheet iron or steel to take the rifling grooves. The first shrapnel shells were made of cast iron, but a later development was to use toughened steel and elongate the body, reducing it in diameter. The diameter of the bullets was also reduced so that a greater number could be contained in a slightly smaller space. The improved shrapnel was also capable of being more accurately directed.

Shrapnel Shells of Present-day Design

Shrapnel shells, as used at the present time by the different governments, vary slightly in construction and general contour as well as in the constituents entering into their different members. As shown in Fig. 1, a completed shrapnel comprises a brass case carrying a detonating primer and the explosive charge for propelling the projectile out of the bore of the gun. The projectile itself comprises a forged shell that carries the lead bullets and bursting charge. Screwed into the front end is the combination timing and percussion fuse which can be set so as to explode the shell at any desired point and from which the flame for exploding the burst[illegible] ing charge is conveyed through a powder timing [illegible] a tube filled with powder pellets down throu[illegible] to the powder pocket.

Associate Editor of MACHINERY.

Of these members of a shrapnel, the shell and timing fuse present the most interesting features from a mechanical standpoint. The shell used by most governments is made from a forging, machined to the desired dimensions in hand and semi-automatic turret lathes as well as in ordinary engine lathes. The fuse, a complete description of which will be given later, is an extremely accurate piece of mechanism, and it is largely produced from screw machine parts, some of which, however, are forged previous to machining. The brass cartridge case—the next member of importance—is drawn up from a brass blank by successive operations in drawing presses, and is indented and headed. Following this, several machining operations on the head and primer pocket are accomplished.

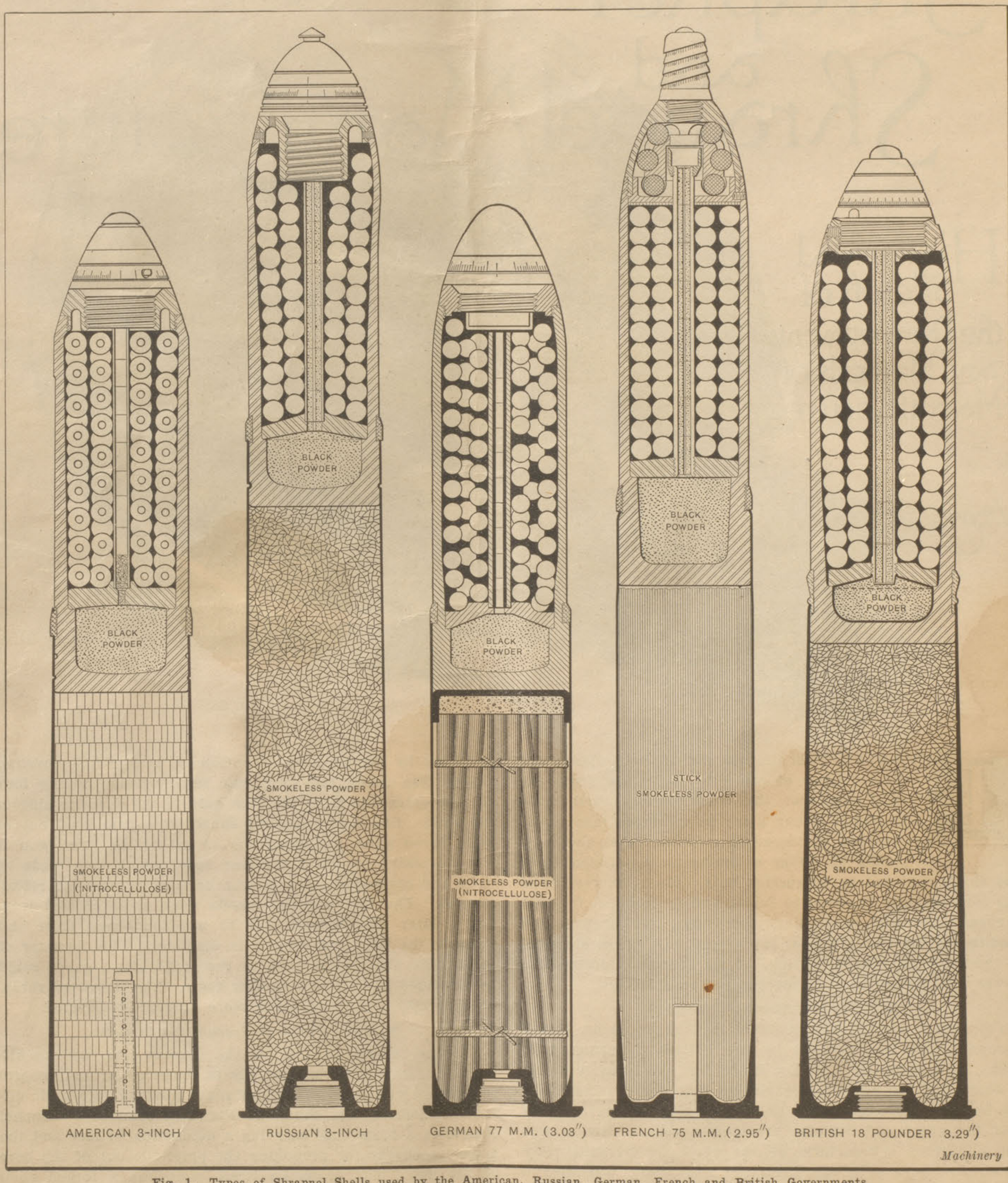


Fig. 1. Types of Shrapnel Shells used by the American, Russian, German, French and British Governments

Construction of Shrapnel Shells

Shrapnel shells are made in two distinct types, one of which is known as the common shell, and the other as the high explosive. The common shell is a base-charged shrapnel, fitted with a combination fuse, whereas the high-explosive shell is fitted with a combination fuse and, in addition, with a high-explosive head, the head also bursting and flying into atoms upon impact. The high-explosive shell is not ruptured upon the explosion of the bursting charge in the base, but the head is forced out and the bullets are shot out of the case with an increased velocity. In the meantime, the head continues in its flight and detonates on impact. This type of shell is not used quite as extensively as the common shrapnel, and for simplicity of description the common shrapnel shell alone will be taken up in the following.

Reference to Fig. 1 will show that as far as the construction of the shrapnel shell and case is concerned, there is very little difference in those employed by the various governments. Starting with the case, it will be seen that these are almost identical, except for length and the arrangement of the head for carrying the detonating primer. There is a marked similarity in this respect between the Russian, British and German and between the American and French. The form of the explosive charge held in the brass case differs in almost every instance, but without any exception smokeless powder in some form or other is used. In the American shell, nitro-cellulose powder composed of multi-perforated cylindrical grains each 0.35 inch long and 0.195 inch diameter are used. In the Russian case, smokeless powder of crystalline structure is used. In the German, smokeless (nitro-cellulose) powder in long sticks and arranged in bundles is held in the case. The French use stick smokeless powder ½ millimeter (0.0195 inch) thick by 12.69 millimeters (½ inch) wide. Two lengths or rows of this powder are arranged in the case. The British use a smokeless powder of crystalline structure somewhat similar to the Russian, but in some cases cordite has also been used, although of late this type of powder has not been quite as commonly employed.

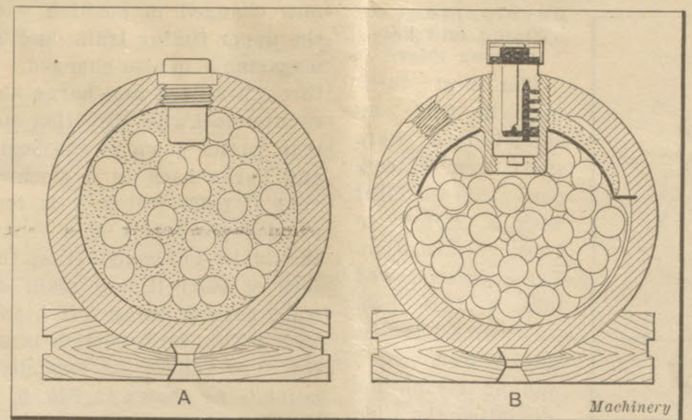


Fig. 2. Original Shell designed by Lieut. Henry Shrapnel and Col. Boxer's Improvement

The detonating agents or primer held in the head of the case varies in almost every type of shrapnel. Practically all primers are provided with "safety heads" so that the shrapnel can be handled without danger of premature explosion. The object, of course, of the detonating agent or primer is to send off the explosive charge in the shell for propelling the shrapnel out of the field gun.

The shell itself, as previously mentioned, is made either from a forging or from bar stock. Forgings, however, are used to a greater extent than bar stock, because the forged shell is more homogeneous in its structure than the bar stock shell, and piping—a serious objection in the bar stock shell—is entirely eliminated. The shells used by the British, Russian, and German governments are made almost exclusively from forgings, whereas those used by the French and American are made both from forgings and bar stock. When the French shell is made from bar stock, an auxiliary base is screwed in to eliminate any danger of piping. Near the base of all shells is a groove in which a bronze or copper band is hydraulically shrunk. This is afterward machined to the desired shape and takes the rifling grooves in the gun so as to rotate the shell when it is being expelled. The body of the shell itself is slightly smaller than the bore in the gun, and the rifling band, of course, is larger and is compressed into the rifling grooves, thus rotating the projectile and keeping it in a straight line laterally during flight. The bursting charge, which in practically all cases is common black powder, is carried in the base of the shell and is usually enclosed in a tin cup. Located above this is the diaphragm which is used for carrying the lead bullets out of the shell when the bursting charge explodes and distributes them in a fan shape. In most shells, upon exploding, the nose blows out, stripping the threads that hold the members together. It will therefore be seen that, in the explosion, the entire fuse, fuse base, tube, diaphragm and bullets are all ejected, the shell itself acting as a secondary cannon in the air.

The range of a 3-inch shrapnel shell is about 6500 yards, and the muzzle velocity of the quick-firing field gun ranges from 1700 on the American to 1930 feet per second on the Russian. The duration of flight ranges from 21 to 25 seconds. When the bullets are blown out of the shell by the bursting charge, they are given an increased velocity of from 250 to 300 feet per second. The velocity of the shrapnel at 6500 yards is about 724 feet per second. The number of lead bullets carried in the 3-inch shrapnel shells ranges from 210 to 360. In all cases, the lead bullets are about ½ inch in diameter, weigh approximately 167 grains, and are kept from moving in the shell by resin or other smoke-producing matrix.

The matrix put in with the lead bullets, in addition to keeping them from rattling, is also used as a tracer. It is of importance in firing shrapnel that the position of the explosion be plainly seen. With large shells this is not difficult, but with shrapnel for field guns at long range certain conditions of the atmosphere make it difficult to see when the shell actually bursts. Various mixtures are used to overcome this difficulty. In some cases fine grained black powder is compressed in with the bullets in order to give the desired effect. In the German shrapnel a mixture of red amorphous phosphorus and fine grained powder which produces a dense white cloud of smoke is used, and in the Russian, a mixture of magnesium antimony sulphide is used.

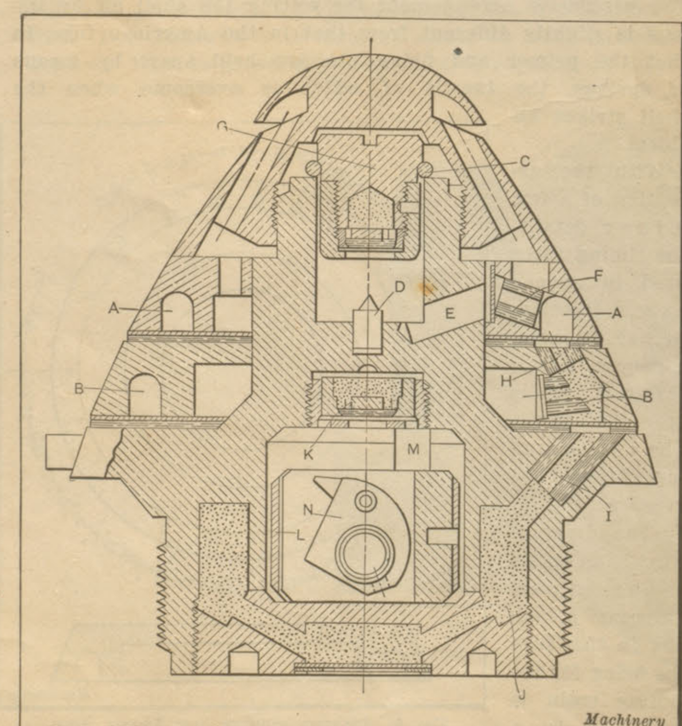


Fig. 3. American Type of Combination Timing and Percussion Fuse used on Shrapnel Shells

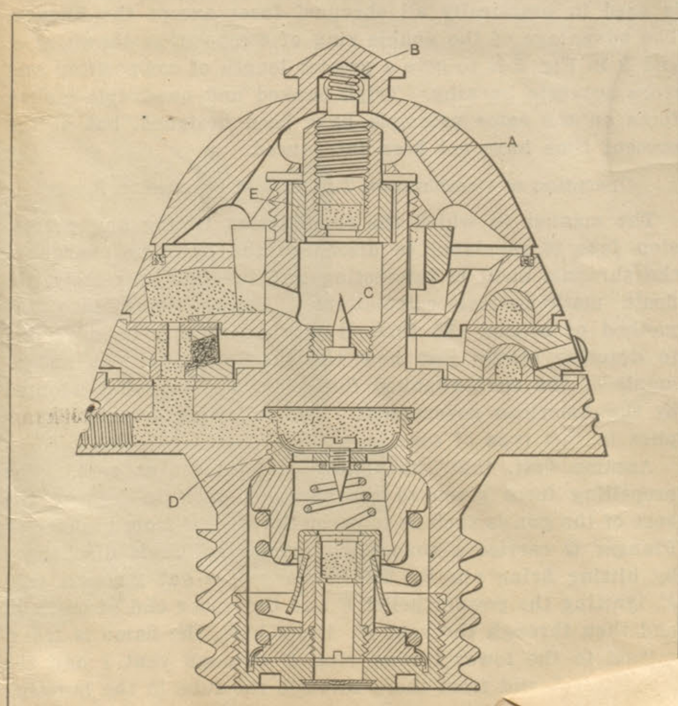


Fig. 4. Russian Type of Combination Timing a… used on Shrapnel Shells

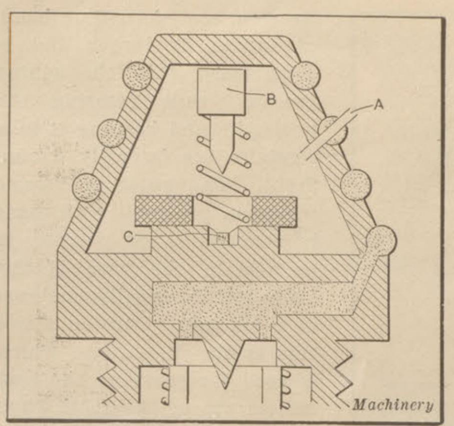


Fig. 5. French Type of Combination Timing and Percussion Fuse

Development of Timing and Percussion Fuses

The first fuses used in field ammunition were short iron or copper tubes filled with a slow-burning composition. These were screwed into a fuse hole provided in the shell, but there was no means for regulating the time of burning. Later—about the end of the seventeenth century—the fuse case was made of paper or wood so that by drilling a hole through into the composition the fuse could be made to burn for approximately the desired length of time before exploding the shell, or the fuse could be cut to the correct length to accomplish the same purpose.

For a considerable time all attempts to produce a percussion fuse were unsuccessful. Upon the discovery of fulminate of mercury in 1799, the chief requirement of a percussion fuse was obtained. About fifty years elapsed, however, before a satisfactory fuse was made. The first percussion fuse was known as the Pettman fuse, and comprised a roughened ball covered with detonating composition that was released upon the discharge of the gun. When the shell hit the desired object, the ball struck against the inner walls of the fuse, exploded the composition and powder charge, thus bursting the shell. There are at the present time three principal types of fuses in use: First, those depending on gas pressure in the gun setting the pellet of the fuse free—this is a base fuse; second, those relying on the shock of discharge or the rotation of the shell to set the pellet free—used in nose and base fuses; third, those depending on impact.

In shrapnel shells advantage is taken of two types of fuses, one of which is the combination timing and percussion fuse used on common shrapnel, and the other the combination timing and percussion fuse of the high-explosive type used on high-explosive shrapnel. These types of fuses are again sub-divided, but only in the manner of construction. The most common fuse is that known as the combination timing and percussion fuse of the double-banked type. This is used in practically all shrapnel fuses except the French. The advantage of the double ring of composition shown at *A* and *B* in Fig. 3 is to give a greater length of composition and more accurate burning. Triple-banked and quadruple-banked fuses on the same principle have been designed, but at the present time have not been introduced.

Operation of Combination Timing and Percussion Fuses

The manner in which the combination timing and percussion fuse is regulated to discharge the bursting charge in the shrapnel shell is interesting and involves extremely difficult mathematical calculations. Before going into the method of setting the fuse, it would probably be advisable to describe briefly just how the fuse operates. As an example of the double-banked fuse, Fig. 3 shows that adopted by the American government. The following description applies to this type of fuse.

Assume first, that the timing ring is set at zero. The propelling force given to the shrapnel shell in leaving the bore of the gun is such as to sever the wire *C* from plunger *G*. Plunger *G* carries a concussion primer which is discharged by hitting firing pin *D*. The flame passes out through vent *E*, igniting the powder pellet *F* and the upper end of train *A*, and then through the vent *H*. From here, the flame is transmitted to the lower timing ring *B* through vent *I* and the magazine *J*, and from there through the tube to the bursting charge in the base of the shrapnel shell.

Assume any other setting, say 12 seconds. The vent *H* is now changed in position with respect to vent *F* leading to the upper timing train, and the vent *I* leading to the powder magazine *J* is also changed. The flame, therefore, now passes through vent *E* and burns along the upper time train *A* in a counterclockwise direction until the vent *H* is reached. It then passes down to the beginning of the lower timing train and burns back in a clockwise direction to the position of vent *I*, from which it is transmitted by the pellet of compressed powder in this vent to the powder magazine *J*. It should be understood that the annular grooves in the lower face of each timing train do not form complete circles, a solid portion being left between the grooves in the ends of each. This solid portion is used to obtain a setting at which the fuse cannot be exploded and is known as the "safety point." As shown in Fig. 6, it is marked *S* on the adjustable timing ring.

The timing fuse shown in Fig. 3 is of the combination timing and percussion type, and if the wire *C* fails to release percussion plunger *G* in Fig. 3, the shell is exploded by means of a percussion fuse which comes into use when the shell strikes. The percussive mechanism consists of a primer *K* held in an inverted position in the center of the fuse body by a cup located beneath the percussive primer. Percussion plunger *L* works in a recess in the base of the fuse body and is kept at the bottom of the recess away from contact with the primer by a light spring in plunger *M*. The firing pin *N* is mounted on a fulcrumed pin, and is normally kept in the vertical position by means of two side spring plungers. When the shell strikes, the impact causes the plunger to snap up against the primer after compressing the spring in pin *M*. This causes the firing of the primer *K* and the explosive charge passes out through a hole in the percussion plunger chamber, not shown, to the magazine *J* and from there down to the powder in the base of the shell.

The Russian fuse shown in Fig. 4 differs only in a few minor details from the American fuse, the chief difference being in the arrangement of the percussive mechanisms. The percussive plunger for the timing arrangement is kept up from the firing pin by means of a spring bushing *E* surrounding the body of the plunger. This bushing is expanded by the plunger which is forced through it due to the force of the shrapnel in leaving the bore of the gun. The spring *B* in the head of the fuse assists the plunger in expanding bushing *E* and in dropping down onto the firing pin *C*. The flame from the exploded primer then travels down to the powder in the shell in practically the same way that it does in the American fuse, except that the magazine chamber is located at *D* and explodes through the impact fuse chamber. The percussive arrangement for setting the shell off by impact is slightly different from that in the American fuse, in that the primer and firing pin are held apart by means of springs, the inertia of which is overcome when the shell strikes an object.

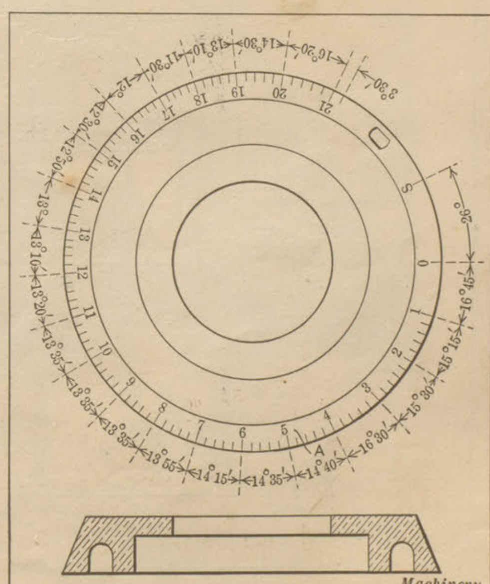


Fig. 6. Diagram showing how Timing Ring on the American Combination Timing and Percussion Fuse is laid out

With the exception of a few minor details, the timing fuses used in American, Russian, British, German, Japanese, etc., shrapnel shells are the same. The French timing fuse, however, as shown by the diagram Fig. 5, operates on an entirely different principle. In this fuse the firing for the timing train is contained in a sealed tube of

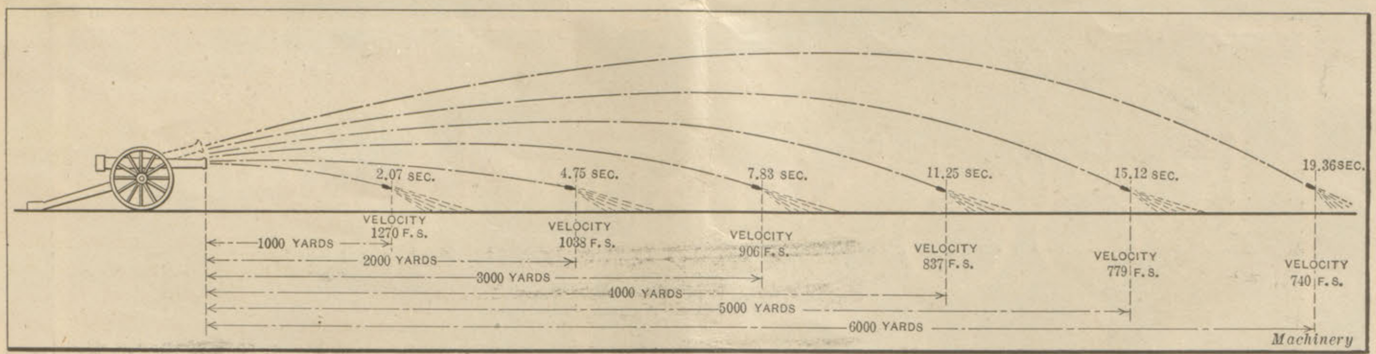


Fig. 7. Diagram illustrating Path of a Shrapnel and the Time of Explosion at Various Distances

pure tin and is wound spirally around the head of the fuse. Inside of the head is the ignition arrangement. To set the timing part of this fuse, it is placed in a fuse-setting machine attached to the field gun and by forcing down a handle on this device, a piercing point is thrust through the outer cap of the fuse, penetrating to the interior space of the head as shown at *A*. Upon the discharge of the shell from the gun, the gas pressure forces firing pin *B* back, hitting the percussive primer *C*. This causes a flame which passes out through the opening previously punched at *A* and ignites the "rope" powder fuse which is wound around the head of the fuse body. This type of fuse is also provided with a fuse which sets off the shell by impact should the timing fuse fail to work. The head of the fuse is covered with a cap with holes for the piercing point, and the whole cap can be shifted around for a short distance and set by the corrector scale marked on the body, as shown in Fig. 1. A projection on the cap engages a recess in the fuse-setting machine and provides for this movement, the machine previously being set to punch the hole.

Setting Combination Timing and Percussion Fuses

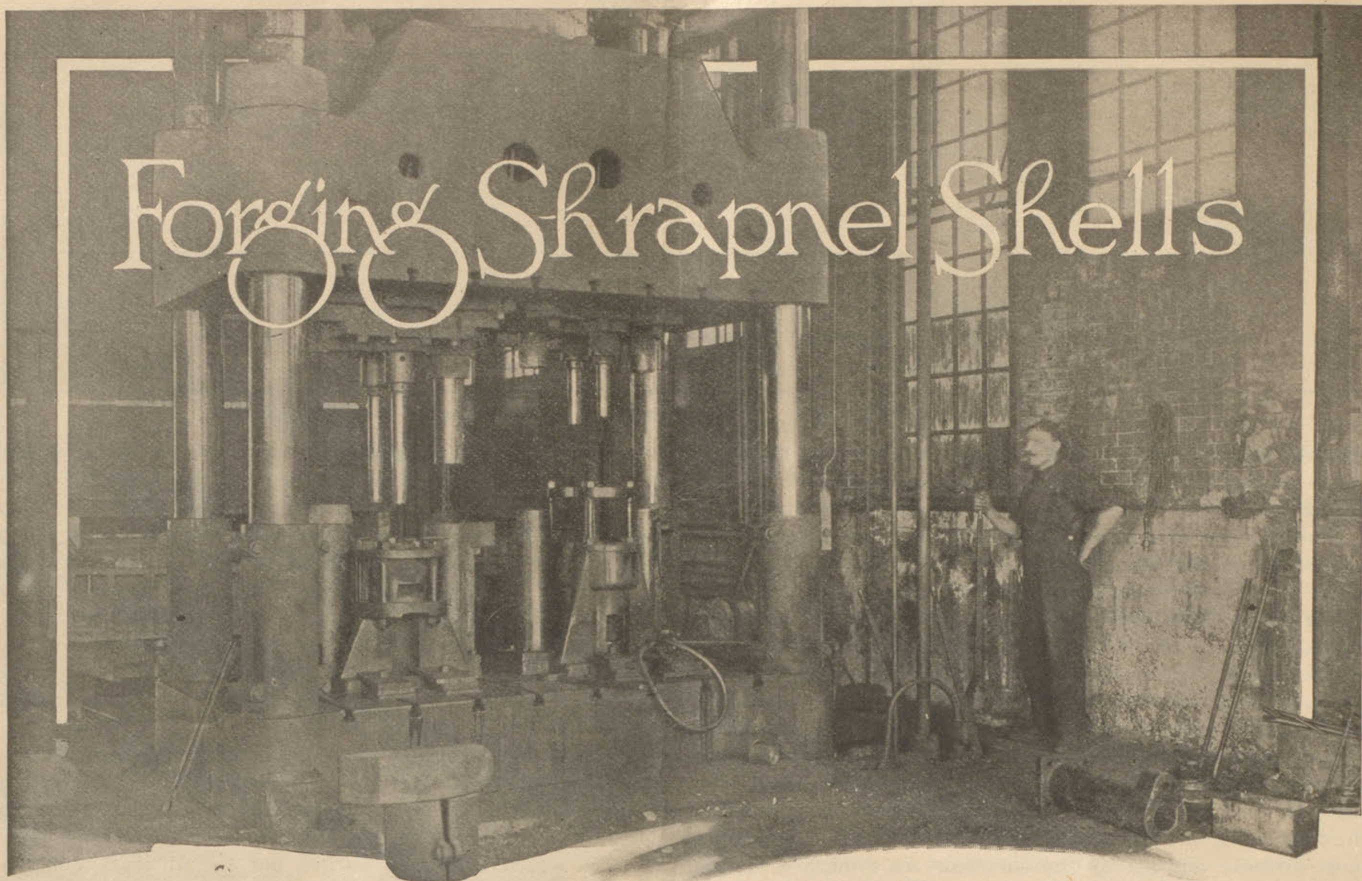
The accuracy with which a shrapnel can be exploded in the air at any desired point is remarkable, considering the number of variable quantities that enter into the construction of the timing fuse and powder train, etc. The calculations necessary for finding the correct setting on the timing ring involve the use of higher mathematics and are consequently not within the scope of this article. In the following, however, will be given a brief explanation of how a fuse is set to explode the shrapnel at a certain predetermined point.

Referring to Fig. 6, the timing ring used on the American fuse is shown. Here it will be seen that the ring is provided with twenty-one graduations corresponding to twenty-one seconds in the duration of flight of the projectile. It will also be noticed that the spacing of the graduations differs. For instance, *S* to zero, or safety to zero, occupies 26 degrees. This, as previously mentioned, is required so that the ungrooved surfaces of the timing rings can be swung around far enough to bring them in line with the vents for firing. From zero to 1 is greater than from 1 to 2. The reason for this is also in the relation of the vents. From 3 to 4 will be seen another variation. This takes into consideration the positions of the lower timing train and the trajectory of the flying missile. From 6 seconds around to 18 is practically a constant drop, taking into consideration the decrease of velocity, and from 18 on, the graduations begin to increase for two reasons: the decrease in the velocity of the missile and the action of gravity.

Diagram Fig. 7 shows in an interesting manner just how a shrapnel is fired. The range is approximately obtained by panoramic sights or other means, and a test shell fired, the point of explosion noted and the necessary corrections made. A table which has been worked out for different distances is then used. In Fig. 7 the diagram shown pertains to the American quick-firing field gun having a muzzle velocity of 1700 feet per second and the American shrapnel of 3-inch size. It will be noted that at 3000 yards the terminal velocity of the shrapnel is 1038 feet per second and the time of flight for the projectile 4.75 seconds. In other words, the timing train to explode the shrapnel at this point would be set at *A* in Fig. 6. The range of a 3-inch American shrapnel is 6500 yards and at this point the terminal velocity is approximately 724 feet per second, the time of flight 21.92 seconds. The shrapnel, when exploded, shoots out the bullets at an increased velocity of from 250 to 300 feet per second, covering an area of about 250 by 30 yards, half the bullets falling on the first 50 yards of the beaten zone.

In manufacturing shrapnel shells, a test shell is taken from every 120 and is actually fired out of a quick-firing gun into a bank of sand. If the contour of the shell in the neighborhood of the powder pocket is expanded during this test, the shell is discarded because of the liability of tearing out the rifling grooves in the gun. The examples shown below have been tested in this manner, but hit a rock instead of the sand bank.

Forging Shrapnel Shells



WITHIN the last few months, many methods have been suggested for making shrapnel forgings, but a comparatively small number have been put into use. Practically speaking, no two governments have adopted the same method. The Russian government uses double-acting horizontal hydraulic forging presses in which two operations are performed at the same time on different forgings. For instance, while the punch in one end of the machine is piercing a heated billet, the ram on the return stroke performs the hot drawing operation on another shell located at the opposite end of the machine. In this way a shell is completed at each cycle of the machine—forward and return stroke. The French government, up to a short time ago, used steam hammers for this purpose, and produced shrapnel forgings in practically the same manner as a drop-forging is made, the punch being carried in the ram of the press and the die held on the bed. This is rather a slow process and requires more than one heating to complete the forging. The German government uses a horizontal hydraulic forging press for piercing the billet and a steam driven machine for drawing the forging, which receives its motion from a rack and pinion. This method has the advantage over the hydraulic press of being more economical in the consumption of power.

The practice followed by different concerns in this country and Canada, at the present time, differs to a large extent. Some manufacturers are using a method that dates back as far as 1890, as will be described later. Others are using a more improved method developed about 1895, whereas about three concerns are using a still more improved method developed in the last three months. These methods will be described, as well as other processes using various machines.

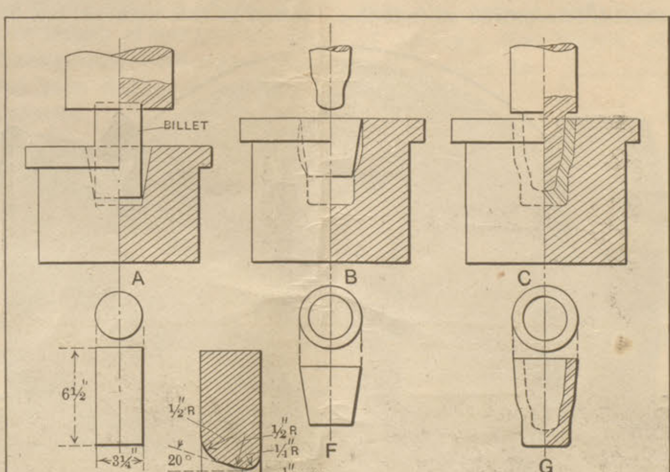


Fig. 8. Diagram showing Caley Process of making Shrapnel Forgings in Hydraulic Forging Presses

Basic Method of Making Shrapnel Forgings

The first method (known as the Caley process) of making shrapnel forgings in this country had its inception about 1890 and was used almost exclusively until 1895. This comprised a slug-forming and billet piercing operation followed by a successive reduction and elongation of the forging through drawing dies. The order of these operations is shown diagrammatically in Fig. 8. The information given herewith pertains to the making of a forging for a 3-inch shrapnel shell. As shown at *D*, a billet of steel 3¼ inches in diameter and 6½ inches long was cut off from a bar with a cold saw, and formed into a cone shape under a vertical hydraulic press having a capacity of 100 tons. The billet was heated in a furnace to about 1900 degrees F., dropped into the impression in the die and forced into shape by a hydraulic plunger having a depression in the lower end which centered the blank. The result of this operation is shown at *F*.

The next step was to anneal the billet, after which it was pierced as shown at *C*, and at the same time slightly elongated. This operation was handled in a hydraulic press of the type shown in Fig. 9. On a 0.70 per cent carbon steel billet the pressure on the punch in the piercing operation was 20,000 pounds per square inch and the machine used was a vertical hydraulic forging press of the type referred to having a capacity of 100 tons. From the piercing operation the forging was taken direct without annealing to the horizontal hydraulic draw press, and as is shown at *H* was located on a punch and forced through a series of drawing dies which gradually reduced the shell to the correct diameter, 3⅛ inches, and drew it out to the required length, about 8¾ inches.

A point worthy of attention

is the preparation of the cone-shaped billet. The smallest end was made slightly smaller than the smallest reduction die in the series. The reason for this was that if any drawing were done on the end of the shell the front corner would be drawn over and deformed, increasing the amount of machining required. The drawing dies in this case were six in number, as shown at *H*, and were reduced on a sliding scale of the following proportional reductions. First, 0.100 inch; second, 0.080 inch; third, 0.060 inch; fourth, 0.040 inch; fifth, 0.030 inch; and sixth 0.020 inch. This gave dies of the following sizes, in inches, starting with the largest in the series: 3.355, 3.275, 3.215, 3.175, 3.145, and 3.125.

The shape given to the drawing edges of the dies is of prime importance. The mouth or entering side of the hole was beveled to an angle of 20 degrees leading to a liberal curve which terminated in a land 1/16 inch wide. The shape was finished off with a ¼-inch radius. These dies were made from chilled cast iron and were held in position as shown at *H*, being slipped into a pocket in the frame of the machine, as shown at *I*. The punches for the coning, piercing and hot-drawing operations were made from special hot punching steel. The first drawing die in the series lasted the longest because the metal was hotter at this point than when it was drawn completely through the dies. As a rule, the last drawing die turned out 100 shells before being worn or scored. Then it was reground to a larger size and used again. The drawing punch was lubricated occasionally with graphite. After drawing, the forging is annealed to obtain the proper physical qualities. This method of making forgings for a 3-inch shrapnel shell is capable of producing 400 in ten hours.

Improved Method of Making Shrapnel Forgings

About 1895 the following method, known as the Holinger process of making shrapnel forgings, was devised. Instead of making the billet conical in shape before piercing, this preliminary operation was dispensed with, and to facilitate the work, as well as to reduce the friction of the flowing metal, the arrangement of the piercing punch and die was changed. This process is shown in Fig. 10, and was accomplished in a hydraulic press provided with two cylinders, one located at the bottom and the other at the top of the press.

The operation was as follows: The die *a* was held in a movable frame *b* and the piston *c* acted first. The first position after the billet was dropped into the die is shown at *B*. Here the die *a* and punch *d* remained stationary while the piston *c* descended, pushing the billet through the die and over the punch. When the piston reached the end of its stroke, as shown at *C*, the lower cylinder began to act and the frame carrying the die was raised. This frame, as shown at *D*, carried a stripper plate *e* which removed the pierced billet from the punch and located it so that it could be picked off with a pair of tongs. A subsequent operation of hot-drawing as shown at *E* was required, which is similar to that described in the first method. The method just described was used chiefly for 6- and 8-inch shrapnel and projectile forgings, and at the present time is still used for 3- and 6-inch shell forgings. It requires much less power and turns out a better and more concentric forging than the method previously described. The production on 8-inch shells is about 180 in ten hours, and 250 on the 3-inch shell.

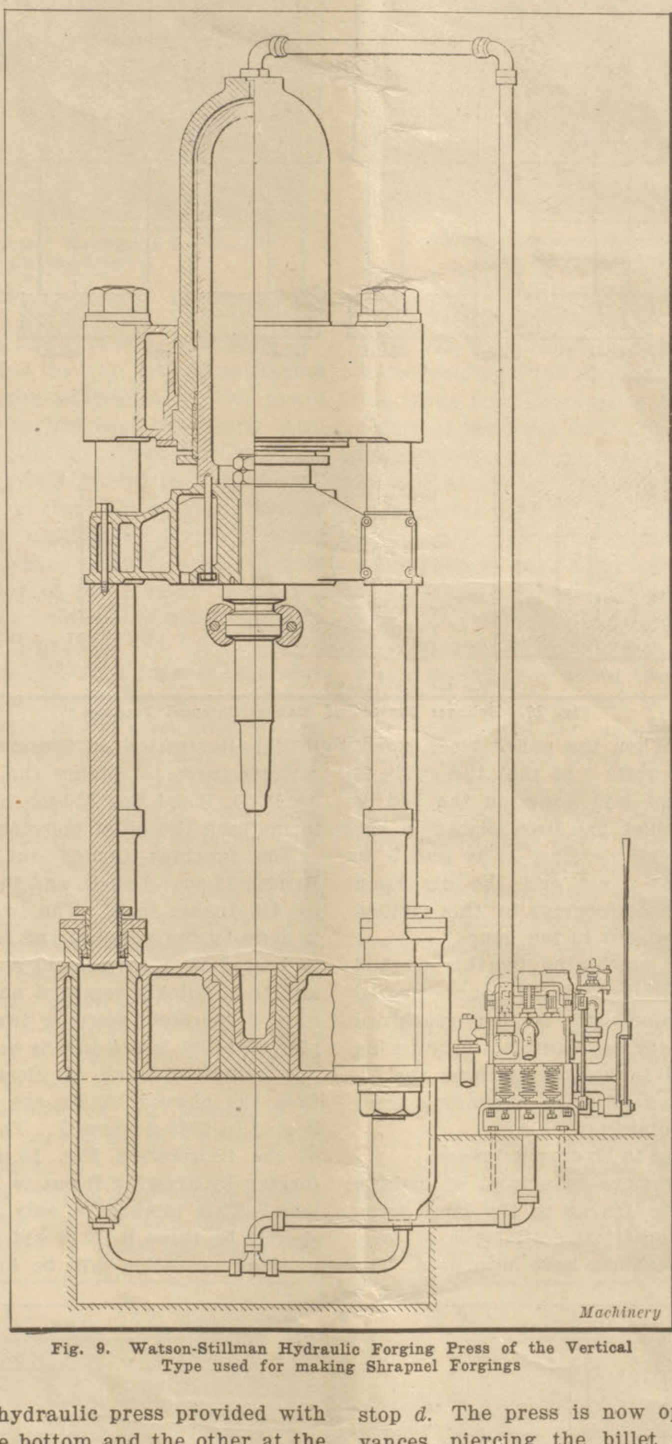


Fig. 9. Watson-Stillman Hydraulic Forging Press of the Vertical Type used for making Shrapnel Forgings

One of the Later Methods of Forging Shrapnel Shells

The increased demand for shrapnel within the last few months has been instrumental in bringing about a radical improvement in the production of forged shells. Previously, the aim was to get the internal diameter as close as possible to the finished size and to do comparatively little machining on it; in fact, this is still, in a great number of cases, one of the requirements. While at first glance this would appear to be the logical way of handling the work, on further investigation it is found that the forging of the shell to the comparatively correct size is much more expensive than to leave sufficient metal to machine all over. In the first place, a hydraulic machine of 100 tons capacity costs considerably more in initial outlay than a turret lathe, and in the second place it is more expensive to operate. The cheapest method of making a shrapnel forging is to rough-forge it to approximately the correct shape and then finish to exact shape and diameter in turret lathes or semi-automatic chucking machines. This simplifies the forging process and also decreases the production costs.

One of the later methods of making shrapnel forgings is shown diagrammatically in Fig. 11. A billet of steel 6½ inches long by 3 5/16 inches diameter is heated to a temperature of from 1900 to 2100 degrees F., and then dropped into the impression in the die *a* held in a special cast-steel die-holder *b*. To do this, die *a* is drawn out from beneath the punch, punch guide *c* removed and the billet dropped in. Then the guide is replaced and the die-holder slid in until it contacts with the stop *d*. The press is now operated, and as shown at *B*, advances, piercing the billet and making the metal flow up around the walls of the punch.

The punch now retreats, carrying the centralizing guide *c* with it. The die-holder is now drawn out from under the punch onto a bracket projecting from the bed of the press. The high-carbon steel, hardened block *e* then drops out of the die, as is also the case with the finished forging. This block *e*, of course, is heated up to a considerable extent due to the hot metal resting on it so that several blocks of this kind are provided. In the illustration, as shown at *C*, centralizing guide *c* is shown attached to the punch. In actu-

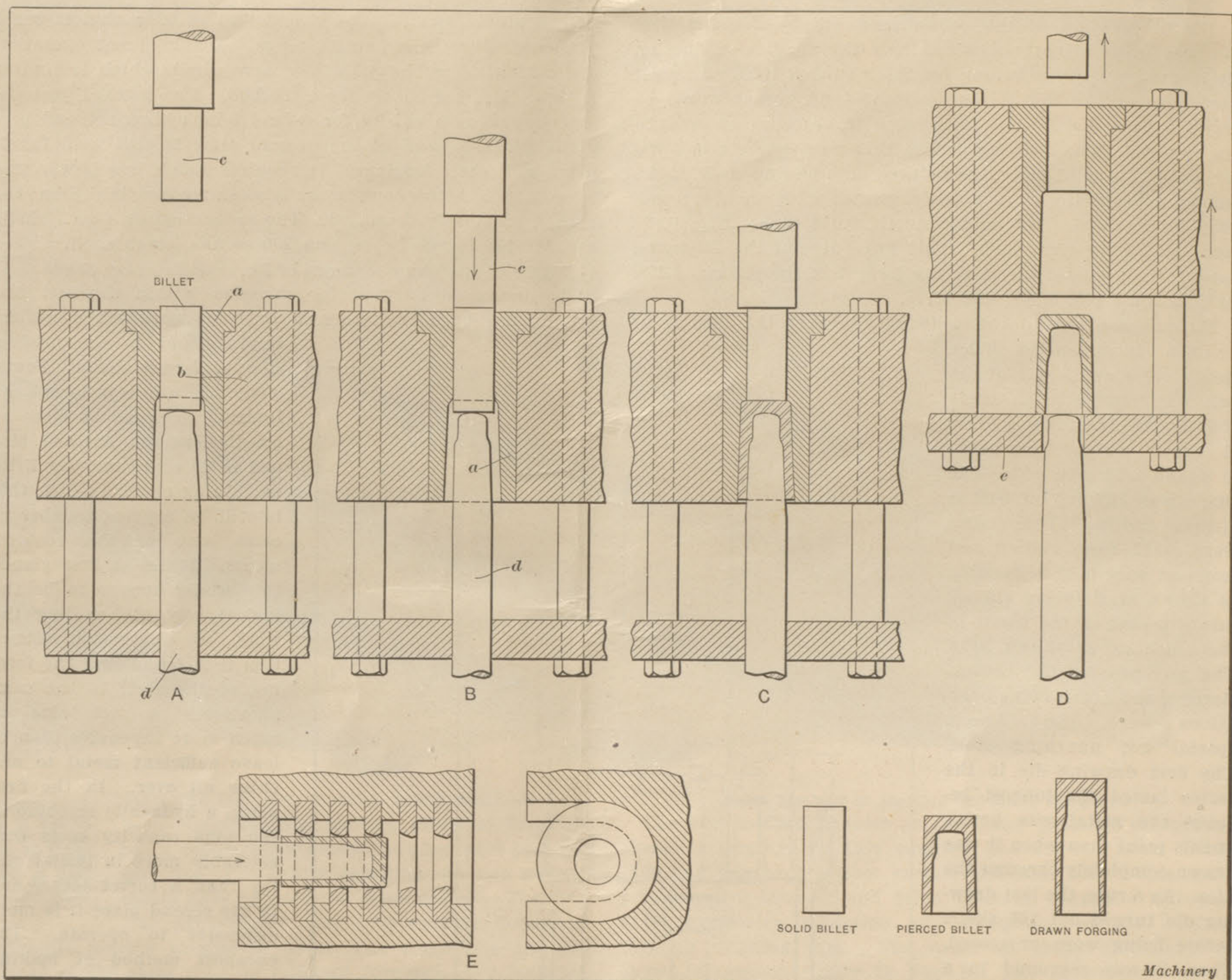


Fig. 10. Holinger Process of making Shrapnel Forgings

operation this is not the case. When the punch rises, guide *c* is stripped from it by stripper plate *f* so that the guide is gripped with a pair of tongs and laid down on the bed of the press until a fresh heated billet has been placed in the die impression ready for the next piercing. The punch is made from special hot punching steel and the die from chilled cast iron. The production of forgings by this method for a 3-inch shrapnel shell is about 600 in ten hours.

The amount of metal left for machining by this method varies from 1/8 to 3/16 inch on the internal and external diameters. The forging after annealing is then machined inside and out on turret lathes, or semi-automatic chucking machines. The accepted method is to first machine the internal diameter and then hold the shell on an expanding arbor and machine it on the external diameter.

Producing Shrapnel Forgings in Hydraulic Presses

In the foregoing description various principles of making shrapnel forgings were described. Owing to the large number of forgings lately required, practically all types of forging presses and power forging machines have been used. The initial illustration on forging shrapnel shells shows how one manufacturer is solving the problem. The machine used is an R. D. Wood Co., 750-ton hydraulic forging press; this performs both the billet piercing and drawing operations.

The forgings turned out on this machine are for the British 18-pound shell, and the billet is 3½ inches in diameter by 4½ inches long. The first operation, piercing the billet, is done by the punches and dies shown in Fig. 12. The billet is heated in a furnace to a temperature of 2000 degrees F., and then quickly removed and placed in the dies. The press is now operated, piercing two billets at the same time. The pierced billet is 3½ inches diameter by 7½ inches long.

A complete batch of pierced billets is first put through, then the pierced billets are taken to the furnace again and heated to 2000 degrees F. The punches and dies in the center of the illustration Fig. 13 are used for finish-drawing the forging by drawing it out to 3½ inches diameter by 11 inches long. This method is only temporary and will be replaced shortly by three R. D. Wood four-post hydraulic presses. The piercing operation will be handled on one press of 350 tons

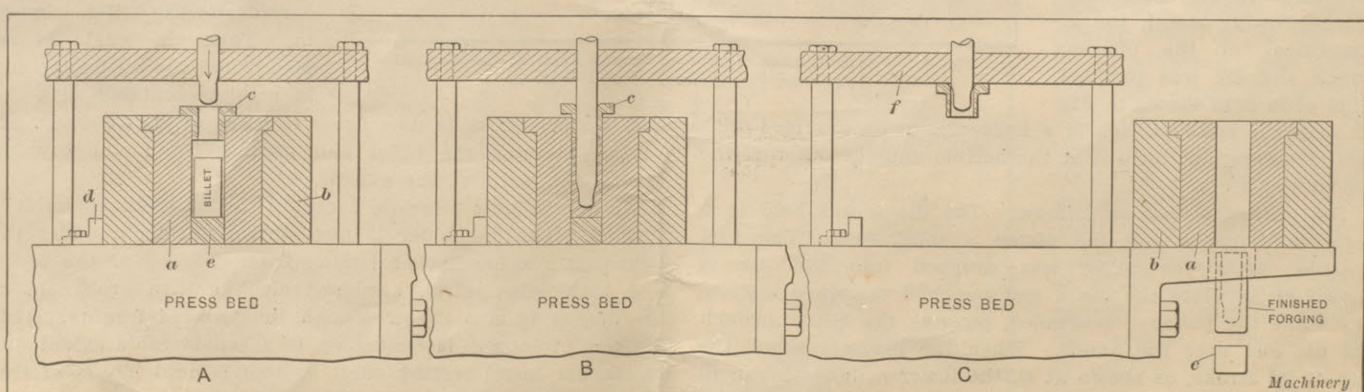


Fig. 11. Improved Method of making Shrapnel Forgings in One Heat and One Operation

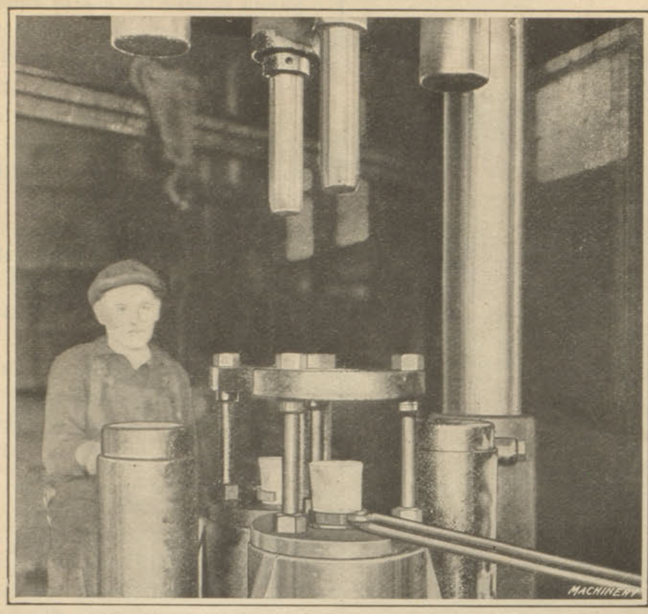


Fig. 12. Piercing Billets for Shrapnel Forgings in a "Wood" 750-ton Hydraulic Forging Press

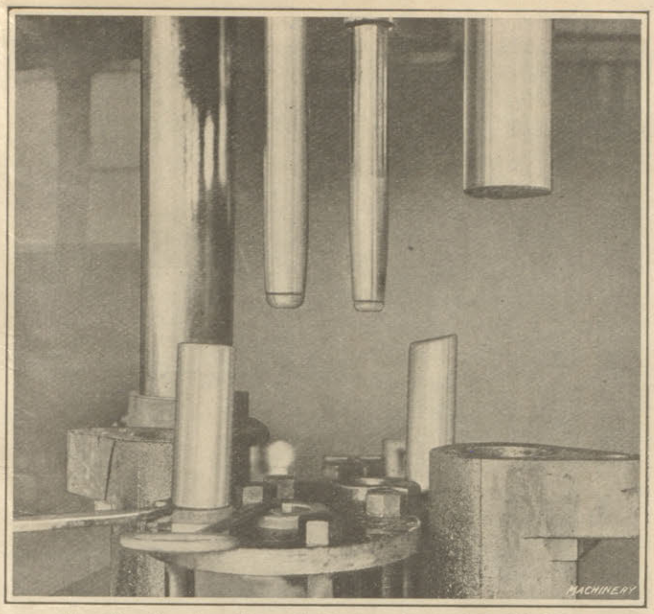


Fig. 13. Drawing Shrapnel Forgings in a "Wood" 750-ton Hydraulic Forging Press

capacity, and the drawing operations on two presses of 200 tons capacity.

Making Shrapnel Forgings in Power Forging Machines

One of the latest developments in the art of producing forgings for shrapnel shells is the adaptation of the power forging machine to this work. As has been previously mentioned, there are several methods of producing shrapnel shells, and as it has been conclusively proved that the forged shell is superior to the shell made from bar stock, it is only natural that several methods for making the forgings would be developed. In the forging machine method, a bar slightly larger than the finished diameter of the forging is cut off, making a billet about 5½ inches long. This billet, for a 3-inch shell, weighs about 9¼ to 9½ pounds.

The billet is heated to a white heat in a furnace, the temperature being about 2000 degrees F., depending on the carbon content and other constituents in the steel, and is then placed in the lower impression of the forging die. The machine used for this size of forging is a standard upsetting and forging machine provided with a special crankshaft. Upon being operated, the lower plunger, which is larger than the diameter of the powder pocket in the shell, advances and pierces the billet. The pierced billet is then raised to the next impression, and the machine again operated. The second punch is longer than the first and smaller in diameter. The billet is forced up on this punch, which reduces it in diameter and increases its length. After the second impression the partially formed shell is then placed in the third or final die impression, where it is given two blows, being given one-half turn after the first blow to form it more perfectly. The operations just enumerated are performed in one heating of the billet, and the production of a 3-inch shell ranges from 400 to 450 in ten hours.

The dies for this work are, of course, constructed upon a somewhat different principle from the ordinary forging die, because in this case it is necessary to make the metal flow up on the punches. The dies, therefore, are so constructed that they recede as the punch advances, which tends to make the metal flow up on the punch. The practicability of this method is well illustrated by the samples shown in Fig. 14. Here *D* is the rough forging just as it comes from the machine, with the exception that the mouth has been trimmed. *C* is a section of a shell made from low-carbon steel about 0.30 per cent carbon; *B* is a shell made from 0.50 per cent carbon, 3½ per cent nickel steel. This has been rough-turned, as the illustration shows. The homogeneity of the forgings is clearly indicated. *A* is a forging made from low-carbon steel, finish-turned.

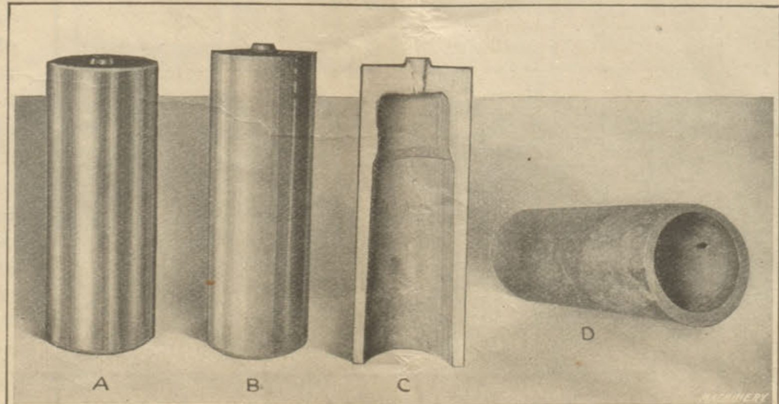


Fig. 14. Examples of Shrapnel Forgings turned out on a Power Forging Machine

One of the most interesting points about this method is its cost as compared with shells made from bar stock. To produce a 3-inch shell from bar stock requires about 22 pounds of material, and on metal costing 10 cents per pound, a bar shell—exclusive of machining—costs $2.20; to produce the same shell on a power forging machine requires about 9¼ to 9½ pounds, and figuring on 10 cents per pound the cost for the material is only $1—a saving of $1.20 on each shell. Furthermore, the production of shells from bar stock on automatic machines is about twelve to fifteen per day. The number of forgings that can be turned out in the same time is 400 to 450, and the number that can be machined in this time varies from forty to fifty for two operations. It is therefore evident that the production of shells by forging is far superior to the bar method, and the forged shell is more satisfactory from every standpoint.

Forging Shrapnel in a Power Press

Another interesting development in the forging line is shown diagrammatically in Fig. 15. This method comprises three operations, and is handled in a No. 80½ Bliss press capable of exerting a pressure of 1200 tons. A billet 3¼ inches in diameter by 3¾ inches long is heated in a furnace to 1976 degrees F. and then quickly placed in the die shown at *A*. The press is operated, and the punch in descending pierces the billet, being guided by the guide *a*, as shown at *B*, which also acts as a stripper. The forging retains its heat to a certain extent after this operation, the temperature being about 1380 to 1425 degrees F. This is sufficient to perform the second minor operation which, as shown at *C* and *D*, consists in forcing the heated billet into the die-block to reduce the diameter of the lower end and facilitate the succeeding operation. This reducing operation is performed with the same type of punch as is used in the succeeding operation, and the die-block is simply laid on top of a bolster while the reducing is being done.

The final forming or drawing of the forging is accomplished as shown at *E* and *F*, the same type of press, *viz.*, a Bliss No. 80½ power press, being used for this purpose.

The pierced billet is now heated to 1976 degrees F., and is then forced through the three drawing dies *b*, *c* and *d*, by the punch *e*. The first die is 3 5/16 inches diameter and reduces the forging from 3⅜ inches to this size. The second is 3 7/32, and the third or last, 3⅛ inches diameter. The forging, after being forced through the dies, is stripped from the punch by plates *f*, and as it still retains a temperature of 1475 degrees F.—sufficient for annealing—is thrown down on the sand to cool off. The billet piercing and drawing dies, shown in the illustration, were made from 50-point carbon steel, hardened. This gave fair results, although chilled cast-iron dies would prove even more satisfactory. The punches were made from several different materials such as chrome-vanadium, 70-point carbon steel and unannealed malleable casting. Of the three materials, the last gave the most satisfactory results, in that pitting was reduced to a minimum. Of course the malleable casting required to be ground to shape.

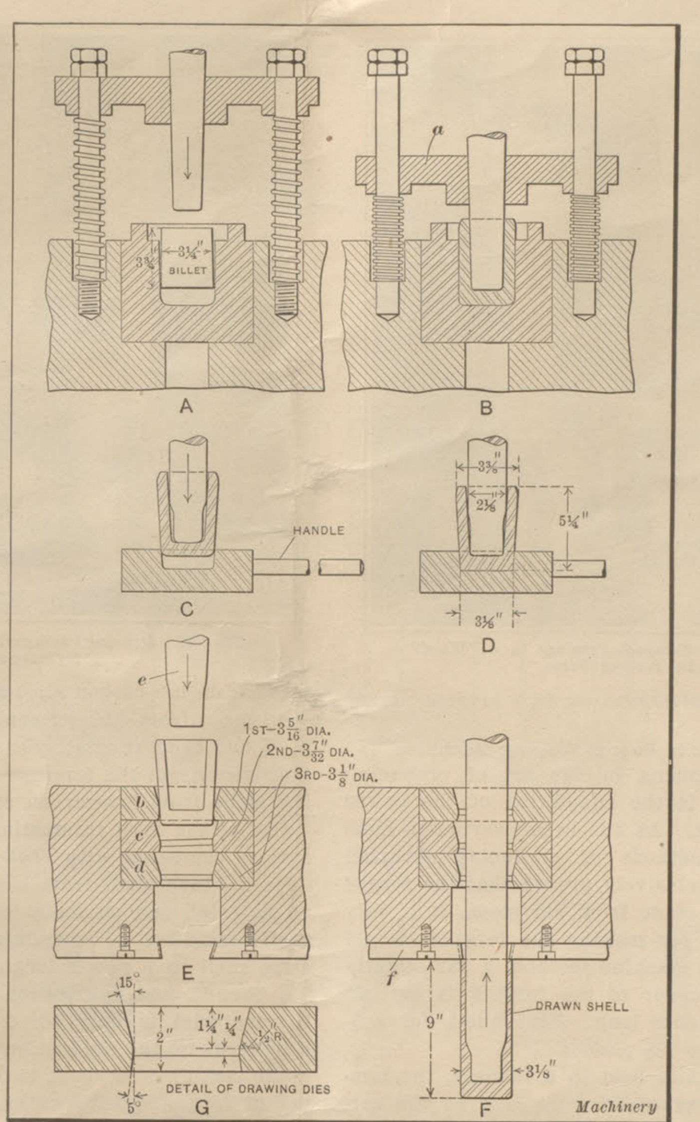


Fig. 15. Diagram illustrating Method of piercing and drawing Shrapnel Forgings in a Bliss Power Press

Flow of Hot Metal when being Pierced

In the manufacture of shrapnel shell forgings, the first operation is that of piercing, and to accomplish this satisfactorily, it is necessary to understand the action of a piercing punch on a semi-plastic billet of steel. There are certain fundamental laws governing the flow of metals under pressure and a study of these is of exceptional interest. An attempt has been made in Fig. 16 to illustrate diagrammatically some of the principles involved, and in the following discussion it should be understood that the billet is made from 50-point carbon, 70-point manganese steel, 6½ by 3 5/16 inches in diameter.

At *A* a round-end tapered punch is shown in contact with the heated billet, and the lines show the possible flow of the metal, *i.e.*, the material commences to "pack" at the end of the punch. In this case the walls of the die are straight. At *B* the billet is being pierced, and the resultant effect on the flow of the metal is indicated. Here it will be seen that the pressure increases as the punch descends, because of the wedging action on the metal and the friction between the surfaces of the sides of the punch and die. The pressure on the end of a punch of this shape is about 20,000 pounds per square inch.

By leaving the sides of the die of the same shape as at *B*, but making the end of the punch square instead of round and not tapered, different action is caused. When the flat punch, as shown at *C*, first contacts with the metal, the pressure required is greater than at *A*, but as soon as the metal commences to flow as at *D*, the pressure decreases. For instance, suppose the pressure required at *B* to pierce the billet was 100 tons; on the same material at *D* the required pressure would be only 70 tons—a decrease of 30 per cent. The metal, however, does not follow the sides of the punch as closely at *D* as at *B*, and this accounts in part for the reduction of power required. The action of hot flowing metal on the face of a square punch is just the reverse of what would naturally be expected. Instead of the punch wearing away at the edge, the center first shows signs of wear as indicated at *e*. Seams are opened up in a radial direction caused by the hot metal attacking the softest parts in the face of the punch.

Again, a different condition exists to that shown at *B* and *D*, when both the die and the punch are tapered as shown at *E*. Here the friction of the extruded metal on the walls of the die and sides of the punch is excessive, and it is practically impossible to produce a satisfactorily pierced billet in this manner. From a theoretical standpoint, the conditions shown at *F* are ideal. Here the sides of the punch are straight, the end flat, and the walls of the die taper or increase in diameter toward the bottom. In this case the friction of the flowing metal is greatly reduced because of the lessening of the wedging action. Other considerations, however, make this method impracticable.

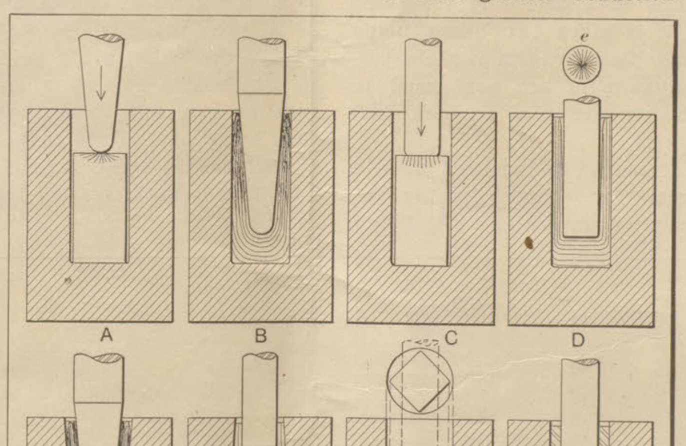


Fig. 16. Diagram illustrating Flow of Hot Metal while being pierced

A still greater reduction in the pressure necessary to pierce a billet is shown at *G*. Here a square billet instead of a round one is being pierced. In the plan view it will be noticed that the friction on the walls of the die is greatly reduced, and the pressure continues low until the extruded billet contacts all around with the surface of the die. The completed product, however, is inferior to that made from a round billet. From the previous remarks, it will be seen that a punch and die that would best meet the requirements is one having a rounded end as at *B*, straight sides as at *D* and straight walls in the die. The most satisfactory punch and die for piercing shrapnel forgings when all the variable conditions are considered would be as shown at *H*.

SHRAPNEL shells are manufactured either from bar stock or forgings. The bar stock method, however, is not considered as satisfactory as forging because of piping, so that the greater number of shrapnel shells made at the present time are turned out from forgings. The first step, therefore, in the making of a shrapnel is to cut off a billet of the required length from a bar of steel of the necessary constituents. In the making of an 18-pound shrapnel shell, the billet is cut off from a bar of 46-point carbon, 70-point manganese steel in machines of different types. One way of doing this, as shown in Fig. 17, is to use a Newton cutting-off machine having an air clamp for holding the bar in place while it is being cut off. A Hunter duplex saw, as shown in the illustration, provided with high-speed steel inserted teeth, performs the cutting operation. The billet for an 18-pound shrapnel is 3½ inches diameter by 4½ inches long. It is then forged to shape, as has been previously explained.

Assuming now that the forging has been completed, the following is a complete summary of the machining operations on the shell up to the point of assembling. In one plant where this work is being done, the shrapnel shells are put through in lots of 120, forty to a box. Out of every 120, one shell after heat-treatment is tested for tensile strength. The tensile strength before heat-treatment must be 30,000 to 40,000 pounds per square inch, and 80,000 to 90,000 pounds per square inch after heat-treatment. For facilitating transportation, trucks of various designs are used. One type of truck used for this purpose is shown in Fig. 18. This is built by the Chapman Double Ball Bearing Co. of Canada, Ltd., Toronto, Ontario, and has some interesting features, the chief of which are the ball bearing swiveling head, ball bearing wheels, and the means of releasing or raising the load with the handle in any position. This latter feature is especially valuable in handling the truck in a crowded space.

Trimming and Facing the Shell Forging to Length

The first machining operation on the forged shell is to cut off the ragged end, which is generally from ½ to 1½ inch longer than that required for the finished shell. This operation is performed in many different ways, but one of the most common is to place it in a Hurlbut-Rogers cutting-off machine as shown in Fig. 19. For performing the cutting-off operation, two plain forged cutting-off tools made from

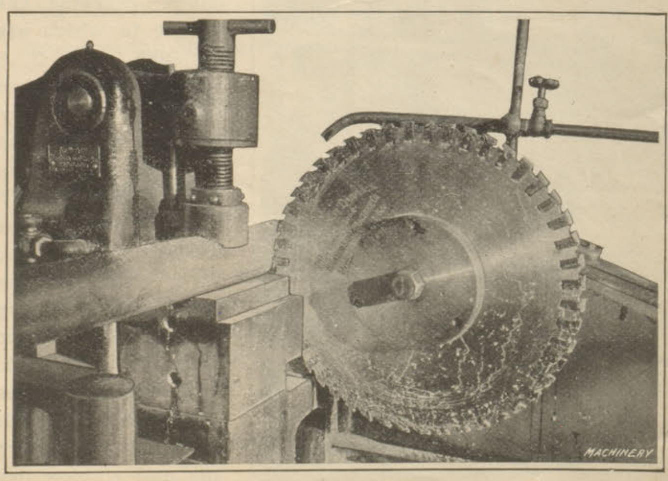


Fig. 17. Cutting off Billets for making Shrapnel Forgings in a Newton Cutting-off Machine

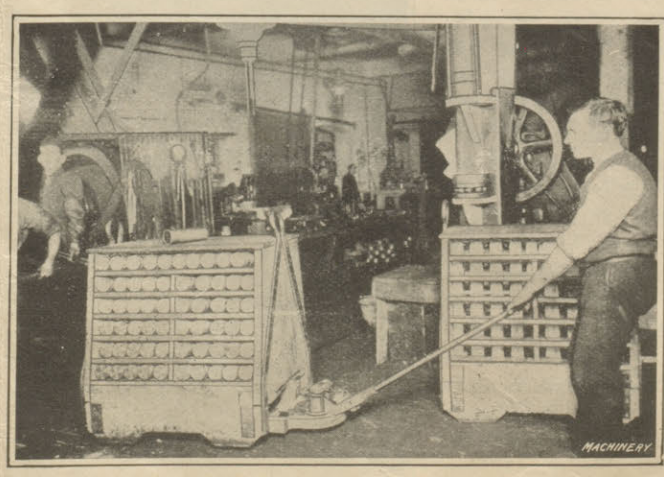


Fig. 18. Truck built by the Chapman Double Ball Bearing Co. for transferring Shrapnel Shells about the Shop

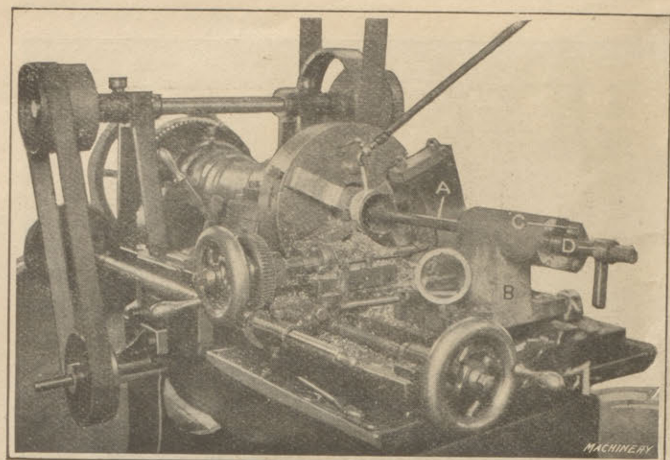


Fig. 19. Cutting off Excess Length of Shrapnel Forging in a Hurlbut-Rogers Cutting-off Machine

"Sabine" extra high-speed steel are used. The forging is located in the proper position in the chuck by a plunger or stop A, sliding in a fixture B clamped to the base of the machine. This plunger locates the shell from the bottom of the hole or powder pocket and forces the shell into the chuck

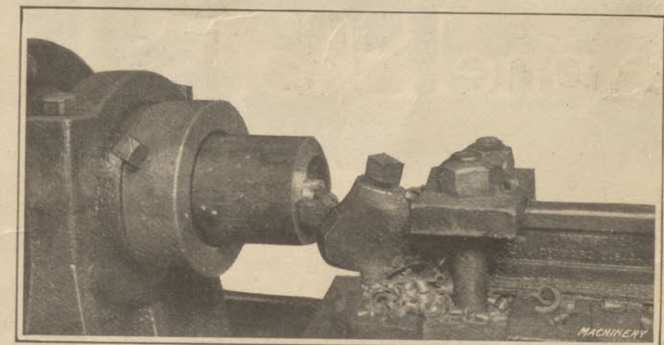


Fig. 20. Facing off Closed End of Shell to Length

against the resistance of an open-wound spring. The stop is then located by a gage C that forms a member of the fixture and fitting ring D on the stop. The chuck jaws are now clamped on the work and the cutting off commences. As soon as the excess stock is cut off, the stop is drawn back and the pressure of the jaws on the work released; the spring in the chuck then ejects the forging. The production of an 18-pound shell from one machine is about 140 in eight hours.

The next roughing operation is to face off the bottom or closed end of the forging, bringing the shell to approximately the correct length. There are also many ways of performing this operation. One method is to grip the forging in a chuck, as shown in Fig. 20, in an ordinary lathe and face off the end with a high-speed steel tool held in an Armstrong toolholder. From 1/4 to 3/8 inch is faced off the end.

Rough-turning Operations on Shrapnel Forging

Practically every type of engine lathe and turret lathe as well as special machines are used for turning and boring shrapnel forgings, and in the following each method will be dealt with separately. Before doing this, however, a complete summary of the methods of machining employed in a large Canadian plant turning out shrapnel will be described. In this plant, the first rough-turning

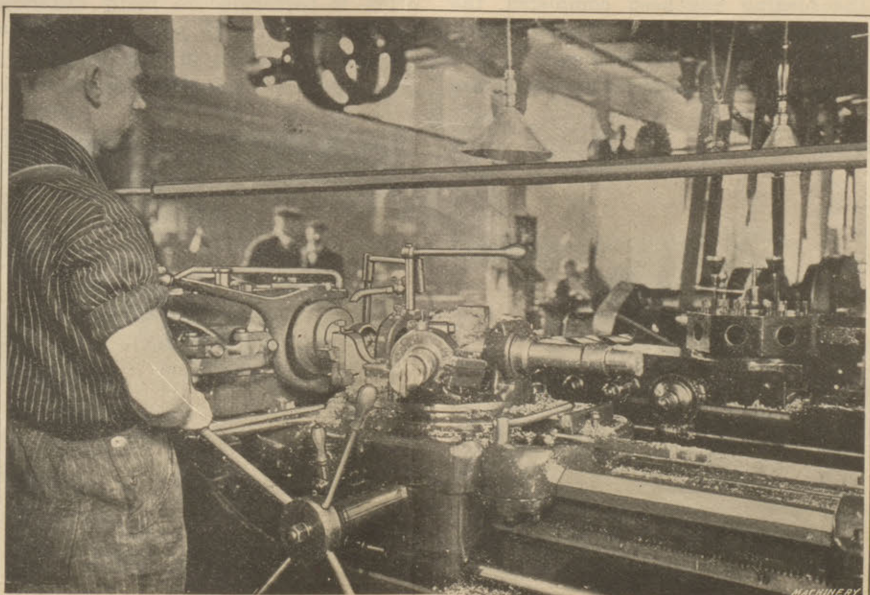


Fig. 23. Third Machining Operation on Shrapnel Shell in a Flat Turret Lathe

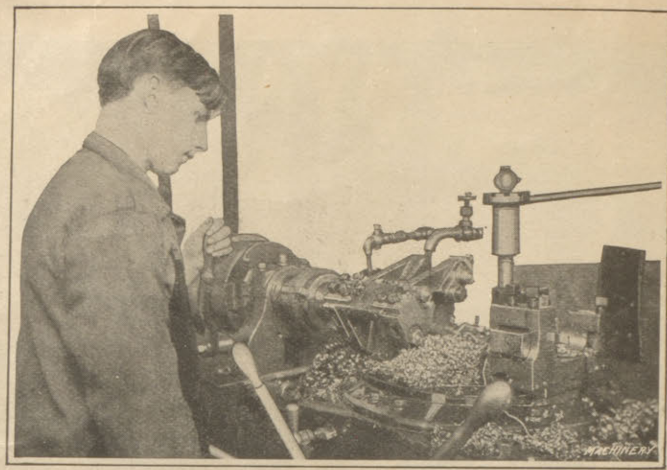


Fig. 21. First Rough-turning Operation on Shrapnel Shell in a Flat Turret Lathe

operation is handled on a flat turret lathe, as shown in Fig. 21. For this purpose, the shell forging is held on an expanding arbor and is driven by a dog fastened to it and driven by the faceplate of the lathe. A multiple tool turner is first brought into position and takes a cut of about 1/8 inch from the diameter for practically the entire length of the shell. The next tool then faces off the end of the shell to length.

The shell forging is now ready for cutting the rifling band groove and producing the waves. This is handled in an ordinary engine lathe equipped with a special fixture, carrying grooving, waving and under-cutting tools. The shell forging, as shown in Fig. 22, is held in a chuck at one end and supported by a revolving center at the other. One part of the

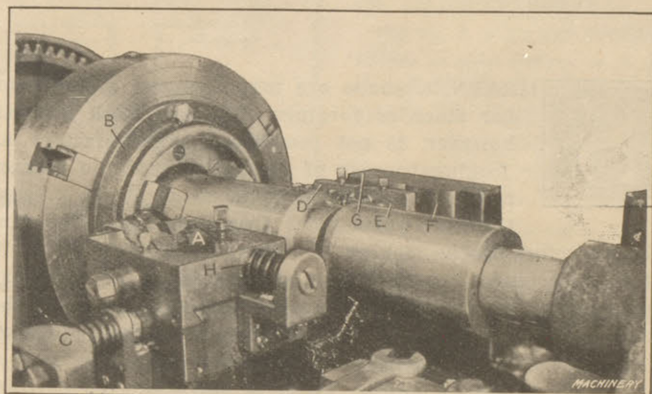


Fig. 22. Cutting the Rifling Band Groove with a Special Grooving and Ribbing Attachment on an Engine Lathe

fixture is clamped to the bed of the lathe and the other to the carriage. The grooving and ribbing is accomplished with a tool held in holder A at the front of the lathe, whereas the two under-cutting tools are held in holders D and E at the rear of the lathe. In operation, the carriage of the lathe is moved toward the chuck, carrying the fixture to which are fastened cams C, F and G. Cam C forces in the holder carrying the combination grooving and ribbing tool, whereas cams F and G force in the holders carrying the two under-cutting tools, these being presented at an angle to the work. The required oscillations to the slide carrying the grooving and ribbing tool are secured through a face cam *B* clamped to a "Whiton" chuck. This face cam operates against the tension of spring *H* and gives the required oscillations to the tool-slide carrying the ribbing and grooving tool, shown at *A*.

The third machining operation is accomplished in a flat turret lathe, as illustrated in Fig. 23. This consists in facing the open end of the shell, boring the powder pocket and facing and boring the diaphragm seat, and also turning the angular surface on the external nose of the shell. First, a roughing drill is brought in to rough out the powder pocket. The turret is then indexed and a tool for turning the angle of the nose is brought into position. The machining on the nose is then accomplished by operating the cross-sliding head. Then a roughing cutter is brought in to rough-bore the powder pocket. The turret is again indexed and a finishing tool is brought in to finish the powder pocket and face the diaphragm seat. This finishes the machining operations on the shell previous to heat-treatment.

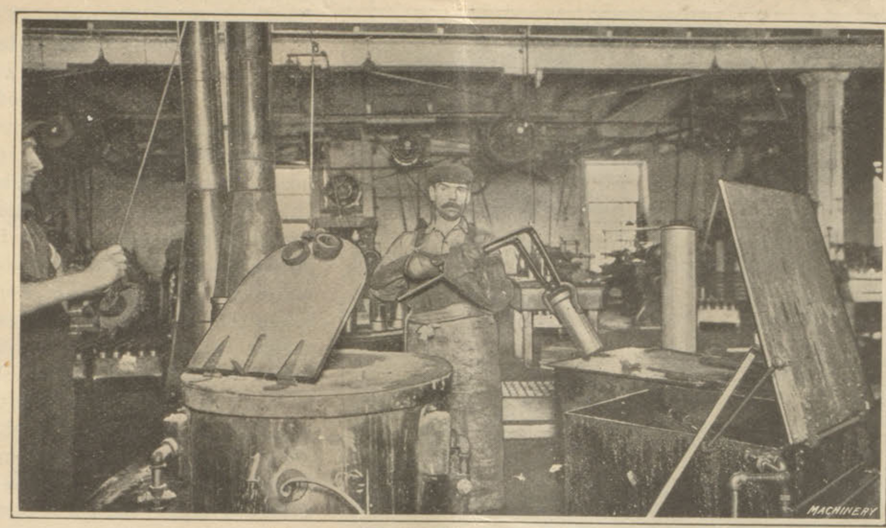


Fig. 24. Heat-treating Shrapnel Shells

Fig. 25. Testing Hardness of Shrapnel Shells with Shore Scleroscope

Heat-treating Shrapnel Shells

As was previously stated, the tensile strength of a forged shrapnel shell after heat-treatment must be 80,000 to 90,000 pounds per square inch, and in order to obtain the desired physical qualities, it is necessary that the heat-treating operations be properly conducted. Several methods of heat-treating employing different cooling solutions are used in the manufacturing plants making shrapnel shells. One method, as shown in Fig. 24, is to heat the shell in a Hoskins electric furnace that contains a barium-chloride bath, heated to a temperature of about 1480 degrees F. The shells are left in this furnace for a half hour and are taken out and dipped in a bath of cotton-seed oil heated to a temperature of 113 degrees F. The temperature to which the shell is heated varies with the different constituents of the steel and practically every different batch of 120 shells requires a slightly different temperature. The proper temperature is determined by cutting out a section of a heat-treated shell and testing it for tensile strength. The next step is to draw the temper on the open end of the shell for about three-quarters of its length. In this operation an oil bath, heated by a muffle gas furnace to a temperature of about 1000 degrees F., is used. The shell is allowed to remain in the bath until it reaches the heat of the bath.

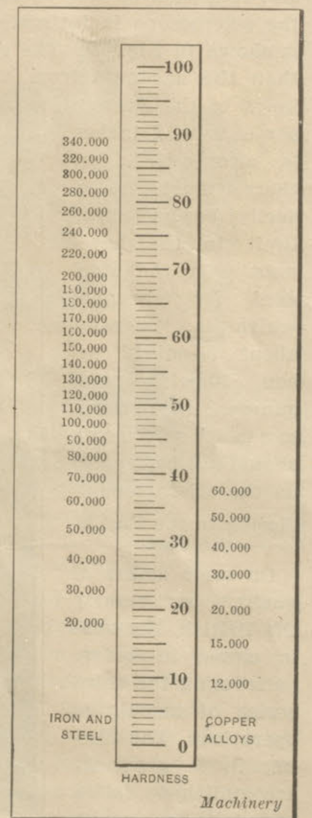


Fig. 26. Relation of Shore Scale to Elastic Limit of Iron, Steel and Copper Alloys

Testing for Hardness and Tensile Strength

One shell from a batch of 120 is now cut open in the proximity of the powder pocket and the cut-out section sent to the government inspectors to test it for tensile strength. Each one of the shells in the batch, in addition, is tested for hardness by a Shore scleroscope as shown in Fig. 25. Before testing for hardness, the shell near the band groove is polished so as to get a true reading, then placed in a fixture, and the hammer of the scleroscope allowed to drop on it. The reading should be between 40 and 50, indicating an elastic limit of 80,000 to 90,000 pounds per square inch. The shell must not be ruptured at the point tested when the charge in it is exploded or when the charge in the case is set off. Should the shell upset near the rifling band groove when it is being propelled out of the gun, it would tear out the rifling in the bore of the gun.

Fig. 27. Closing in Nose of Shrapnel Shell in Hydraulic Press

Experience with the scleroscope has disclosed the existence of a definite relation between the hardness and strength of metal. In determining the strength of metal, two stages are recognized: First, the elastic limit, yield point or load re-

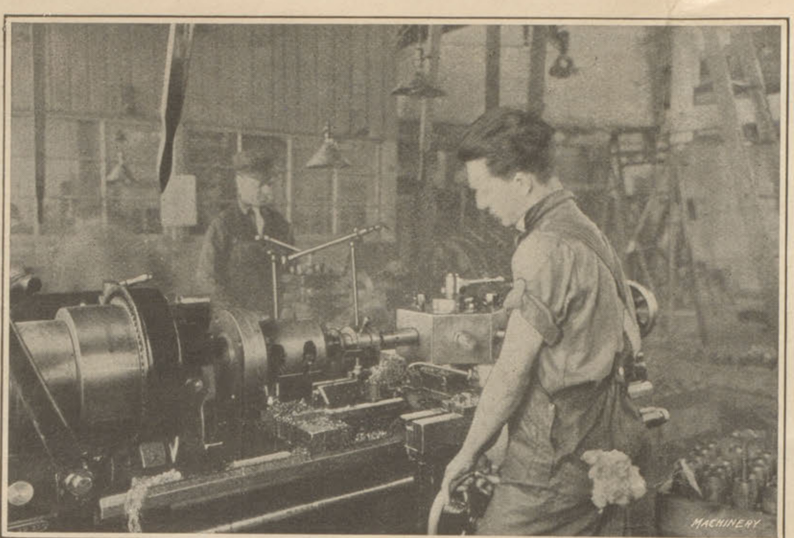


Fig. 28. Third Operation on Nose of Shrapnel Shell—turning, facing and threading

quired to start permanent set; second, the ultimate strength or load required to terminate permanent elongation and reduction of area in rupture. The hardness indicated by the scleroscope is intimately related to the elastic limit, as is shown in Fig. 26. The elastic limit increases more rapidly than the hardness from 43 to 45, this being the minimum index of the strength value required. As an elongation of 8 per cent in 2 inches is also called for, there must necessarily be an upper limit to the hardness. On the steel used for shrapnel which is generally about 50-point carbon, 70-point manganese, the maximum hardness should not be over 60 on the scleroscope.

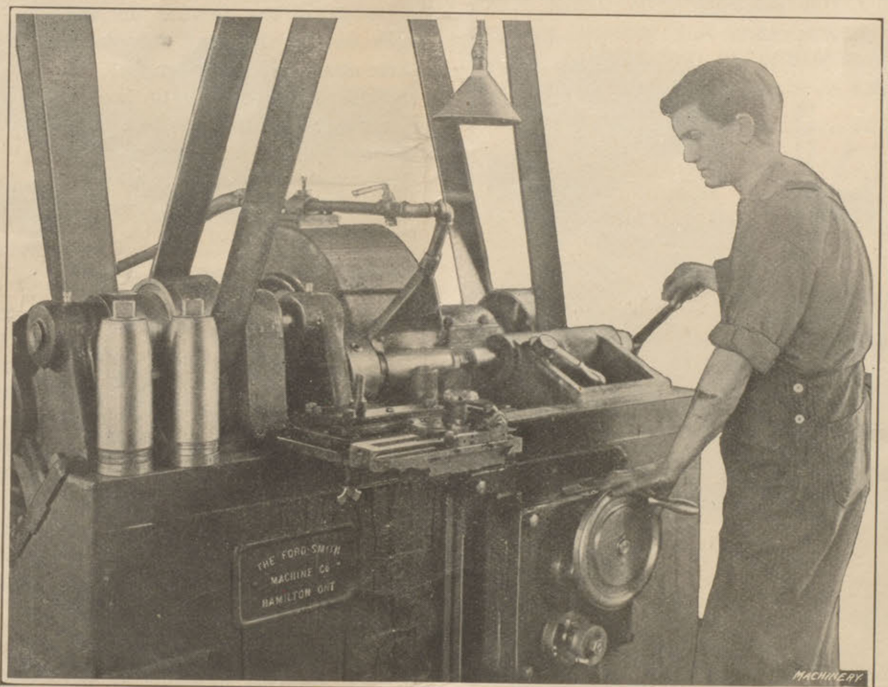


Fig. 29. Grinding Shrapnel Shells in One Operation in a Ford-Smith Grinding Machine

Closing in the End of the Shell

On some makes of shells, particularly the British, the nose is closed in before performing the third series of machining operations. The closing in is generally accomplished in a hydraulic or power press. Fig. 27 shows the closing in operation being performed in a vertical hydraulic press capable of exerting a pressure of 800 pounds per square inch. Before closing the open end of the shell, it is heated in the lead bath, shown to the left of the illustration, which is kept at a temperature between 1450 and 1500 degrees F. The steel diaphragm, which is larger in diameter than the nose of the shell, is first thrown in. Then the shell is placed in the press, and a cone-shaped die descends, closing in the nose to the proper shape and diameter. The third machining operation consists in finishing the radius on the nose, both inside and outside, and cutting the thread. This is done, as shown in Fig. 28, in an ordinary engine lathe with a turret on the saddle. The boring is done with cutters held in boring-bars and the thread cut with a Geometric collapsing tap. The thread on the 18-pounder is 2.94 inches diameter, 14-pitch, Whitworth type.

Grinding Shrapnel Shells

The exterior surface of a shrapnel shell is straight for a portion of the length and then curved on the nose. While the limits required are not extremely close, it is necessary where large production is required, to accomplish the finishing operations on the exterior of the shell in some way by which fairly close dimensions can be secured as well as large production. Grinding has therefore been recommended for finishing the exterior of the shell. One method of grinding shrapnel shells in which a wide faced wheel is used that covers the entire ground surface, is shown in Fig. 29. This machine is built by the Ford-Smith Machine Co., Hamilton, Ont., and carries a wheel about 8¼ inches wide, 20 inches diameter. The grinding wheel is rotated at 1200 R. P. M., and the work at 50 R. P. M. The depth of cut is about 1/32 inch, and the time to complete one shell varies between two and three minutes. For grinding, a plug is screwed into the open end of the shell. This is held on the tailstock center and a chuck holds and drives the shell from the other end.

It is necessary, of course, that the wheel be kept the correct shape, and for this purpose an interesting type of wheel truing device, differing considerably from that shown in Fig. 29, is now used. Referring to Fig. 31, it will be seen that this comprises a combination wheel guard and bracket, the latter being used as a base for the wheel truing device proper. The diamond *A* is carried in a holder *B* that operates in a slide in the face of the traversing wheel truing slide *C*. The diamond holder carries a cam point *D* which is kept in contact with the guide or former cam *E* by means of a spring *F*. The wheel truing slide *C* is traversed by a triple-pitch screw *G* so as to give a rapid movement to the slide in order to produce what might be termed a "rough-truing" of the wheel. For change in diameter, and also for bringing the diamond in contact with the wheel, a vertical slide *H* is provided that is operated by handle *I*. In order to observe the diamond when truing the wheel, a trap door *J* is provided in the wheel guard, which can be dropped down into place when the actual grinding of the shell is being done.

Pressing on the Rifling Band

In order to rotate the shrapnel when propelling it out of the howitzer, it is necessary to put on a rifling band to take the rifling grooves of the gun bore. As a rule, these rifling

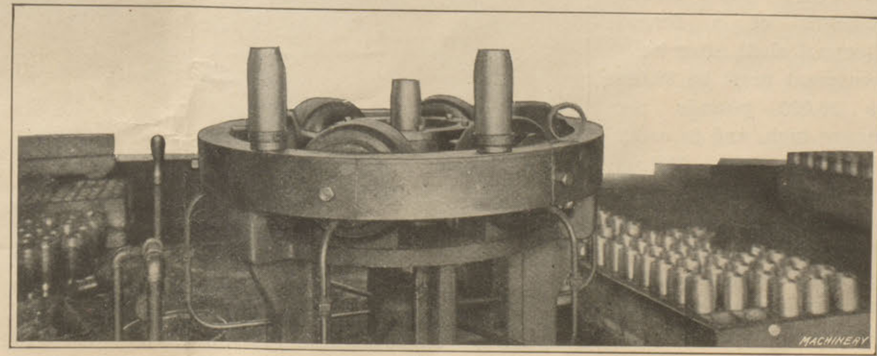


Fig. 30. Closing in Copper Band on Shrapnel Shell

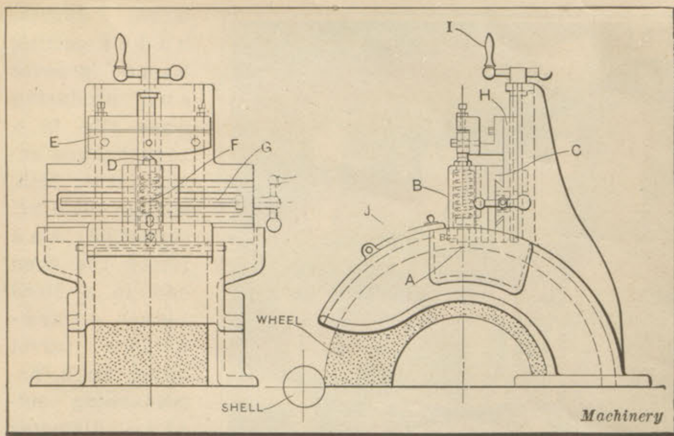


Fig. 31. Special Type of Wheel Truing Device used on Ford-Smith Grinding Machine shown in Fig. 29

bands are made from copper tubing and are simply cut off in a hand screw machine or turret lathe. The next operation is to close in the rifling band on the shrapnel shell. The ring is dropped over the shell and a fixture is used to locate it in the correct relation to the groove in the circumference of the shell. Then a slight pressure is exerted on it to align it properly in the groove. It is now placed in the banding machine shown in Fig. 30. This particular machine is provided with six dies as shown in Fig. 32, and back of each one is a hydraulic cylinder operated by water pressure. Two squeezers are necessary to close the rifling band properly into the groove, the shell being given a half turn after each squeeze.

There are several different machines on the market for performing this closing in operation on the rifling band. Another machine, built by the West Tire Setter Co., Rochester, N. Y., is shown in Fig. 33. The principle upon which this machine operates is almost identical with that previously described, but in this case oil is used as a pressure medium. It is forced into the machine by means of a belt-driven pump shown to the left of the illustration, which drives the oil from the oil tank and carries it to the center of the base of the press. An oil head is located at

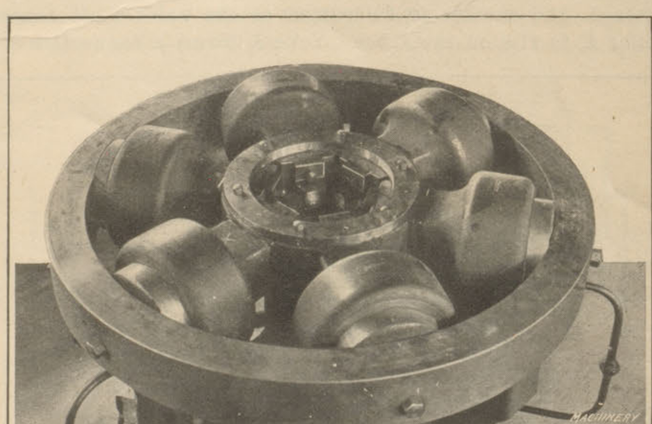


Fig. 32. Close View showing Closing in Dies of Banding Machine shown in Fig. 30

this point from which the pipes are run to each of the six rams or cylinders. The amount of pressure required for compressing the copper band depends largely upon the width and thickness and the amount that the band must be spread to fill the grooves, rather than upon the diameter of the shell. The machine shown in Fig. 33 is capable of exerting a pressure of 30 tons on each cylinder or a combined pressure of 180 tons on all six cylinders. It has a capacity for compressing at least two bands per minute.

Machining the Rifling Band

One method of machining the rifling band to the correct shape is shown in Fig. 34. Here a Fox lathe is used which is provided with a chuck for holding the shell and which carries in the turret a revolving center for additionally supporting it. The machining is done by form tools which are of the correct shape. Before any other machining operations can be accomplished it is necessary to put in the tin powder cup, brass fuse tube, bullets and resin. The tin powder cup is slipped in past the steel diaphragm, then both parts are allowed to drop to the bottom and the fuse tube is screwed into the diaphragm. The required number of lead bullets, which for the British 18-pound shrapnel is about 375 per shell, is then poured in. The bullets are held in a tank and are allowed to flow out upon the opening of a stop-cock. In order to pack the bullets solidly, a compressed air ramming device forms the base upon which the shell rests while the bullets are being poured in. This is operated three or four times for the filling of each shell and arranges the bullets compactly.

The resin is now poured in, as shown in the center of Fig. 35. This is carried in the tank which is heated by a gas furnace and is poured in almost level with the top of the bullets. The shell is then placed on the scale in the immediate foreground and weighed. One dram plus or minus

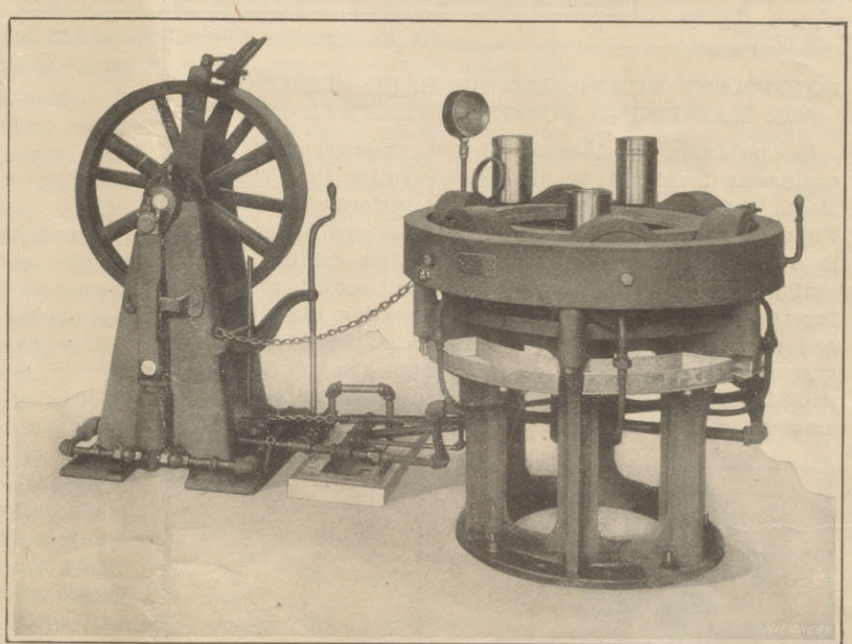


Fig. 33. Shrapnel Banding Machine built by the West Tire Setter Co.

is allowed as a variation, and in order to secure this, more or less resin is poured in until the correct weight is obtained. The brass fuse socket is now screwed in as shown to the left of the illustration, and upon the completion of this operation the shell is ready for the fourth and last machining operation. This last operation consists in machining the brass socket on the outside diameter to conform to the radius on the nose of the shell and boring on the inside and threading to fit the fuse body. These operations are handled in a Fox brass working lathe. Upon the completion of the machin-

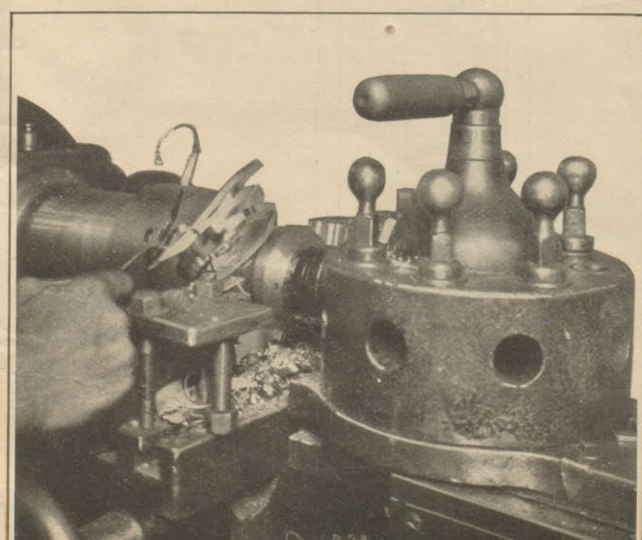


Fig. 34. Finishing Rifling Band on Shrapnel Shell to Shape

ing operations, the plug is screwed in, the shell stamped, cleaned, weighed and inspected by government inspectors. After this, the shell is given two coats of paint and a red band is painted around the nose. It is now packed in boxes holding six shells and is ready for shipment. This completes the manufacture of the shrapnel shell.

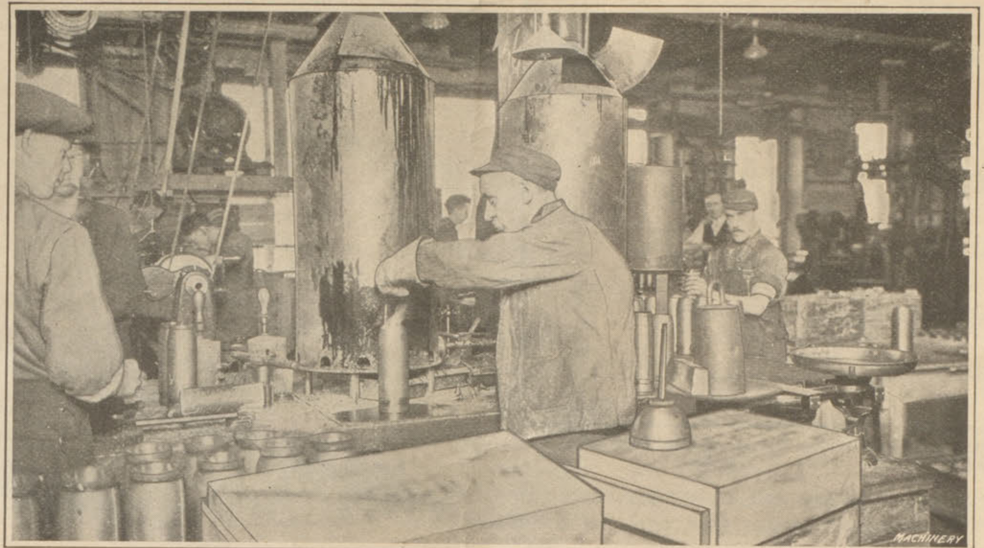


Fig. 35. Assembling Bullets, Resin and Fuse Socket in Shrapnel Shell

EQUIPMENT FURNISHED BY REED-PRENTICE CO. FOR MACHINING FORGED SHRAPNEL SHELLS

In machining the 18-pound British shrapnel shell on the equipment furnished by the Reed-Prentice Co., Worcester, Mass., eight distinct operations are performed as follows: First, drilling a center hole in the closed end of the forging in a Prentice 16-inch ball-bearing sensitive drilling machine equipped with a special centering fixture; second, rough-turning the outside diameter, grooving, squaring the closed end and rounding the corners in a Reed-Prentice 14-inch heavy type automatic lathe; third, machining the powder pocket and diaphragm seat, as well as the internal and external diameters of the nose in a 14-inch Reed extra heavy turret lathe; fourth, under-cutting band grooves and producing wave ribs in a 14-inch Reed engine lathe; fifth, boring, reaming, threading and facing the open end in a Reed 14-inch extra-heavy turret lathe; sixth, finish-turning outside diameter and radius on nose, also form-turning copper band in a Reed 14-inch heavy type automatic lathe; seventh, cutting off center projection on closed end of shell in a Reed 14-inch engine lathe; eighth, finishing brass socket to form, cleaning inside of socket and cutting off excess length of tube in a Reed 14-inch extra-heavy turning lathe.

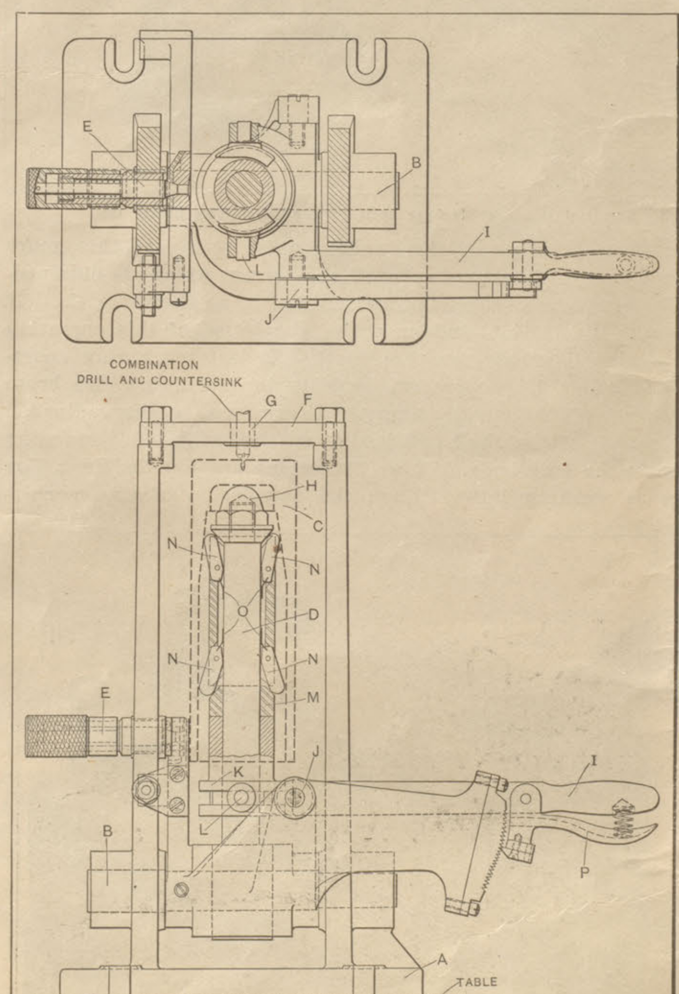


Fig. 36. Fixtures used for holding Shrapnel Shell Forgings when drilling Center Hole in a 16-inch Prentice Ball Bearing Sensitive Drilling Machine

First Operation on Rough Shell Forging

The drilling of the center hole in the closed end of the forging is a comparatively simple operation, and is performed in an interesting fixture held on a 16-inch Prentice ball-bearing sensitive drilling machine.

This fixture, which is designed for handling the work quickly, is shown in Fig. 36, and consists of the base casting *A* clamped to the table of the drilling machine. The entire back part of the jig swings on the trunnion *B* to provide a means for quickly removing the forging *C* from the arbor *D*. A locking pin *E* is used for locating the fixture in its upright position for drilling. Bushing *G* in the top plate *F* of the fixture guides the combination drill and countersink.

The construction of the work-holding arbor is worthy of special attention. This arbor *D* has a cap *H* on its top end that acts as a stop for the inside of the forging, which, in being placed over the arbor, is located centrally and clamped by fingers *N*. To operate these fingers, hand lever *I* is depressed, and as this is fulcrumed at the point *J*, it causes collar *K* to rise on the arbor. Yoke *L* forms a connection between the lever and the collar with which the sleeve carrying fingers *N* is integral. Fingers *N* are fulcrumed in arbor *D* and are thrown outward to grip the forging when sleeve *M* is raised. Light springs *O* tend to keep the gripping fingers in a vertical position against the arbor when they are not being forced outward by the inclined surfaces on sleeve *M*. Handle *I* carries a spring pawl *P* that holds the sleeve *M* stationary while the forging is being center-drilled.

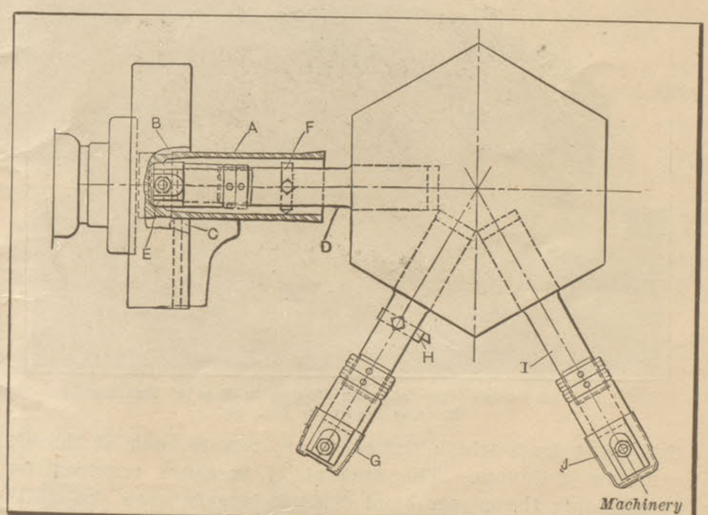


Fig. 37. Tooling Equipment for performing Third Series of Operations on 14-inch Extra-heavy Turret Lathe

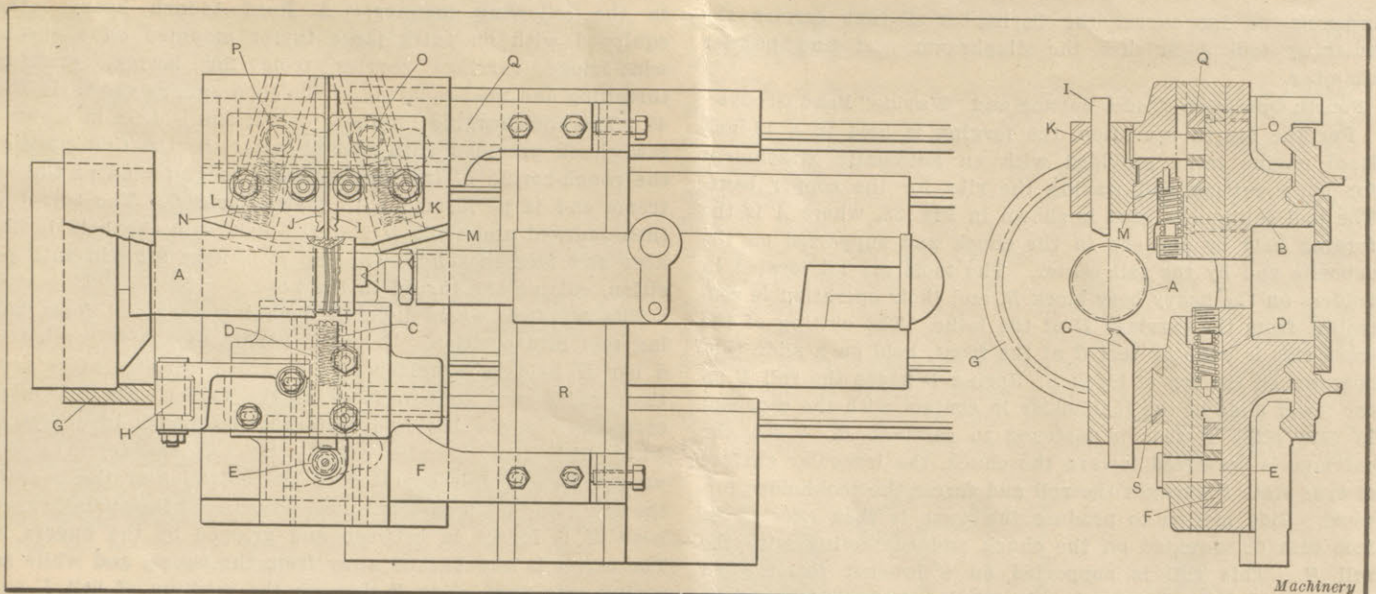


Fig. 38. Tools used for under-cutting and waving Band Grooves on Reed 14-inch Engine Lathe

Second or Rough-turning and Facing Operations

The second operation is performed on a Reed-Prentice 14-inch heavy type automatic lathe, as shown in Fig. 39. The forging *A* is held on an internal expanding arbor *B*, the driving part of which is supported by the head-center. At the closed end, the shell is steadied by the tail-center. The bottom of the shell rests against the end of the arbor which acts as a gage. In this setting, the external diameter of the forging is rough-turned by four tools *F*, mounted on the carriage *G*. This carriage has a travel slightly less than two inches, and an automatic throw-off is provided at the end of the cut that disengages the tools, draws them back and returns the carriage.

At the rear of the carriage on this machine a facing arm is mounted on a heavy bar. Turning tools are carried on this facing arm, as shown, and when the front carriage feeds longitudinally a cam bracket *O*, bolted to the carriage, is carried along with it. Clamped on this bracket is an adjustable cam *N* held in place by screws. Cam roll *M* on the facing arm contacts with cam *N*, causing the facing arm to rock forward as the carriage travels longitudinally.

Referring to the plan view in Fig. 39, tool *H*, held in the arm, faces the end of the forging, tool *I* chamfers the corner,

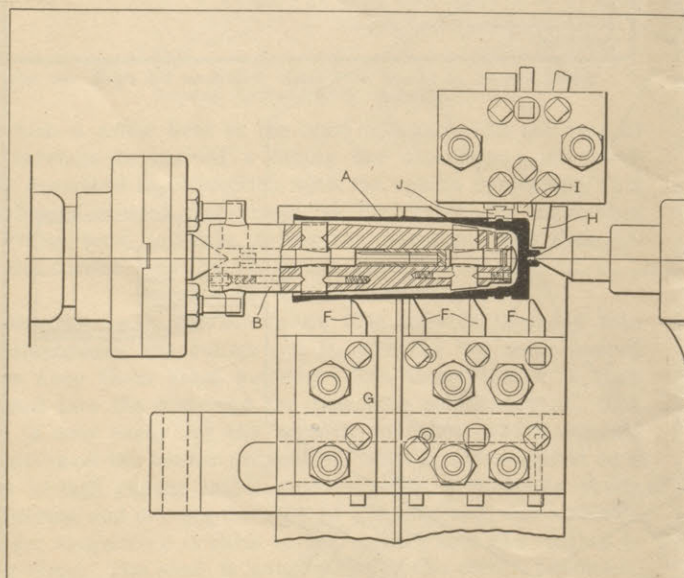
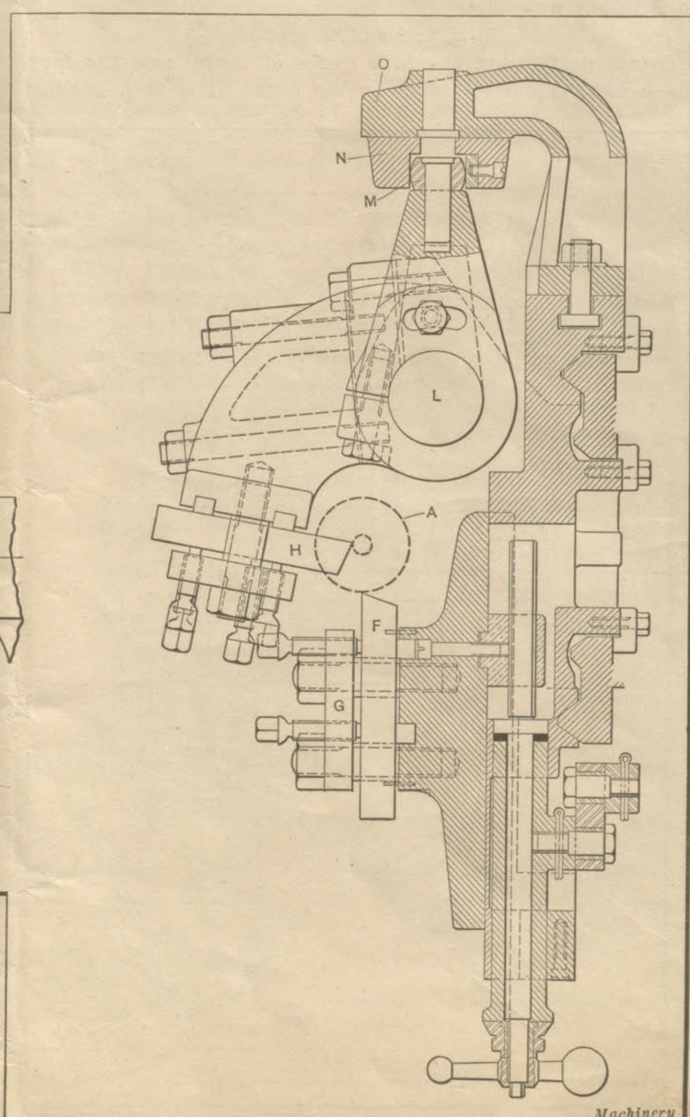


Fig. 39. Tool Layout for performing Second Series of Operations on Reed-Prentice Heavy Type Automatic Lathe

and tool *J* cuts the depression for the wave ribs, leaving a projection in the center from which the ribs are formed. It should be understood that the tools on the carriage and facing arm work together. One man can run two of these machines without trouble, and fifteen pieces are produced per hour.

Third Series of Machining Operations

The third series of operations on the shrapnel forging is performed on a 14-inch Reed heavy lathe with a specially large turret, as shown in Fig. 37. This lathe is fitted with a 12-inch three-jaw chuck, bored out to 3½ inches to permit the forging to extend into it. The forging *A* is put in the chuck as shown at *B*, and the jaws grip at *C*. The first operation is performed with a bar *D* carrying a blade cutter *E* that rough-bores the powder pocket, and tool *F* that rough-bores the mouth. The turret is now indexed, and a boring-bar carrying a blade *G* roughs out the diaphragm seat, while an auxiliary tool *H* faces the shell to length. At the next



indexing of the turret the boring-bar *I* that carries the finishing tool *J* finishes the diaphragm seat and powder chamber.

Fourth Operation—Under-cutting and "Waving" Band Groove

For the fourth operation, the forging is held in a 14-inch Reed engine lathe provided with an automatic attachment for under-cutting and waving the ribs for the copper band. The tool equipment used is shown in Fig. 38, where *A* is the forging held by one end in the chuck and supported on the opposite end by the tail center. The tools are all located in holders on the heavy base block *B*, and their operation is controlled from the carriage *R* of the lathe. The cutting of the wave ribs is done by tool *C* at the front, held on a slide that operates on the top of block *B*. Spring *D* keeps the roll *E* on the lower slide of the tool-holder in contact with the cam slot in cam plate *F* that is fastened to carriage *R*. When the carriage is traversed toward the chuck, the irregular surface of cam plate *F* engages the roll and forces the tool-holder forward. Side motion to produce the wave is then effected by face cam *G*, mounted on the chuck and contacting with the roll *H*. This roll is supported on a bracket forming an auxiliary slide *S* that carries the waving tool *C*. A stiff barrel spring keeps slide *S* in contact with the cam *G*. Thus, when the machine spindle revolves, the auxiliary slide is caused to oscillate back and forth far enough to give the desired amount of wave.

The under-cutting in the band groove is accomplished by tools *I* and *J* which are mounted on separate tool-slides *K* and *L*. These slides are fed in at an angle to the axis of the forging, against the action of coil springs *M* and *N*, by the cam surfaces of plate *Q* in which rolls *O* and *P* work. Plate *Q* is bolted to carriage *R* which, in advancing toward the chuck, forces in the under-cutting tools in the manner just described. The tail-center of this machine is fitted with a quick-acting mechanism so that it may be withdrawn quickly to insert a new piece.

Fifth Series of Operations

Before performing the fifth series of operations, the forging is heated and closed in on the nose. It is then handled in the following manner: A Reed 14-inch heavy lathe, equipped with an extra large turret mounted on a special wide-bridge carriage carries tools for boring, reaming, threading and final squaring of the open end, as shown in Fig. 40. The shell forging for these operations is held in a three-jaw chuck provided with special jaws. In the first position the rough-boring of the nose and the rough-facing of the extreme end is performed with tools *B* and *C*. The turret is then indexed and tools *D* and *E* finish-ream the hole in the nose and face the end. The tap *F* is next brought into position, cutting the thread in the nose.

The turret is again indexed, bringing a special form boring tool into position. Here the boring tool *G* is carried in a bar *H* held in a holder of the cross-sliding carriage type that is fastened to two faces of the turret. By means of cross-screw *J*, the boring tool *H* may be drawn in or out at will. This tool operates as follows: As the turret is advanced, handle *J* is operated to let tool *G* enter the nose of the shell, and upon the continued advance of the turret, arrow head *M* is forced in between and gripped by the fingers *N*. The turret is now backed away from the chuck, and while receding acts upon slide *P* through the medium of roll *L* and cam groove *R*. The plate containing cam groove *R* is attached to the arrow head *M* and consequently is held stationary while the turret is being withdrawn from the work. This backward movement of the turret is continued until the tool *G* is withdrawn from the work and slide *S* comes in contact with check-nuts on rod *O*, withdrawing arrow head *M* from fingers *N* and allowing the turret to be indexed ready for the first operation on the next forging.

Sixth or Finish-turning Operations

The sixth series of operations is performed on a Reed-Prentice 14-inch heavy type automatic lathe, similar to that used for the second operation, and the machine is also operated in a manner similar to that previously described. The operations consist in finish-turning the outside diameter of the shell and turning the radius on the nose. In addition, the copper rifling band, put on previous to this operation, is turned to shape. Referring to Fig. 41, the shrapnel shell *A*

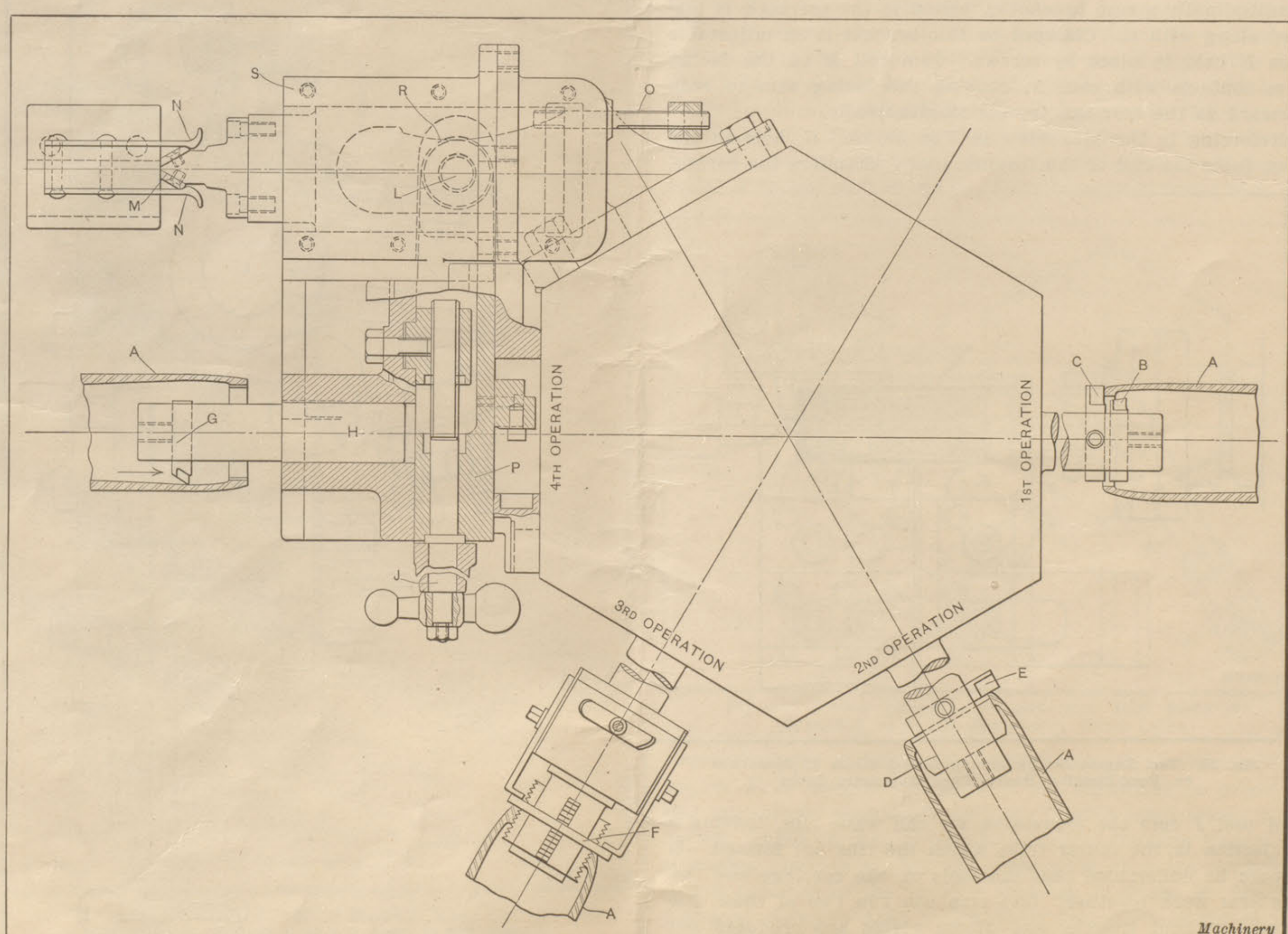


Fig. 40. Turret Tools held on Reed 14-inch Extra-heavy Lathe for performing Fifth Series of Operations

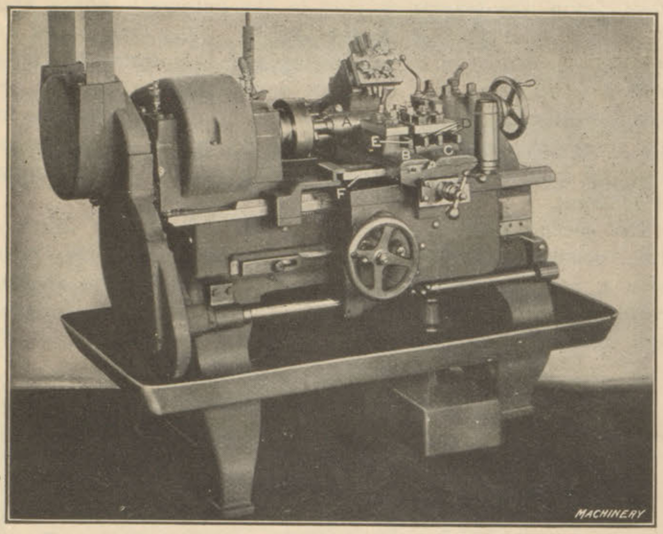


Fig. 41. Reed-Prentice 14-inch Heavy Type Automatic Lathe used for performing Sixth Series of Operations

is held by the tail-center at one end and is supported and driven from the other end by a plug screwed into it. This plug is held on the live center and is driven by an equalizing driver, coming in contact with pins in the special faceplate.

Two slides *B* and *C* are carried on the front of the carriage. Slide *C* carries three tools *D*; two of these start in from the rifling band and turn in toward the nose, and the other works up toward the rifling band from the closed end. Tool *E*, carried in slide *B*, turns the curve on the nose of the shell and is controlled in its action by means of a slot in cam *F*,

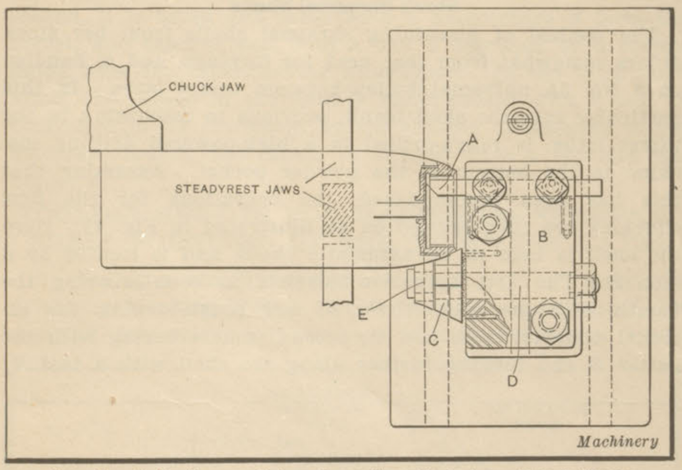


Fig. 42. Tools for machining Brass Fuse Socket on 14-inch Heavy Turning Lathe—Eighth Operation

in which a roller held to the slide operates. At the rear of the carriage is carried a facing bar attachment, as previously described in connection with the second operation. This attachment carries three tools, as illustrated, for machining the rifling band to shape, facing the closed end and chamfering the corner.

Seventh and Eighth Operations

After the sixth operation, the fuse tube is threaded into the diaphragm, the bullets put in, and the hot resin poured in to keep them from rattling. The brass socket is then screwed into the nose and the fuse tube soldered to it. The shell is now ready for the seventh operation which consists in cutting-off the center projection. This is accomplished in a Reed 14-inch engine lathe, provided with a faceplate chuck for holding and driving the shell at the open end, and a steadyrest for supporting it close to the point where the cutting is being done. The shell is now ready for the eighth operation, which consists in machining the brass socket to shape in an extra-heavy lathe as shown in Fig. 42. The tools used for machining are retained in a special holder on the carriage. Tool *A*, which is used for facing off the fuse tube and the brass socket, is inverted, starts at the center and is fed out toward the circumference. The external surface of the socket is machined with a circular forming tool *C* held on a stud *D* located in block *B*. The inward travel of this tool is limited by stop *E* coming in contact with the shell.

SET-UP ON WARNER & SWASEY TURRET LATHE FOR MACHINING FORGED SHRAPNEL SHELLS

In Fig. 43 is shown a typical set-up on a Warner & Swasey No. 2A universal hollow-hexagon turret lathe for machining an 18-pound shrapnel shell forging. The arrangement of the various tools for performing the first series of operations is more clearly illustrated in Fig. 44, to which reference should now be made. The forging is located for machining on a special arbor fitted into the spindle and carrying two spring-controlled centering bushings *A*. These serve to locate the shell, which is then gripped by the floating jaws of the chuck on the external diameter, and a stop on the end of the arbor locates the shell from the bottom of the powder pocket.

The first operation consists in taking a cut from the external diameter with a special box-turner provided with a roll steadyrest and carrying two turning tools. The second

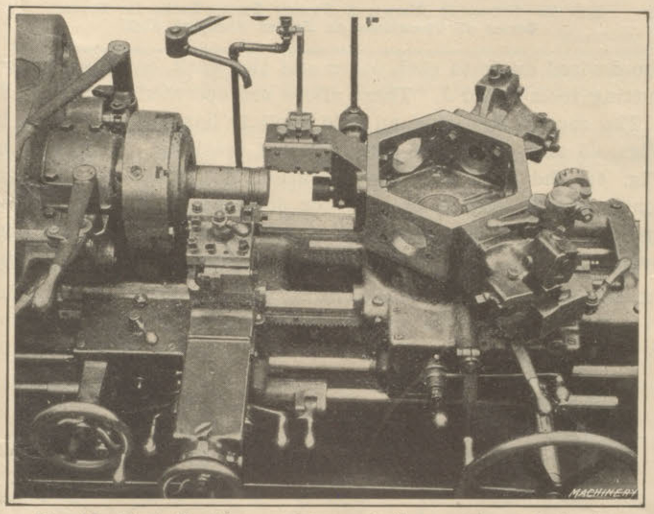


Fig. 43. First Chucking on Warner & Swasey Turret Lathe for machining British Forged Shrapnel Shells

operation is handled from the cross-slide, the shell forging meanwhile being supported by a roll steadyrest clamped to the turret. In this operation the closed end of the shell is faced with tool *C*, the corner rounded, and the band groove formed with forming tool *D*. The third operation—first chucking—is performed with tool *F* which produces the waves in the band groove, and is operated in the following manner: Referring to the lower left-hand corner of the illustration, it will be seen that a roll *G* is brought in contact with the face cam *B*, thus giving the desired oscillating movement to the waving cutter. The fourth and final operation consists in under-cutting the band groove with a tool clamped to the turret. This tool gages from the end of the shell by a revolving stop *H*, and is provided with two slides, set at

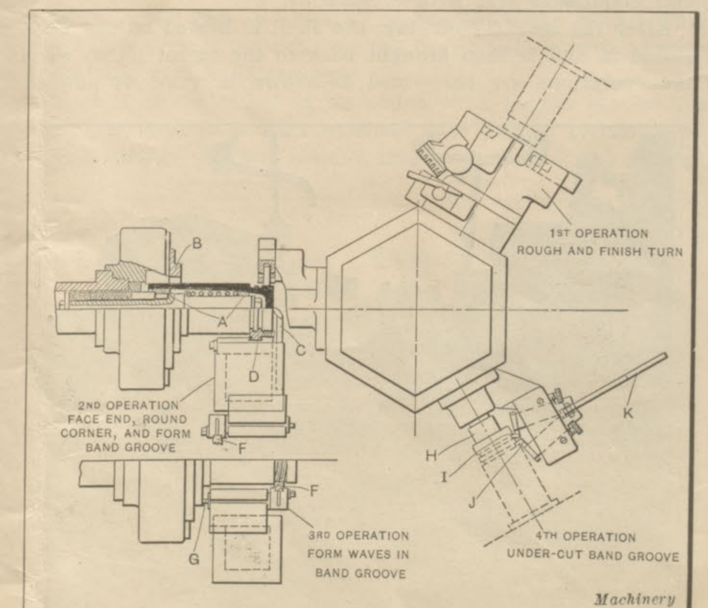


Fig. 44. Diagram illustrating Position and Relation of Tools for First Chucking on British Forged Shell

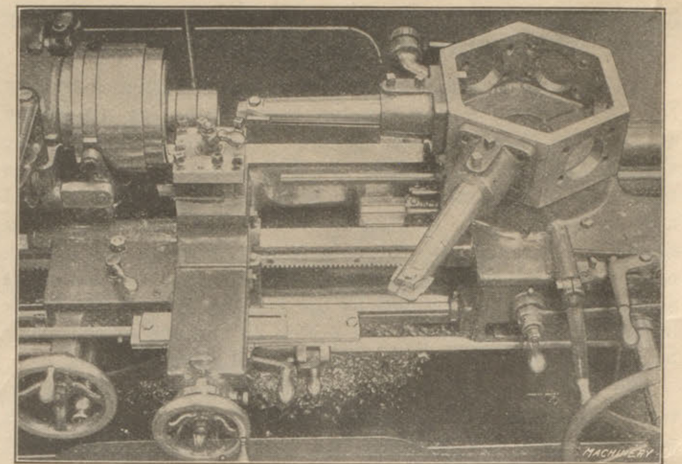


Fig. 45. Set-up on Warner & Swasey Turret Lathe for Second Series of Operations on Forged Shrapnel Shell

the desired angle to each other and the work, carrying undercutting tools *I* and *J*. These slides are operated by handle *K*.

The second chucking on this shell is handled as shown in Figs. 45 and 46 on the same type of machine. As shown in Fig. 46, the shell for this operation is gripped in an automatic chuck, and a stop *A* for locating it is held in the spindle. The first operation consists in roughing out the powder pocket and diaphragm seat with a cutter *B* and

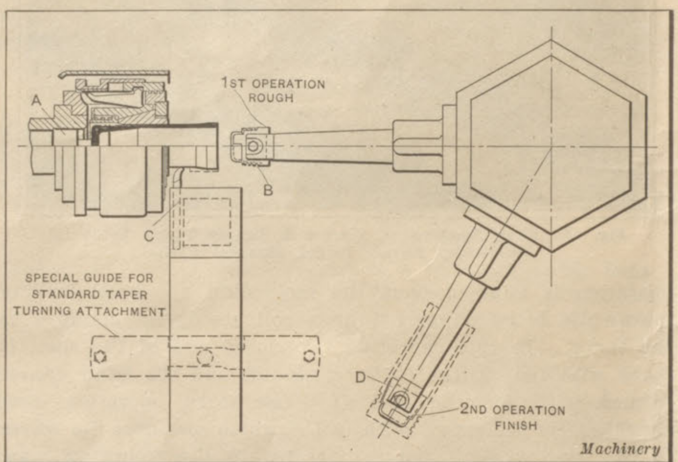


Fig. 46. Diagram illustrating Sequence of Operations performed at Second Chucking

rough-turning that portion of the shell held in the chuck in the previous chucking with a tool *C*. This tool is held in the cross-slide toolpost, and is controlled in its movement by a special guide fastened to the regular taper-turning attachment. The second operation finishes the powder pocket and diaphragm seat with a cutter *D*.

After the second chucking, the shell is heated on the nose, closed in and is then brought back to the turret lathe, when the operations are performed as shown in Figs. 47 and 48.

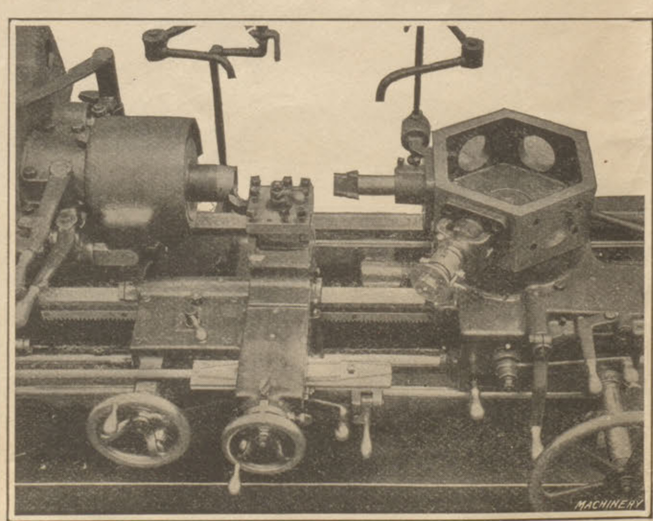


Fig. 47. Third Chucking Set-up on British Forged Shrapnel Shell

Here, again, the forging is held in the automatic chuck and is located by a plug *A* in the spindle. The first series of operations consists in boring, facing and chamfering the nose with a counterbore *B*, and at the same time turning the external radius on the nose with a tool *C*. Tool *C* is held in the cross-slide square turret and is controlled in its movement by a special guide fitting on the regular taper-turning attachment.

The second operation, shown to the left of the illustration, consists in machining the radius inside the nose with a tool *E*, controlled in its movement by the special guide *D* as previously mentioned. The third and final operation consists in cutting the thread with a collapsible tap *F*.

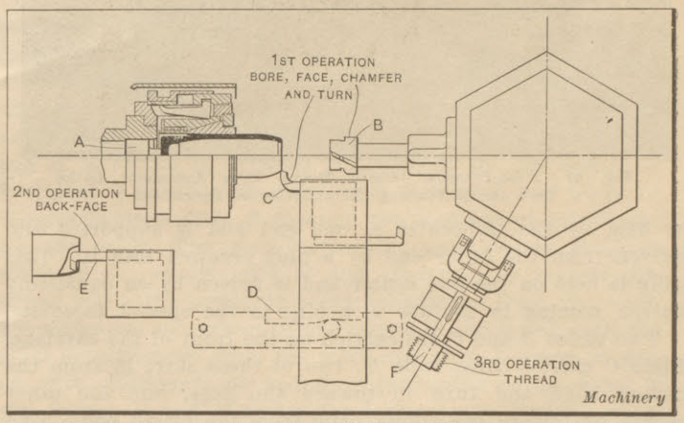


Fig. 48. Diagram illustrating Relation of Tools for performing Third Series of Operations

Set-up on Warner & Swasey Turret Lathe for Machining Bar Stock Shrapnel Shells

The method of machining shrapnel shells from bar stock differs somewhat from that used for forgings, and is handled on a No. 2A universal hollow-hexagon turret lathe. In this particular case the shell blank, previous to machining in the turret lathe, is rough-drilled in a high-powered drilling machine to the bottom of the powder pocket. Assuming that this has been accomplished, the operations for the first chucking are then carried on as illustrated in Fig. 49. Here the shell is held in an automatic chuck and is located by a stop *A*. The first operation consists in counterboring the mouth with the counterbore *B*, and rough-turning the external diameter with tool *C*; second, counterboring with the cutter *D* and turning further along the shell with a tool *E*;

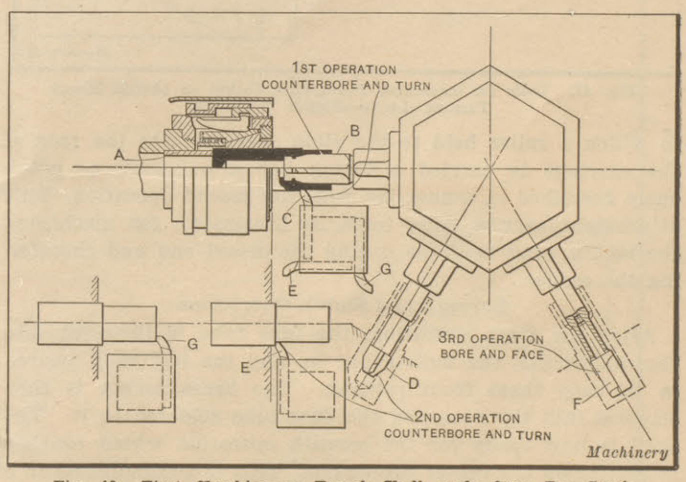


Fig. 49. First Chucking on French Shell made from Bar Stock on Warner & Swasey Turret Lathe

third, finishing the bottom with a cutter *F* and facing the end of the shell with a tool *G*.

In the second chucking, the operations shown in Fig. 50 are performed. Here the shell is reversed in the automatic chuck and is located, as before, by a stop *A*. The first operation consists in turning that portion of the body held in the chuck in the previous chucking with a roll-supporting turning tool *B*. Second, supporting the shell with a roll-support *C* held on the turret, facing the end with a tool *D* and chamfering the band groove and the end with a cutter *E* held on the cross-slide square turret. The third operation is to support the shell from the turret and knurl with a knurl *F* from the cross-slide square turret. Fourth, taper-turn from the end to the band groove with a tool *G*, guided by the taper-turning attachment.

For the third chucking, the shell, as indicated in Fig. 51, is held in the same manner as for the first chucking. First, it is recessed with a tool *A*, brought into action by operating

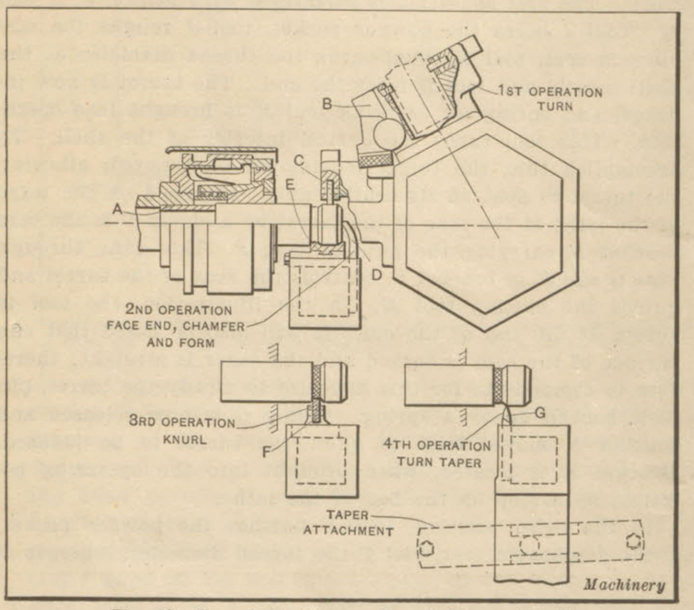


Fig. 50. Second Chucking on French Shrapnel Shell

the special holder which has a cross-sliding movement; second, it is bored and faced with a counterbore *B* from the turret, and taper-turned with a tool *C* operated by a special guide from the taper-turning attachment. In the third operation, the thread in the nose is rough-chased with a tool *D*, controlled in its movement by the chasing attachment of the machine; fourth, the thread is finished with a tap and tap-holder *E*.

TOOLING SET-UPS FOR MACHINING SHRAPNEL SHELL FORGINGS ON THE "LO-SWING" LATHE

By adding a simple carriage to its "Lo-swing" lathe, the Fitchburg Machine Works, Fitchburg, Mass., has adapted this machine for machining shrapnel shells of different types.

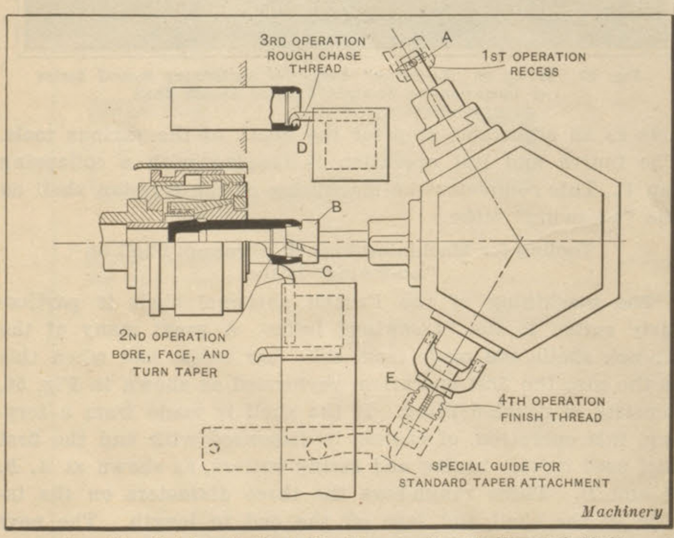


Fig. 51. Third and Final Chucking on French Shrapnel Shell

The following data and illustrations refer particularly to tooling used for machining the Russian and French shells. On the Russian shell, after centering, the forging *A* is held on a special arbor *B* shown in Figs. 52 and 54. Placed over this arbor is an expanding collar *C*, the inside surface of which is chamfered to fit against surface *D* on the stem of the arbor. The section of the arbor next to the spindle is threaded and a large nut and handwheel *E* are turned to pull the sliding sleeve *C* along the arbor and thus expand it to firmly grip the inside of the shell forging. Sleeve *C* is connected to the nut *E* by a threaded collar *F*. After the forging is securely

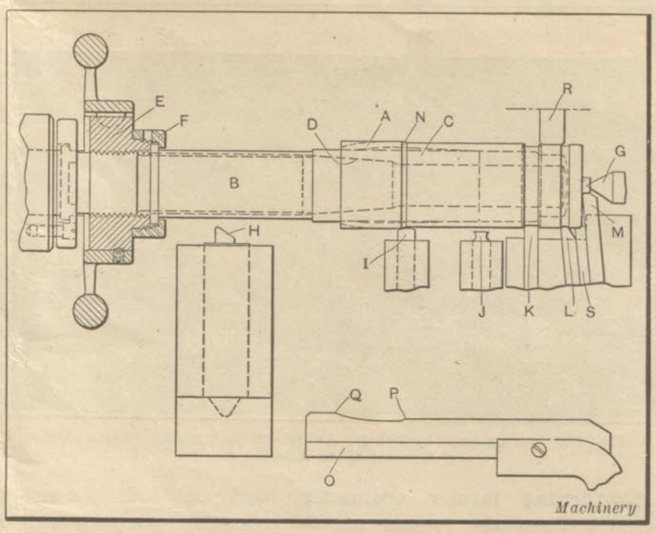


Fig. 52. Diagram showing Method of holding and performing First Series of Operations on Forged Shells on "Lo-Swing" Lathe

located on the arbor, which it should be understood extends to the bottom of the powder pocket to gage it for length, the tail-center *G* is run in to support it.

To those familiar with the "Lo-swing" lathe, it will be appreciated that its chief efficiency lies in its system of multiple turning tools. Thus on this job, tools *H*, *I*, *J*, *K*, *L* and *M* are all mounted on one slide, and in the illustration are shown in the positions they occupy after taking their respective cuts. At the beginning of the cut, turning tools *K*,

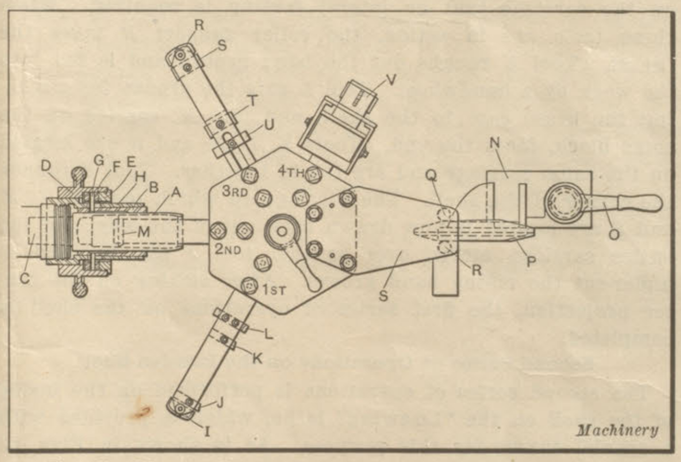


Fig. 53. Diagram showing Method of performing Second Series of Operations on Forged Shrapnel Shells on "Lo-Swing" Lathe

L and *M* are drawn back clear of the work to allow sufficient clearance for tools *H* and *I* to operate. With the tools drawn back and the carriage at the extreme right of the bed, tool *H* is the first to come in contact with the work. This tool takes a roughing cut over the body of the forging, finishing at the radius on the nose.

Tool *H* is controlled in its action by a former pin on the tool-slide, held in contact with the face of cam former *O* by a stiff spring. Former slide *O* takes the place of the regular

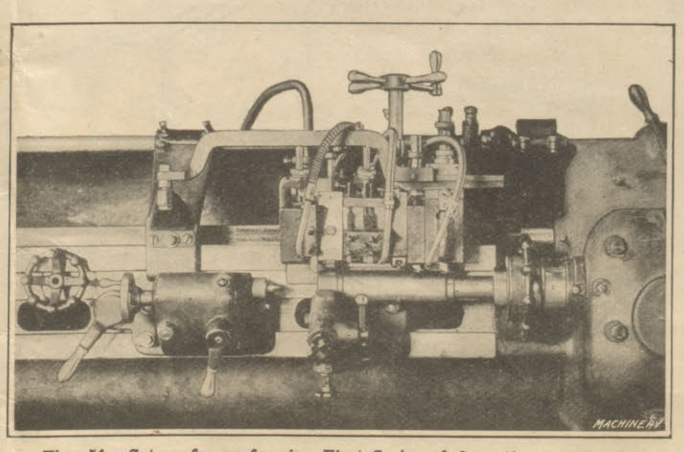


Fig. 54. Set-up for performing First Series of Operations on Russian Forged Shell on "Lo-Swing" Lathe

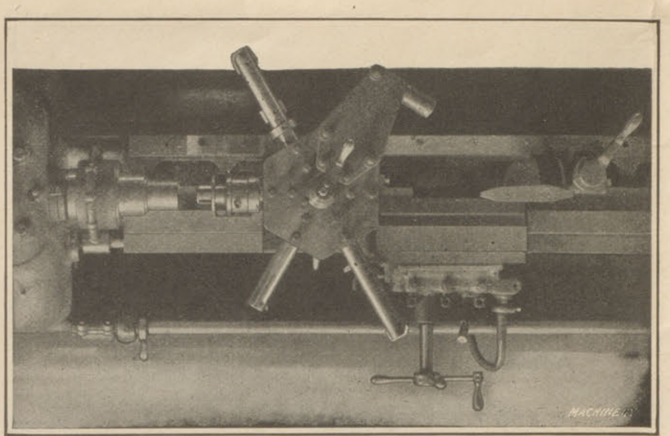


Fig. 55. Set-up on "Lo-Swing" Lathe for performing Second Series of Operations on Russian Shell

taper-turning former ordinarily used on the "Lo-swing" lathe. When the former pin in the slide carrying tool *H* reaches point *P* on former *O*, the tool is withdrawn to conform with the shape shown at *N* on the forging. The tool is then fed in further toward the axis of the arbor, until the former pin reaches point *Q* on the slide, when the radius on the nose is completed. Tool *H* is the only one mounted on a taper-turning block.

Just after tool *H* passes point *N*, tool *I* commences to cut at the end of the forging, taking a finishing cut and ending up in the position in which it is shown in the illustration. After tool *I* reaches this position, the other tools *J*, *K*, *L* and *M* are brought into action. Tools *K*, *L* and *M* are so situated on the carriage that no lateral feeding is required. When these tools are in action, the roller support *R* takes the thrust. Tool *K* roughs out the band groove and is fed into the work by a handwheel. Tool *L* cuts the groove for attaching the brass case to the shell, and tool *M*, carried on the same block, faces the end. Tools *K*, *L*, *M* and *S* are located on the same carriage and are fed in together. Tool *S* rounds the corner of the shell. The carriage on which tools *K*, *L*, *M* and *S* are located is now drawn back out of the way, and the entire carriage moved over so that tool *J* can be used to under-cut the rifling band groove. After cutting off the center projection, the first series of operations on the shell is completed.

Second Series of Operations on the Russian Shell

The second series of operations is performed on the inside of the shell on the "Lo-swing" lathe, which is provided with a special turret for this purpose. As is shown in Figs. 53 and 55, the shell *A* is held in special collet jaws *B* that have a two-point bearing on the shell. Stop *C* in the spindle locates

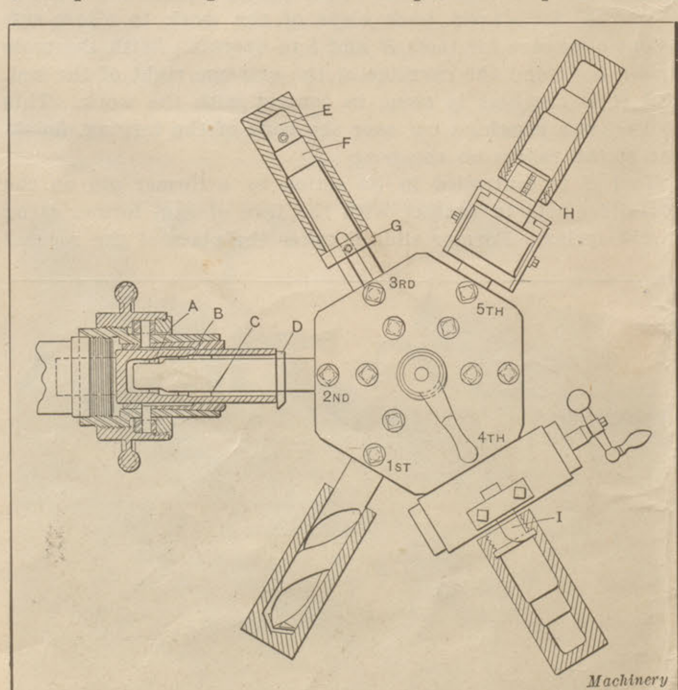


Fig. 56. Diagram showing Method of machining French Shells on "Lo-Swing" Lathe—First Series of Operations

the shell in the chuck. To manipulate the chuck for tightening it on the work, handwheel *D* is turned, carrying with it the nut *E* and ring *F*. Ring *F* carries pins sliding in slots in sleeve *H* and driven into collet *B*, so that when nut *E* is drawn back it also carries collet *B* into the taper in sleeve *H*, closing the collet on the work. Turning handwheel *D* in the opposite direction releases the grip of the collet *B* on the work. The first operation is performed with tools *I*, *J*, *K* and *L*. Tool *I* bores the powder pocket, tool *J* roughs the diaphragm seat, tool *K* rough-turns the thread diameter at the shell mouth, and tool *L* faces the end. The turret is now indexed, and boring-bar carrying tool *M* is brought into operation. This tool turns the curved interior of the shell. To accomplish this, the turret locking-pin is removed, allowing the turret to float on its central axis. Fastened on the ways of the lathe at the rear of the turret by a clamp *O* is the cam bracket *N* carrying the guiding cam *P*. This cam, through pins *Q* and *R* in bracket *S*, controls the float of the turret and guides the cutting tool *M*. In the illustration, the tool is shown at the end of the cut. It will also be noted that one surface of the cam is curved and the other is straight; therefore to compensate for this and also to steady the turret, pin *R* is backed up by a spring. Clamp *O* is now released and bracket *N* moved back to allow the turret to be indexed. Bracket *N* is located, when brought into the operating position, by a stop on the bed of the lathe.

In the third position, tool *R* finishes the powder pocket, *S* the diaphragm seat, tool *T* the thread diameter, whereas *U*

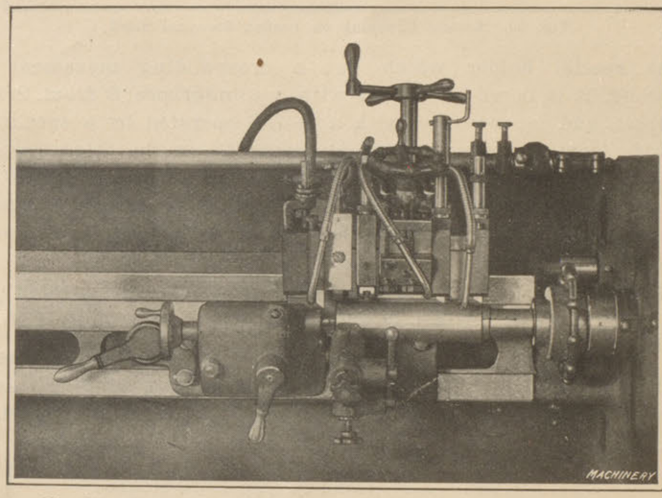


Fig. 57. Set-up on "Lo-Swing" Lathe for performing Second Series of Operations on Straight Type of French Shell

acts as an adjustable stop for the depth of the various tools. The fourth and last operation is tapping with a collapsing tap *V*. This completes the machining of the Russian shell on the "Lo-swing" lathe.

Tooling for Machining French Shrapnel Shell on "Lo-Swing" Lathe

The machining of the French shrapnel shell is particularly suited to the "Lo-swing" lathe. A great many of the French shells are made from solid bar stock, and when this is the case the first operation, performed as shown in Fig. 56, consists in rough-drilling. If the shell is made from a forging, this operation, of course, is dispensed with and the first tool used carries boring and facing cutters, as shown at *A*, *B*, *C* and *D*. These rough-bore the three diameters on the inside of the shell and face off the end to length. The next operation is accomplished with two finishing boring tools *E* and *F*, the depth of which is obtained by an adjusting collar *G* that comes against the end of the shell. Following this, the thread in the nose is produced with a collapsing tap *H*. The turret is then indexed two holes, bringing the special recessing tool into position. This tool is of the cross-slide type and carries a back recessing cutter *I*.

Second Series of Operations on French Shell

The second series of operations on a French shell is accomplished as shown in Fig. 58. Here the shell is held in the same manner as described in connection with Fig. 52. The forging is placed on arbor *B* that has an expanding

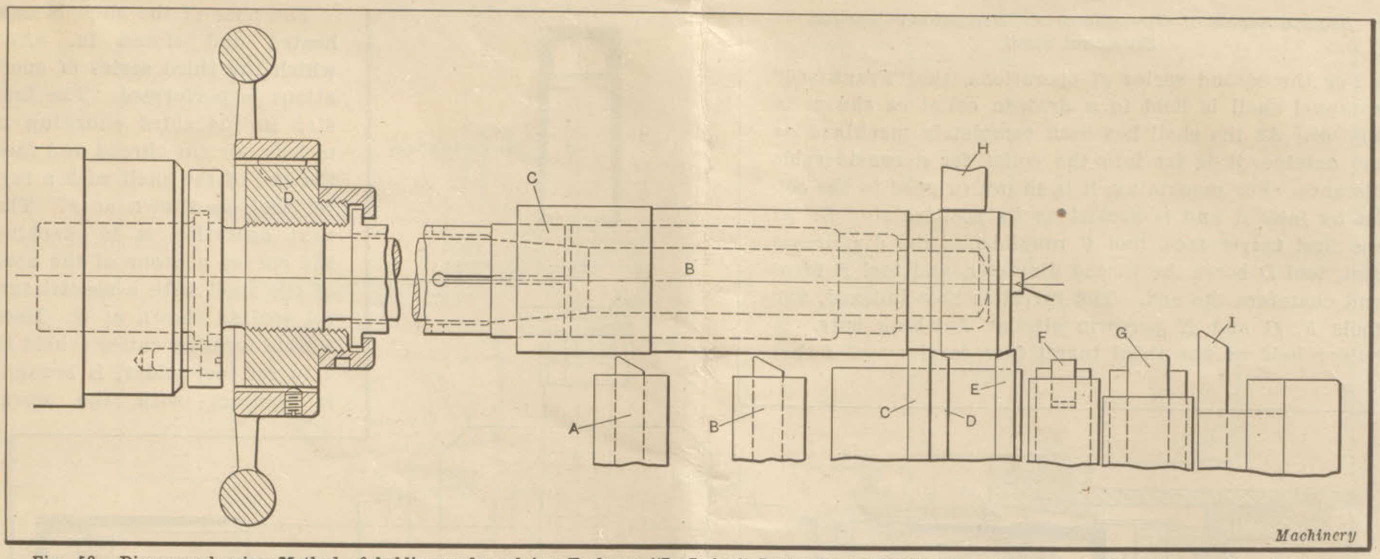


Fig. 58. Diagram showing Method of holding and applying Tools on "Lo-Swing" Lathe for performing Second Series of Operations on French Shell

sleeve *C* operated by the hand clamping wheel nut *D*. Eight cutting tools are located on the carriage. Tool *A* turns the diameter at the open end of the shell, *B* the central part, *C* cuts the band groove, *D* chamfers the section adjacent to the band groove, *E* chamfers the end of the shell and *F* knurls the band groove. Roll *G*, in connection with roll *H*, supports the shell while the knurling is being done, whereas tool *I* faces off the end of the shell. At the beginning of the cuts, tools *C*, *D*, *E* and knurl *F*, also roll *G* and tool *I*, are withdrawn. This permits tool *A* to cut the front end of the shell at the beginning and finish the diameter at the open end of the shell. Tool *B* next comes into action and turns the central part of the shell. Tool *C* is then located in the correct position for the band groove and the carriage on which tools *C*, *B*, and *E* are located is fed straight in, cutting the band groove and chamfering. Knurl *F* is then brought into position to knurl the groove, with roll *G* backing up the work against roll *H*. The last operation is to cut off the center projection with tool *I*.

Fig. 57 shows the tool set-up on the "Lo-swing" lathe for machining the straight type of French shell, in which two tool-blocks are used for doing the straight turning. The leading tool turns the end of the shell a little larger than the main body. The procedure for grooving, knurling and facing the shell is that previously described for the forged shell, which is shown in Fig. 52. On the French shrapnel shell the second operation follows directly after the first, whereas on the Russian forged shell a nosing in operation comes between the two machining operations.

SET-UPS FOR MACHINING "FRANKFORD" FORGED SHELL ON POTTER & JOHNSTON AUTOMATIC CHUCKING MACHINE

The machining of the American or "Frankford" 3-inch type of high-explosive shrapnel shell is comparatively easy, inasmuch as there is no nosing to be done, and the entire shell may be machined at two settings. Fig. 59 shows the way in which the first operation is taken care of on the No. 6A Potter & Johnston automatic chucking and turning lathe. The forged shell is held on an expanding arbor of the same type as that shown in Fig. 5, which appeared in the article on "Machining Shrapnel Shells" in the March number of MACHINERY. In the first turret position, the operations consist in taking a straight cut across the diameter and facing off the end. The external turning tool *A* is of the relieving type, and *B* is a facing tool that works on the end. Both of these tools are supported and operated from the turret. A roll support, not shown, steadies the work while tool *A* is working. The turret now backs out, and a forming tool, held on the cross-slide, advances, cuts the rifling band and the semicircular grooves in the end of the shell, and at the same time chamfers the corner. Knurl *D*, held on the rear of the cross-slide, is then advanced. This knurls the bottom of the rifling band groove.

By referring to Fig. 59, it will be seen that the grooves do not extend entirely across the face of the knurl, but instead two "knurl" ribs similar to a double thread are formed on the periphery. This construction makes it possible to sink the knurl into the work to the proper depth without exerting excessive pressure on the arbor and throwing it out of line. The knurl also stands up longer and does not tend to break away at the edges.

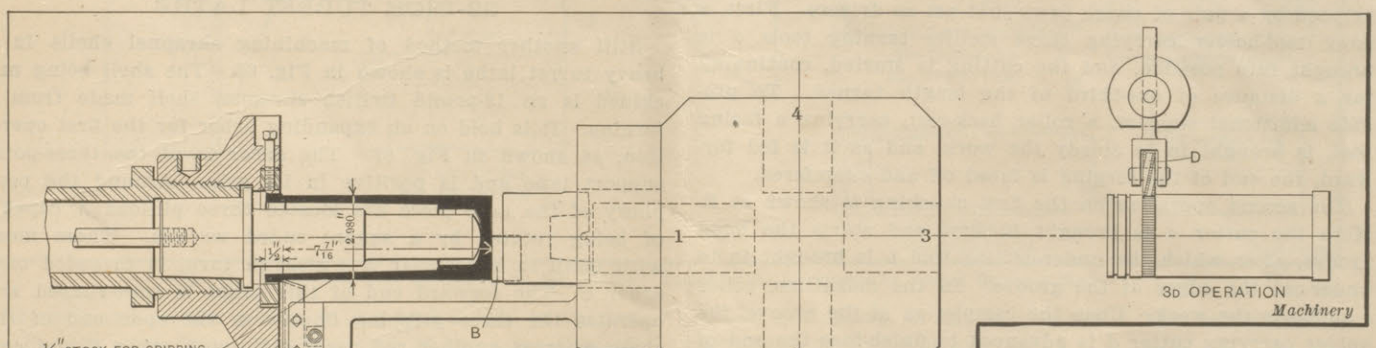
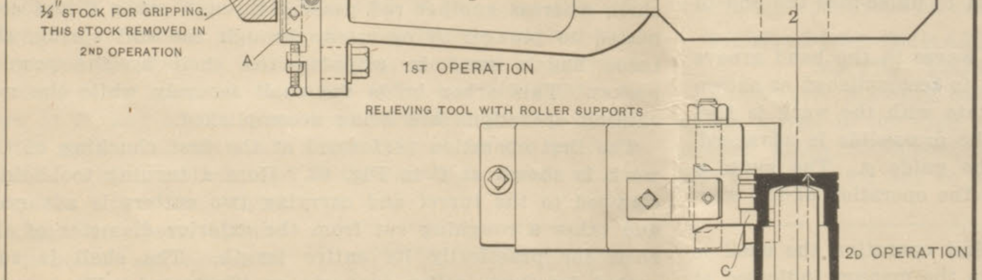
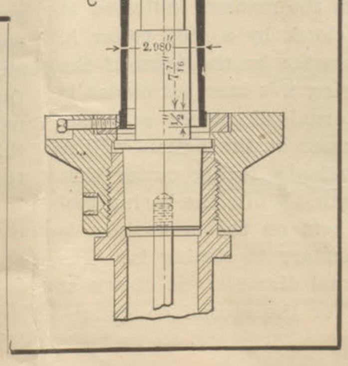




Fig. 59. First Series of Operations on "Frankford" Shell on a Potter & Johnston 6A Automatic Chucking and Turning Lathe

Second Series of Operations on "Frankford" Forged Shrapnel Shell

For the second series of operations, the "Frankford" shrapnel shell is held in a draw-in collet as shown in Fig. 60. As the shell has been completely machined on the outside, it is let into the collet for a considerable distance. For machining, it is shown gripped in the collet by jaws *A* and is backed up by positive stop *B*. At the first turret face, tool *C* rough-bores the diaphragm seat, tool *D* bores the thread diameter, and tool *E* faces and chamfers the end. The turret is now indexed, and tools *F*, *G* and *H* perform similar finishing cuts. A holder held on the third turret face carries tool *I* that chamfers the powder pocket, and at the fourth turret face a collapsing tap threads the open end.

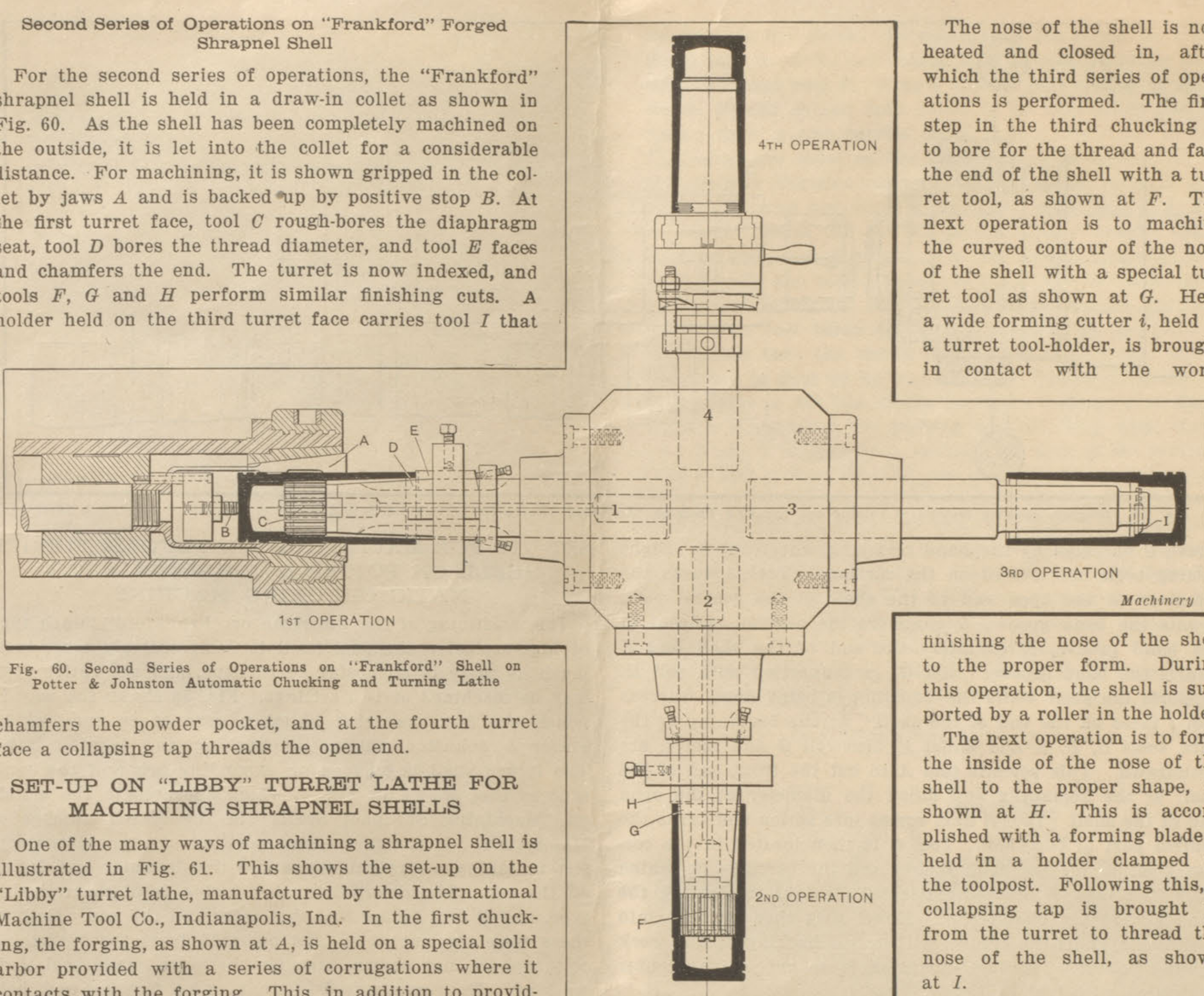


Fig. 60. Second Series of Operations on "Frankford" Shell on Potter & Johnston Automatic Chucking and Turning Lathe

SET-UP ON "LIBBY" TURRET LATHE FOR MACHINING SHRAPNEL SHELLS

One of the many ways of machining a shrapnel shell is illustrated in Fig. 61. This shows the set-up on the "Libby" turret lathe, manufactured by the International Machine Tool Co., Indianapolis, Ind. In the first chucking, the forging, as shown at *A*, is held on a special solid arbor provided with a series of corrugations where it contacts with the forging. This, in addition to providing a rigid support, assists in gripping, and the shell is also gripped by a pair of chuck jaws that act as drivers. First, a gang tool-holder carrying three stellite turning tools *o* is brought into position, and the cutting is started, continuing for a distance of one-third of the length turned. To provide additional support, a roller back-rest, carrying a facing tool, is brought in to steady the work, and as it is fed forward, the end of the forging is faced off and chamfered.

The second operation on the first chucking is shown at *B*. Here the cutter *a* is brought in first and starts the band groove, after which the under-cutting tool *b* is brought in to under-cut the edges of the groove. In the meantime, roller *c* supports the work. Upon the completion of the groove, the holder carrying cutter *d* is advanced to finish-face the end of the work and chamfer.

The third operation—cutting the waves in the band groove—is of an interesting character and is accomplished as shown at *C*. A cam *e* which is free to rotate with the work is first brought in contact with it; then the cross-slide is advanced, carrying the waving tool *f* and the guide *g*. The guide *g* fits in the cam groove and controls the operation of the waving tool.

In the second chucking on the first operation the shell is reversed in the chuck and is held in the manner indicated at *D*. The forging is located in the chuck by a stop collar *h*, and is gripped on the external diameter by the jaws of the chuck. A stepped boring tool carrying five inserted blades is brought in to rough-bore the internal diameters and machine the shell to the proper thickness at the bottom of the powder pocket. This tool also carries a facing cutter that faces off the shell to the proper length. While the boring tool is working, a broad turning tool, held on the cross-slide, is brought in to bevel the nose preparatory to closing in. The next step is to taper-ream the internal diameter, as shown at *E*. This completes the operations for the second chucking.

The nose of the shell is now heated and closed in, after which the third series of operations is performed. The first step in the third chucking is to bore for the thread and face the end of the shell with a turret tool, as shown at *F*. The next operation is to machine the curved contour of the nose of the shell with a special turret tool as shown at *G*. Here a wide forming cutter *i*, held in a turret tool-holder, is brought in contact with the work, finishing the nose of the shell to the proper form. During this operation, the shell is supported by a roller in the holder.

The next operation is to form the inside of the nose of the shell to the proper shape, as shown at *H*. This is accomplished with a forming blade *j*, held in a holder clamped in the toolpost. Following this, a collapsing tap is brought in from the turret to thread the nose of the shell, as shown at *I*.

MACHINING SHRAPNEL SHELLS ON A HEAVY 22-INCH TURRET LATHE

Still another method of machining shrapnel shells in a heavy turret lathe is shown in Fig. 63. The shell being machined is an 18-pound British shrapnel shell made from a forging. It is held on an expanding arbor for the first operation, as shown in Fig. 62. The arbor is of the three-point support type and is positive in its grip. Around the periphery of the nose piece are located three pinions *A* capable of being rotated by a square ended wrench. These mesh with teeth in bevel gear *B* which, in turn, is threaded onto arbor *C*. The forward end of this arbor is cone-shaped and operates the three gripping fingers in the open end of the shell, whereas another rod passing through arbor *C* and connected to plunger *D* operates, through the coil spring, the three fingers used in gripping the shell by the powder pocket. This arbor holds the shell securely while the machining operations are being accomplished.

The first operation performed at the first chucking of the work is shown at *C* in Fig. 63. Here a turning tool-holder clamped to the turret and carrying two cutters is advanced and takes a roughing cut from the exterior diameter of the shell for practically its entire length. The shell is supported by three roller supports as illustrated. The second operation at the first chucking is performed from the cross-slide, as shown at *D*. Here a forming tool of the tangent type roughs out the rifling band groove, leaving sufficient metal in the center for the production of the wave ribs. The third operation is facing off the closed end of the shell from the turret as shown at *E*, and the fourth operation consists in machining the waved ribs as shown at *F*. The tool for accomplishing this operation is held on the cross-slide and is operated from a face cam on the nose of the spindle.

In the second chucking the shell is held in a three-jaw scroll chuck. The first operation is to rough-bore the inside

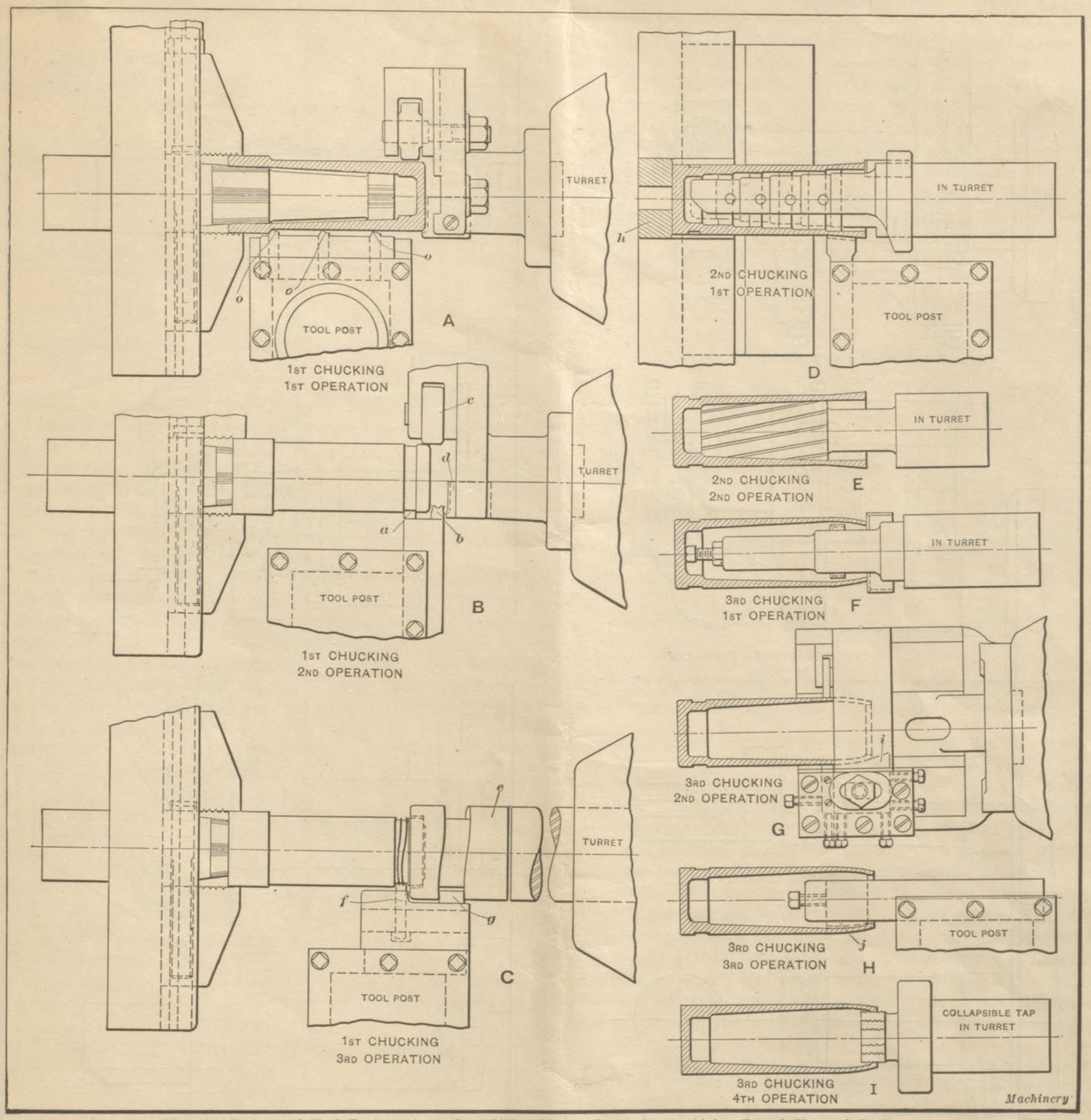


Fig. 61. Set-up and Tool Equipment on the "Libby" Turret Lathe for machining Forged Shrapnel Shells

of the shell and powder pocket with a tool *G* held in the turret; directly after this a finishing tool of the same shape is brought in, finishing the surfaces previously roughed out. The second operation is to face off the open end of the shell and taper-form back of the nose from the cross-slide, as shown at *H*, and at the same time turn that portion of the exterior surface of the shell not machined in the previous operation, with a tool clamped to the turret as shown at *I*.

Previous to the third chucking, the nose of the shell is heated and closed in. The shell is then held in a three-jaw scroll chuck provided with special jaws. The first operation, as shown at *J*, consists in boring and turning the nose of the shell with a tool held in the turret. Following this, the hole is reamed with a standard reamer and tapped with a collapsing tap. Both of these tools are held in the turret but are not shown in the illustration. This completes the machining operations on the shell.

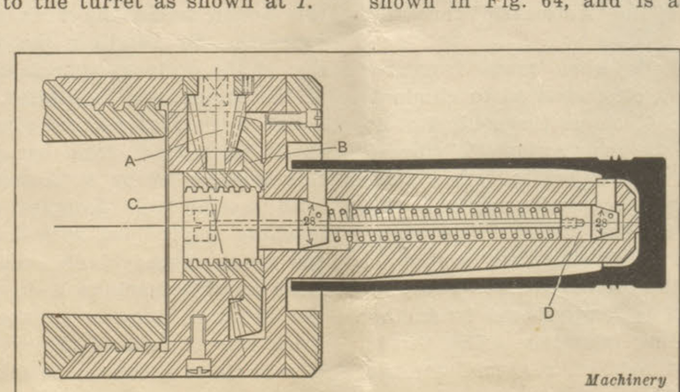


Fig. 62. Method of holding Shrapnel Shells for First Operation on a 22-inch Turret Lathe

THREADING SHRAPNEL SHELLS ON "AUTOMATIC" THREADING LATHES

Considerable difficulty has been experienced in cutting the square thread in the nose of the French shrapnel shell. One method which accomplishes this operation satisfactorily is shown in Fig. 64, and is accomplished on a 12-inch "Automatic" threading lathe built by the Automatic Machine Co., Bridgeport, Conn., and equipped with special tools for this purpose. Referring to this illustration, it will be seen that two tools are used—a roughing tool *A*, and a finishing tool *B*. Tool *A* roughs out the thread to a shape similar to the Acme type of thread, whereas tool *B* squares it up. The roughing and finishing tools are held on the forward and rear

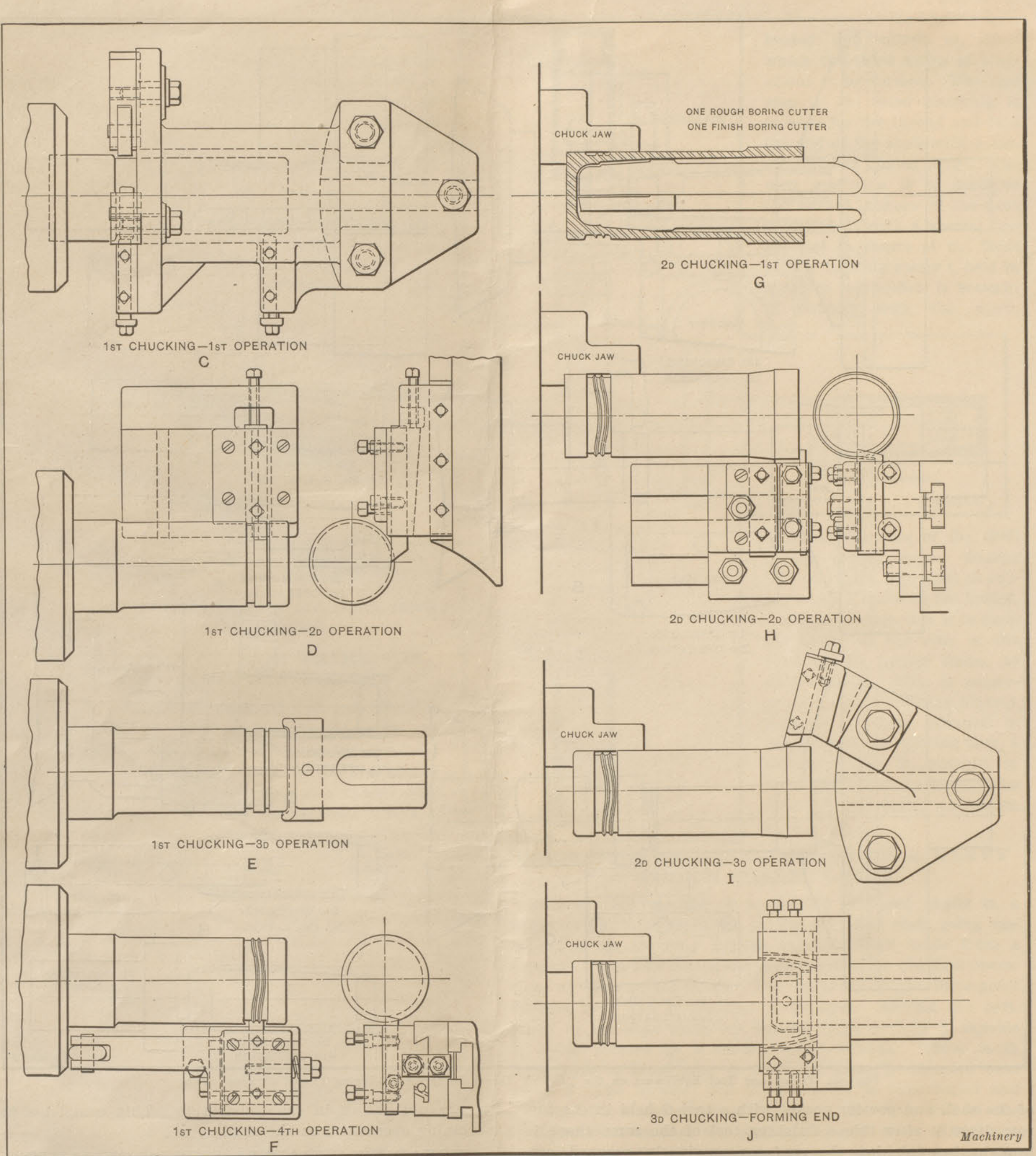


Fig. 63. Machining Shrapnel Shell Forgings on a 22-inch Extra-heavy Turret Lathe

carriages, respectively, and are operated simultaneously, being advanced throughout the length of the thread, withdrawn and returned to start a new cut. The method of operating the tools is one of the chief features of the "Automatic" threading lathe.

The base end of shrapnel shells when made from bar stock is as a rule bored out and a plug inserted to eliminate any piping effect in the bar. Fig. 65 shows the method of accomplishing this operation on a 12-inch "Automatic" threading lathe. The work is held in a three-jaw universal chuck and is supported by a roll steadyrest comprising two rolls that are located beneath the work. On the extended end of the rear roller stud is fastened a swinging stop that is used for locating the base of the shell in the correct position ready for threading. The base of the shell is counterbored in another machine, previous to the threading operation. The threading is done with a circular tool held on a special internal threading tool-holder, the latter being retained in the tool-post carriage. The threading tool-holder can be moved longitudinally to bring it into the proper relation to the work. It is also held so that the cutting edge is turned upside down as this action forces the work down in contact with the roller supports. By handling the work in this manner, a steadyrest of the ordinary type is dispensed with and the operation of the attachment facilitated.

One method of making plugs for the base end of shrapnel shells when made from bar stock is shown in Fig. 66. For this work, a 12 by 4 "Automatic" threading lathe equipped with special tools designed for this purpose is used. The machine is provided with a draw-in collet chuck that holds the rough forged blank. The order of handling the operations on this machine is to use the rear tool *A* for turning the external diameter of the plug. This is handled at the same rate of feed as that required for threading, so that it is sometimes necessary to take more than one cut, depending on the amount of material left on the diameter. The vertical

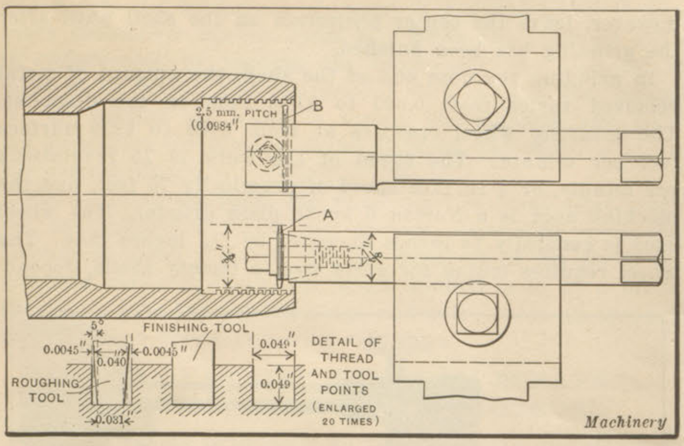


Fig. 64. Cutting Square Thread in Nose of French Shrapnel Shell in "Automatic" Threading Lathe

slide *B* is for facing only and carries a cutting tool *C*. This is supposed to finish the face in one cut, but as the work will spring considerably, a light finishing cut is taken when the tool is being drawn back from the center to the circumference of the work. The threading tool *D* is held on the front toolpost and is of single-point construction. The feed given to this tool is automatically controlled, both as to pitch and depth of cut at each traverse.

In actual operation, both the threading and turning tools are in motion all the time on the work, but the tools are independently controlled so that either one can be operated separately. A stop is provided on the back toolpost so as to turn each plug to the same diameter. The automatic

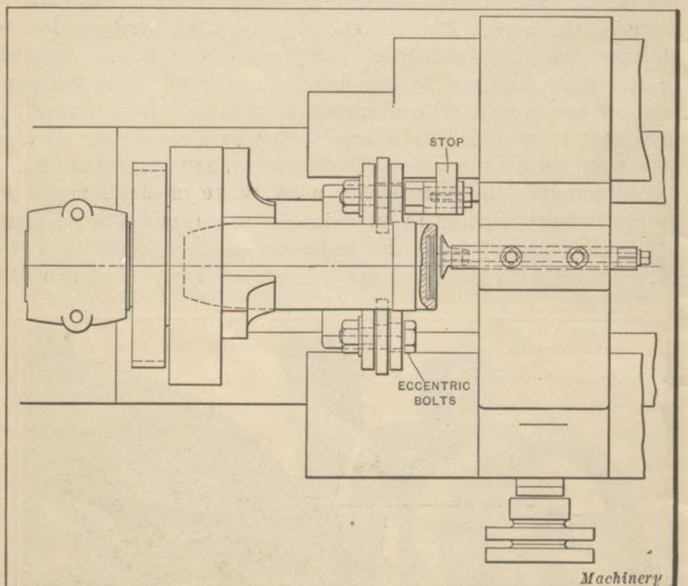


Fig. 65. Threading Base End of Bar Stock Shrapnel Shells in "Automatic" Threading Lathe

throw-out for the feed of the threading tool is set from the front handle on the ratchet and pawl as regularly furnished on the "Automatic" threading lathes.

GRINDING SHRAPNEL SHELLS ON NORTON GRINDING MACHINES

An increasingly large number of shrapnel shell manufacturers are finishing the steel shell by grinding instead of finish-turning. That is, the exterior surface of the shell is rough-turned to within from 0.030 to 0.080 inch of the finished size and is then finished to the required limits and shape by grinding, as shown in Fig. 67. It is claimed by the advocates of grinding that the finishing operations are more speedily performed in this manner and that a more accurate and concentric shell is produced. They also point out the fact that portions of the shell are so hard that it is extremely difficult, if not impossible, to turn it in the allowable time.

The varied heat-treatment given to the shell on the closed end and nose leaves it harder in some sections than others, as indicated in Fig. 68. The section *E*, 2½ inches from the closed end of the shell, must strike from 42 to 50 on the scleroscope, and the section *A* at the nose must strike between 20 and 25 The section marked *D*, or that part of it to the left of the line that marks the limit of the heat-treating on the closed end, has not been heat-treated at all, and partly on this account and also because of the gradually diminishing thickness of the shell along this section, it strikes between 40 and 45, decreasing as the thickness of the wall diminishes, until at *C* the section strikes but 35. Section *B*, adjacent to the annealed nose of the shell, strikes about 30 on the scleroscope.

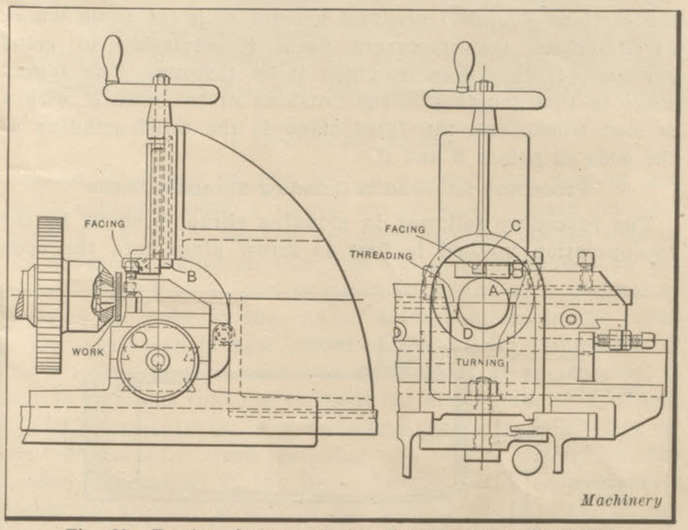


Fig. 66. Turning, facing, and threading Plugs for Closed End of Bar Stock Shrapnel Shells in "Automatic" Threading Lathe

On the other hand, some manufacturers are not putting the shell through this heat-treating and tempering process, and omit the annealing and machining of the nose after the nosing in operation. This leaves the nose with considerable stock to remove and in such a condition as regards hardness that the grinding machine becomes a necessity. In the face of these varying degrees of hardness of the shrapnel shell, it will be seen that it is difficult to secure wheels of the right grain and grade to suit all of these conditions. With this information in mind, we can more intelligently take up the actual grinding of the shell. The Norton Grinding Co., Worcester, Mass., has been actively engaged in developing methods of grinding shrapnel shells and the following illustrations and description apply to the work as done on Norton grinding machines.

Fig. 69 shows the two-operation method of grinding the shrapnel shell. Section *A* at the open end of the shell is covered by a wide faced wheel formed to shape, that finishes the radius on the nose at one in-feeding of the wheel. Sections *B*, *C* and *D* are covered by a wide faced wheel, formed to shape so as to finish these three surfaces at one in-feeding of the wheel. Section *E* at the closed end of the shell is finished completely by turning.

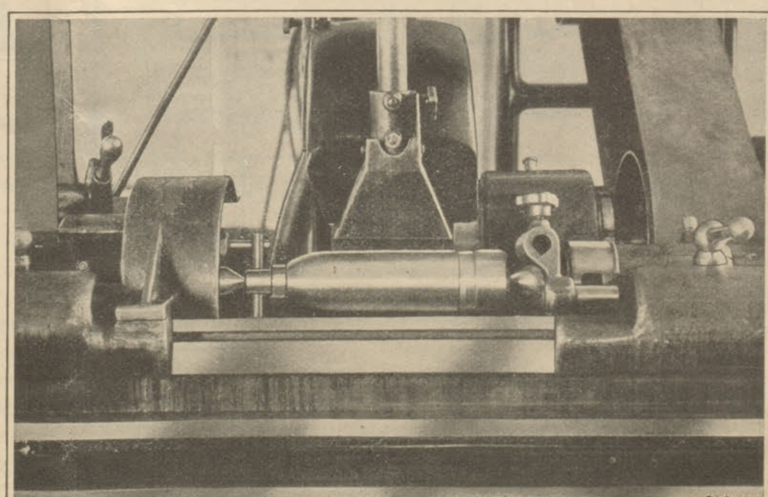


Fig. 67. Grinding Shrapnel Shells on a Norton Special-purpose Grinding Machine

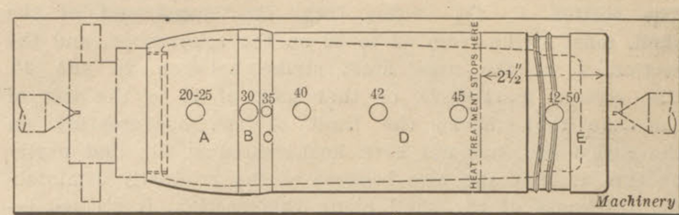


Fig. 68. Diagram showing Scleroscope Hardness Test of Heat-treated Shrapnel Shell at Various Points along its Surface

Some manufacturers use a three-operation method of grinding the shrapnel shell as illustrated in Fig. 70. In this case, the sections *A* and *D* are first ground with the same wheel, as American manufacturers deem it advisable to grind surface *A* rather than to finish it by turning. The second stage in this grinding is the finishing of the nose *E* with a formed wheel, and the third stage is the finish-grinding of the body at points *B* and *C*.

Procedure followed in Grinding Shrapnel Shells

The procedure followed in grinding shrapnel shells by the two-operation method is first to screw plugs into the open

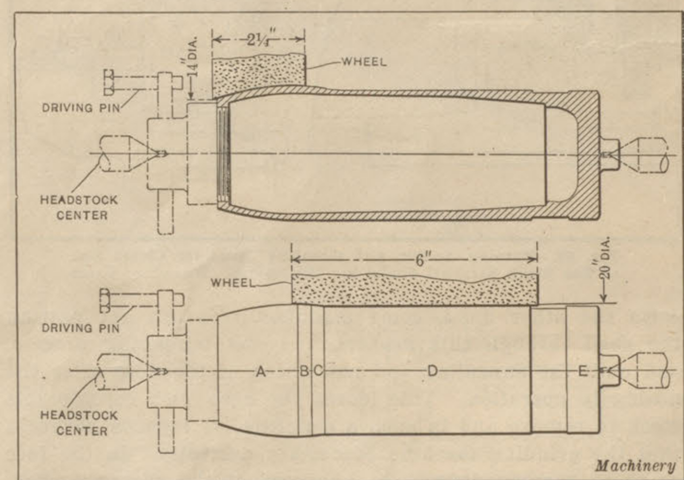


Fig. 69. Two-operation Method of grinding Shrapnel Shells on Norton Grinding Machines

end of the shells, as shown in Fig. 69. The outer ends of these plugs are centered, and the projection left on the closed end of the shell with the center intact acts as a means of supporting the shell. Some of the Canadian manufacturers vary this practice by cutting off the center projection on the closed end of the shell and fitting a cap with a center hole over the closed end. Others use a ball bearing cup center to carry the closed end. American manufacturers,

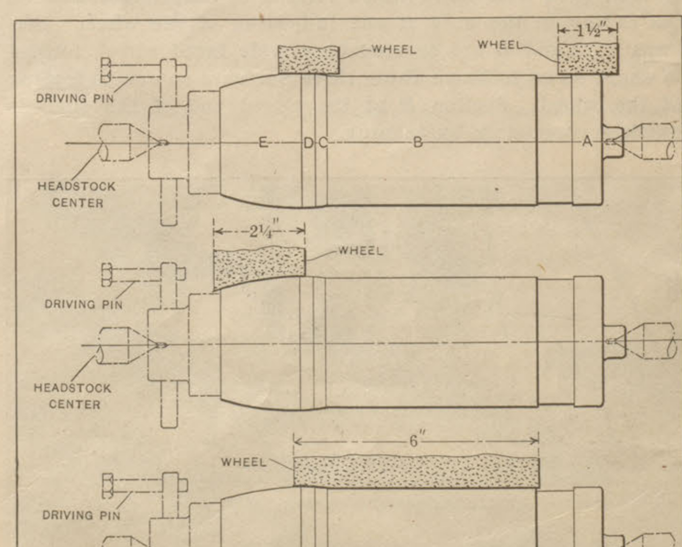


Fig. 70. Three-operation Method of grinding Shrapnel Shells on Norton Grinding Machines

however, leave the center projection on the shell until after the grinding has been finished.

In grinding the nose end of the shell, the amount of metal removed varies from 0.020 to 0.090 inch on the diameter. The grinding wheel operates at from 6000 to 6250 surface feet per minute. The speed of the work is 75 revolutions per minute, or a surface speed of practically 75 feet, and the machine used is a Norton 6 by 32 plain grinder. The wheel used is generally 14 inches diameter by 2¼ inches face. The wheel requires truing for every five to twenty shells, depend-

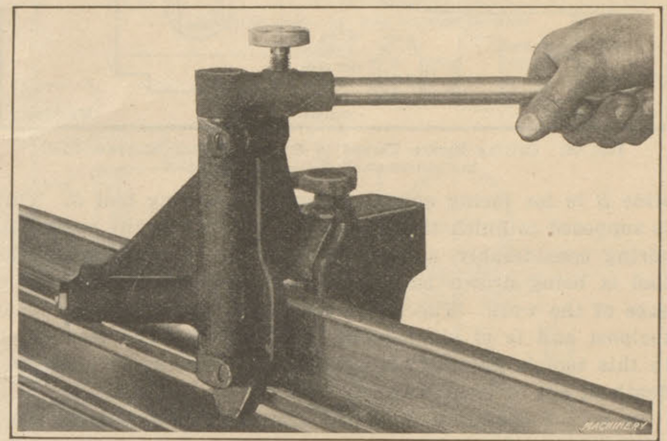


Fig. 71. Radius Wheel Truing Device for forming Grinding Wheel for grinding Shrapnel Shell Nose

ing upon the amount of metal removed and the hardness of the shell. For truing, a simple radius fixture carrying a diamond is used. Fig. 71 shows this wheel truing device clamped on the grinding machine bed. It is applied in the same manner as the usual steadyrests used for supporting the work. The diamond is mounted in a swinging arm that is operated by a hand lever as shown. By successive cuts across the wheel, the desired shape is attained.

For grinding the body either a 10 by 24 special-purpose or 10 by 36 Norton grinding machine is employed. The amount of metal removed from the body varies from 0.030 to 0.075 inch on the diameter, and the limits vary from 0.002 to 0.010

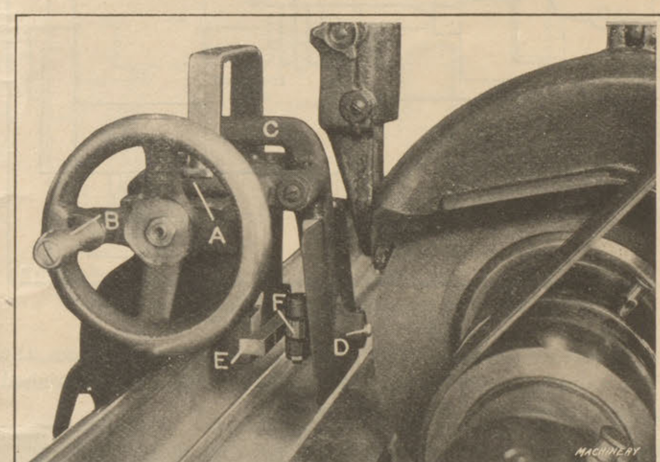


Fig. 72. Norton Special Form Wheel Truing Device for truing Wheel for grinding Shrapnel Shell Body

inch, depending largely on the requirements of the plant in which the work is being done. The wheel used on the body is 20 inches in diameter and is of the ring wheel type. It will be noticed in Fig. 69 that the wheel for grinding the body is also formed to shape. The method of truing the wheel for shaping the shrapnel shell body is shown in Fig. 72. This attachment is clamped to the front of the grinding machine bed and at the top of the bracket is fitted a slide *A* operated by handwheel *B*. Upon the face of this slide nearest the grinding wheel is pivoted an angular arm *C* that supports the diamond *D* at its lower end. Under the end of the upper arm is a spiral spring that keeps the diamond normally back from the wheel. A plate former *E* clamped to the bottom face of the bracket is shaped to agree with the form to be given the wheel. Located at the lower extremity of the arm and behind the diamond is mounted a roll *F* that bears constantly against form *E*. When the diamond slide is reciprocated by turning the handwheel, the diamond is made to traverse a path conforming with the cam that guides it. By moving the wheel in toward the diamond and making successive traversings of the diamond, the wheel is given the desired shape.

For grinding the body, the wheel must be trued after every ten to twenty-five shells are ground, depending upon the amount of metal removed and the hardness of the shell. In grinding shrapnel shells, the usual method is to fit a lot of the shells with the driving plugs and carry them all through to completion before removing the plugs.

REMOVING CENTER END FROM SHRAPNEL FORGINGS ON BESLY DISK GRINDER

For performing practically all the machining operations on the shell, a center projection is left on the closed end of the shell for supporting it. This, of course, must be removed before the shell is completed. One method of doing this is to use a Besly No. 14 ring wheel grinder equipped with a

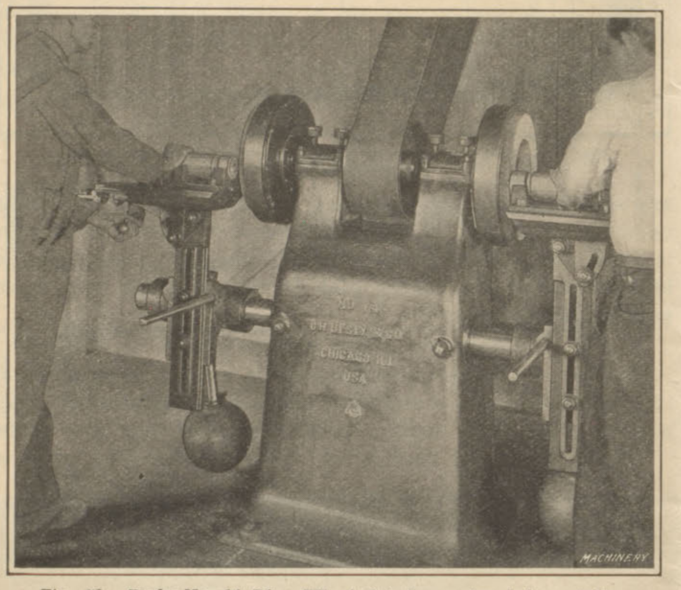


Fig. 73. Besly No. 14 Ring Wheel Grinder equipped for grinding Shrapnel, but shown without Hoods and Water Attachments

special fixture. A Besly grinder fitted up for this work is shown in Fig. 73, and the fixture used for holding the shell is shown in Fig. 74. The machine, as furnished, is arranged for wet grinding but is not so fitted up in the illustration. The fixture shown in Fig. 74 is fastened to the geared lever feed table and is of simple design. It is provided with a backing-up stop *A*, the work resting in two semi-spherical groove projections on the fixture. The operator simply holds the shrapnel shell in place by hand and then feeds it in against the wheel and traverses it past in the usual manner. The time for removing a ⅝-inch diameter stub end projecting ⅜ inch from the body of the shell is less than a minute.

FORGING THE SHRAPNEL HEAD

The shrapnel head shown at *A* in Fig. 75, that screws into the end of the shell and into which the fuse body is screwed, is made from a forging of low-carbon steel for the French shell. One method of producing this which is of unusual

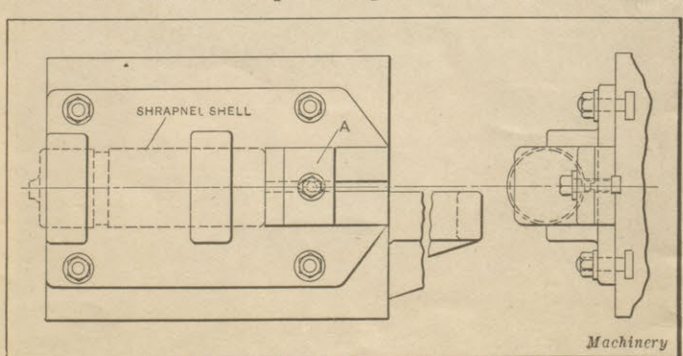


Fig. 74. Fixture used on Besly No. 14 Ring Wheel Grinder for grinding Center End from Shrapnel Forgings

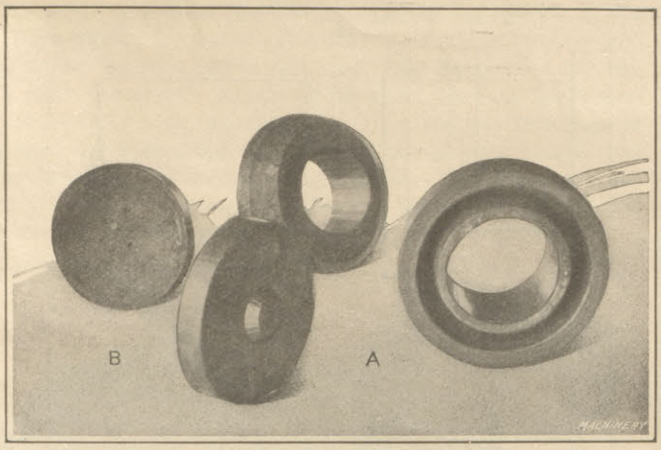


Fig. 75. Shrapnel Shell Head and Diaphragm produced in a Power Forging Machine

interest is shown in Fig. 76. A power-driven forging machine equipped with a special set of tools is used for this purpose. A bar of steel of the same diameter as the hole in the finished forging, in this case 1½ inch, is gripped in the dies as shown at *A*, and is upset by means of a plunger *a*, forming an upset on the end of the bar shown to the right.

The upset bar is now placed in the second impression of the gripping dies, as shown at *B*. By way of explanation, it should be stated that the views of the dies shown at *A*, *B* and *C* are sections taken in a horizontal plane at each stage or die impression. Upon gripping the upset forging in the second impression in the dies, the plunger *b* advances and forms an annular groove in the face of the forging, at the same time increasing its width as shown at *c*.

The forging, still integral with the bar, is now quickly removed and placed in the last impression of the dies. The diameter of the hole in these dies is larger than the bar, allowing it to slip back as the punch advances to punch the

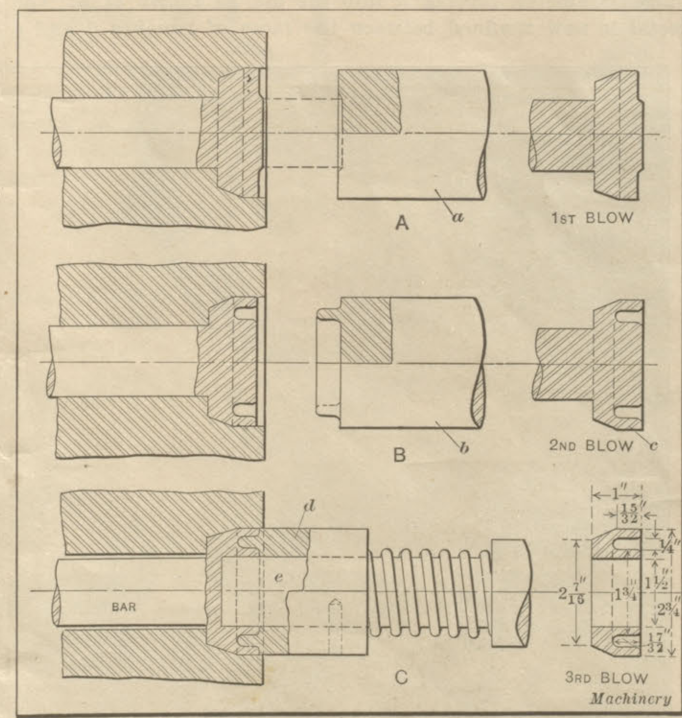


Fig. 76. Diagram illustrating Method of producing Shrapnel Shell Heads in a Power Forging Machine without any Waste of Stock

hole in the forging. When the punch moves forward it carries with it the spring-operated sleeve *d*, thus finishing the forging in one heat. This method of forging is very satisfactory, producing a homogeneous forging at the rate of 1500 in ten hours.

Forging the Steel Diaphragm

The steel diaphragm shown at *B* in Fig. 75 is made from low-carbon steel in a special type of forging machine operated similarly to a hot-pressed nut machine. That is to say, the bar, instead of being fed in from the front, as in a regular forging machine, is fed in from the side.

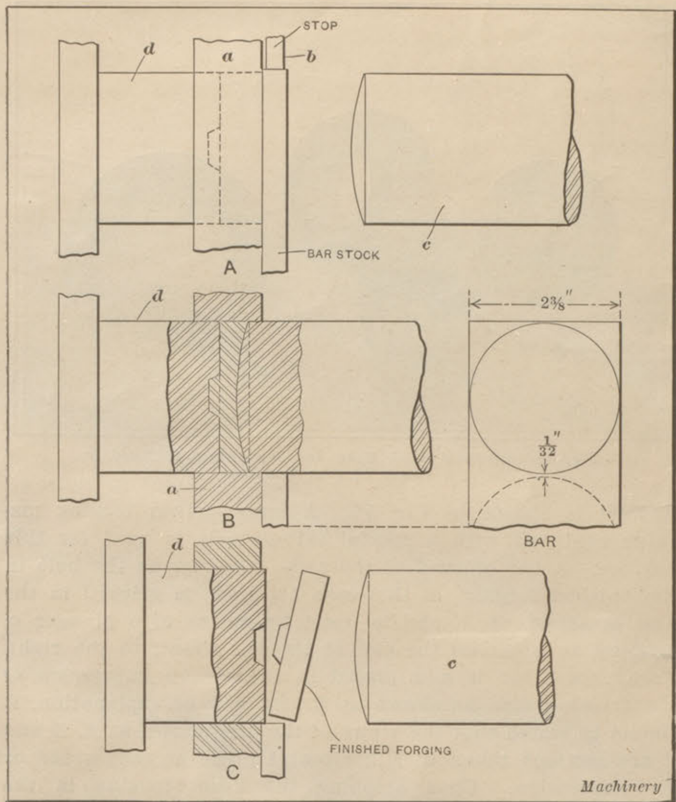


Fig. 77. Diagram illustrating Method of making Shrapnel Shell Diaphragms in a Special Type of Power Forging Machine

The manner in which this is accomplished is shown in Fig. 77. A flat bar of steel 2⅜ inches wide by ⅜ inch thick, heated to the proper temperature for a distance of three feet, is fed across the face of the die as at *A* and located by stop *b*. Punch *c* then advances and cuts out a blank of the required diameter, forcing it into the die, as shown at *B*. The metal is now confined between the faces of punches *d* and *c* and in die *a*, and is forged to the required shape. The next step is shown at *C*, where punch *d* advances and forces the formed forging out of the die. The production on this diaphragm is in the neighborhood of 8000 to 10,000 in ten hours.

GAGING SHRAPNEL SHELLS

The machining operations on shrapnel shells are required to be held within certain limits, and government inspectors watch these closely. Some of the principal gaging operations on the shrapnel shell body are shown in Fig. 78. Fig. 79 shows the 18-pound shrapnel shell in section, and gives the principal dimensions together with the limits; it will be seen from this illustration that the range allowable is in most cases large. The Wells Bros. Co., Greenfield, Mass., has made a large number of shrapnel gages, some of which

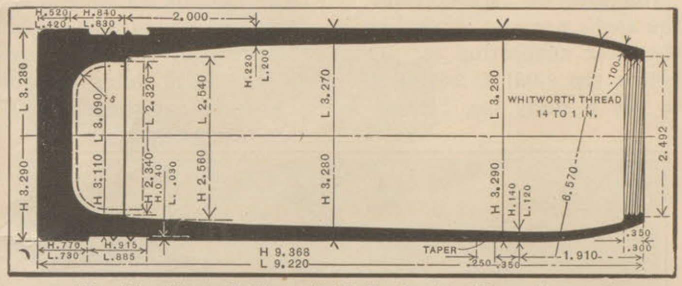


Fig. 79. 18-pound Shrapnel Shell showing Dimensions and Manufacturing Limits

are shown in the accompanying illustrations. In the three upper views of Fig. 78, the Wells Bros. standard thread gage is illustrated. This is used for all diameter measurements by substituting flat gaging pins for the V-points used when gaging thread diameters.

Gages for British Shrapnel Parts

Fig. 80 illustrates typical gages for gaging such parts of the British shrapnel as body diameters, diaphragm seat, powder pocket, fuse socket, thread diameters, and fuse parts.

Fig. 81 shows the application of several different types of

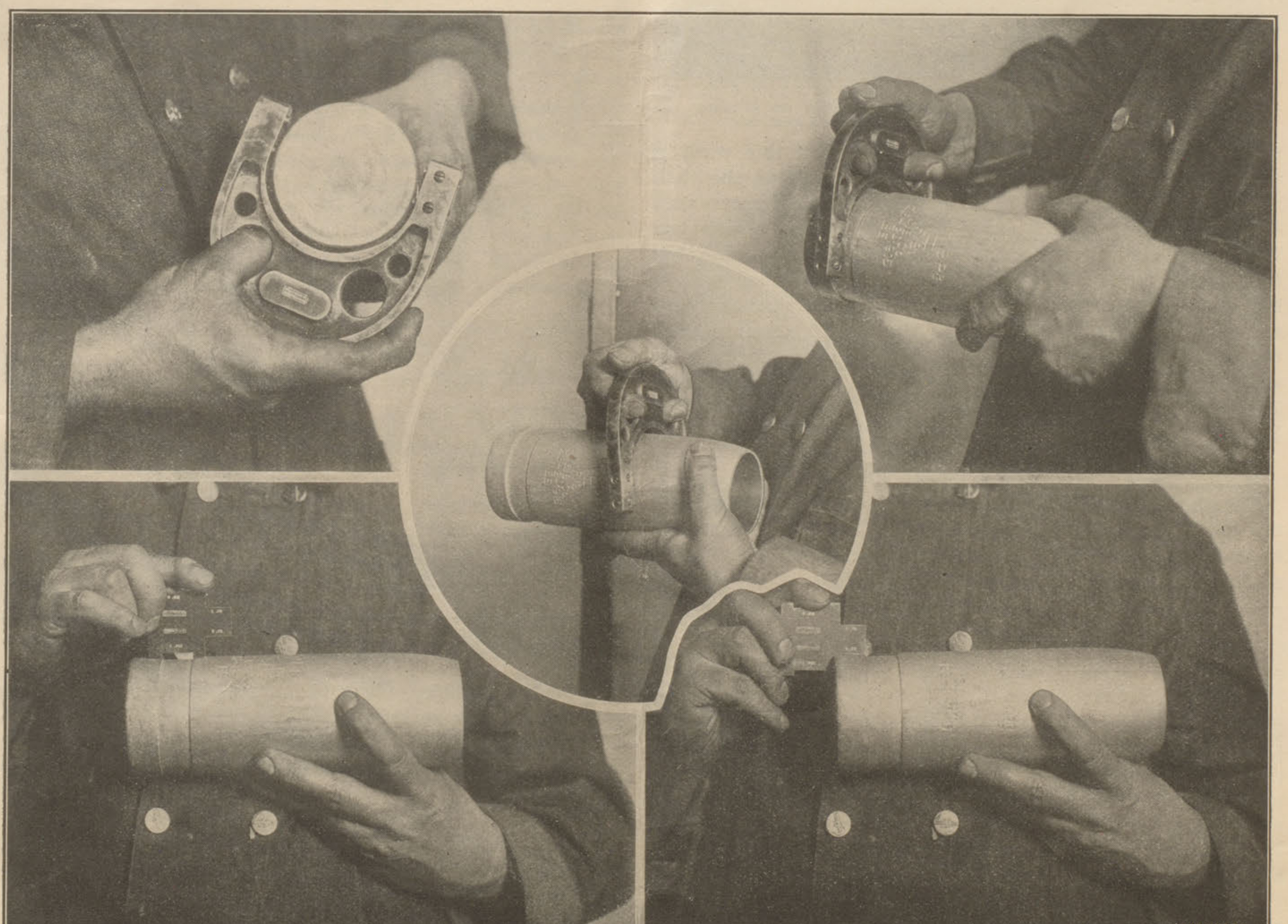


Fig. 78. Illustration showing Some of the Principal Gaging Operations on Shrapnel Shells

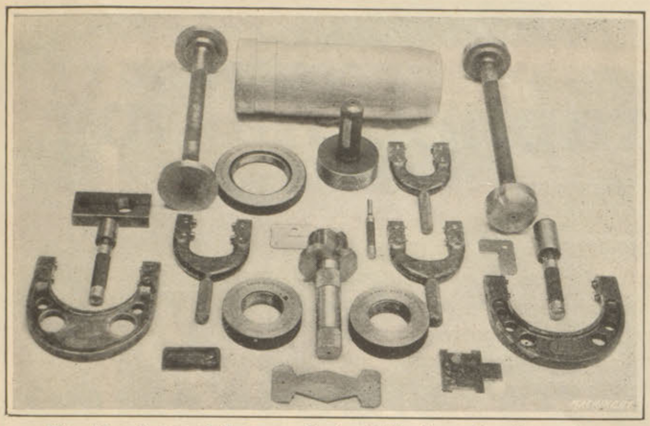


Fig. 80. Group of Gages made by Wells Bros. Co. for gaging British Shrapnel Shells and Parts

shrapnel shell gages. At *A* is the gage for the over-all length. At *B* is the gage used for measuring the thickness of the closed end. The outer arm of this gage can be swung away to allow the placing of the gage on the standard. At the extreme lower left-hand corner of the gaging arm is a slight shoulder on the rod and the height of this acts as the limit. *C* shows the application of outside diameter and thread gages.

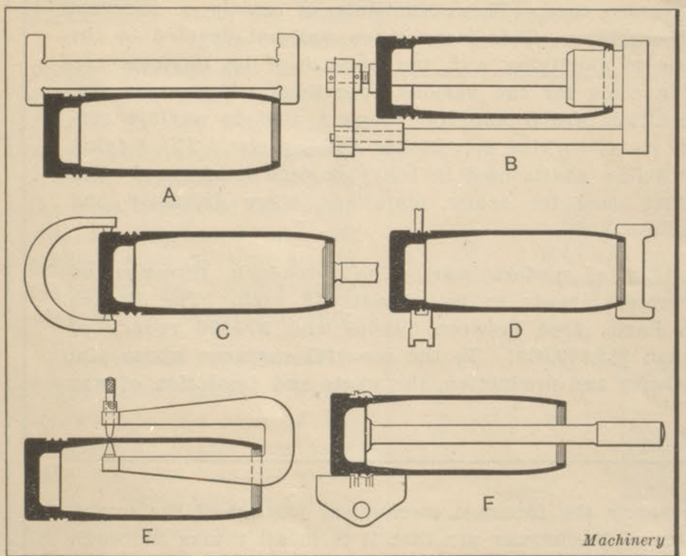


Fig. 81. Diagram showing Application of Wells Bros. Gages

D shows three form gages for checking the shape and dimensions of the wave ribs, the diameter and shape of the under cut in the band groove and the shape of the nose of the shell. *E* shows the gage used for checking the thickness of the wall of the shell at different distances from the mouth. *F* shows the application of a powder pocket gage, and also a gage for checking the shape of the finished rifling band.

Gages for American Shrapnel Shells

Fig. 82 shows a miscellaneous collection of gages used in checking the dimensions of the American shrapnel shell. Gages *A*, *B*, *C* and *D* are for measuring the diameter of the diaphragm seat. *E* is for checking the distance from the diaphragm seat to the mouth end of the shell, and gage *F* is for the outside diameter of the shell. Gage *G* is used for the rifling band groove. Gages *H* and *I* are for the thread in the mouth of the shell, *H* being a "not-go" and *I* a "go" gage.

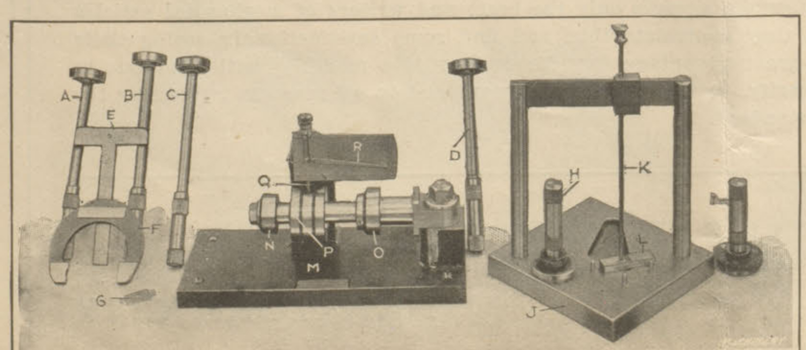


Fig. 82. Collection of Wells Bros. Co.'s American Shrapnel Shell Gages

The gage at *J* performs several gaging functions on the American shell. It consists of a standard having two upright posts across which a bar is mounted. The purpose of the bar is to gage the overall length of the shell, and its lower surface is provided with two steps giving the limits. This gage is also used for measuring the depth of the powder pocket, rod *K* and block *L* performing this function. Two rings are cut around the rod *K* registering with the top surface of the bar, the purpose being to show the accuracy of the work.

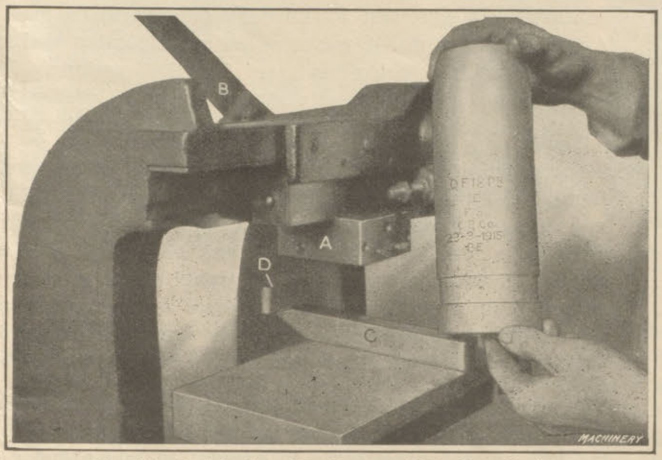


Fig. 83. Dwight-Slate Hand-operated Marking Machine for Shrapnel Shells

Another interesting gage is shown at *M*. This is for gaging the concentricity of the shell and consists of an arbor mounted so that it can be swung on a pivot. The arbor carries two collars *N* and *O* that fit in the shell. Collar *P* is merely a sizing plug and when the gage is in use this plug is removed. A gaging finger *Q* rests against the shell when it is on this arbor, and a standard type of indicator *R* shows the variation in concentricity when the gage, collars and shell are rotated on the arbor.

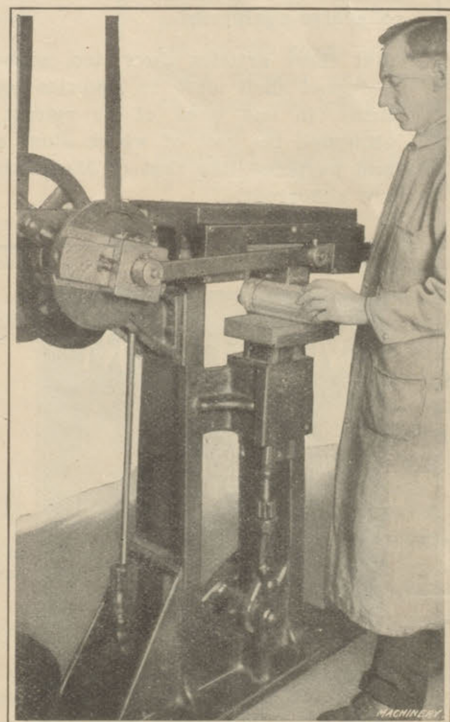


Fig. 84. Power-driven Dwight-Slate Marking Machines for Shrapnel Shells

MARKING SHRAPNEL SHELLS

All shrapnel shells are marked on their circumference with five or six lines of lettering, as shown in Fig. 83. This indicates the size of the shell, the series, muzzle velocity, name of the manufacturer, date completed, etc. Two types of machines for producing the stamping, built by Noble & Westbrook, Hartford, Conn., are shown in Figs. 83 and 84. The machine shown in Fig. 83 is of the hand-operated type. The figure block *A* is held in a slide that is moved longitudinally by pulling down handle *B*, rolling the shell, and at the same time stamping it. The shell is located on the table in the two positions by gages *C* and *D*.

The "Dwight-Slate" stamping machine shown in Fig. 84 is power-driven, and the work is held on an elevating table. The stamp is held in a slide operated by an eccentric and connecting-rod. In this machine the shell is not distorted, as in hand-stamping.

Shrapnel and Shrapnel Making

Editorial from April MACHINERY

The shrapnel shell, invented by an Englishman, Lieut. Henry Shrapnel, in the latter part of the eighteenth century, was conceded by military experts to be most effective for the purpose intended, even in its early form. As originally made, it was a spherical explosive shell that burst by ignition with a time fuse, the fragments and bullets contained being scattered in all directions. The modern, or "shooting shrapnel," is a thin walled projectile made of high tensile strength steel, cleverly designed to act like a blunderbuss; it blows its charge of bullets out at a still greater velocity than that imparted to the shell by the howitzer.

The design of shrapnel and the machining of the component parts are matters of world-wide interest to manufacturers, toolmakers and mechanics at present. Shrapnel is being used in enormous quantities, and American machine tool builders have been called on to provide machines and tool equipment of the latest and most efficient designs to meet the demand. Many shops are running full force day and night, and are months behind their orders. A small percentage of shrapnel shells is made from bar stock but most shrapnel are made from forgings, formed hollow with hydraulic presses or in forging machines. The forging processes, which are of extraordinary interest, especially to those who know something of the difficulties attending them, are not finishing processes. Whether made from the bar or forged hollow, machining must be done on all.

The articles in this number treat in detail of the construction, forging and machining operations and the tool equipment used for making the shell, fuse parts and the brass case. They constitute as nearly a complete treatise as was practicable to present in one number of MACHINERY. This large space was not devoted to the design and manufacture of a deadly missile for the purpose of glorifying war, but because of its intrinsic mechanical interest and the ingenuity displayed in providing tools for the various operations. It is true, unfortunately, that the making of spears, rifles, guns, ammunition, armor and the weapons used in warfare generally has promoted the development of metallurgy and the metal-working arts as has nothing else. The forging of great gun tubes made possible the production of large hollow shafts used in heavy modern machinery. The alloy steels now so generally used for automobiles were first used for armor plate and other defensive and offensive equipment.

But these articles show, too, something of the cost and folly of modern war. The three-inch, fifteen-pound shrapnel shell made in America costs the European governments, ready to fire, about $18 each. The French army, in one week of its retreat from Belgium toward Paris, fired between 800,000 and 900,000 rounds of shrapnel, the cost of which alone must have been more than $15,000,000! To the peaceful engineer whose aim and purpose—like that of MACHINERY—are to promote efficiency and production, the waste and desolation of war are abhorrent.

COMBINATION timing and percussion fuses comprise a large number of small parts made from different metals and alloys, and are produced in various ways. Some of the parts are made from rod brass or alloys of copper and aluminum, whereas others are made from hot-pressed forgings and are machined after being formed to shape. In the following, a brief description of several different methods of making the most important fuse parts will be illustrated and described, together with details regarding the forging tools used for the socket and plug.

Forging the Fuse Socket

The fuse socket, which screws into the nose of the shrapnel shell and acts as a base for the fuse, is made from a special forgeable alloy casting containing 40 per cent copper, 58 per cent zinc and 2 per cent lead. The first step in this process is to melt the above constituents in the usual manner and then to cast the slugs in sand molds, six to eight being gated together. These castings are made 2 11/16 inches diameter by 11/16 inch thick, as shown in Figs. 85 and 86. There are several methods in use for forging the plugs, but the general principle is the same. In this particular case, a No. 23 Bliss press capable of exerting a pressure of 250 tons is used. The castings are placed in the furnace where they are allowed to "soak" at a temperature varying from 1200 to 1300 degrees F., or in other words, until they reach a dull red color. One casting at a time is then quickly removed and placed in the impression of the die shown to the right in Fig. 85 and in detail in Fig. 86. The working parts of these dies are made from Jessop's high-carbon tool steel and one blow of the press completes the forging, turning out about 3000 in ten hours. The tools used for this purpose are of interesting construction, as shown in Fig. 86. They comprise a lower die *A* machined out to the shape of the finished forging and carrying an ejector and lower former *B* operated by plunger *C* which ejects the forging if it sticks in the die. The top member or punch comprises a holder *D* into which the punch *E* is screwed. This is bored out to fit an ejector *F* which ejects the forging as the ram of the press ascends. Punch *E* and stripper or ejector *F* are made from high-speed steel, hardened. *G* shows the cast blank and *H* the completed forging.

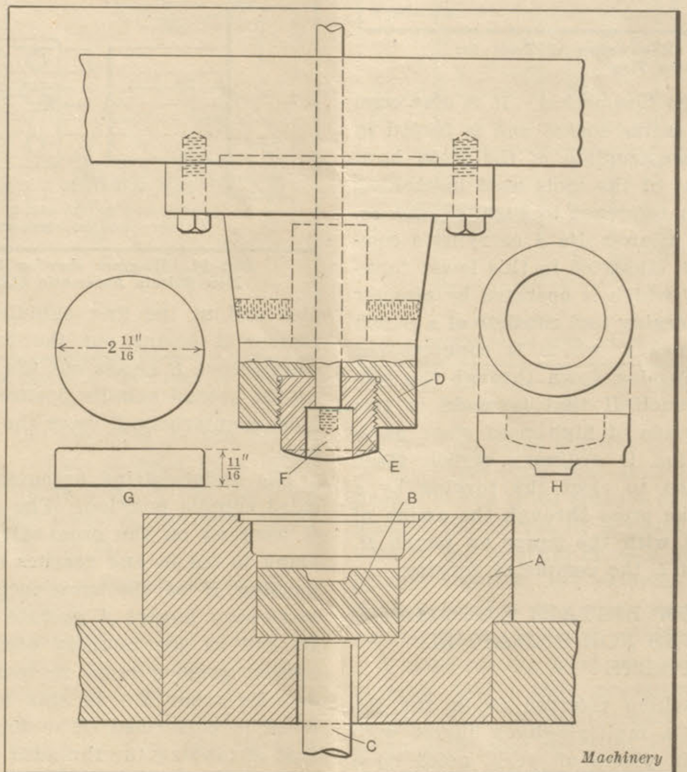


Fig. 86. Diagram showing Construction of Tools used in forging Fuse Socket

Forging Brass Plugs

The brass plug shown in Fig. 87 is used as a temporary cap for the shrapnel to protect it during transportation. It remains in the fuse socket until the shrapnel shell reaches the field of operations, when it is removed and replaced by the timing fuse. This member is made from a special forgeable alloy casting 2 inches in diameter by 7/8 inch thick and is cast in sand

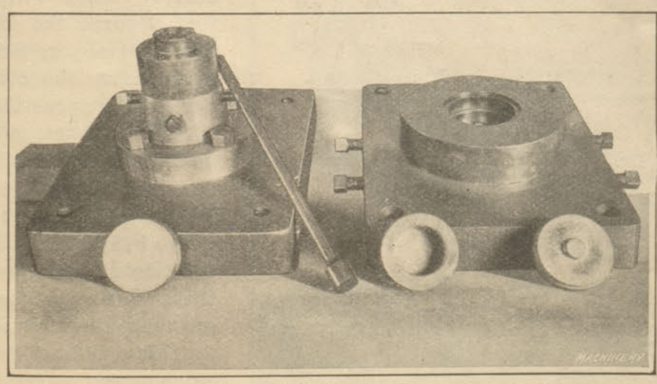


Fig. 85. Tools used in forging Brass Fuse Socket

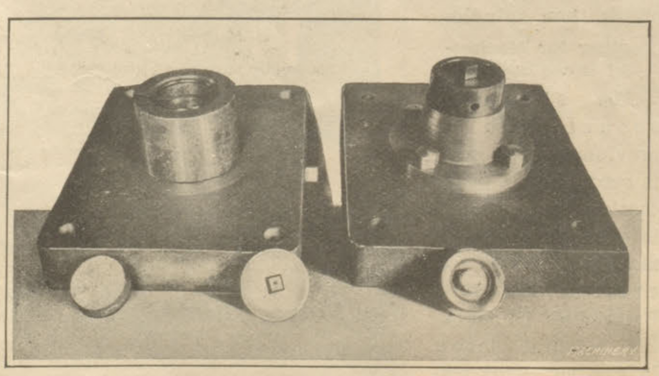


Fig. 87. Tools used for forging Brass Plug

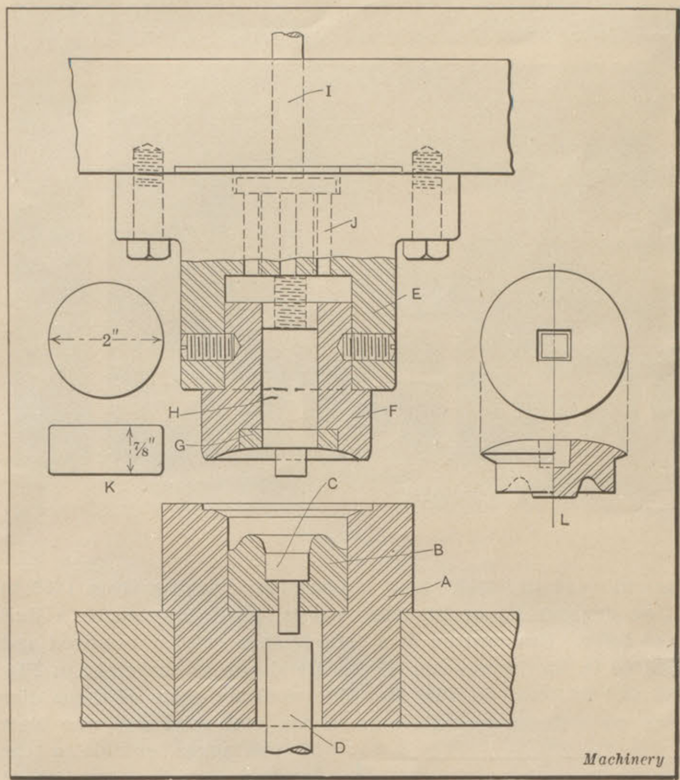


Fig. 88. Diagram showing Construction of Tools for forging Brass Plug

molds in a similar manner to the fuse socket. It is also composed of the same constituents as the socket and is forged in the same type of press. The construction of the tools, however, varies somewhat from that of the tools used in making the socket, as will be seen upon reference to Figs. 87 and 88. The tools for the plug comprise a lower die *A* carrying a combined ejector and forming die *B*. Inserted in this lower forming die is a secondary ejector *C* which is operated by plunger *D*. The upper member of this forging tool consists of a punch holder *E* carrying forming punch *F* which is counterbored to receive an ejector ring *G*. Passing down through the center of punch *F* is a center punch *H* that is made in two parts. The lower member is made of high-speed steel, hardened, whereas the upper portion is ordinary carbon steel. This center plunger is operated to eject the forging by a plunger *I* on the up-stroke of the press through the action of three pins *J* coming in contact with the flange on punch *H*. *K* shows the rough casting and *L* the completed forging.

TOOLING SET-UPS ON NEW BRITAIN AUTOMATIC CHUCKING MACHINES FOR SHRAPNEL FUSE PARTS

The automatic chucking machine referred to in the following, consists essentially of a multiple-chuck turret with capacity for holding five or six pieces of work, acted upon simultaneously by four or five tool-holding spindles. The sequence of operations is similar to that of a multiple spindle screw machine. A finished piece is removed and a rough blank inserted at each indexing. The machine is not idle while chucking, there being one more chuck than spindles.

Tooling for Machining Brass Socket

The shrapnel socket which, as previously explained, is made from a brass casting and pressed into rough shape, is machined in two settings in the New Britain No. 24 chucking machine shown in Fig. 89. This machine has four spindles and at the first spindle position, as shown in Fig. 90, reamer *A* cleans out the hole in the pressed brass blank, counterbore *B* cleans out the inside, and tool *C* faces the end. At the second spindle position, reamer *D* finishes the central hole, counterbore *E* faces the bottom, and tool *F* chamfers the hole.

The under-cutting preparatory to threading is done at the third spindle position. The operation is performed with tool *G* working on the cross-cutting head *H*. When the pressed blank is fed in and reaches stop *I*, it commences to push the housing *H* of the cross-cutting head backward. A pair of stationary fingers *J* operate in oblique slots in the housing *H*, and as the housing presses down on these fingers, the motion gives a cross movement to the under-cutting tool *G* and its arbor *K*. In this manner, the under-cutting of the piece is performed. The fourth spindle operation is simply that of tapping the threaded interior with a tap *L*.

Second Operation on Shrapnel Socket

Fig. 91 shows the order of operations performed on the shrapnel socket at the second chucking, the work being screwed on threaded arbors. At the first spindle position, pilot *A* engages the central hole, while tool *B* turns the external diameter, tool *C* chamfers the corner, tool *D* turns the thread diameter, tool *E* faces the shoulder, and counterbore *F* finish-forms the nose of the piece. At the second position, these same surfaces are machined with finishing tools of the same design as those just described.

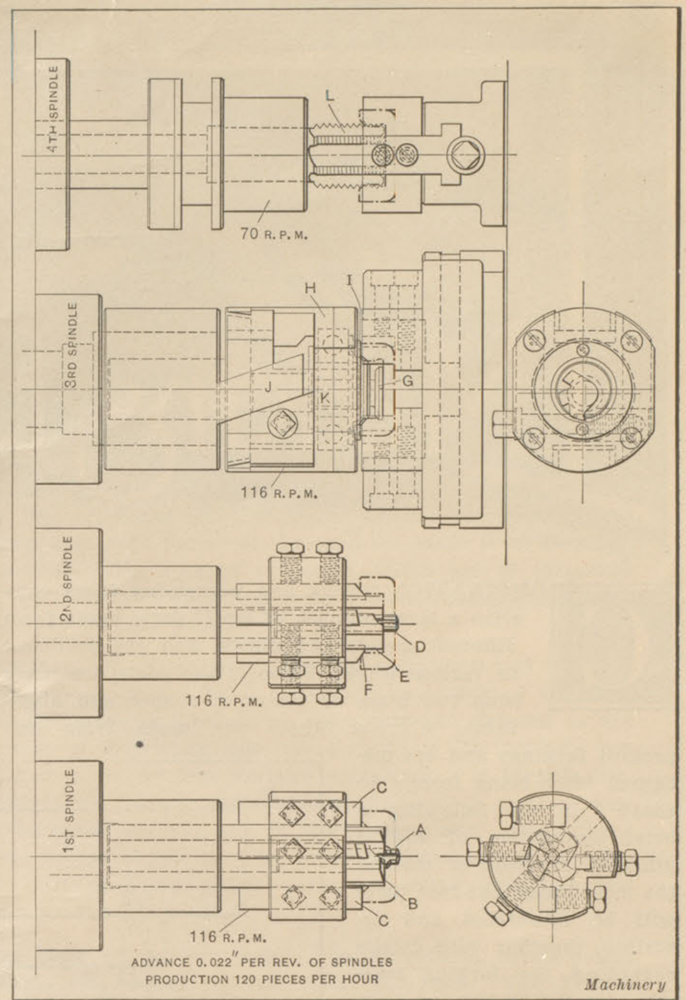


Fig. 90. Diagram showing First Series of Operations in the New Britain Automatic Chucking Machine on Fuse Socket

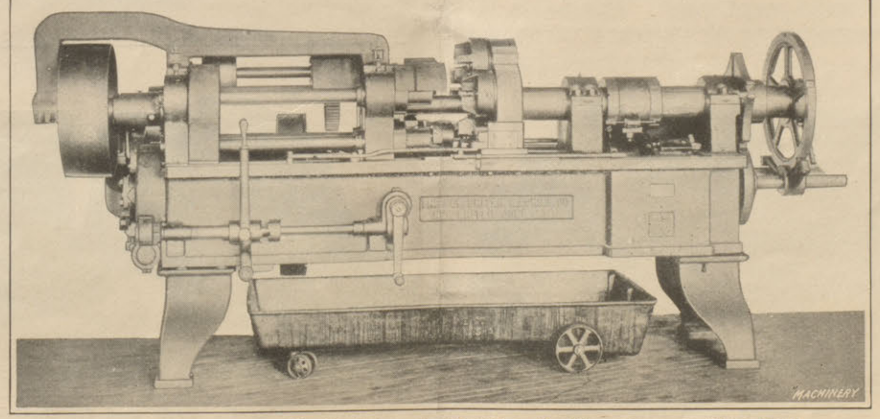


Fig. 89. New Britain No. 24 Automatic Chucking Machine set up on Fuse Parts

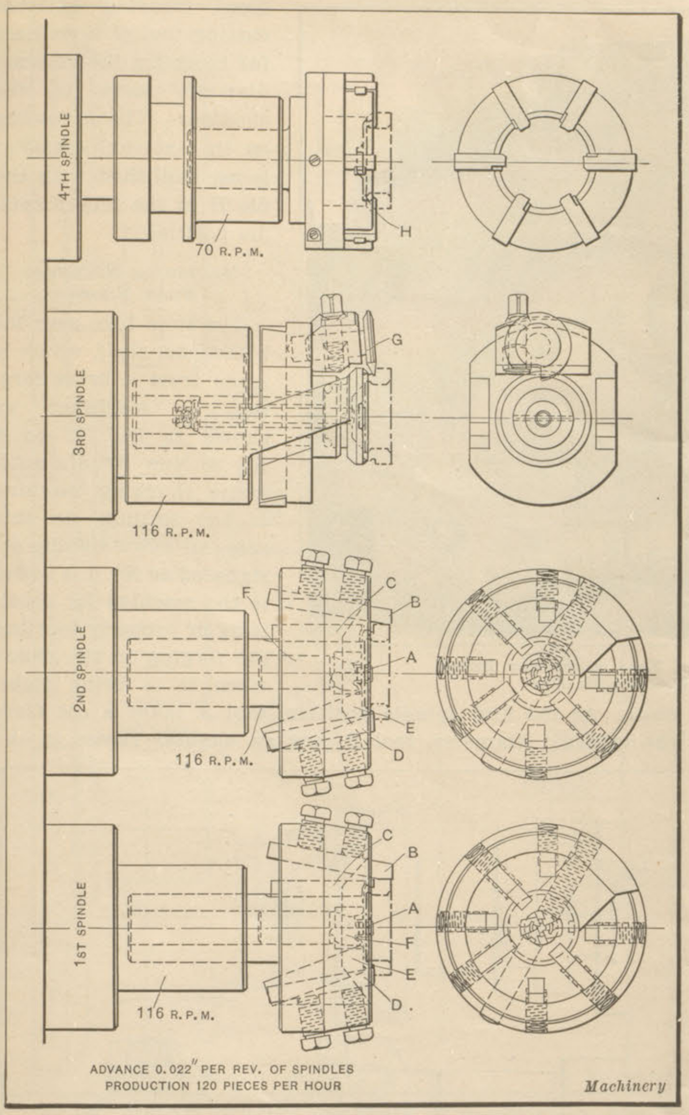


Fig. 91. Diagram illustrating Second Series of Operations on Fuse Socket on New Britain Automatic Chucking Machine

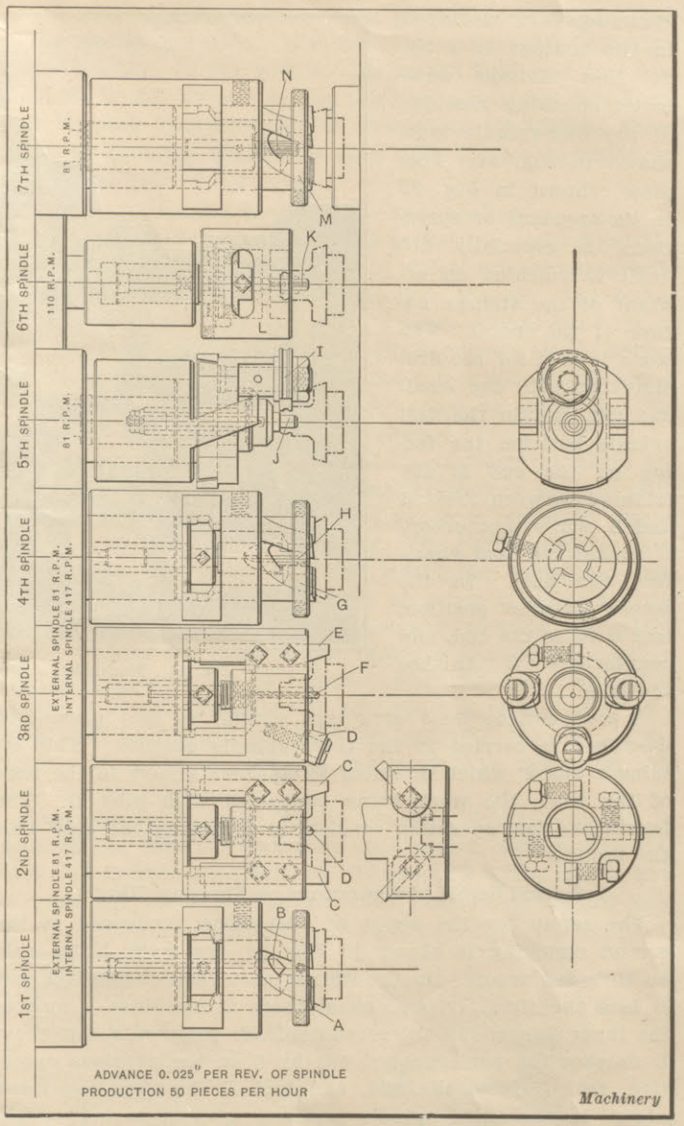


Fig. 92. First Series of Operations on Fuse Body on No. 73 Seven-spindle New Britain Automatic Chucking Machine

At the third spindle position, the shoulder at the end of the threaded section is under-cut. This is done by a cross-cutting head, similar to that shown in Fig. 90 and carrying the cutter *G*. At the fourth spindle position, the final operation—threading—is performed with die *H*.

Machining Fuse Bodies on No. 73 New Britain Automatic Chucking Machines

In Fig. 92 is illustrated an interesting tooling set-up for machining a fuse body. This is done on the No. 73 seven-spindle New Britain automatic chucking machine shown in Fig. 93. The operations in this set-up are performed on one end only of the fuse body, as shown in Fig. 92. Strictly speaking, this is a seven-spindle machine, but the first four spindles carry internal spindles running at high speed that cooperate with the external spindles in machining the work, making this virtually an eleven-spindle machine. At the first spindle position, the broad face and stem are machined with cutters *A* of the hollow mill type, and the centering tool *B*, carried in the inner spindle, centers the work for drilling.

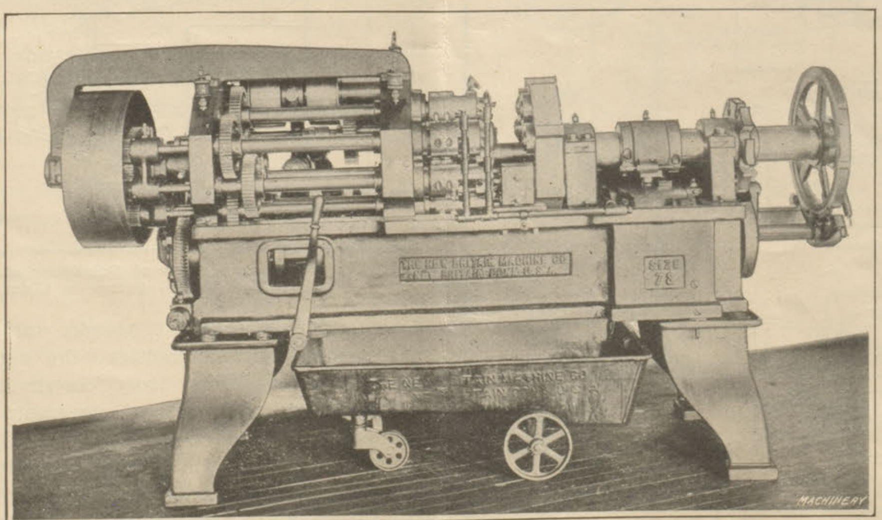


Fig. 93. New Britain No. 73 Seven-spindle Automatic Chucking Machine

In the second spindle position, tools *C* bevel the external diameter of the flange at the same time that drill *D* is producing the hole in the stem. In the third spindle position, roll *D* supports the work against the thrust of beveling tool *E*, and the small drill *F* held in the internal spindle deepens the hole. At the fourth spindle position, the external spindle carries a hollow mill *G* that finishes the stem diameter, and a counterbore *H* is carried in the internal spindle to machine the central hole.

A cross-cutting head in the fifth spindle position carries a circular tool *I* that machines on both sides of the section spbsequently to be threaded, and while this operation is being performed the pilot *J* steadies the work as well as the tool-holder. In the sixth spindle position, the small hole is threaded with tap *K*, and the exterior is threaded with a die, tap and die being of different pitches. In the seventh spindle position, a holder carries the forming tool *M* for cutting the grooves in the face of the flange, and the same spindle carries a reamer *N* that finishes the hole in the stem.

Machining Steel Shrapnel Heads

Heads for shrapnel shells made from cold-drawn steel stampings are machined in two settings on a No. 24 New Britain automatic chucking machine of the four-spindle type, shown in Fig. 94. This piece, shown in Fig. 95 in its sequence of operations, is especially difficult to machine on account of the stringy nature of the metal. The work is held for the first chucking with the small end out, and in the first spindle position the facing on the end is distributed between tools *A* and *B*, while counterbore *C* roughs out and chamfers the hole. In the second spindle position, tool *D* faces the end, and counterbore *E* finishes the hole.

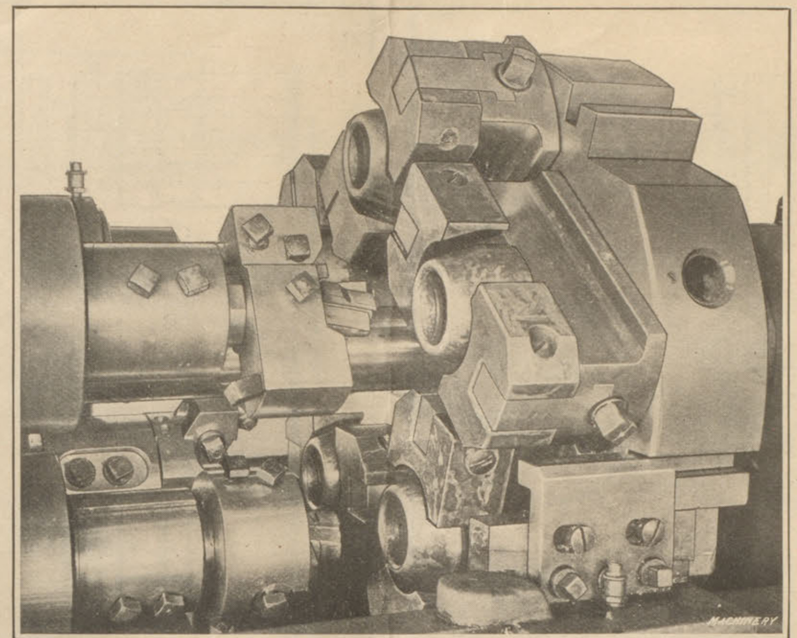


Fig. 94. Machining a Shrapnel Head on the New Britain No. 24 Automatic Chucking Machine

A cross-cutting head of a type similar to that previously described is carried in the third spindle position. This retains a tool *F* which produces an annular groove in the nose of the head, the work being supported with pilot *G*. The fourth and last operation consists in threading the hole with the tap *H*.

Second Series of Operations on Shrapnel Heads

The set-up for the series of operations performed at the second chucking is shown in Fig. 96, the work being held on threaded arbors. In the first spindle position, tools *A* and *B* face the shoulder, and counterbore *C* machines a seat in the inner flange. In the second spindle position, counterbore *D* finishes the part roughed out by *C* in the previous operation, tool *E* faces the end, and tool *F* chamfers the inner edge. In the third spindle position, a cross-cutting attachment carrying external cutting tool *G* is utilized for recessing the external diameter next to the shoulder. The threading on the external diameter is accomplished with the die *H* in the fourth spindle position.

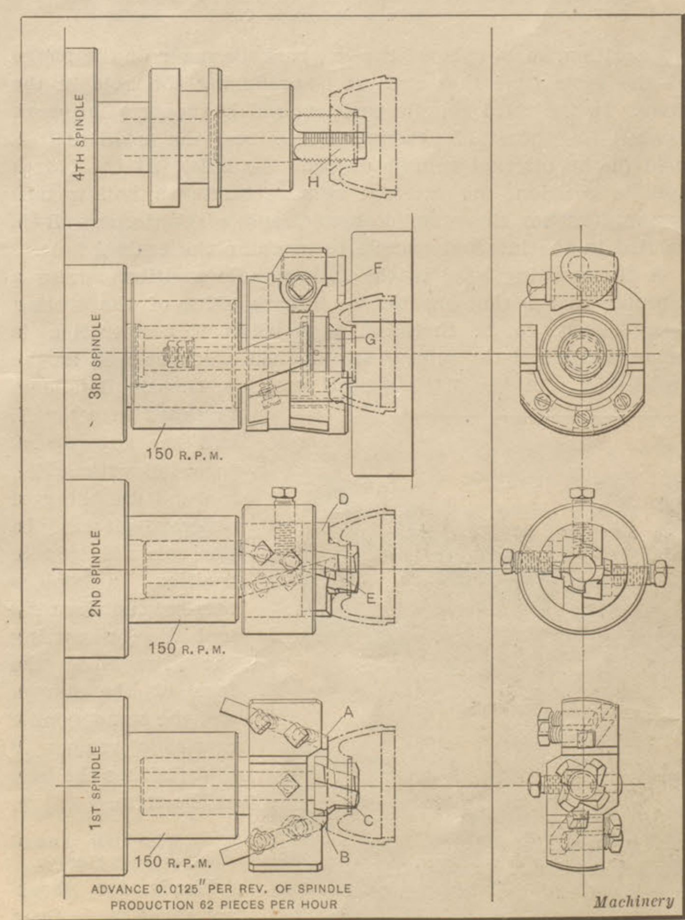


Fig. 95. First Series of Operations on Shrapnel Head on the New Britain Automatic Chucking Machine

Machining Shrapnel Fuse Noses

The time fuse nose for a shrapnel shell, which is made from a brass forging, is machined as shown in Fig. 97 on a No. 33 New Britain automatic chucking machine at one setting. In this case, an extra spindle designated as No. 0 is added to the machine for equalizing or properly locating the forging in the chuck when it is being tightened. At the first spindle position, tool *A* takes a cut from the external diameter, tool *B* cuts an angular recess in the face, and counterbore *C* roughs out the center portion. In the second spindle position, the same operations are performed with finishing tools. In the third spindle position, a cross-cutting head carries a recessing tool *D* that forms a recess back of the tapped portion. The hole is then tapped in the fourth spindle position, and in the fifth spindle position a special counterbore *F* takes a light finishing cut from all the surfaces previously machined. The external surfaces of the fuse nose are machined on a turret lathe.

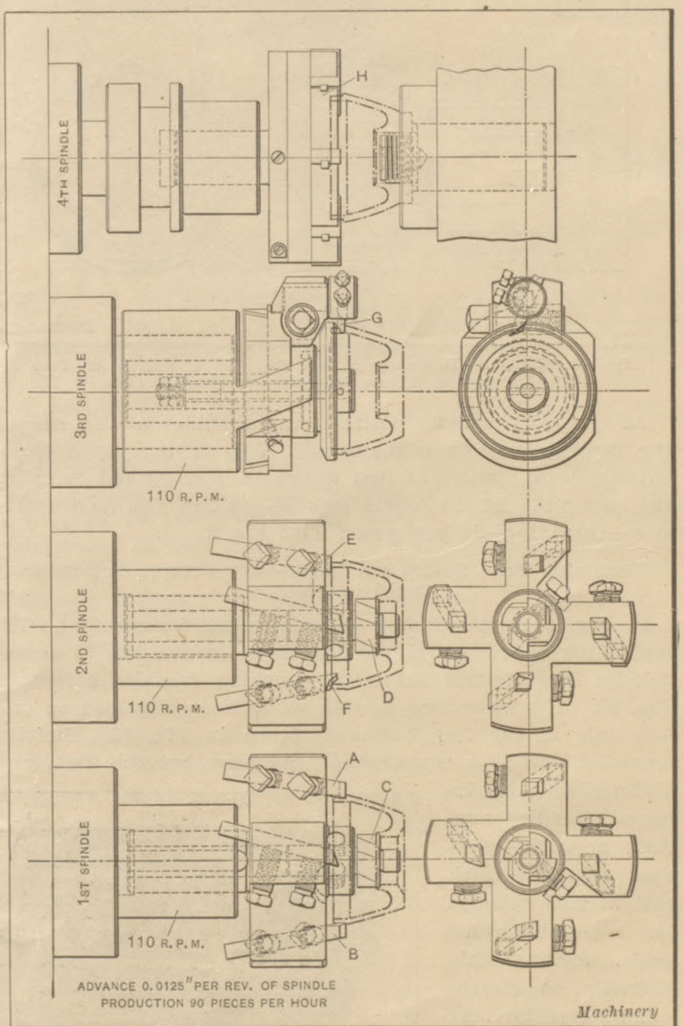


Fig. 96. Second Series of Operations on Shrapnel Head on the New Britain Automatic Chucking Machine

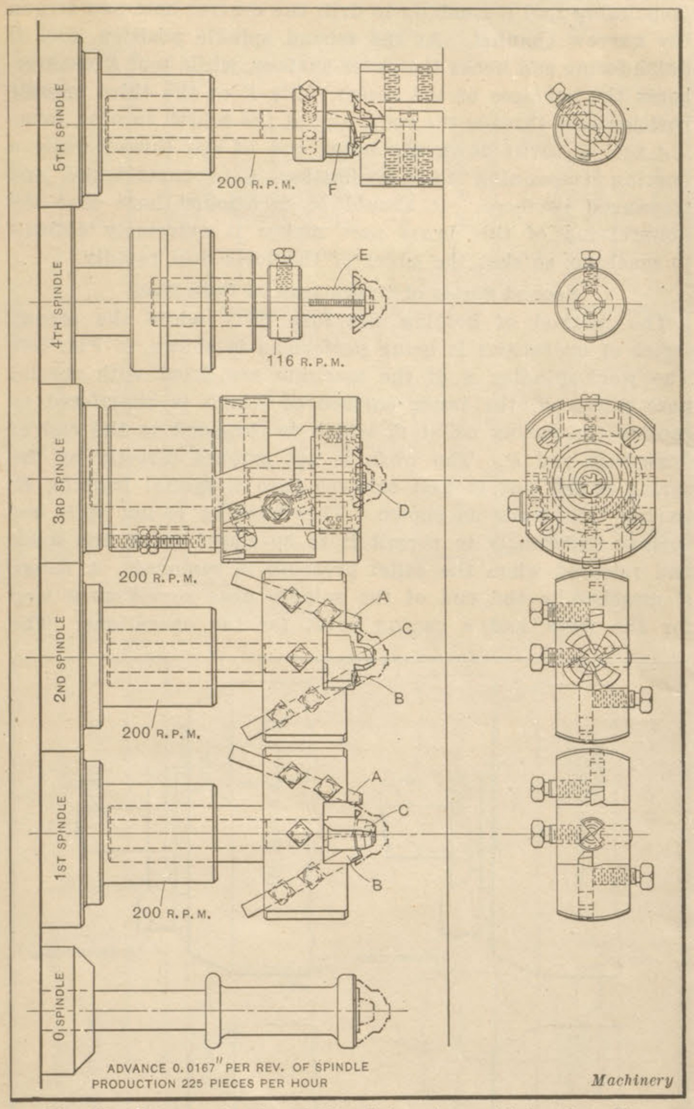


Fig. 97. Diagram showing Tooling Set-up for machining Fuse Nose on New Britain Automatic Chucking Machine

MACHINING SHRAPNEL FUSE PARTS ON "GRIDLEY" AUTOMATICS

The machining of fuse parts for the British shrapnel shell on "Gridley" single- and multiple-spindle automatics, made by the Windsor Machine Co., Windsor, Vt., forms the basis of several interesting tooling equipments. A number of the parts are machined from hot-pressed brass forgings, so that they must be handled separately.

Machining the Brass Fuse Socket

The fuse socket, as has been previously described, is made from a brass forging and is machined complete in two operations on a 3¼-inch "Gridley" automatic turret lathe of the single-spindle type. The manner in which the work is loaded in the chuck and held for the first series of operations is shown at *A* in Fig. 98. The rough blank *a* is first placed over the spring fingers *b*, which are held in a holder clamped in the turret, but are free to rotate. When the work is pushed into the chuck, it forces back spring-ejecting stud *c*, which, as soon as the pressure of the chuck is released, ejects the work.

As the loading device operates on the first slide of the turret, the first machining operation takes place on the second slide. This is a comparatively simple operation and consists in boring the central recess with tool *d* and chamfering with tool *e*. The turret is then indexed, bringing the internal necking tool *f* into position. This is held in a holder and is operated by the forward motion of the forming slide. Following this, tap *g* is brought into position to thread the recess in the socket. The operation of the turret is now stopped automatically until the operator loads a new piece in the chuck. The tapping is done with the spindle running in the forward direction on slow speed. After the hole has been tapped, the spindle is reversed and operated at a higher speed. The spindle continues to run backward for loading, and is still running backward, but slowed down, at the time of the second operation. It is for this reason that the boring tool *d* operates on the reverse side of the hole, and tool *e* is mounted upside down. At the third operation, the spindle is still running backward but is speeded to its highest speed while the internal necking is done with the tool working on the reverse side of the hole.

Second Operation on Fuse Socket

The method of holding the fuse socket for performing the second operation on the 3¼-inch "Gridley" single-spindle automatic turret lathe is shown at *B* in Fig. 98. The socket *h*, which has now been threaded, is screwed onto the body of special arbor *i*, fitting in sleeve *j* that is gripped by the spring collet. On the reduced end of arbor *i* is a nut which serves to clamp the work up against the face of sleeve *j*. The method of using this arbor is as follows:

To chuck the work, sleeve *j* and its auxiliary members are removed from the spring collet, and the work is screwed onto the nose of arbor *i*, the position of which is locked by means of a nut on the stem of the arbor. The entire arbor is then replaced in the collet and the machining operations performed on the work. This type of arbor is necessary because of the heavy cutting with the wide forming tool which would tighten the piece on the threaded nose to such an extent that it could not be removed when finished. With this device, it is only necessary to hold the square end of arbor *i* in a vise, and loosen the work by relieving the nut on the arbor. In order to facilitate the work, two arbors of this type are provided.

The operations performed in the first position consist in forming the external diameters with tool *k*, facing with side tool, and drilling with drill *m*. The second turret face is now skipped and the third brought into position, presenting self-

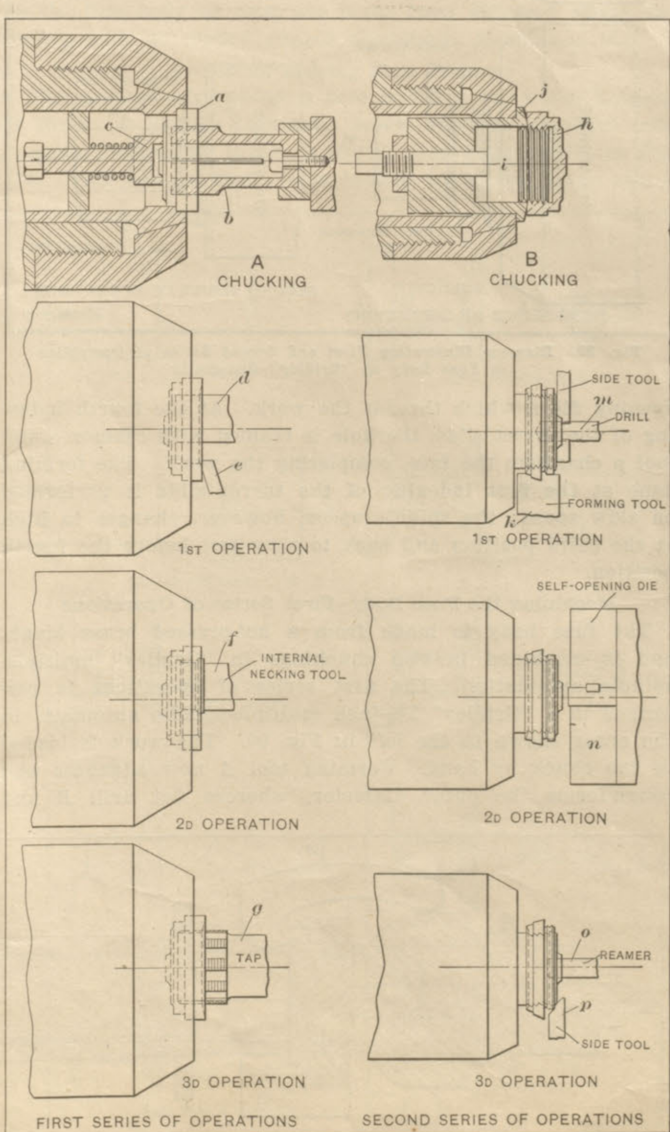


Fig. 98. Machining Brass Fuse Socket on 3¼-inch "Gridley" Automatic Turret Lathe—First and Second Series of Operations

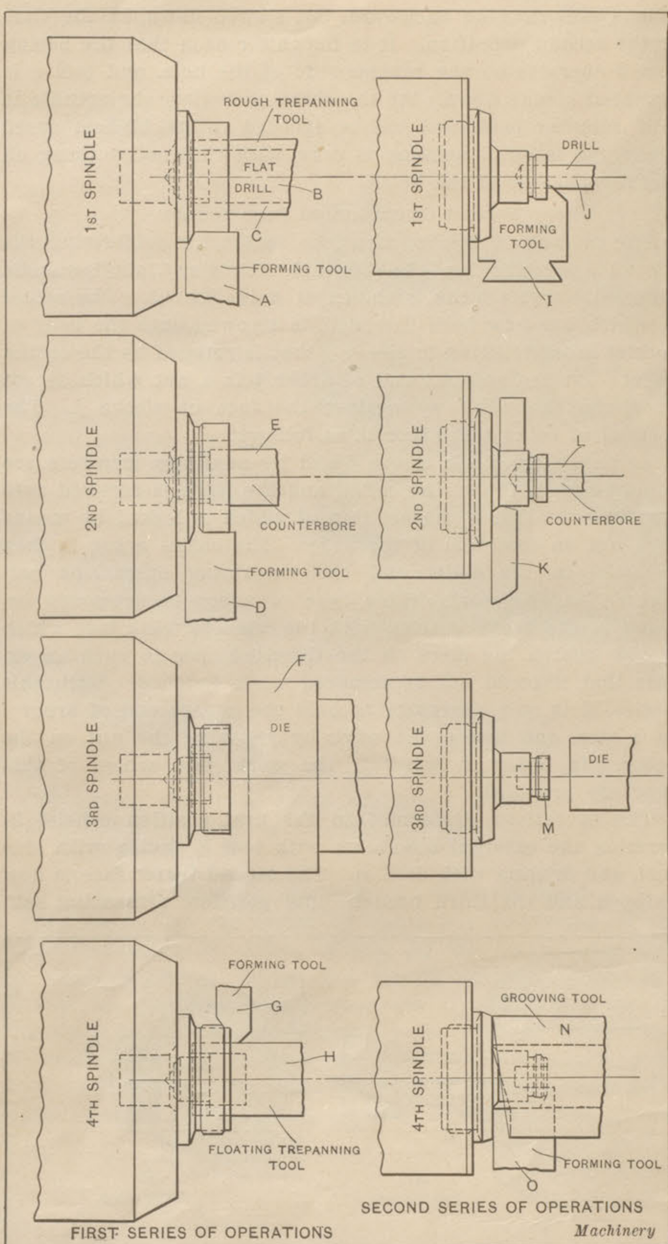


Fig. 99. Diagram illustrating First and Second Series of Operations on Fuse Body on "Gridley" Automatic

opening die *n* which threads the work. At the fourth indexing of the turret slide, the hole is reamed with reamer *o* and tool *p* chamfers the face, completing the work. The forming done at the first indexing of the turret slide is performed on slow speed; the spindle speed, however, changes to high at the third position and back to slow just before the fourth position.

Machining the Fuse Body—First Series of Operations

The fuse body is made from a hot-pressed brass blank, and is machined in two chuckings in "Gridley" multiple-spindle automatics. The first series of operations is performed in a "Gridley" 1¾-inch multiple-spindle automatic in the order shown to the left in Fig. 99. The work is loaded in the chuck by hand. Forming tool *A* now advances and rough-forms the outer diameter, whereas flat drill *B* and trepanning tool *C* combine to drill the central hole and trepan the narrow channel. At the second spindle position, tool *D* finish-forms and necks the outer surface, while tool *E* counterbores the surfaces of the recess. Die *F* at the third spindle position now threads the body, and at the fourth spindle, forming tool *G* turns down the outer end of the thread while a floating trepanning tool *H* finishes the counterbored and trepanned surfaces. It should be mentioned here that the hot-pressing of this brass part makes it extremely difficult to machine, so that the edges of the tools dull rapidly.

Second Series of Operations on Fuse Body

The method of holding the fuse body while the second series of operations is being performed is shown in Fig. 100. The work-spindles *A* of the machine are fitted with special nose pieces *B*, the inner surface of which is chamfered to receive the spring collet *C*, which is threaded to the end of draw-back rod *D*. The work is not gripped directly by the spring collet, but is first screwed into a special bushing *E*, having thin walls as shown. This bushing is not split but springs sufficiently to permit it to be closed in on the work and released when the collet pressure is removed. A flange *G* attached to the end of the spindle nose serves as a stop for the work and a gaging point for the operations. The

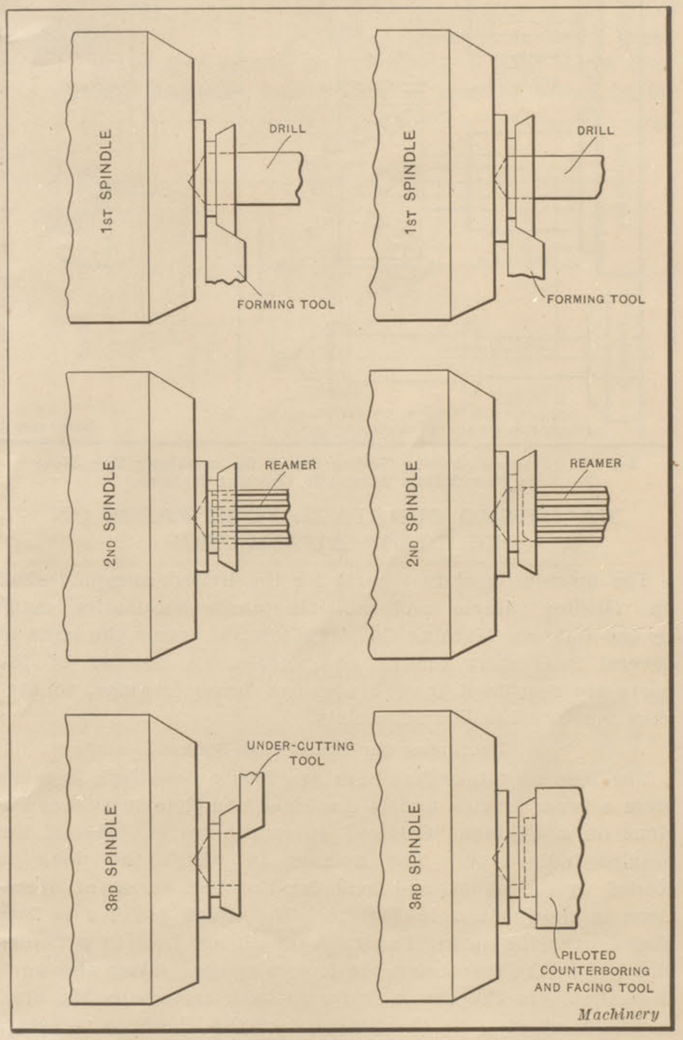


Fig. 101. Diagram illustrating Set-up for machining Timing Train Rings on "Gridley" Automatic

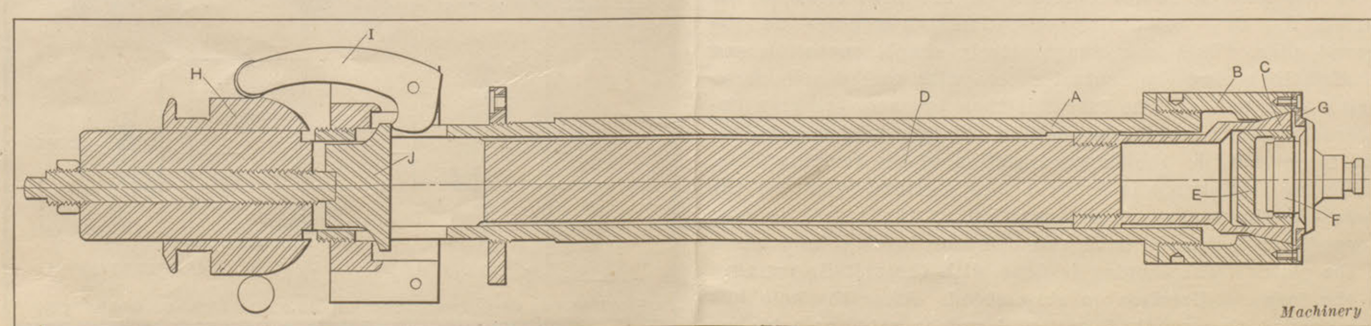


Fig. 100. Section through a "Gridley" 3¼-inch Automatic Turret Lathe Spindle showing Method of chucking Shrapnel Fuse Body

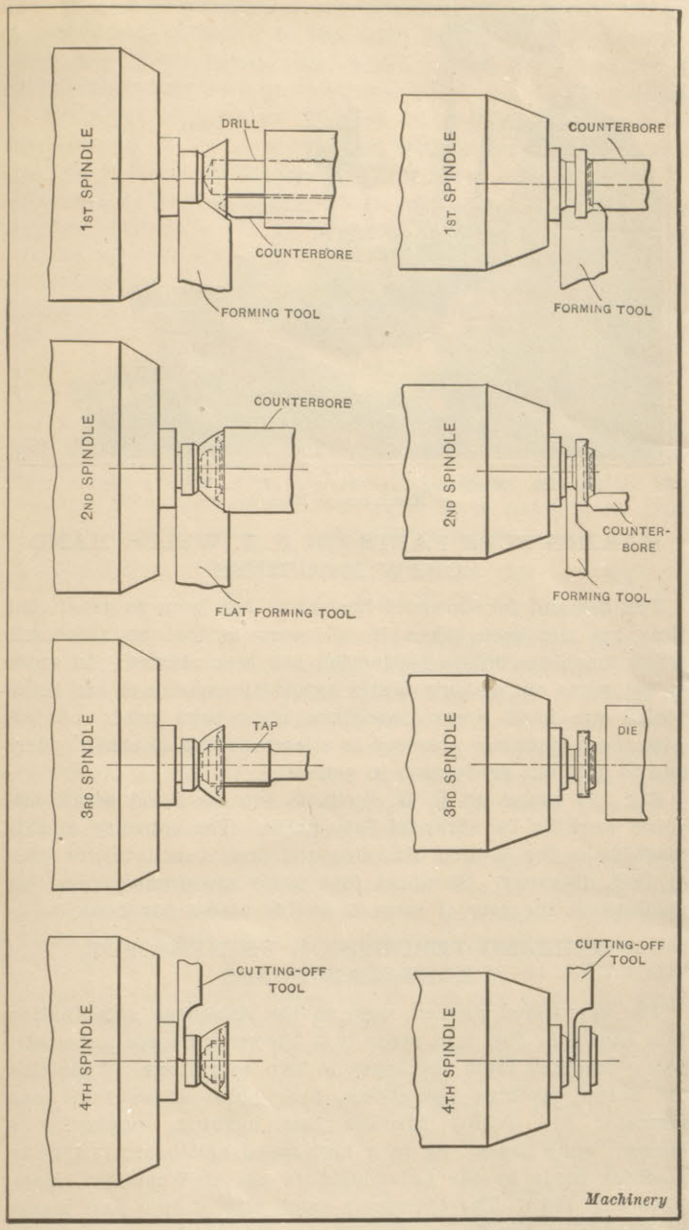


Fig. 102. Diagram illustrating Set-ups for machining Closing Cap and Bottom Closing Screw on "Gridley" 1¾-inch Multiple Spindle Automatic

regular collet closing mechanism is used, but as may be seen in the left-hand end, the finger holders are reversed. When the clutch ring *H* is pushed forward by the chuck-closer, gripping fingers *I* swivel and draw rod *D* backward through contact with flange *J*. When the clutch ring *H* is moved backward, the gripping fingers release rod *D*, relieving the pressure of the collet on bushing *E* and the work.

Referring again to Fig. 99, the second series of operations on the fuse body are shown to the right of the illustration. At the first spindle position, forming tool *I* advances and forms the exterior diameters, while drill *J* drills the hole in the end. At the second spindle position, the rear part of the work is supported by a roll back-rest, while the regular turner *K* takes a cut across and chamfers the shoulder. At the same time counterbore *L* comes in, cleans up the drilled hole and faces the bottom. At the third spindle position, the diameter *M* is threaded with a plain die. At the fourth spindle position, a tool *N* operated from the turret cuts a series of concentric grooves in the flange of the fuse body. The grooving tool is cut away to clear the forming tool *O* which takes a light cut over the grooved face, finishing the body as illustrated.

Machining the Stationary Timing Train Ring

The machining operations on the stationary timing train ring are shown to the left in Fig. 101, and as can be seen are of a comparatively simple nature. This fuse part is made from a tobin bronze bar in a 2⅜-inch "Gridley" multiple-spindle automatic. At the first spindle position, a drill held on the turret drills the hole, and a forming tool on the cross-slide forms it to shape and breaks it down for the cut-off tool. At the second spindle position, the piece is reamed, and at the third position it is faced off with an under-cutting tool. In the fourth spindle position, not shown, the finished piece is cut off, and the stock is fed out.

Machining the Graduated Timing Train Ring

The machining operations on the graduated timing train ring are almost identical with the stationary ring and are shown diagrammatically to the right in Fig. 101. This part is also made from a bar of tobin bronze in a 2⅜-inch "Gridley" multiple-spindle automatic. The only difference in the operations on this part is in the use of a combination floating counterbore, and facing tool provided with a roller pilot.

Machining the Closing Cap and Bottom Closing Screw

The closing cap and bottom closing screw for the shrapnel timing fuse are made from brass rod with a comparatively simple tool set-up as shown in Fig. 102. The machine used is a 1¾-inch "Gridley" multiple-spindle automatic. The machining operations on the closing cap are shown to the left of Fig. 102, and consist in drilling, counterboring, forming, threading and cutting off. The operations on the bottom closing screw, shown to the right of this illustration, are counterboring, forming, recessing, threading and cutting off.

MAKING FUSE PARTS ON BROWN & SHARPE AUTOMATIC AND HAND SCREW MACHINES

A brief description of two of the many interesting set-ups on Brown & Sharpe automatic and hand screw machines for making timing fuse parts is given in the following. Timing fuse parts are made from several different materials. The screws and other small members as a rule are made from rod brass, whereas the parts such as the capsules, primer cups, etc., are made from sheet brass. Other members such as the fuse body or stem are made from different alloys and metals such as copper, copper aluminum, aluminum, etc.

Set-up for Making Fuse Hammer

The method of making a fuse hammer on a No. 2 Model G Brown & Sharpe automatic screw machine provided with a special eight-hole turret is shown diagrammatically in Fig. 103. This part is made from ⅞-inch round rod brass and is

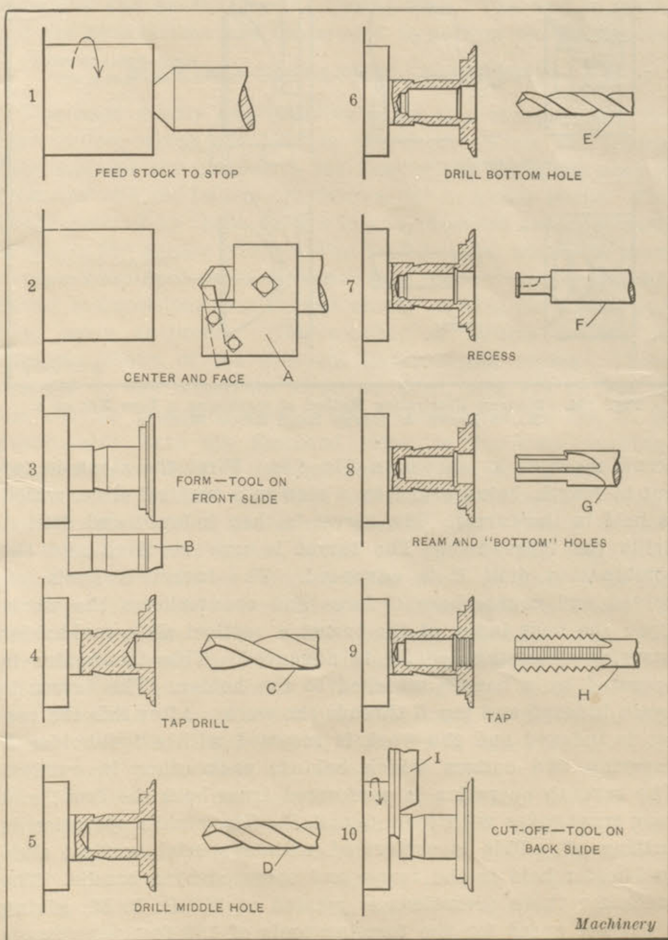


Fig. 103. Method of machining Fuse Hammer on a No. 2 Model G Brown & Sharpe Automatic Screw Machine equipped with an Eight-hole Turret

finished complete in the screw machine. First the stock is fed out to the stop in the turret. Second, the end is centered and faced with tools held in tool-holder *A*. The body is then formed with a circular tool *B* working from the front cross-slide; at the same time the turret is revolved, bringing tap drill *C* into operation. The forming tool is working at the same time as the drills. The turret is again revolved and drill *D* for finishing the middle hole is brought in and completes its operation. At the next index of the turret, drill *E* finishes the bottom hole. The turret is now indexed and a recessing tool-holder carrying tool *F* advances and is brought into operation to recess the work by a pusher on the cross-slide. The turret is again indexed and a reamer *G* is advanced to bottom and ream the holes. Upon the next index of the turret, tap *H* threads the work, which is finally cut off with circular tool *I*. The stock is rotated at 973 R. P. M. forward and backward and at 421 R. P. M. forward and backward. The stock is cut off rotating backward. The surface speed for the forming tools is 220 feet per minute and 31 feet per minute for the tap.

Tool Set-up for Making Fuse Nut

The fuse nut on the Russian timing fuse is made from 1⅞ round brass rod in a No. 6 wire feed Brown & Sharpe hand

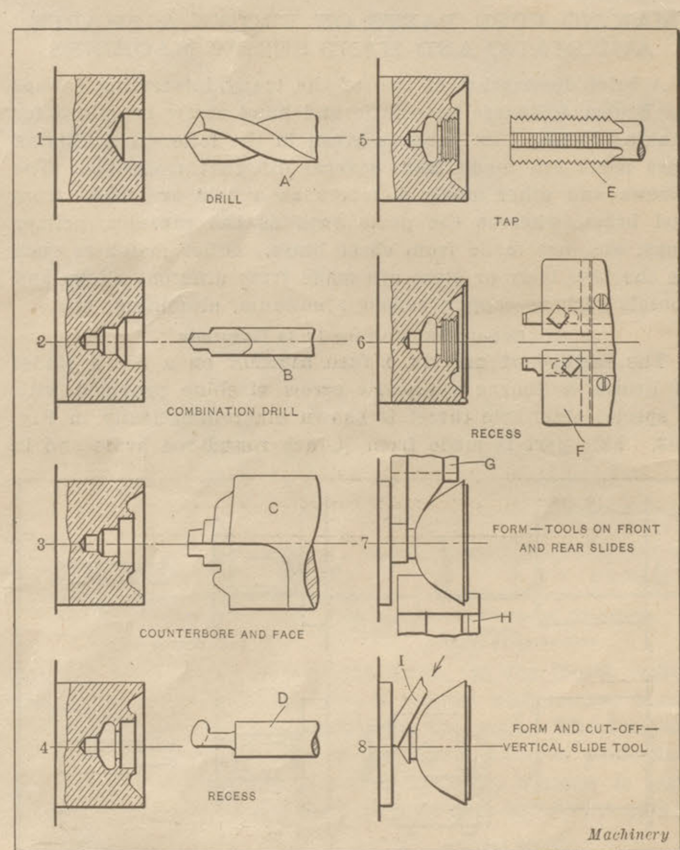


Fig. 104. Diagram illustrating Method of machining a Fuse Nut on a No. 6 Brown & Sharpe Hand Screw Machine

screw machine as shown in Fig. 104. First the stock is fed out to length, being gaged by a stop in a vertical slide, which is held in the turret. The turret is then indexed and drill *A* drills the large hole. The turret is now revolved and the combination drill *B* is advanced. The turret is again revolved and counterbore *C* faces and counterbores the work. Upon the next index of the turret a vertical slide tool-holder carrying recessing tool *D* is advanced. This tool-holder is operated by a handle attached to the holder. The turret is again indexed and tap *E* threads the work. After this the turret is indexed and the work is recessed with a tool-holder *F* carrying two cutters which balance each other in cutting. The seventh operation is performed from both the front and rear cross-slides with tools *G* and *H*. The eighth operation is cutting off. This is performed with a special vertical slide tool-holder held in the turret and operated by a handle. The stock for these operations is rotated at 352 R. P. M., giving a surface speed for the forming tools of 180 feet per minute and 66 feet per minute for the tap.

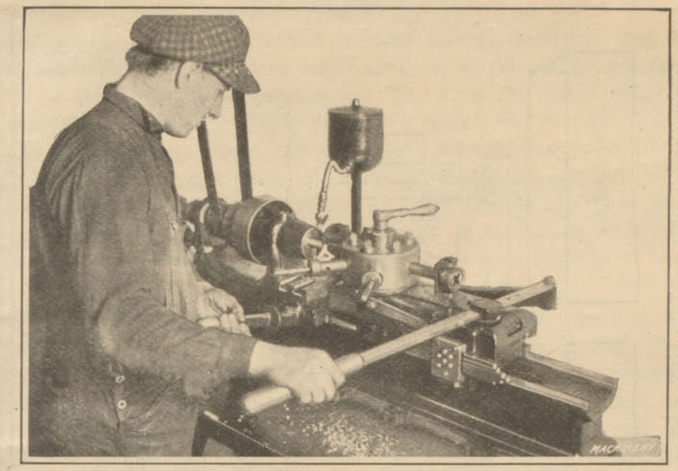


Fig. 105. Machining Fuse Parts on F. E. Wells & Son's Hand Screw Machine

MAKING FUSE PARTS ON F. E. WELLS HAND SCREW MACHINES

The demand for shrapnel fuse parts has been so great that time has not been taken in all cases to tool up automatic screw machines before production has been started. In order to get parts out quickly while automatic machines are being tooled up, hand screw machines have been made use of. Also these machines are used to a large extent on small orders and to help out production in general.

Fig. 105 shows an F. E. Wells & Son Co. hand screw machine working on shrapnel fuse parts. The capacity of this machine is for ⅞-inch diameter rod and it will tap or drill ½ inch diameter. Shrapnel fuse parts are produced on this machine at the rate of from 25 to 100 pieces per hour.

DRILLING PERCUSSION PRIMERS FOR AMERICAN FUSES

The percussion primer, used in the American combination fuse shown in Fig. 3, is made in a Brown & Sharpe automatic screw machine from rod brass in two operations. Following the screw machine operations, four holes about 1/32 inch diameter are drilled through this bushing, employing a special "snap index" jig in a high-speed ball bearing drilling machine made by the Leland-Gifford Co. of Worcester, Mass. (See Fig. 106.) The extremely small size of this part makes it difficult to handle, so the jig was designed with a special

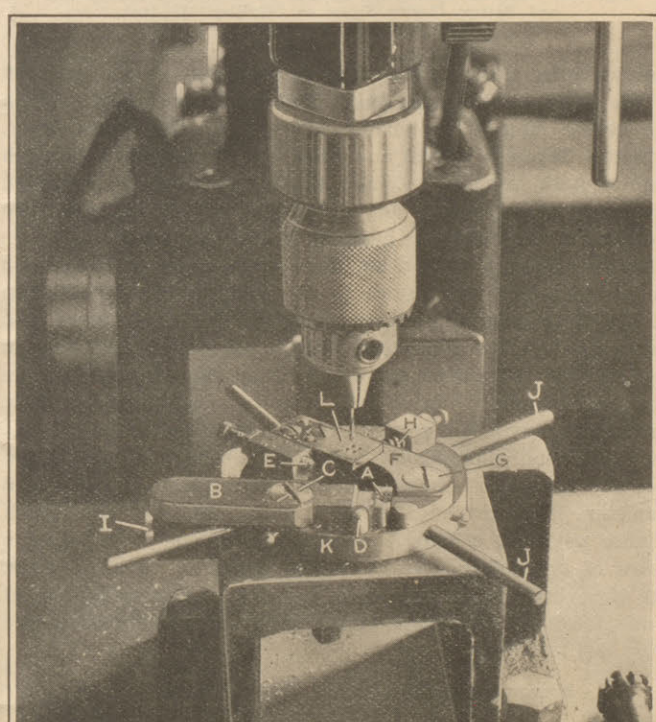


Fig. 106. Drilling Percussion Primers on a Leland-Gifford Ball Bearing Sensitive Drilling Machine

loading arm to facilitate rapid handling. The jig consists of a platform base bolted to the table of the drilling machine. Upon this is the index ring, which is turned by handles *J* and indexed for the four drilling positions by spring plunger *I*. The center of rotation is in the center of the four holes in the part. *B* is the loading lever, with a nest *A* at the end into which the work is slipped. This lever swings on stud *C*. The work is located in the swinging arm *B* when it is in the position shown in the illustration, with the arm *B* resting against stop *D*. The arm is then swung under the drill until it reaches stop *E*. It is maintained in this position by spring plunger *H* that bears against lever *F*, fulcrumed on stud *G*. The side of this lever bears against the work and holds it firmly while the drilling is proceeding. The drill is guided by four bushings in plate *L*, mounted on the index ring.

The operation consists in rotating the index ring to the four stations for drilling the respective holes. By means of this quick-indexing rig, and the high speed at which the Leland-Gifford drilling machine runs, it is possible to drill as many as 6000 pieces, or 24,000 holes in ten hours.

DRILLING TIMING FUSE PLUGS ON "AVEY" DRILLING MACHINE

An application of a regular No. ½ "Avey" drilling machine, built by the Cincinnati Pulley Machinery Co., Cincinnati, Ohio, to the drilling of brass timing fuse plugs is shown in Fig. 107. The requirements are to drill three No. 55 (0.052 inch) holes through the dome of the plug; a number of pieces are shown on the table of the machine. These three holes practically run together at the inside of the dome, making it necessary to drill one hole at a time.

The fixture used for this purpose is of unique construction. The body *A* is made of an aluminum casting, whereas the operating mechanism is of hardened tool steel. The drill spindle is operated by a foot treadle, connection being secured through rod *B*, passing down through the fixture and fastened to the spindle sleeve by the L-shaped piece and yoke *C*. The work *E* is held on a special work-spindle located inside the fixture that is indexed one-third revolution through the medium of rod *B* upon the raising of the drill spindle sleeve. The work holding-down and ejecting mechanism is supported in aluminum bracket *F*. Attached to this bracket is a supporting arm for the lower crank of lever *G*, which holds a segment gear. Bracket *D* carries the drill bushing.

After drilling the third hole, the operator depresses lever *G*, rotating the segment gear meshing in rack teeth in rod *H*, which lifts the latter up to eject the work and at the same time through a connection, not shown, raises the holding-down rod. The ejector, not shown, which is spring controlled returns to a neutral position immediately upon the ejection of the work, while the holding-down rod is still raised. The work, after being discharged, falls into a chute and is carried to the rear of the machine. The operation of this fixture is rapid, the production being 9000 to 10,000 pieces in ten hours.

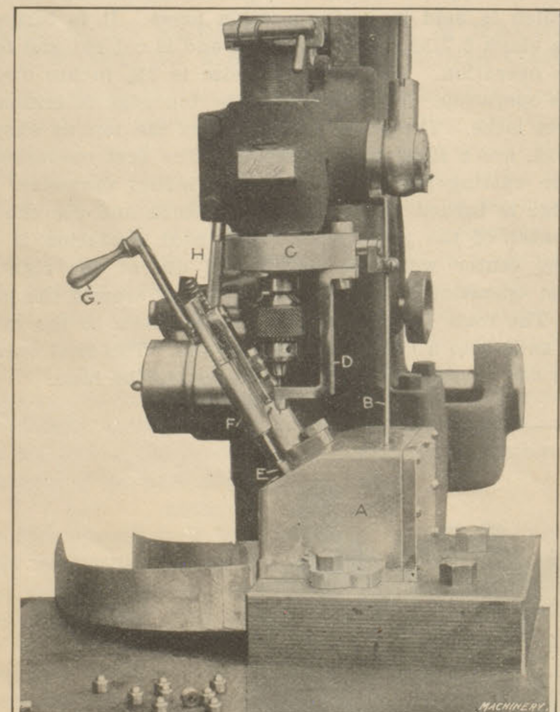


Fig. 107. Drilling Fuse Plugs on "Avey" Drilling Machine

GRADUATING FUSE TIMING RING

As has been previously stated in this article, the adjustable ring on the timing fuse is graduated in seconds, starting at zero and running to twenty-one seconds. As shown in Fig. 108, the graduating of this timing ring is performed in the Dwight-Slate marking machine built by Noble & Westbrook, Hartford, Conn. The main arbor of the machine carries the stamping roll *A* and is turned by the handle shown. The timing ring to be graduated and marked is held at *B*. The two gears *C* prevent the stamp from "creeping" ahead or slipping on the work. The work-holding arbor, as shown, is held in a bracket and is raised to the stamp roll by pressure on the foot treadle. Two operations are required for stamping and graduating the timing ring. The first is marking the graduations and the second is putting on the figures.

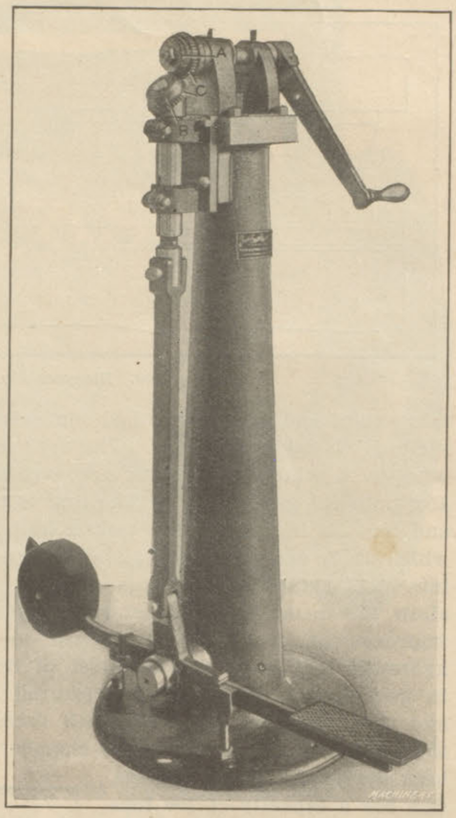


Fig. 108. Graduating Timing Fuse Rings on Dwight-Slate Marking Machine

MAKING SHRAPNEL BULLETS

The most deadly and effective parts of a shrapnel are the lead bullets which are held in the shell. When the timing fuse explodes the powder in the base of the shell, the nose is blown off and the bullets are thrown out in a cone shape. The range covered by these bullets in the 18-pound shrapnel shell is about 250 square yards. The lead bullets, which in most shrapnel are ½ inch in diameter, are made from several different compositions, but consist chiefly of 87½ parts lead and 12½ parts antimony. The number of bullets carried in shrapnel shells of the different governments varies. There are 252 in the American 15-pound shell, and 235 or 236 in the British 15-pound shell. The bullets used by the U. S. government have six flattened sides, to facilitate packing, whereas those used by foreign governments are spherical.

There are several methods of making shrapnel bullets, two of which are in use at the present time. One is to cast the bullets in iron molds, which are split in the center, so that the bullet can be removed when cast. Another is to cut off slugs from lead wire and strike these between dies in a heading machine. The bullet heading machine takes the wire from a reel, cuts it off, forms it and trims off the resultant flash automatically. In making the American bullets, a second operation follows, consisting in flattening the sides. The Waterbury Farrel Foundry & Machine Co. furnishes unit equipments for doing this work. For the flattened bullets, the unit consists of one hydraulic wire extruding press and fourteen heading machines capable of giving a production of 850 bullets per minute. For the spherical bullet, the unit equipment consists of one hydraulic extruding press and eight heading machines, giving a production of 950 bullets per minute.

The method of casting lead bullets is antiquated to a cer-

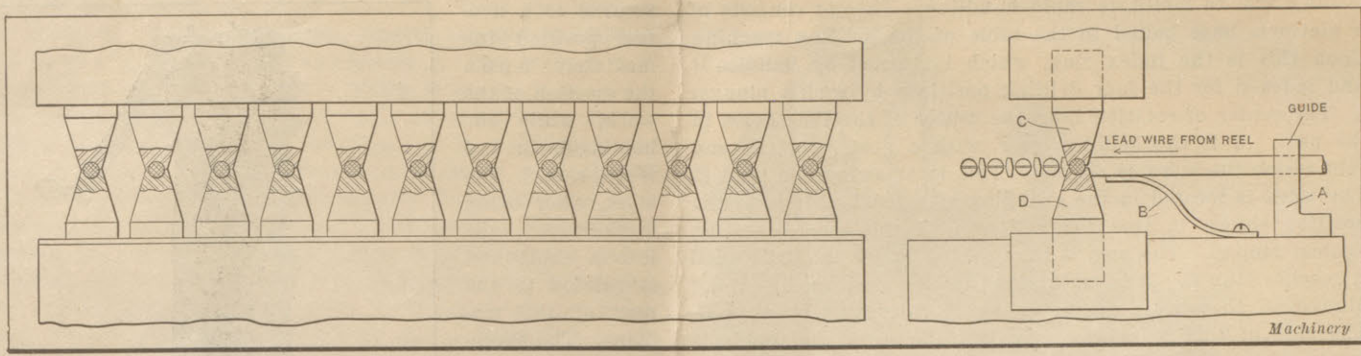


Fig. 109. Diagram illustrating "Twelve-punch" Method of making Shrapnel Bullets from Lead Wire

tain extent and another method somewhat similar to that described has taken its place. The first step is to produce the wire from which the bullets are eventually made. This is accomplished in two ways. The first is the hot metal process and consists in pouring the molten lead into a cylinder, from which it is extruded through a die by a plunger advanced into the cylinder. By this method, it is necessary to allow the metal to settle before the press can operate. An improvement over this is utilized in presses built by a hydraulic lead press manufacturer of Brooklyn, and consists in first casting ingots of the required diameter and length and then charging the press with these instead of pouring the molten lead into the press chamber. Two presses have been designed for this process. One has a capacity of 700 tons and is charged with ingots weighing 150 pounds, whereas the other has a 900-ton capacity and is charged with 200-pound ingots. The product from these two machines is 1800 pounds of lead wire from the small and 2500 pounds from the large press per hour. The operation of these presses is somewhat similar to that which was described on page 642 of MACHINERY, April, 1914. The wire as it is extruded from the die is wound on a reel carrying 2000 pounds of wire.

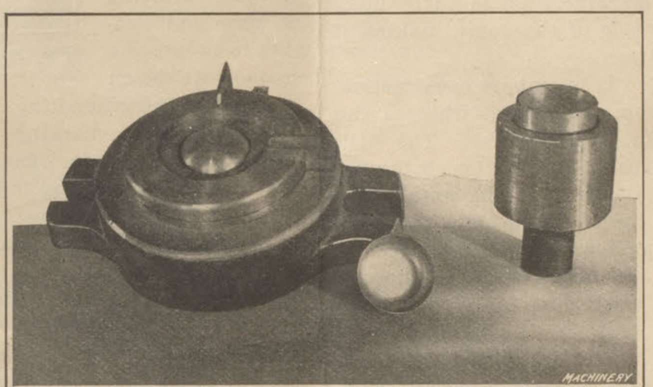


Fig. 110. Tools for making Base of Powder Cup

There are two principal types of swaging machines used for making these lead bullets from wire. One carries a single set of dies, whereas the other carries twelve sets of tools. The operation of the latter will be described. Referring to the diagram, Fig. 109, twelve reels of lead wire—not shown—are arranged in tandem on stands behind the press, six reels in a row. The wire is conveyed from these reels to the dies by a feeding mechanism, being guided to the individual tools by a plate *A*, having twelve U-shaped impressions in its top edge. The wire now passes over a spring *B* which serves to lift it up slightly at each stroke of the press. The tools *C* and *D*, as shown, are provided with half-spherical depressions in their adjacent faces and are set so that they come within 1/64 inch of meeting. The dies are guided and controlled in action by a special mechanism, and the press in which they are carried operates at 70 revolutions per minute. This gives a rated production of 840 bullets per minute. As is clearly indicated in Fig. 109, considerable scrap is formed in making lead bullets by this process—in fact the scrap is about 33 per cent of the reel of wire; also owing to the setting of the punches a slight fin is formed around the periphery of the bullet, which is removed in a subsequent operation.

After forming, the bullets are taken to a tumbling machine where they are tumbled for one hour. No other material is put into the tumbling barrel, but the action of the bullets working on themselves satisfactorily removes all the fins. Both the swaging and tumbling operations must be carefully watched because of the necessity of having the bullets a certain weight. The allowable variation on one pound of bullets is one dram, and there are forty-one bullets to the pound. Ten pounds of lead rod make 6½ pounds of bullets, and the scrap resulting from the swaging operation is remelted and used over again. After tumbling, the bullets are inspected and are then ready for use.

PRESS TOOLS FOR MAKING POWDER CUP

In the British shrapnel shell, the powder in the base of the shell used for exploding it and ejecting the lead bullets, etc., is held in a tin-plate powder cup. This is completed in the punch press in the manner shown in Figs. 110 and 111 and comprises two parts, a base and a top. The base is made from tin-plate 0.022 inch thick, whereas the top is made from 0.036 inch thick tin-plate. The bottom of the cup is completed in one operation with the punch and die shown in Fig. 110 which is held in a single-action press. It is turned out from a blank 3 7/32 inches diameter and is cut out and formed in one operation. The completed size is 2¼ inches diameter in one operation. After cupping, the top edge is trimmed in a turret lathe. The press operations on the top, as shown in Fig. 111, are a little more complex. The first operation consists in cutting out a blank 2 19/32 inches diameter. Then the edge is turned up with another punch and die shown in the center of the illustration. The next operation is piercing the center with the punch and die at the right, and the last operation is drawing out a flange around the pierced hole. The tools for this operation are shown to the extreme right, as is also a completed powder cup. The final operation on the cup consists in soldering the top to the base.

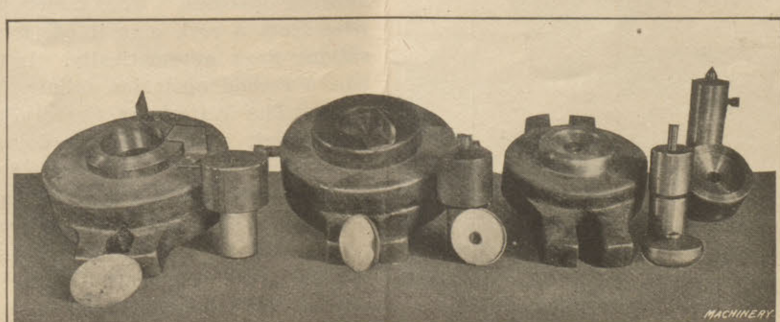
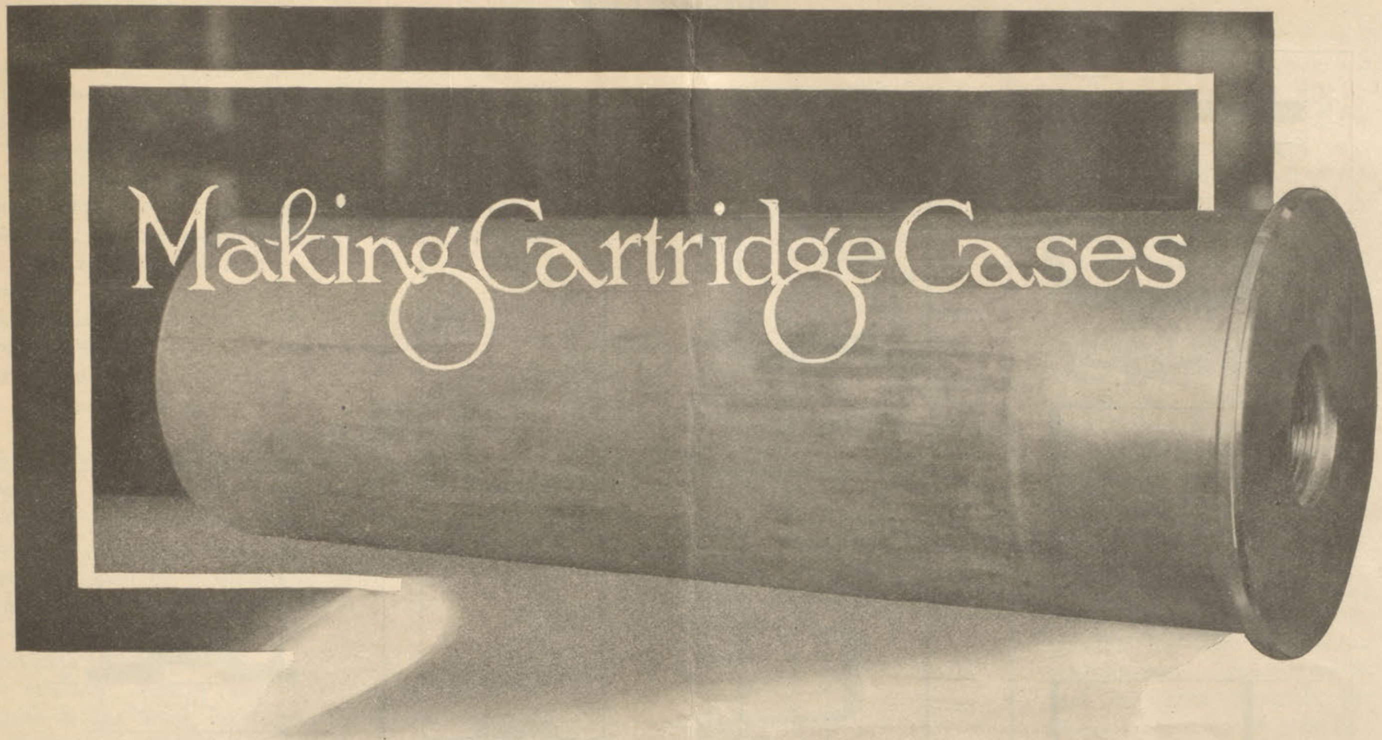


Fig. 111. Tools for making Top Member of Powder Cup



THE brass cartridge case that contains the powder charge for propelling the shrapnel shell from the bore of the quick-firing gun is drawn up from a blank of sheet brass. The number of operations necessary to complete the case depends on its size and the method of handling. Some shell manufacturers prefer to do more or less drawing at one operation, but in all cases the sequence of operations is practically the same. The material used for shrapnel cartridge cases generally consists of a composition of 2 parts copper and 1 part zinc. This alloy has been found to possess the best physical qualities, that is, high tensile strength and a large percentage of elongation when properly annealed. The drawing operations through which the cartridge case passes increase the hardness, and the ductility of the metal is restored by annealing. The annealing temperature in most cases is from 1150 to 1200 degrees F. On reaching this temperature, the work is either cooled off in water or allowed to cool off gradually, as the speed of cooling does not affect its physical qualities. In the following, two methods of handling the various operations will be described.

WATERBURY FARREL FOUNDRY & MACHINE CO. METHOD OF MAKING CARTRIDGE CASES

Fig. 112 shows the sequence of operations—blanking, cupping, redrawing, indenting, trimming, heading and tapering, as advocated by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., for making cartridge cases for 18-pound shrapnel. The first operation consists in cutting out a blank from ⅜-inch sheet brass 6¼ inches in diameter. The next operation is cupping. This is handled in a short-stroke geared straight-sided press. Before re-drawing, the cup is annealed, and the third operation, which is handled in a longer stroke press, is then performed. Annealing follows this operation, and then the fourth drawing or second re-drawing operation is performed. This consists in reducing the fillets slightly at the corners, decreasing the diameter of the cup to 4⅛ inches and increasing its length to 4½ inches. The dimensions given here are approximate.

Indenting Operations

The fifth operation or first indenting operation, which consists in indenting the bottom, is handled in a press similar to that used for the cupping and re-drawing operations. This shortens the length of the case by ¼ inch and forces the indentation about half way through the thickness of the stock. The second indenting is then accomplished. This again shortens the case by an additional ¼ inch and squares up the corners. The case, without annealing, is now passed through the third re-drawing or seventh operation, reducing its diameter to 4 inches and increasing its length to 5½ inches. It is annealed after this operation, and is then drawn out to 8 inches long by 3⅞ inches diameter and the wall decreased in thickness to 1/16 inch. The case is then annealed and passes through the fifth re-drawing operation. The machine used for handling the fourth, fifth and sixth re-draws is a long-stroke straight-sided rack and pinion press. After the fifth re-draw or ninth operation, the case is trimmed and about two inches cut off the end. This leaves the case in better condition for the succeeding operations. The trimming machine is of the horizontal type.

Final Re-drawing Operations

The sixth re-draw or eleventh operation is performed in a horizontal drawing press of the hydraulic type provided with automatic reversing valves. This operation increases the length of the case to 13¼ inches and reduces its diameter to 3¾ inches. After this operation, the case is annealed and then 1¼ inch is trimmed off the open end. The thirteenth and fourteenth operations consist in heading the case. These are practically of the same nature, and combine to form the head of the case as shown in the illustration. The heading operations each reduce the length of the case ¼ inch, and are performed in a 1000-ton hydraulic heading press operated by a geared compound power pump and having a working pressure of 5600 pounds per square inch on the ram. After heading, the case is annealed and the fifteenth operation, which consists in tapering, is performed. The first tapering or fifteenth operation reduces the mouth of the case to 3 9/16 inches diameter and gradually tapers it for a distance of 5⅞ inches—half the length. The case is then annealed, pickled and washed and a second tapering operation is performed. This reduces the mouth of the case to 3⅜ inches and tapers it completely to the head. The case is not annealed after the last tapering operation, but ¼ inch is trimmed off the end.

TOOLS FOR DRAWING CARTRIDGE CASES—SUPPLIED BY FERRACUTE MACHINE CO.

The various operations through which a cartridge case passes in drawing and forming to the correct length have previously been described, and in the following particular attention will be given to the type of tools used for this purpose. These tools have been designed and built by the Ferracute Machine Co., Bridgeton, N. J., and are used with its presses for making cases for 3-inch projectiles.

Cupping and First Series of Re-drawing Tools

The cutting out of the blank is frequently omitted because the specified thickness and size can be furnished by the

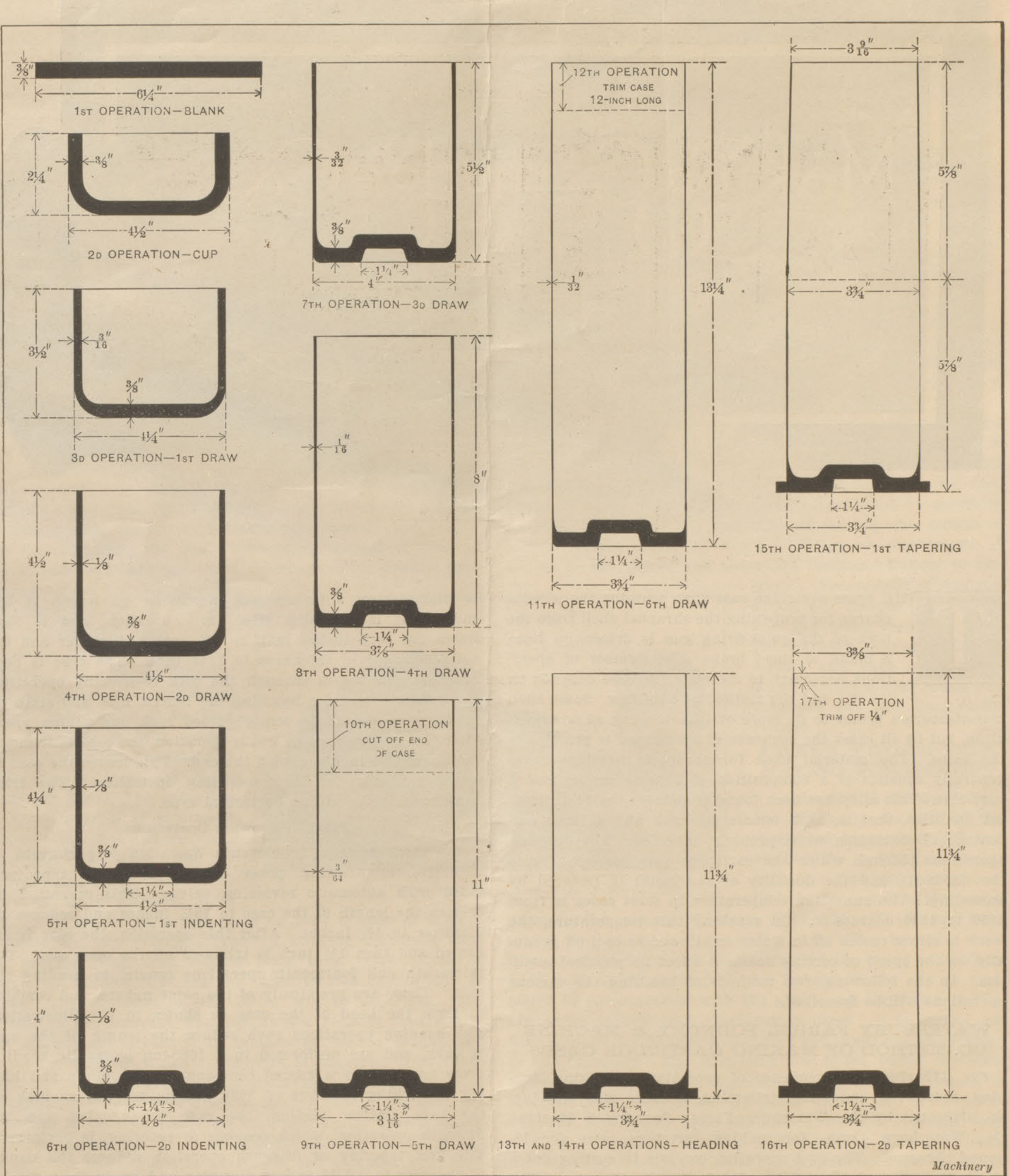


Fig. 112. Sequence of Operations in making an 18-pound Cartridge Case—Waterbury Farrel Foundry & Machine Co.'s Method

mill. Before cupping, the dies and blanks are well greased, as this assists in drawing. Olive oil or soapy water is used, depending on the stage at which the drawing operations have arrived. The first cupping operation is accomplished with a punch and die as shown at *A* in Fig. 113. This operation is accomplished in a Ferracute 100-ton ram press equipped with a dial feed. The die consists of a hardened ring of tempered steel having an interior shape similar to a truncated cone. The punch is slightly tapered on the lower end and has an air vent hole drilled up through it to facilitate the drawing and produce a cup free from wrinkles.

The second operation, or first re-drawing operation is shown at *B*. Here the type of die used differs somewhat from that shown at *A*, in that the drawing angle is 15 instead of 45 degrees. The cup, after this operation, is reduced in diameter to 3.877 inches and is 2⅞ inches long. After the first cupping operation, the case is annealed.

The second re-drawing operation is accomplished as shown at *C*. The die in this case is the same as at *B*, as is also the punch, except for an increase in the taper and change in shape on the end. The object of this, of course, is to keep the case thick at the head but reduce the walls further up along the section. The case, after this operation, is also drawn out to a length sufficient to necessitate using a stripping device for removing it from the punch. This is accomplished by six spring-operated stripper pins as shown, which slip over the top edge of the case as it is forced through the die, stripping it from the punch. The cup now passes through the third annealing operation and is ready for the third re draw, shown at *D*. The press used for performing this opera tion is similar to that described, and the die and punch is similar in construction to that shown at *C*.

Final Re-drawing Operations

For the final re-drawing operations, horizontal double ended screw presses instead of the horizontal hydraulic pressses formerly used are employed. Horizontal presses are used because the length to which the cartridge case is drawn after the third re-draw is such that it exceeds the stroke of the vertical presses. The cartridge case, after each drawing operation, is annealed. *E* in Fig. 113 shows the fourth re-drawing tools, which are handled in a horizontal screw press. The die used is similar in shape to that shown at *D*, but the holder in which it is held differs, of course, owing to the difference in the type of press used. The stripping arrangement for removing the case from the punch is also of a different type. In this case five spring-operated stripper pins are held in a holder which is free to oscillate within certain limits in the block in which it is retained. The reason for having this oscillating stripper is that it accommodates itself to the irregular shape on the end of the case and gives practically a constant pressure all around the circumference of the case, assisting in removing it from the punch. The case is now annealed and is finish-drawn as shown at *F*. Here the same type of die, stripper arrangement, etc., is used as that shown at *E*. The case in the fifth re-drawing operation is 14⅜ inches long by 3.186 inches outside diameter.

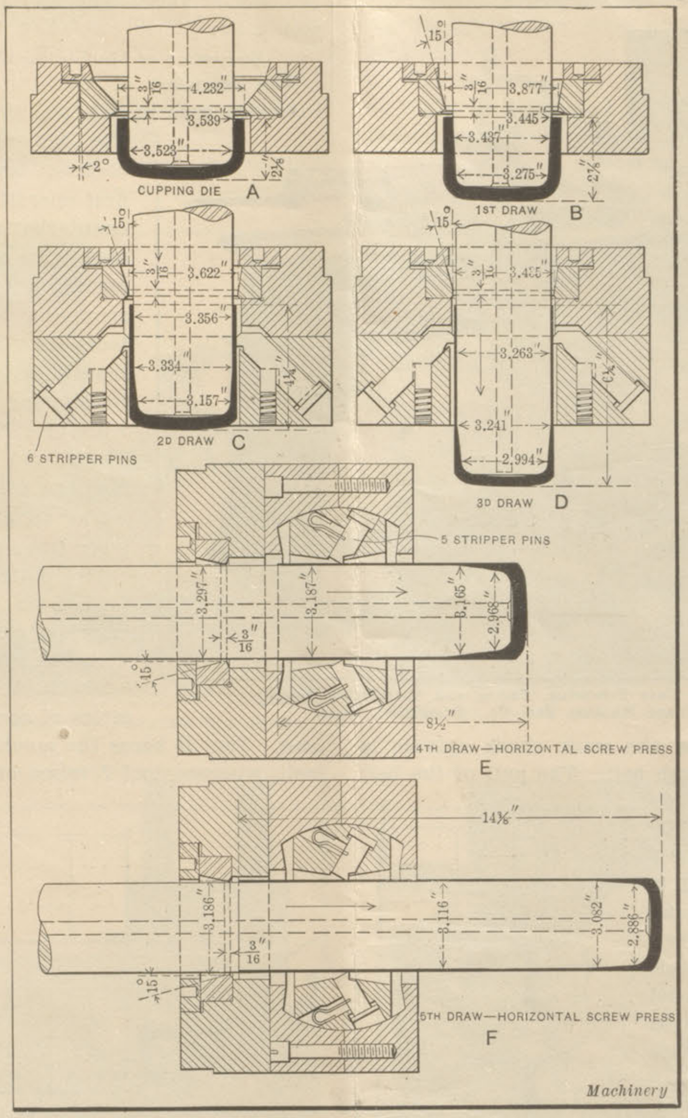


Fig. 113. Tools for drawing a 3-inch Shrapnel Cartridge Case—Ferracute Machine Co.'s Method

Annealing and Washing Cartridge Cases

As was previously stated, the cartridge case, after practically every re-drawing operation is annealed, being subjected to a temperature of about 1150 to 1200 degrees F. and then allowed to cool off or dipped in water which, of course, forms a scale on the surface of the case. This must be removed before any subsequent operations can take place. Several different solutions are used for this purpose, but a common one comprises the following: Sulphuric acid diluted with water to a strength of 1 to 4. This pickling solution is held in lead-lined wooden troughs and the case is allowed to remain in the bath varying from eight to fifteen minutes, according to the strength of the solution. The cases are then washed in lead-lined wooden troughs through which a stream of water is circulated to remove all traces of the acid.

TESTING HARDNESS OF CARTRIDGE CASES

The hardness of a cartridge case must be up to a certain standard. When too soft, a permanent set will occur from the pressure of the firing charge and the case will stick in the breech of the gun. When the hardness is too high for a given composition of brass, it is too brittle and will split or the head may blow off. There is, therefore, a certain hardness which must be adhered to as closely as possible. Some manufacturers hold the standard to within 20 to 25 on the scleroscope and reject cases striking 15 as being too soft, and 30 to 35 as being too hard.

Owing to the thinness of the walls of the case, it is impossible to take a reading without rigidly supporting it, and for this purpose the Shore Instrument & Mfg. Co., 551-557 West 22nd St., New York City, has devised a special fixture as indicated in Fig. 114. This comprises a bracket *A* held in an ordinary vise, to which is fastened an anvil plug *B*, as indicated. In order to hold the case tightly against the anvil plug, a spring *C*, fastened to the bracket *A*, is also fastened to a yoke *D* surrounding the case. A rod attached to this and to a foot treadle furnishes a means of drawing the yoke down to hold the case in contact with the plug. The anvil plug provides the weight or inertia to resist the impact of the drop-hammer of the scleroscope, but in order to be sure that there is proper contact of the case with the plug a rubber cushion *E* is provided between the pressure ring or yoke and the brass case.

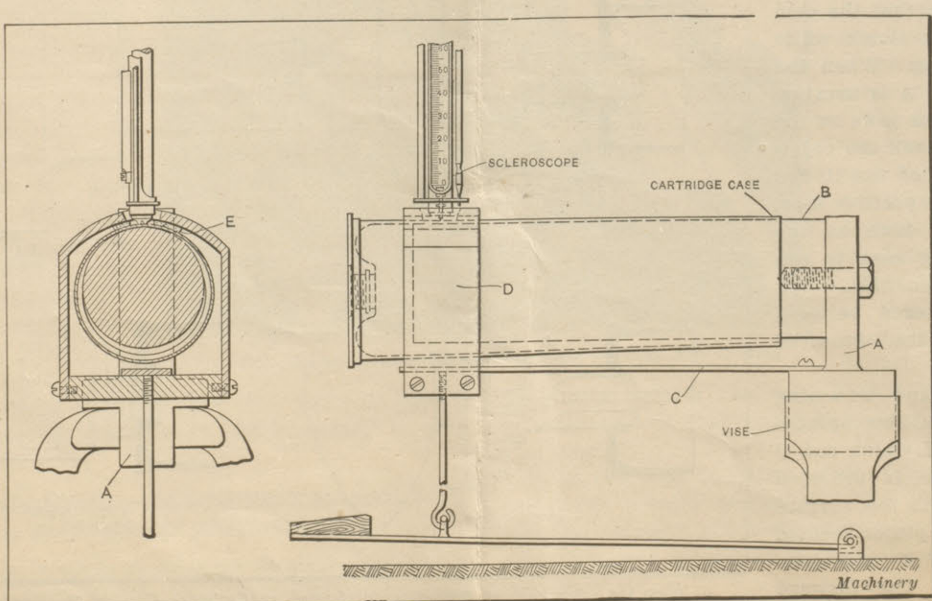


Fig. 114. Fixture for testing Hardness of Cartridge Cases with Shore Scleroscope

MACHINING SHRAPNEL CARTRIDGE CASES ON SPECIAL "BULLARD" MACHINE

The Bullard Machine Tool Co., Bridgeport, Conn., has designed and built a number of special machines for performing the machining work on the head and mouth ends of brass cartridge cases. This machine, as will be seen from Fig. 115, is of the hand turret machine type, designed to work on the case from both ends. In this machine the brass case is chucked in the center of an extremely large spindle, and worked on from the head end with four sets of turret tools and two sets of cross-slide tools, while the mouth end is bored and trimmed with tools held on a carriage located on the

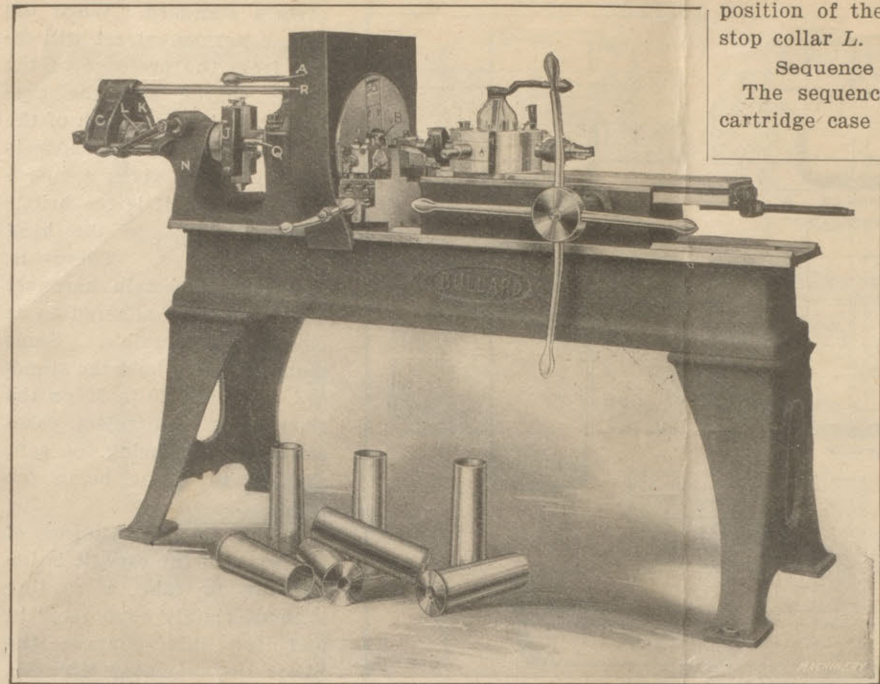


Fig. 115. Special Shrapnel Case Trimming, Facing and Chamfering Machine designed by the Bullard Machine Tool Co., Bridgeport, Conn.

back facing bar. The drive for the work chuck spindle is over a 16-inch pulley with a 3-inch belt. The pull of the belt is not taken directly on the spindle, but on a special pulley bearing 7⅜ inches diameter and 5 inches wide. The spindle itself is supported in bearings 9 inches long and 5⅞ inches diameter. As previously mentioned, the spindle is hollow so that any type of shrapnel cartridge case up to 4¼ inches in diameter and from 10 to 18 inches in length can be machined.

From the construction of the machine in Fig. 115 it will be seen that the front end of the spindle carries a large three-jaw chuck of special design. These jaws catch the cartridge case just under the head and revolve it for machining. The case is supported internally by a tubular arbor *B* which also acts as a stop and is attached to the rod *Q* extending to the rear bracket *C* where it is backed up by a spring. The front end of this tubular support or stop is provided with a thrust ball bearing so that the case can be loaded in the chuck while the spindle is running. When the chuck operating lever *A* is manipulated to close the chuck jaws on the work, it first draws back the rod *Q* through the medium of the tie-rod *R* and bracket *C* to a positive stop, and then closes the jaws on the work. The cartridge case is put in and removed from the chuck with the turret indexed between stations to give the required space.

The back boring and trimming head is held on a hollow spindle through the center of which rod *Q* passes. This spindle is provided with rack teeth on its top surface which engage with a pinion located in extension bracket *N* and operated by handle *K*. The forward position of the boring and trimming head is governed by a stop collar *L*.

Sequence of Machining Operations on Cartridge Case

The sequence of machining operations performed on the cartridge case in this machine is shown diagrammatically in Fig. 116, and also in Figs. 117 to 121 inclusive. Referring to Figs. 116 and 117, the first operation consists in rough-drilling and counterboring the hole in the head of the case with combination tool *A*. The second operation (see Fig. 116) consists in facing, trimming and chamfering the head with tools *B*, *C* and *D* held on the front of the cross-slide. The third operation is to finish chamfering and facing the head of the case with tool *E* on the rear of the cross-slide. The fourth operation consists in under-cutting the primer seat with the tool *F* which works on a turret slide and is operated by lever *G* as shown in Fig. 118.

The following operations are now performed on the mouth or open end of the cartridge case as shown in Figs. 116 and 119, with the spindle running at the same speed —500 R. P. M.—as that used for the first series of operations. Two tools *H* and *I* are used. Tool *H* bores the mouth of the case for a distance of 1 inch, whereas tool *I* trims off the open end of the case and

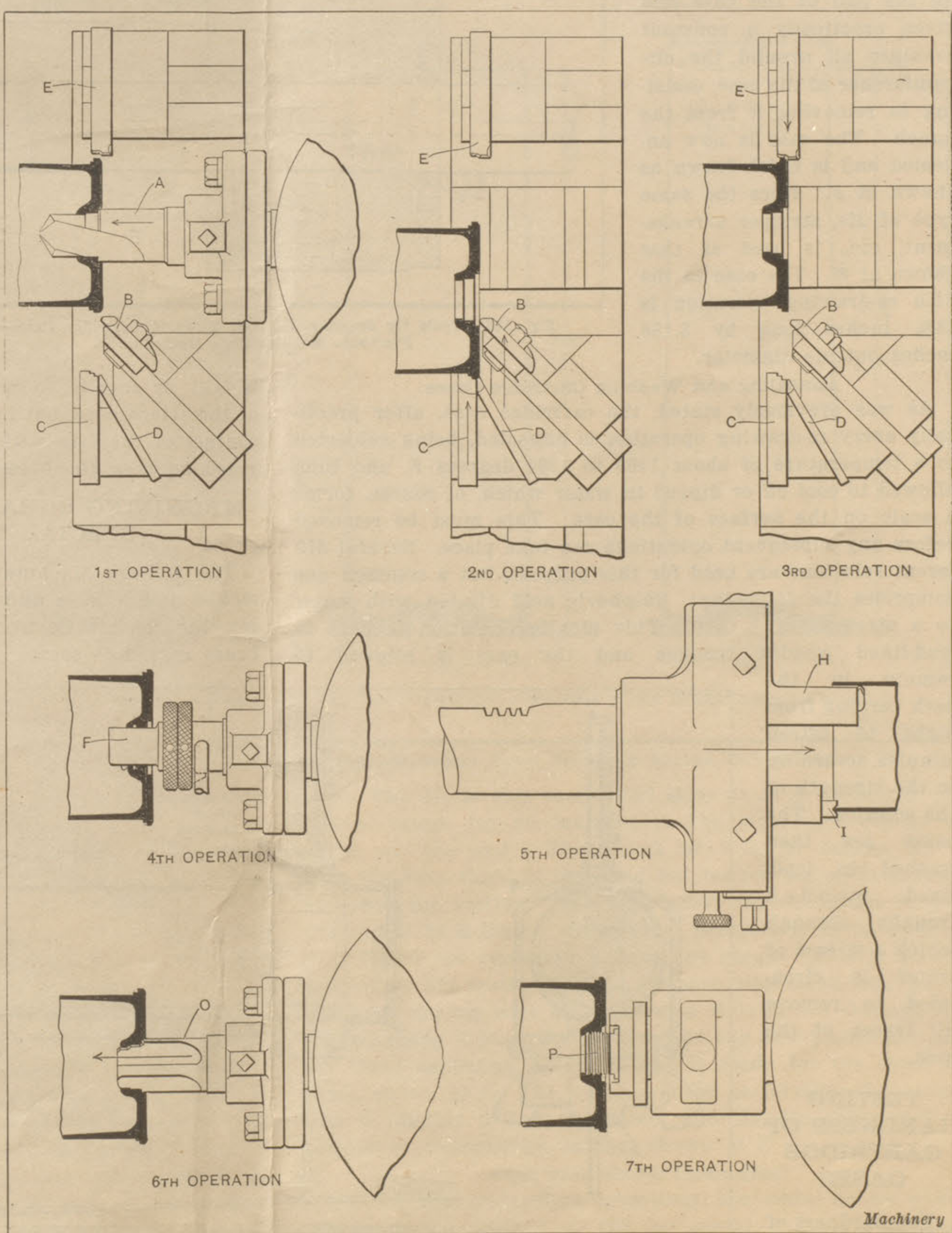


Fig. 116. Sequence of Operations performed on Cartridge Case in Machine shown in Fig. 115

rounds the edges. The mouth of the case at the rear end of the spindle is supported by a hardened bushing to prevent it springing away from the action of the boring tool. The boring and trimming tools are mounted in a special head *J*, Fig. 119, that is operated back and forth by a handle *K* through the medium of a rack and pinion. The forward movement of this head, as previously explained, is controlled by means of an adjustable collar *L* screwed onto spindle *M*. This collar contacts with the face of bracket *N*.

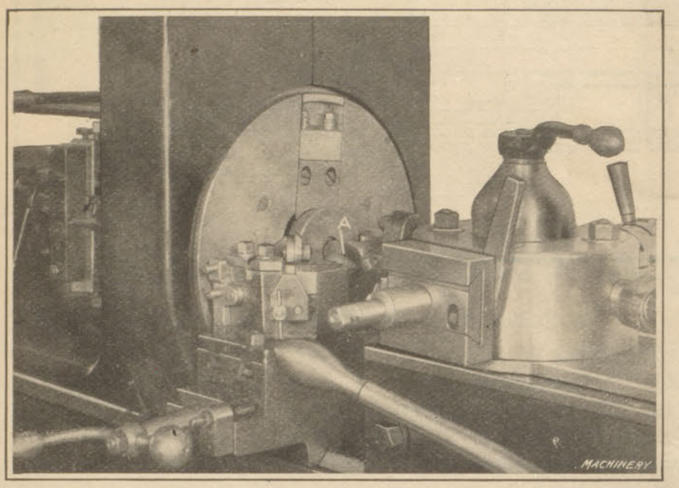


Fig. 117. Set-up showing First Operation on Cartridge Case Head

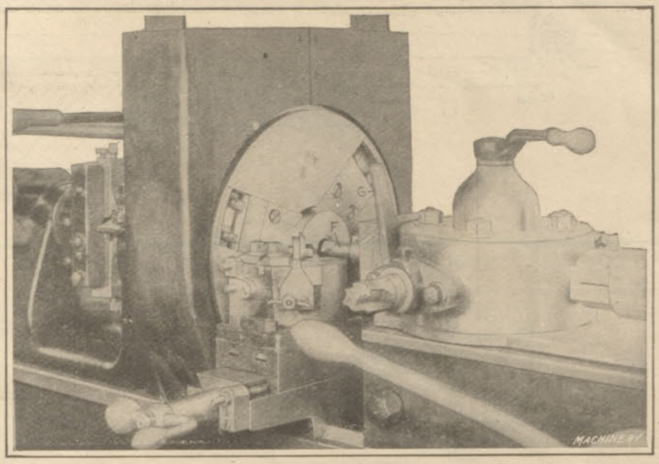


Fig. 118. Set-up showing Fourth Operation on Cartridge Case Head

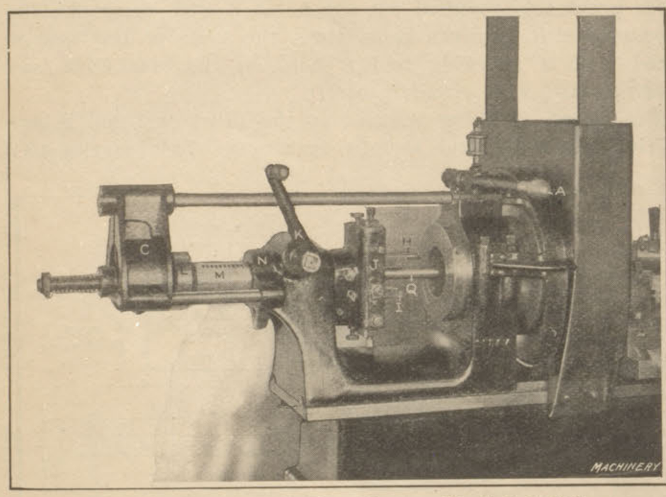


Fig. 119. Set-up showing Operations on Mouth End of Case

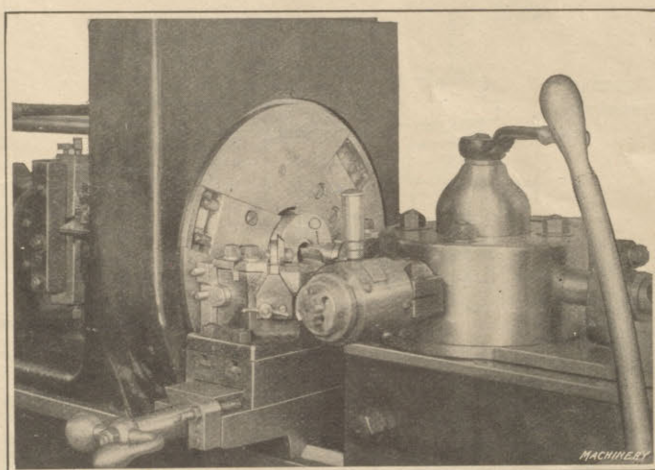


Fig. 120. Set-up showing Sixth Operation on Head End of Case

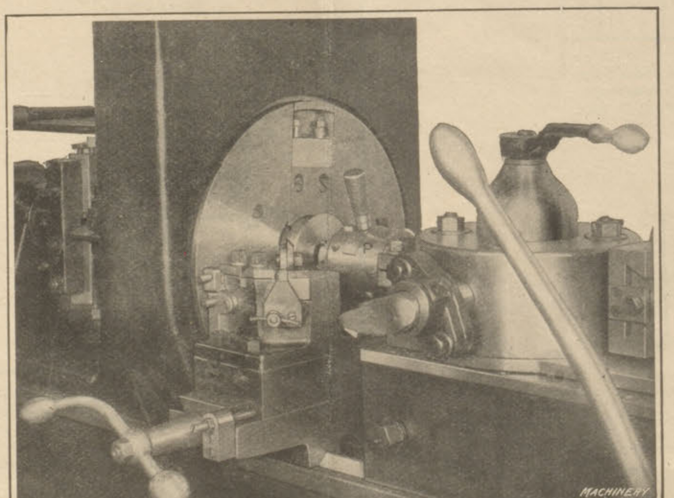


Fig. 121. Set-up showing Seventh Operation on Head End of Case

The work-spindle is now slowed down and the following operations, shown in Figs 116, 120 and 121, are performed on the head end of the case. The sixth operation is to finish-counterbore and ream the primer pocket with tool *O* held in an adjustable holder, whereas the seventh operation is threading the primer pocket with collapsing tap *P*. The chuck lever *A*, Fig. 115, is now manipulated, first releasing the grip of the chuck jaws on the case and second advancing rod *Q* to eject the case sufficiently to enable it to be easily removed from the chuck. The spindle is changed to the highest speed after the next case is put in. In changing the work, it is not necessary to stop the spindle.

MACHINING SHRAPNEL CARTRIDGE CASES ON POTTER & JOHNSTON AUTOMATICS

The cartridge case is made from sheet brass as previously stated. It is practically formed to shape in drawing and heading machines, but to secure the desired accuracy on the head and primer pocket these surfaces are machined. The method of holding the French 75-millimeter case on a No. 5A Potter & Johnston automatic chucking and turning machine for machining the head and primer pocket is shown in Fig. 122. Here it will be seen that the cartridge case butts up against a stop *B* and fits over the tapered plug *C* which steadies it. It is held in place by an ordinary draw-in collet *D*. This is operated by means of a lever *E*, fulcrumed to a bracket on the rear end of the machine and operating a sliding clutch collar. The chuck is operated through fingers which draw back the sliding sleeve to which it is attached. These fingers operate against a spring at the rear of the spindle which serve to open the collet.

The machining operations on the French shrapnel cartridge case are handled in the manner illustrated in Fig. 124. The first operation is to rough-drill the hole in the head. The turret is then indexed, bringing in a roughing reamer which reams the hole previously drilled, whereas the front cross-slide carries the tool *B* that faces the head and a circular tool *C* that rough-forms the external diameters of the head.

Upon the next indexing of the turret, the tool *D* counterbores the powder pocket and the circular forming tool *E* finish-forms and rough-chamfers the head. The last operation consists in finishing the primer pocket with a taper reamer *F*.

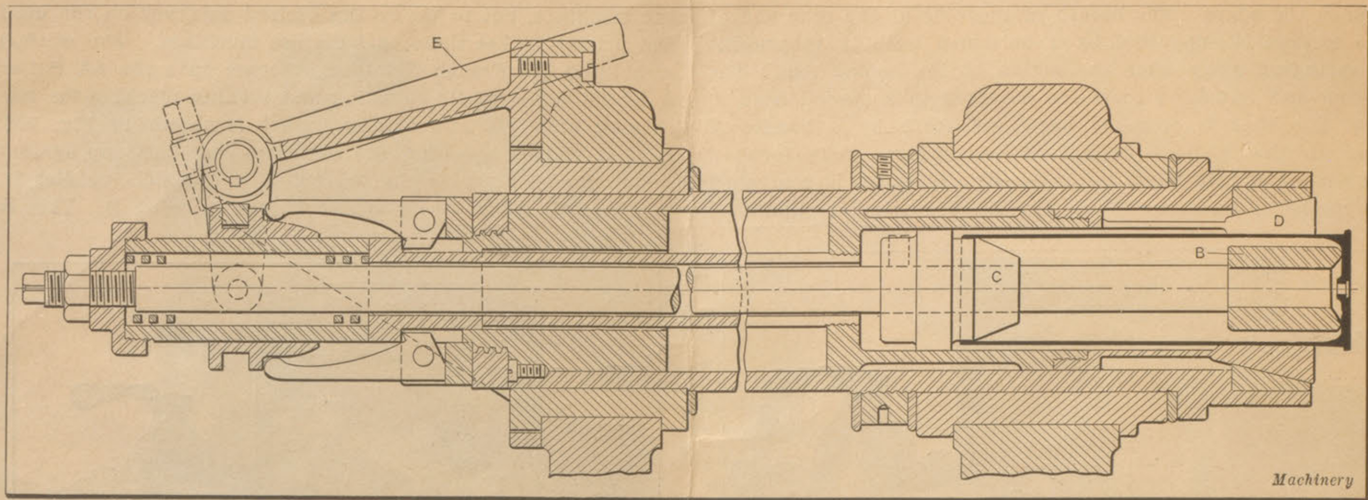


Fig. 122. Diagram showing Method of chucking a French 75-millimeter Cartridge Case on a Potter & Johnston Automatic Chucking Machine

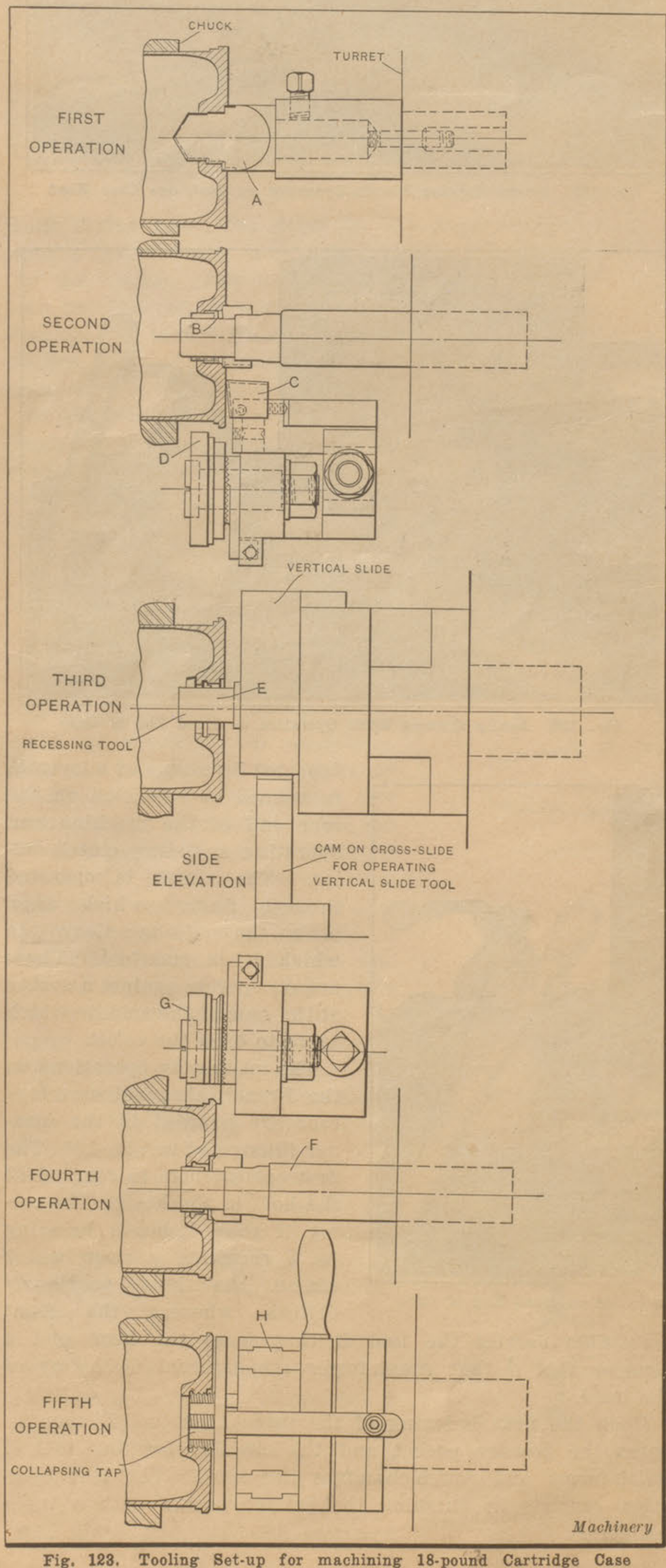


Fig. 123. Tooling Set-up for machining 18-pound Cartridge Case

Machining the British Shrapnel Cartridge Case

The brass cartridge case for the British shrapnel is more difficult to machine than the French case, as reference to Fig. 123 will clearly show. The machining operations are accomplished on a No. 5A Potter & Johnston automatic chucking and turning machine having a five-sided turret. The first operation is to drill the primer pocket hole with a three-step drill *A*. The turret is now indexed and the surfaces previously roughed out are finished with inserted-blade counterbore *B*. At the same time, the head of the case is faced with a relieving tool *C* held on the cross-slide and rough-formed with circular tool *D*.

The turret, in being indexed to the third position, brings vertical recessing tool *E* into operation. This carries two

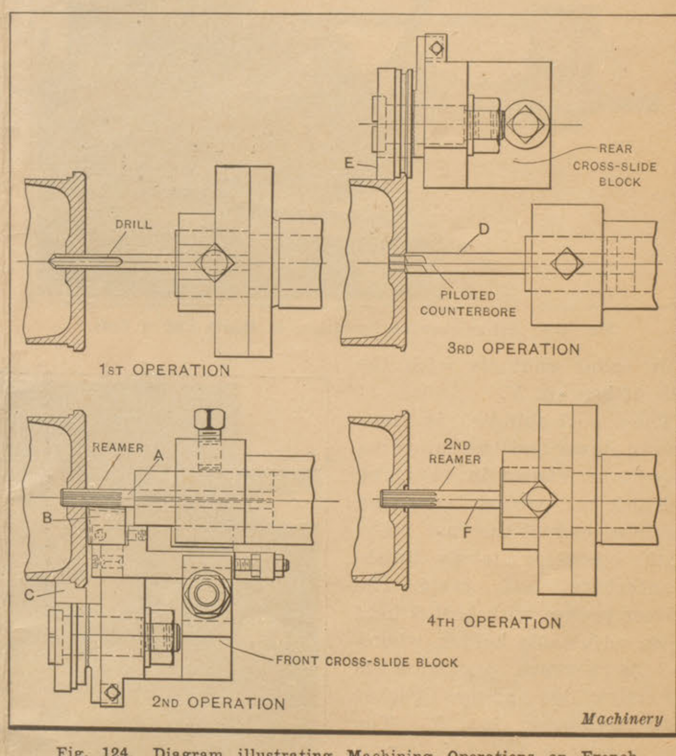
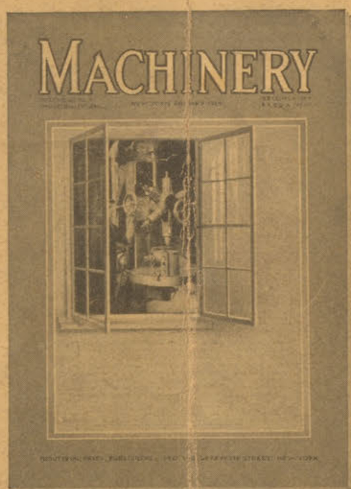


Fig. 124. Diagram illustrating Machining Operations on French Cartridge Case on Potter & Johnston Machine

cutters, one of which recesses the primer pocket at the point where the thread is to terminate, whereas the other removes the burr and faces the inner boss. In the fourth operation, the smallest diameter of the primer pocket is reamed and the largest diameter of the hole chamfered by tools held in bar *F*. The rear cross-slide is advanced at the same time, carrying the circular tool *G* that finish-forms the head. The final operation—threading—is performed with the "Geometric" collapsing tap *H*.

In closing, it should be stated that the methods and machines employed in shrapnel manufacture call for the best mechanical skill obtainable, as is evident from the preceding review of current practice.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