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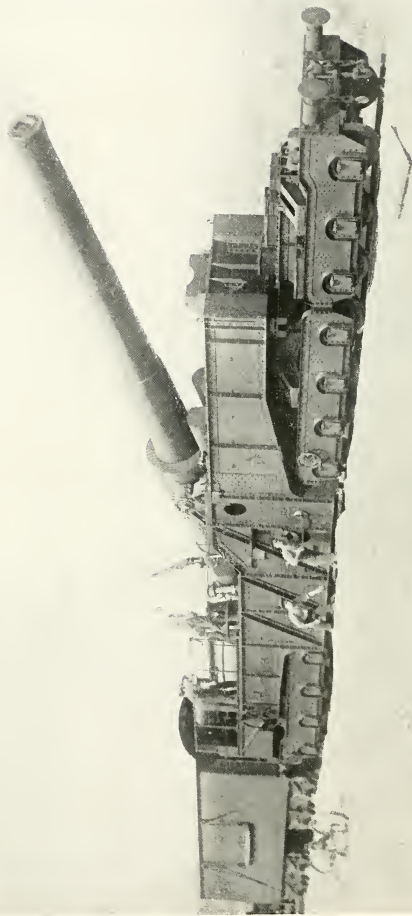


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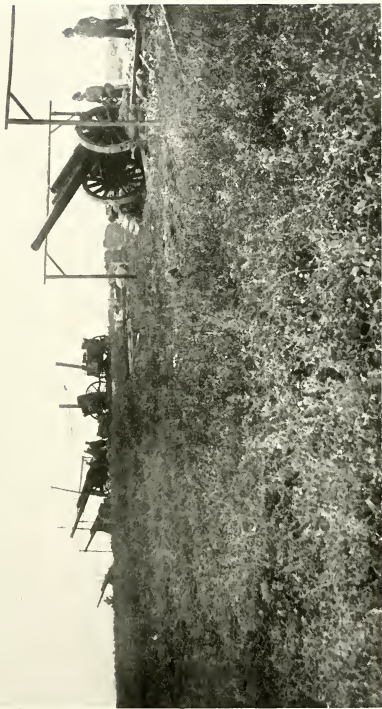
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WHEN Armageddon began, the forces liberated were unmeasured. "No single brain," Mr. Churchill declared, "achieved a complete and rightly proportioned view of the cataract of events." Stupendous masses of men, armed with the deadliest weapons, were precipitated against each other; fortresses dissolved like clouds of vapour, great battles were fought unnoticed. Neither belligerent nor neutral could visualise the dimensions of the conflict; much less could they calculate the potentialities which loomed ahead or define the duration of the struggle.

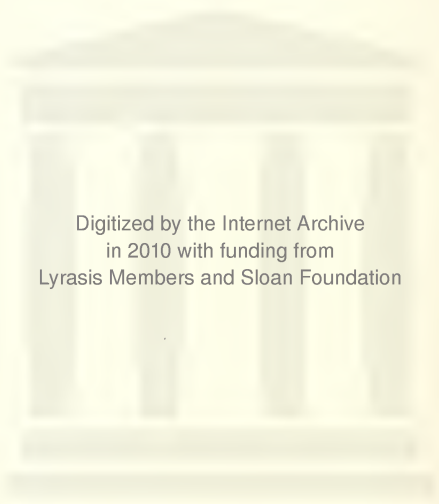
No one realised the sinister forces that had been loosed against civilisation—not even the Governments of the countries attacked. That fact alone demolishes the plea of Germany that she was the victim of a "crushing out" conspiracy formed by her neighbours, that she was engaged in a defensive war. It

also explains why, on the eve of war, Britain, like France and like Russia, was mobilised for peace. Did not a well-known American declare that Germany's readiness at the outbreak of war would redound to her eternal dishonour, while Britain's unreadiness would be to her eternal honour?

At the beginning of August, 1914, the British Army was a mere unit in the world's fighting forces. It consisted of 200,000 men. Their ammunition needs were served by three Government factories, augmented by a few private armament firms. This establishment, be it noted, was in accordance with a fixed national ideal, fully appreciated by our Allies. When Germany opened her attack on Europe, no one had foreseen—or, indeed, could have foreseen—the number of heavy guns and the quantities of high explosives that operations would consume. The colossal demand was generated by the changed conditions of warfare. During the heroic defence of Verdun, France, it is asserted, fired on one occasion as many as 800,000 shells in 24 hours. On the front in Picardy, according to a British officer, British artillery hurled about 10,000,000



HEAVY GUNS IN ACTION ON THE SOMME.



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against the enemy's lines, "without counting the grenades, or the missiles of machine guns and rifles." Germany was the first to require, and, therefore, the first to produce, such huge stores of war materials. For the expedition against Russia, for example, Mackensen was supplied with 50 batteries for each army corps and 24 machine guns for each regiment—a number since increased to 48.

THE NATURE OF BRITAIN'S TASK

Not until the fluctuating lines of the armies in the West congealed into entrenchments did Britain realise the measure of her task on land. She had to face then a blasting operation of such magnitude, demanding so many men and so many shells, requiring such a continuous supply of big guns, machine guns, aircraft and other engines of destruction, that only by the complete mobilisation of the country's engineering and industrial resources could it be pursued. Only by transforming Britain could the attempt be made to restore the North of France and Belgium to their

rightful owners. Only by an herculean effort, by sacrificing all to the one paramount idea, could the invader be hurled back, and the cause for which Britain entered the war upheld.

Many neutrals—especially those far removed from the war and unsusceptible to its penetrating realities—are ignorant of what has actually been achieved. They know nothing of the silent revolution that has taken place in the island country, of that marvellous metamorphosis which has affected every class of life, every industry, every home, every man and woman in the realm. It is the purpose of this brief survey to enlighten them, to show them what Britain has achieved in two fateful years, to prove the truth of the old proverb that will-power finds a way.

A YEAR'S WORK IN FOUR DAYS

What *has* Britain done? Instead of providing for an army of 200,000, she has provided for an army of five millions, and, in addition, helped to equip the armies of her



A FEW BIG SHELLS READY FOR FIRING.

Allies.* Instead of three arsenals in the United Kingdom she has built or improvised 90, all working night and day. Instead of a few private armament firms working for the Government, there are now 4,000 controlled firms engaged exclusively in the production of munitions. Ninety-five per cent. of these firms had never produced a gun, shell or cartridge before the war. Yet in 10 months they supplied more shells than all the Government arsenals and armament shops existing at the outbreak of war. Even then there was an enormous balance of shells over. It would now be practicable—and, indeed, has been practicable since the great Allied offensive began on July 1—to have a battle of Loos every week. The weekly output of .303 cartridges for example, is now greater by millions than the annual output before the war. The output of guns and howitzers has been increased

* One of Britain's armament firms has a factory devoted entirely to the provision of a particular gun for the French Government. Russia has been supplied with great quantities of grenades, rifle cartridges, guns and explosives. The Belgian and Serbian armies have been re-equipped. Italy and Roumania have been supplied with most important munitions.

by several hundreds per cent. A year's work in 18-pounder ammunition is now done in three weeks, a year's work in howitzer ammunition in two weeks, *a year's work in heavy shells in four days.*

SOME MIRACLES IN MUNITIONS

Before the war the Navy absorbed almost all that the national arsenals produced. There was no room in the workshops for an army gun programme ; and even if there had been room, there were no workmen—or, rather, the labour of Britain was engaged elsewhere. The new Ministry of Munitions had, therefore, a stupendous task before it. It had not only to create guns and shells, but heavy guns and heavy shells ; not only to find the material, but to find the machinery and the human hands that could shape that material ; not only to provide for the pressing present, but for the still more pressing future ; not only to meet the requirements of an army 25 times the size of a “ peace ” army, but the requirements of other and even larger armies which were allied to it. And this colossal



TRENCH MORTAR AMMUNITION BEHIND THE LINES.

undertaking was achieved, thanks to the unity of the nation, in spite of the widespread upheaval of existing industries, in spite of trade union conventions, in spite of the fact that the skilled manhood of the country had been heavily drawn upon for the fighting services.

Dr. Addison, Parliamentary Secretary to the Ministry of Munitions, has explained the genesis of this great mobilisation. "In June, 1915," he said in an interview, "we made an inventory of all the available machinery in the country, and it was evident that it was entirely inadequate to meet the demands. There were, however, a great many private firms which could be brought in to make munitions and it was decided to mobilise them for national service. In order to do this we created an organisation embracing the entire country. The country was divided into districts, in each of which a working board of management was set up. By means of this scheme of local organisation, thousands of firms have been brought in, many of which had never seen a shell body, or a fuse, or a grenade, or a bomb before,

much less made them. Now munition-making, in some form or another, has extended to every considerable town—indeed, to a large number of villages.

“An earnest desire to help, an adaptability and eagerness to learn, have brought into munition-making the most remarkable assortment imaginable of shops and factories. In one area alone shell bodies or the components of shells are being made, not only in engineering works, but in confectionery works, by a music-roll manufacturer, by an infants’ food maker, by a candle maker, by a flour miller, by a tobacco merchant, by an advertising agent, in several breweries, by some jobmasters, by a glazier, by syphon manufacturers, and so on. Shells, and good shells, have been turned out by machines and methods which would be horrifying to the apostles of orthodoxy. What all this amounts to in the aggregate you can form some conception of when I tell you that a calculation made three weeks ago showed that there were being turned out weekly by firms who, a year ago, had not been engaged in munition work, 16 times

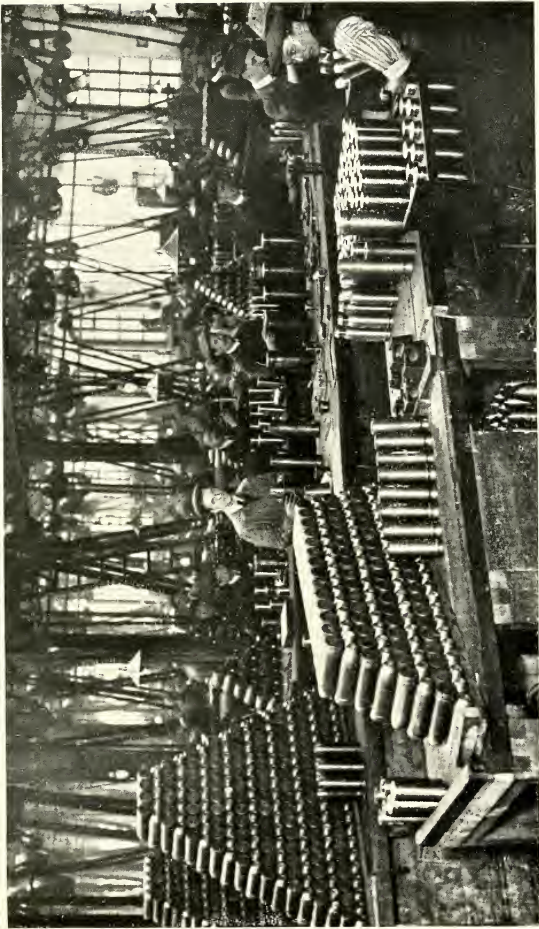
as many heavy shells as were being produced a year ago by all the national plants and private armament firms put together."

GERMANY AND BRITISH INVENTIONS

Much of the industrial development of Germany, upon which her military preparations were based, was due to her adoption and development of British inventions. It is perhaps a consequence of Britain's peace-loving tendencies that, when an English scientist has made a valuable discovery, it has been left to German manufacturers, with war potentialities in view, to develop and reap a rich harvest from it. One of these cases was an Englishman's discovery of how to utilise the waste products of coal-tar. Pacifist Britain did not see her opportunity. In Germany it was taken up with enthusiasm. Something like two million pounds was spent by German manufacturers in development, with the result that they created a huge dye industry on which the world became dependent. Out of this arose Germany's trade in fine chemicals, and the factories employed

in the work were of the first importance to Germany for the production of explosives. She did not even need to build new factories. They were all ready to hand.

Another example was the discovery, about 30 years ago, by two British engineers, Thomas and Gilchrist, of a steel-smelting process which made it possible to use phosphoric ores. Up to that time, ore which contained phosphorus and, to a certain extent, sulphur, could not be utilised, the steel made from it being brittle and unsuitable for most purposes. This discovery increased our supply of ore for high quality steel by 40 per cent. To Germany it was even more advantageous. Nearly all of her ores—certainly 95 per cent.—are phosphoric, and would have been useless to her but for the British discovery. In July, 1915, the German output of steel—and most of it was used for naval and military purposes—was 1,130,000 metric tons. Of that total 1,060,000 tons was basic steel, that is to say, steel which she could not have used except for the British invention. Incidentally a striking illustration of her dependence on the kultur of other nations!



SHELL-MAKING AT SHEFFIELD.

“ ONE GIGANTIC ARSENAL ”

The Ministry of Munitions is the general staff of British industry organised for war. The existing factories previously engaged in “ war ” manufactures have increased their output to such an extent that the weekly output of explosives of every description now exceeds, as we have seen, the previous yearly output. Existing works used for entirely different purposes have been converted, together with their workpeople, to the special needs of warfare. Works engaged in cotton-spinning, in the manufacture of machinery gas engines and motor-cars, are now armament firms—flaring night and day with the furnaces of Mars. The following typical industries have been converted so swiftly as to turn the United Kingdom into one gigantic arsenal :—

- Agricultural implements
- Motor engineering
- Brass band instruments
- Doors, locks and springs
- Table stationery
- Printing machinery

Fire-extinguishing apparatus

Arc lamps

Pleasure boats

Boot polishes

Gramophones

Milk sterilising

Not only have ploughshares been beaten into swords, but sewing machines have been expanded into aeroplanes. Sporting apparatus makers are making shells and plugs for shells. A confectionery works is making shells instead of hot-cross buns. A music-roll manufacturer is making gauges for that earth-shaking music which rolls over the trenches of Europe. Men who have been employed all their lives in making the springs of watches are now turning out, with the same minute care, some of the most difficult parts of a shell, knowing, too, that on their care the lives of their sons and brothers may depend. A firm of jewellers has built a great new factory for making optical instruments which require great accuracy ; thousands of delicate instruments and skilled manipulators are using up nerve and brain to make these eyes for the Army and Navy.

INSIDE A SHELL FACTORY

Let the reader accompany Mrs. Humphry Ward into one of the improvised shell factories. Situated in Yorkshire, it is under the control of one of the country's leading engineers. "It is filled," writes this visitor, "with 800 to 900 men, all 'medically unfit' for the Army, and almost all drawn from the small trades and professions of the town, especially from those which had been hit hard by the war. Among those are a keeper of bathing machines, a publican's assistant, clerks, shop assistants, three clergymen (these going home for their Sunday duty, and giving their wages to the Red Cross), unemployed architects, and the like. No shop makes a greater impression of energy, of a spirit behind the work, than this shop. In its inspecting room was a graduate from Yale. 'I had to join in the fight,' he said quietly; 'this was the best way I could think of.' And it was noticeable, besides, for some remarkable machines which America had sent. In other shell factories, a single lathe carries through one process, interminably repeated,

sometimes two, possibly three. But here, with the exception of the fixing and drilling of the copper band, and a few minor operations, one lathe *made the shell*—cut, bored, roughed, turned, nosed and threaded it, so that it dropped out all but the finished thing—minus, of course, the fuse. The steel pole introduced at the beginning of the process made nine shells, and the average time per shell was 23 minutes. No wonder that, in the great warehouse adjoining the work shop, one saw the shell heaps piling up in their tens of thousands, only to be rushed off week by week, incessantly, to the front.”

The introduction of these machines had been largely the work of an able Irish manager, who described to Mrs. Humphry Ward the intense anxiety with which he had watched their first putting up and testing, lest the vast expenditure incurred should have been in any degree thrown away. His cheerful looks and the shell warehouse told the sequel. “When I next met him it was at a northern station in company with his director. They were then apparently in search of new



DRILLING BLADE STOPS FOR PATROL BOAT TURBINES.

machinery. The workshop I had seen was being given over to women, and the men were moving on to heavier work." And this is the kind of process which is going on over the length and breadth of industrial England.

NEW INDUSTRIES CREATED

Before the war Germany had obtained a virtual monopoly in the production of both chemical and optical glass. The production of these glasses is essential to success in modern war. Without optical glass of the most perfect quality an army cannot be provided with gun-sights, range-finders, periscopes, and telescope sights for the snipers' rifles. No explosive factory can work for a day without an adequate supply of chemical glass. It must be of such a quality as to stand a very high temperature and resist chemical action. Britain had nothing of the kind, not even the equipment for its manufacture. At the beginning of the war certain chemicals were sent to the front in inferior glass bottles. Chemical reaction took place between the

contents and the bottle, with the result that a useless product reached the front. On this side alone, therefore, a side of which the layman is absolutely ignorant, it was necessary to create a new industry.

It is almost impossible to convey an adequate picture of the transformation of industry which was effected throughout Great Britain by the Ministry of Munitions in the course of a comparative few months. Railway workshops, hitherto devoted to the building and repair of locomotives, were given over to the construction of gun-carriages and field guns. Four-fifths of the energy of the companies normally occupied in manufacturing heating apparatus was soon employed in turning out trench mortar bombs and hand grenades. Boot and shoe factories were utilised for the manufacture of 4.5-inch shells and primers—and this in spite of the fact that Britain has supplied many million pairs of boots to her Allies! Here, machinery was adapted to new purposes; there, machinery was removed and fresh machinery installed.

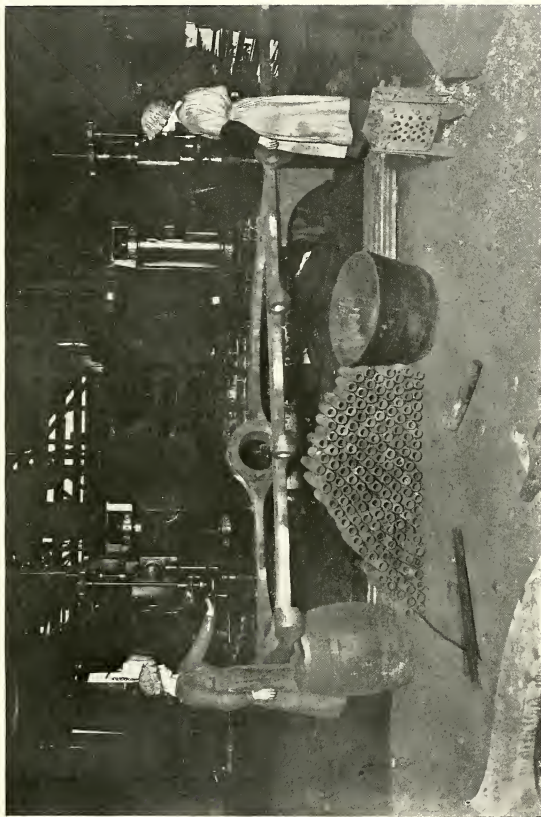
INDISPENSABLE "KEY" INDUSTRIES

Elsewhere, factories were requisitioned to produce machine tools, for one of the earliest steps taken by the Ministry of Munitions was to acquire control of every machine tool-maker in the United Kingdom. Practically every weapon used in the war has been fashioned with the aid of a machine-tool, but, unfortunately, the greater proportion of these tools is of foreign origin. During the war it has been necessary to secure scores of thousands of machine tools in order to enable the munitions output of the Allies first to approach, and then to surpass, that of the enemy. Millions and millions of pounds' worth of machine tools have been bought in America during the war period to ensure adequate supplies of munitions from our factories—national and otherwise. Without imported machine tools Britain could not have thought of winning the war. Her own facilities for producing these machines were totally inadequate at the commencement of hostilities. The British machine-tool trade was being steadily squeezed out by German

and American competition. Britain exported, in the year before the war, less than £750,000 worth of machine tools as compared with Germany's export of over £3,000,000 worth in 1913. The war pointed out the urgent necessity for different methods and greater co-operation among manufacturers in order to secure for Great Britain a larger share of the machine-tool trade. In the case of such a "key" industry—the indispensable basis of all engineer-manufacturers, from a tin-tack to a battleship—she now aims at becoming self-supporting.

MOBILISING THE CHEMISTS

It was soon discovered that more metals of one kind and another would be required to meet the varied needs. Under Mr. Lloyd George's direction the Ministry of Munitions took control of the metal market. It proceeded to develop fresh supplies, assisted by the Governments of Australia and Canada. It was also necessary to create industries which hitherto had been practically unknown in the British Isles. Courage and ingenuity facili-



GIRLS DRILLING HOLES IN SHIPS' STERN PLATES.

tated this work. Isolated illustrations only can be given. Chemists declared that the gasworks throughout the country could be adapted to produce material needed for the manufacture of high explosives. Immediately the Ministry provided the necessary plant, rendering the country independent of foreign supplies of elements necessary for the making of T.N.T. and other high explosives. The illuminating power of gas in domestic use was thus somewhat reduced, but the sacrifice on the part of householders was a small one and was readily and cheerfully made.

Another example of the spirit in which the munition movement has been conducted was furnished by the course adopted with reference to the nation's supply of sulphuric acid. Large quantities had hitherto been imported for the making of chemical manures and for galvanising iron, while the textile industries had also used no small quantity. It became apparent that the Ministry would require all the sulphuric acid which it could obtain, and the various industries which had hitherto been dependent upon it were in danger of having to close down. Necessity is the mother

of invention, and the chemist is the godfather of modern industry. Research was encouraged, and it was found that, in some cases, industry could be pursued by utilising by-products of the sulphuric acid not required for the making of munitions, and that, in other instances, substitutes could be employed.

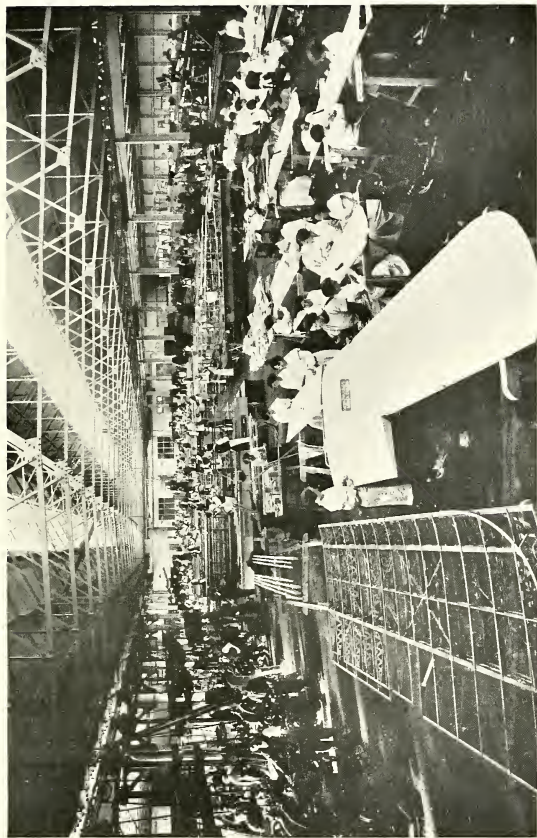
Yet another industry affected was the making of spirits. Fifty-seven per cent. of the British Merchant Navy had been requisitioned by the Government for themselves and their Allies, mainly for naval and military purposes. In consequence, the Government was compelled to restrict imports, and, among other things, grain for the making of spirits came under the ban. The Minister of Munitions immediately saw his opportunity. He took over the control of all the distilleries in the United Kingdom and became the largest producer in the world of alcoholic spirits, which form a constituent in the production of modern explosives. And so, step by step, county by county, industry by industry, the great scheme of creation, conversion, and reconstruction proceeded.

LABOUR'S GREAT SACRIFICE

One of the most anxious problems was the supply and distribution of skilled labour. There was not enough skilled labour to go round. This fact was recognised by the trade unions, and the Government has received their hearty assistance throughout, both in the distribution of skilled labour and in the dilution of skilled labour with unskilled. Skilled men have trained and instructed unskilled workers, and, in thousands of cases, have voluntarily been removed from piece work to day wages, with the result that they have sometimes earned smaller wages than those they trained have received at piece work.

British organised labour gave to the army at the front more than its heart and hands. It yielded up, in the hour of national crisis, many of the legal rights and privileges only established after years of effort and controversy. To realise what this sacrifice meant, it is necessary to consider the delicate character of the industrial situation when war broke out. For the past four years labour

had been in irruption. The great railway strike of 1911, with its menace of a still greater upheaval to come, had been forgotten neither by the public nor by the men. The Welsh miners were restless; the transport workers generally were demanding reforms. Capital and labour, in August, 1914, if not openly hostile, were suspicious of each other's designs. There was no guarantee that the new methods of organisation adopted to safeguard the interests of the workers would avert further strikes. Yet when Great Britain took up arms against German tyranny and in defence of democratic freedom, her workmen not only postponed a settlement of outstanding differences with the capitalists; they sheathed those weapons of offence and defence with which Parliament had equipped them. In other words, they voluntarily abrogated the whole of the combatant code of trade union regulations. They sank the immediate interests of their class in the broad demand for national unity. No stronger proof of the country's whole-hearted concentration on its grave task could be conceived. And labour made this supreme renunciation, not in the



COVERING WINGS AT AN AIRCRAFT FACTORY.

first weeks of the war, when it believed that the struggle would be short, but after it was borne in on the public mind that the conflict might go on for years. Labour gave up something it greatly valued for an indefinite period.

WHAT WOMEN HAVE DONE

The problem of "hands" for the work at home was also solved by the employment of women. In the first few months of the war less than 200,000 women were engaged in war industries. To-day, there are over 1,000,000. Of the 4,000,000 workers they constitute a quarter; and every month their total is increasing. It follows that much labour has been expended in housing the munition workers, which form about half of the total engaged on war supplies. Whole villages have been built. During the past year housing accommodation has been provided for 60,000 people.

What are these workshops like where women feed the armies in which their kith and kin are fighting? Here is Mrs. Humphry

Ward's impression of one which she inspected in the north, a factory which makes fuses and primers and gages :

“ The large airy building with its cheerful lighting, the girls in their dark blue caps and overalls, their long and comely lines reminding one of some processional effect in a Florentine picture ; the high proportion of good looks—even of delicate beauty among them—the upper galleries, their tables piled with glittering brass work, among which move the quick, trained hands of women : if one could have forgotten for a moment the meaning of it all, one might have applied to it Carlyle's description of a great school as ‘ a temple of industrious peace.’ *Some day, perhaps, this ‘ new industry ’*—as our ancestors talked of a ‘ new learning ’—this swift, astonishing development of industrial faculty among our people, especially among our women, *will bear other and rich fruit for England under a cleared sky.* It is impossible that it should pass by without effect—profound effect—upon our national life. But, at present, it has one meaning and one only—*war !*”



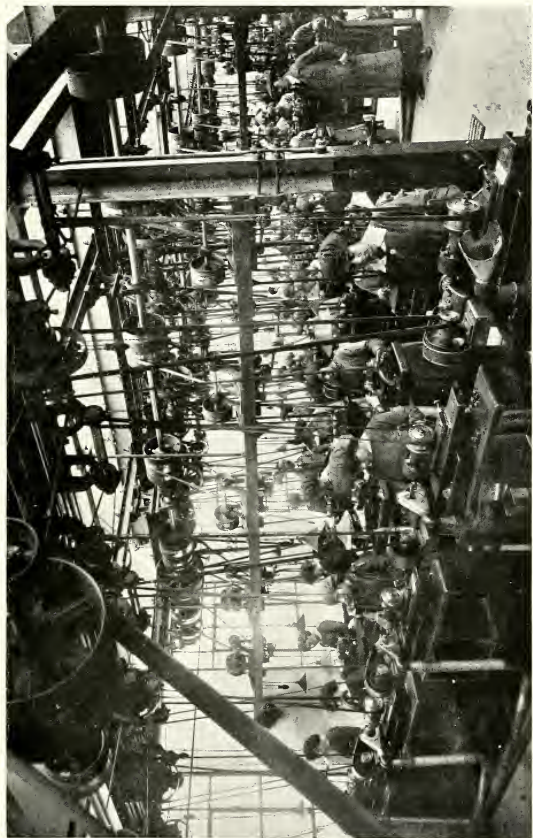
RANGE OF SLOTTING MACHINES ON 60-PDR. BREECH RINGS.

“Talk to these girls and women. This woman has lost her son—that woman her husband. This one has a brother home on leave, and is rejoicing in the return of her husband from the trenches, as a skilled man, indispensable to the shop; another has friends in the places and among the people which suffered in the last Zeppelin raid. She speaks of it with tight lips. Was it she who chalked the inscription found by the Lady Superintendent on a lathe some nights ago?—‘Done 14 to-day. Beat that if you can, you devils.’ No; under this fast-spreading industry, with its suggestion of good management and high wages, there is the beat of no ordinary impulse. Some feel it much more than others; but, says the clever and kindly Superintendent I have already quoted, ‘the majority are very decidedly working from the point of view of doing something for their country. . . . A great many of the fuse-women are earning for the first time. . . . The more I see of them all the better I like them.’ And then follow some interesting comments on the relation of the more educated and

refined among them to the skilled mechanics—two national types that have perhaps never met in such close working contact before. One's thoughts begin to follow out some of the possible social results of this national movement."

A HAPPY ARMY OF 10,000

Here is the report of another unofficial inspector: "I was astonished at the aspect of the women workers. I had expected to see them weary, pale, heavy-eyed, doggedly doing their 'bit.' Instead, I found a township of 10,500 girls and women, looking well, strong, happy and determined, glad of the work, proud of their achievements. The hours are 12 at a shift, out of which an hour is taken for dinner and half an hour for tea. Some start at seven, others at eight. Every woman works alternately a week on day shift and a week on night shift. No woman works on Sundays. At the end of two months, every woman is entitled to the coveted triangular badge with the inscription, 'On War Service.' No woman of 21 and upwards



GANG OF SPECIAL GRINDERS ON BALL-BEARINGS.

earns less than 25s. a week, even during her first week, while, in a very short time, she is earning 35s. a week, and when she goes into the 'danger buildings' or the factories where the shells are filled with the innocent-looking but deadly cordite and high explosive materials, she earns from 45s. to 55s. a week."

"At this particular munition works they prefer their apprentices 'raw.' The authorities like to train the women themselves, and the women they most urgently need are those of the public school type—intelligent, well-educated, capable 'sportswomen.' There are a certain number of 'over-lookers' employed, who can start as 'over-lookers in training,' and who earn from £2 to £3 15s. a week. The girls either take their own meals or go to one of the many canteen rooms scattered about the munitions township. In many of the 'shops' they prefer to take their own dinner, as they vary their meal with music, having bought a piano from a fund subscribed by themselves. At a given signal in the middle of the day, all lathes are stopped, and the ceaseless hum of machinery gives way to

women's tongues and the strains of a valse or of the latest music-hall song rattled out on the common-property piano."

A MODEL FACTORY

Two-thirds of the operations involved in making munitions of war had never been done by a woman previous to a year ago. Now, the women and girls from a myriad homes whence men have gone to fight are engaged on 471 different munition processes. These include operations in connection with aeroplane production, the manufacture of howitzer bombs, the making of shrapnel bullets, making shells, making tools, and even some of the work connected with marine mines and shipbuilding. At first sight it seems almost incredible, but when you find young girls hard at work for 12 hours a day, working on shells, lubricating bullets, using cordite, making fuses, inspecting and gauging fuses, examining work where the thousandth part of an inch is a vital matter, running their machines deftly and easily, and spending their days in the danger buildings among



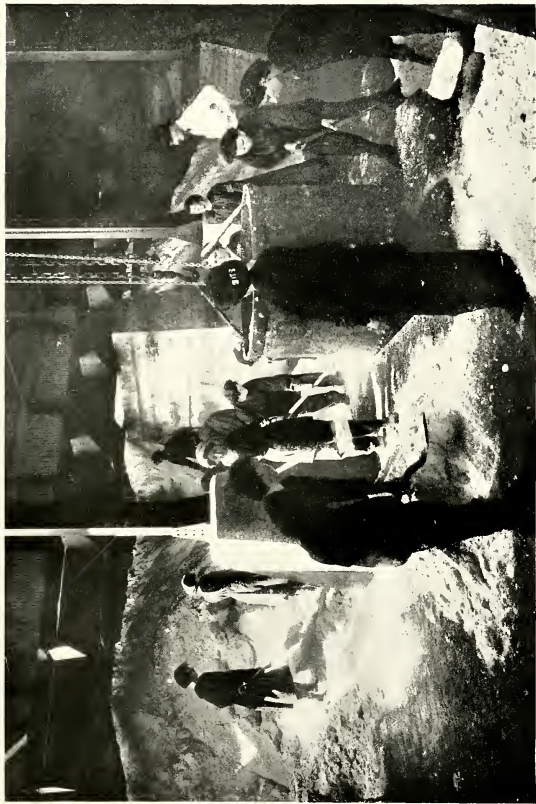
MESS ROOM AT A NATIONAL PROJECTILE FACTORY.

explosives, with as little fuss as if they were knitting socks, you realise something of what lies behind that list of operations on which the patriotic women, upholding the hands of the men, are engaged.

In shop after shop you see only an occasional man. However well the women are doing, they cannot take the place of all the skilled workmen, and, so far, a woman tool-setter is almost unknown—though women workers act as tool-makers. Thus there are men watching their work and coming to their aid in difficulties. Row after row of girls in overalls and caps, khaki colour or blue; pretty girls with flushed cheeks and hair escaping from their mob caps; merry girls with dimples, all working on the instruments of destruction; wives working for a man who is fighting to keep women and children safe; brides of a few days; widows. There are different grades of society represented, and every branch of industrial life; but all are linked together by England's need. Social distinctions are levelled in the democracy of overalls and caps. Quaint little feminine touches brighten the shops. Roses nod from

glasses. Most of the girls look healthy and well, for the authorities have realised that it is in their interests, as well as in those of the individual worker, that health should be guarded and preserved. One lady doctor in the Midlands, who said smilingly that she sometimes included the duties of a parson, has discovered an antidote for fumes which discolour the skin of the workers.

This same factory in the Midlands, which is growing and spreading and gobbling up green fields, is a model one, where girls gently bred can work with comfort and under proper control. Hostels built on the hut system contain pretty little bedrooms, either double or single, for which, and all their meals, the girls pay 13s. weekly. There are a matron and three maids for each hostel. Many of the matrons are trained nurses, and have taken certificates in sanitary inspection. There are also laundries where the girls can amuse themselves doing up collars and blouses; but the laundry work is done for them very cheaply. Recreation rooms, noisy and quiet, so that all tastes may be satisfied,



WOMEN LOADING NITRATE OF SODA INTO A SKIP FOR TRANSPORT TO THE STILL.

are a feature, and there is a splendid canteen, where good food is served on tables decorated with flowers.

With piece work, overtime, and bonuses, most of the girls here earn very good wages. A girl shell maker over 21 begins at £1 weekly, with the possibility of earning a bonus. Girls of 16 are earning 38s. weekly on certain work, and older ones £3 10s. weekly. Girls engaged in gauging and examining fuses, from 8.15 to 5 o'clock only, earn £1 weekly, and others average 35s. Educated women as overlookers, assistants to the supervisors, earn £3 and £4 weekly. Lately, certain orders of the Ministry of Munitions have come into force to improve the wages of the women working in controlled establishments engaged in the production of arms, ammunition, ordnance, and all branches of mechanical engineering and shipbuilding. In addition, allowances for processes inimical or dangerous to health are decided on the merits of the case. The rates are an improvement upon the pre-war pay for unskilled women's work.

HANDLING HIGH EXPLOSIVES

At another factory the women are engaged in all the processes of filling the 100 "graze" fuse, and, in many of those for making the 18 "time" fuse—a tribute to the accuracy and delicacy of touch which women display. The work entails the handling of high explosives—though, as one visitor remarked, "if one had not to leave all handbags and umbrellas outside these shops, and slip on goloshes, one would not realise it." The girls handle, without a trace of nervousness, the deadly T.N.T., and the even more deadly fulminate of mercury, displaying a steadiness of hand, and smoothness of movement that shows how each realises the vital importance of the full concentration of every sense upon the operation in hand. The shops where these important processes are carried on are small, each tenanted by only three or four girls—in order to localise any explosion—and each room has doors open to the fresh air at either end, so that the atmosphere may not become poisoned by the chemicals. Indeed, every possible pre-

caution one could think of to eliminate danger is taken. For processes, such as screwing up of finished fuses, where the chance of an explosion must be risked, a machine, called a safety gig, invented by one of the owners of the factory, is in use. It is a globe of hardened metal into which the fuse is inserted for tightening. Any explosion takes place inside the globe, which is strong enough to resist it; the operator goes unharmed.

To mention all the processes performed in these workshops would involve unnecessary detail, but they range from the "breaking down" and examination of every separate part of a single fuse to the filling of the detonator—that hollowed tube no longer than the first joint of the little finger—which, when filled with four grains of fulminate of mercury and four and a half grains of pistol powder, can fire a shell of practically any size.

A standard of high efficiency both in speed and accuracy is maintained in these shops. One girl charging detonators declared that, in her corridor, they were turning

out 4,000 a day. Another girl, whose work required the utmost care—for the dropping of a grain or two of the chemical would mean a dangerous explosion—said she filled regularly between 1,500 and 1,600 detonators a day; while a third, whose work was to measure the length of powder pellets, claimed 1,500 a day as her average output. An interesting process to watch was the making of the tetryol (T.N.T.) powder into pellets. One girl carefully wipes and polishes the mould, a second measures the powder and pours it in, and the third, the girl on the press, completes the process. All the workers engaged in handling explosives wear masks and shields for the eyes. Their hands and faces are stained with yellow, but not to a marked degree, owing to the precautions taken. “We hope to adopt the gas helmet used in the trenches for the use of the girls,” said an official

AND THEN——

And when all this has been said, the thousandth part has not been told of this



FITTING BREECH RINGS FOR 60-PDR. HOWITZERS.

gigantic industrial effort of Great Britain. It involved the establishment of schools—innumerable classes—for the education and training of thousands of workers who had absolutely no previous experience. The normal course in a school is six weeks, the work of tuition occupying four hours a day, six days a week. No charge is made for the instruction, which is of a comprehensive character. It includes teaching the rudiments of the use of most of the bench and machine tools employed in a munitions factory. The pupil has only to contract that he or she will go into such a factory at the end of the course. Students from all grades of society, as we have seen, are to be found in these classes—musicians, solicitors, actors. An earl's daughter has worked at a lathe for a year; and, in one city, the members of the legal profession, with the officials attached to the Courts, spend their week ends—under the leadership of a well-known judge—on munition work.

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