

Return to W.P.B. 51



BOURNVILLE UTILITIES



A W A R R E C O R D

ONE SHILLING

ACKNOWLEDGMENTS

Bournville Utilities Ltd. wish to acknowledge the help and the many kindnesses which they have received from firms and individuals. They would particularly like to mention Messrs. Fisher & Ludlow Limited, Baxters, Leyland Rubber Co. Ltd., Boots Pure Drug Co. Ltd., Dunlop Rubber Co. Ltd., and the many Regional Controllers and Officers of the various Supply Ministries, who were unfailingly helpful and without whose assistance War Contracts could not have been satisfactorily completed. The Directors and officials of many private firms passed on information and help with the utmost readiness. This co-operation has extended up to the present time. Our acknowledgment should also include those who have so ably and energetically worked on the production of this record of our work.

A W A R R E C O R D



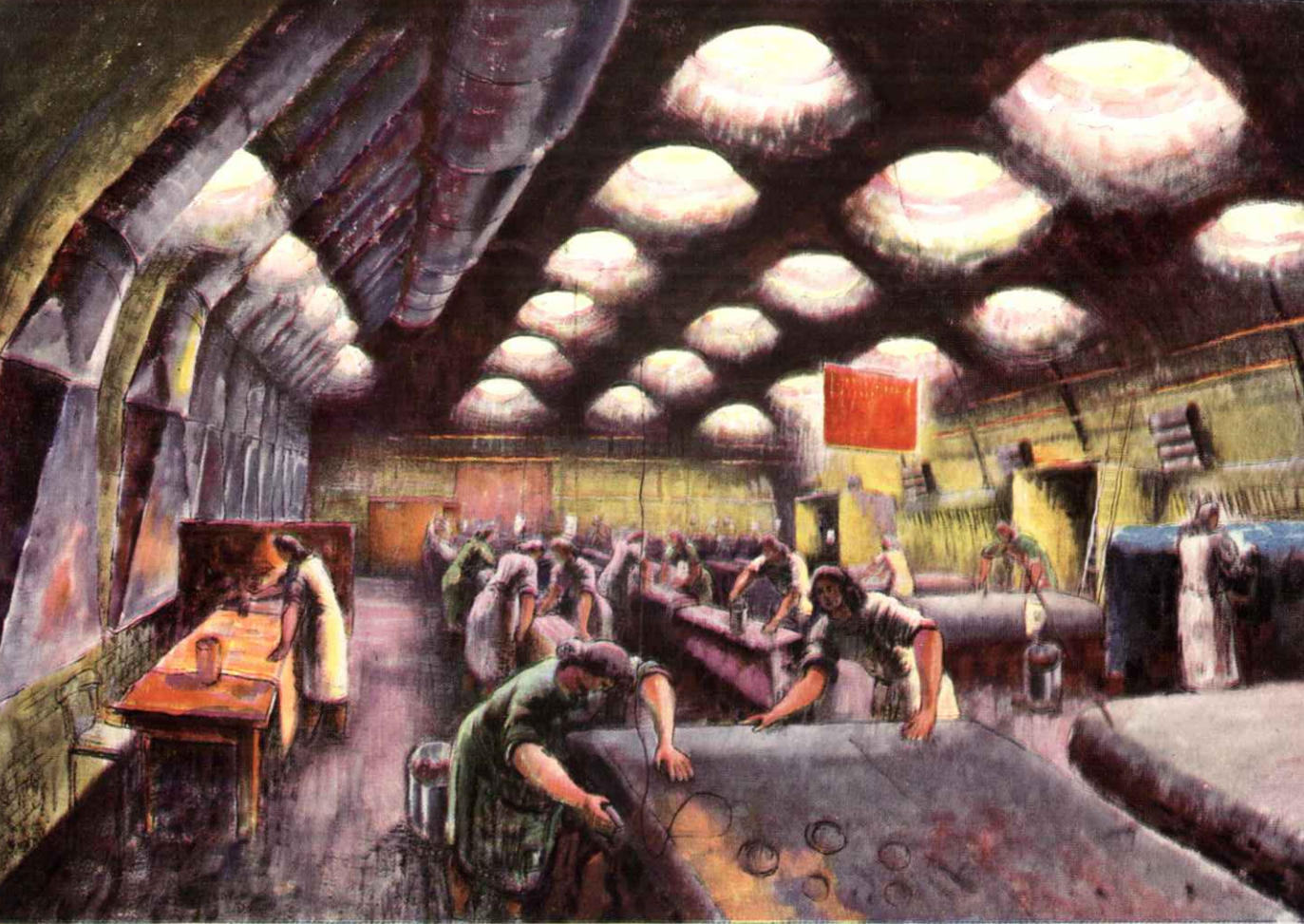
BOURNVILLE UTILITIES



Bournville Utilities Limited was set up in 1940 with the idea of utilising the plant, tools, craftsmanship, and technical and administrative ability available at Bournville in such a way that it would make a direct contribution to the country's military needs. At the peak of production 2,000 people were employed.

1945

BOURNVILLE UTILITIES LTD., BOURNVILLE, BIRMINGHAM, 30.



COVERING AEROPLANE TANKS WITH SELF-SEALING MATERIAL
From a Colour Sketch by Frank Dobson, A.R.A.

FOREWORD

FROM CHOCOLATE TO MUNITIONS

TOWARDS the middle of 1940, when the national outlook was very dark, many at Bournville were anxious that a contribution, more direct than had previously been possible, should be made to the urgent military needs of the country. In particular, this was felt on the engineering side of the organisation. Before the war Bournville had a thousand tradesmen and technicians of all grades and every variety of experience. Some of these had left to serve in the Forces or in munition works, but there were many who were bound to Bournville by ties of affection, pension considerations, domestic responsibilities, or house location, but who wished to do something more directly for the nation's war effort, yet without severing their connection with the Firm.

It was felt that at Bournville there was the skill, there were the workshops, the machine tools, the technical direction and powers of organisation, which might be employed directly on munitions production. This feeling was crystallised in the formation of Bournville Utilities Limited, a subsidiary of Cadbury Bros. Ltd., using the premises and material resources of the parent firm to carry out work for the Supply Departments of the British Government.

The Directors were Mr. Laurence Cadbury, Mr. C. W. Gillett, and Mr. W. N. Hallett. From the first, this Company has had enthusiastic co-operation and unstinted support from all sections of the factory. Not only have chocolate workers turned to unfamiliar tasks, such as making aeroplane parts and filling rockets, and the factory mechanics to the production of machine tools, but in the offices men who had been trained on devising piece-rates for chocolate or cocoa production turned with great success to similar work in connection with jerricans, respirators, and the pre-packing of warlike stores.

The story of the different jobs that have been done by Bournville Utilities Limited is told in the following pages.

Many of us, however, remember the great difficulty in those early days of getting any work to do at all. Most of that which was offered appeared to be unsuitable for a food factory to attempt to merge with its standard production.

Before the establishment of Bournville Utilities Limited an offer had been made to the Government to furnish a complete factory-building organisation, but this offer was not accepted.

One of the jobs we took on after a good deal of hesitation was the filling of rockets. We are proud that many thousands of these were filled with cordite at Bournville without any serious accident. It is a tribute to the care and skill of all concerned.

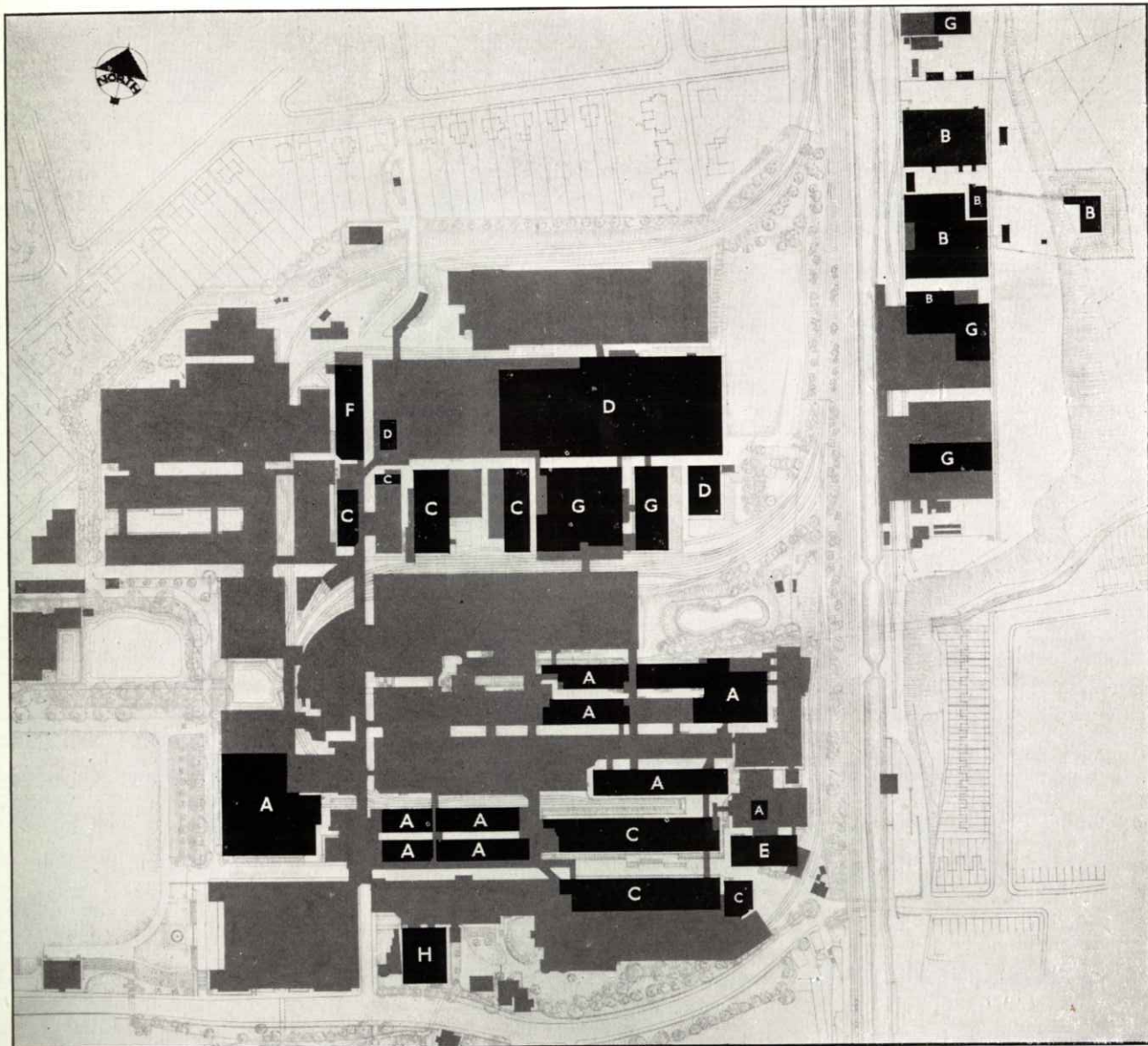
Soon after we started assembling respirators we suggested to the Government that it would be a good idea if we had conferences with the other firms doing similar work, in order that ideas could be exchanged and all suggestions and inventions pooled and used by all. This was agreed to and many of our ideas were adopted by other people, while we in turn benefited from their experience. The net result was that the cost of producing respirators was materially reduced. When we started filling rockets we made a similar suggestion to the appropriate Government Department. It was more difficult to carry this out as many Royal Ordnance Factories were involved, but eventually conferences were fixed up and were held in turn at each factory. Here, too, many valuable ideas were exchanged with mutual benefit.

As a result of this and our other efforts, Bournville Utilities Limited gradually came to occupy a not unimportant position in the minds both of local and headquarters supply organisations. We were often approached on difficult problems, and even where we had not undertaken the jobs our advice was sought.

It would be unfair to close this brief memorandum without a special word of praise for the way the men and women in the factory established by Bournville Utilities Limited at Battersea continued at work through the London blitz, and the V.1 and V.2 attacks, first of all on the production of Jerricans and later on the packing contract.

Our wartime activities are naturally now closing down, and, as raw material supplies return to pre-war standards, we shall get back to our normal peace-time work. The job done by Bournville Utilities Limited on the production of armaments for the second World War will then be but a memory. A few odd jerricans, a few scattered parts of respirators, and photographs of machine tools, will be all that will remain to remind us of the effort put forth by the employees and management of Bournville Utilities Limited during the period when the very existence of the country was at stake. It would be idle to pretend that Bournville's contribution was a major one, but "mony a mickle makes a muckle" and the mickle at Bournville and Battersea we feel was one which was worthy of the Firm and all associated with it.

W. N. H.



BOURNVILLE FACTORY



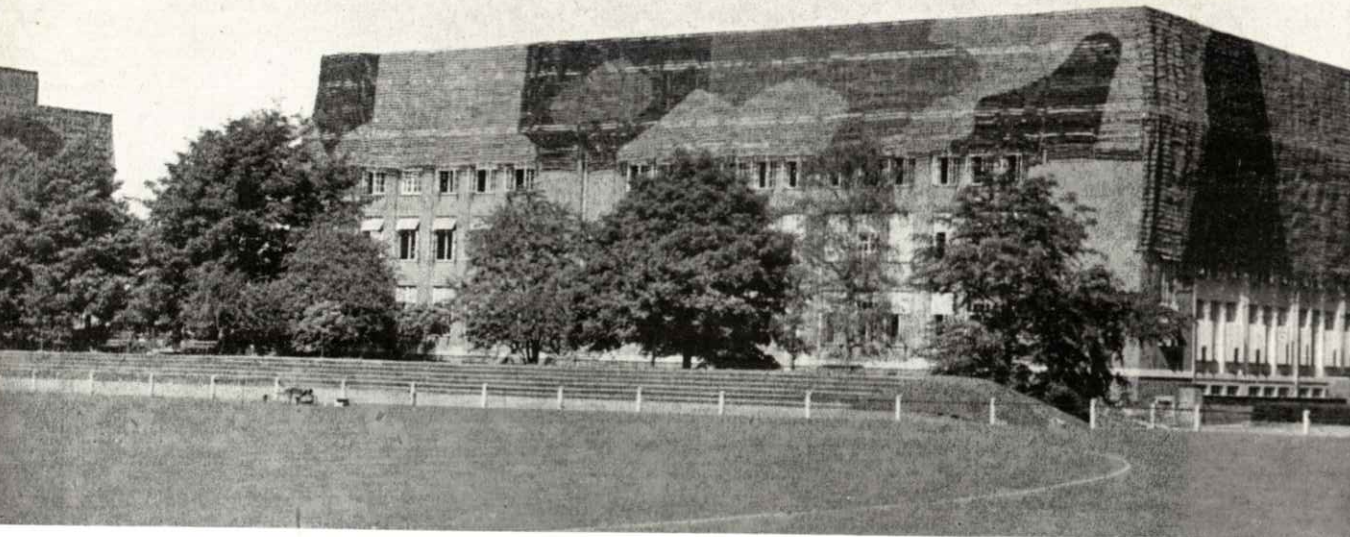
BUILDINGS USED FOR WAR CONTRACTS

- A Gas Masks.
- B Rockets (later for Tank Covering).
- C Machine Tools, Aircraft Components
- D Joseph Lucas, Ltd.

- E Austin Motor Co., Ltd.
- F John Player & Sons.
- G Ministry of Food.
- H Ministry of Works.

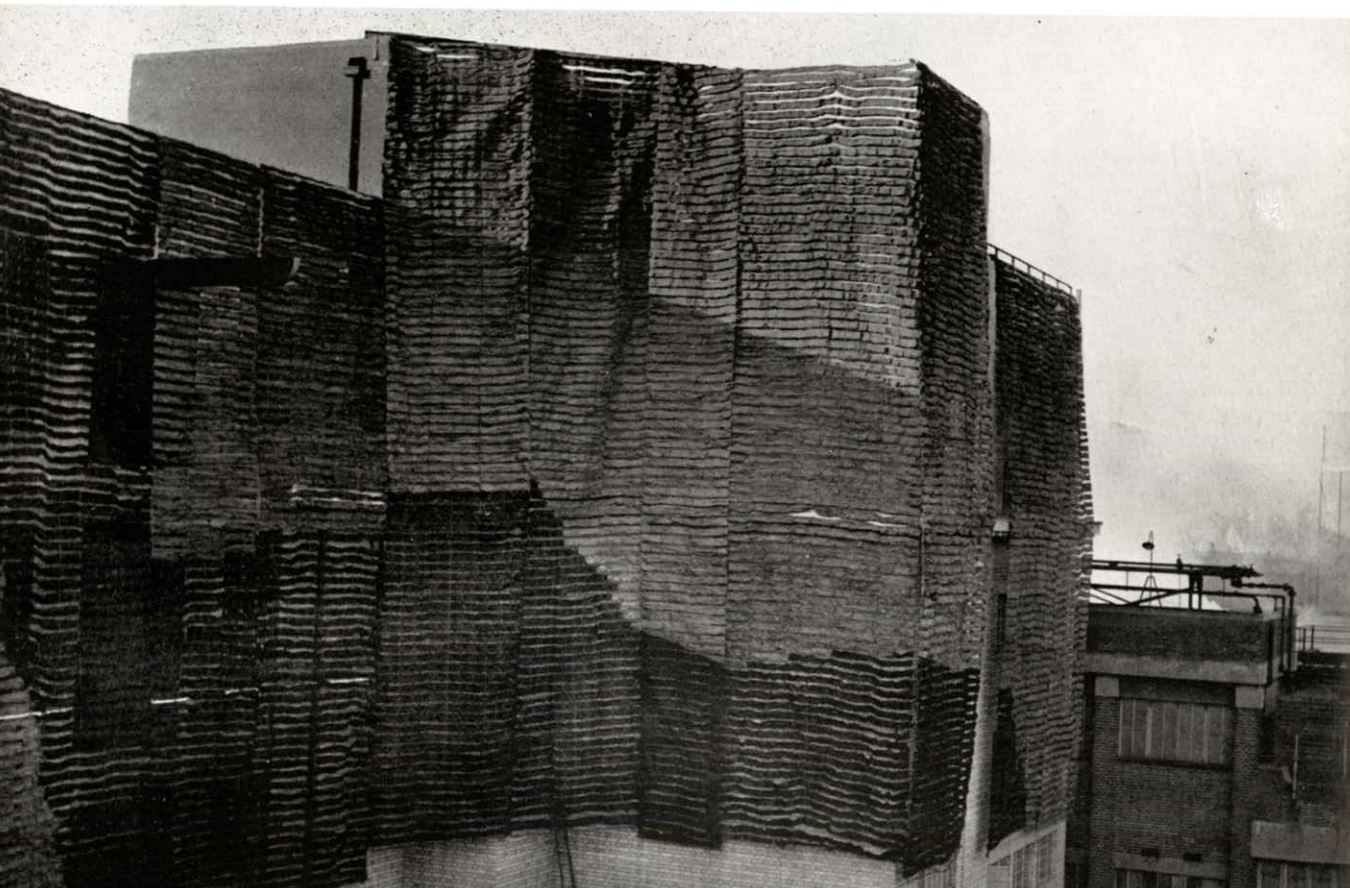
HOW BOURNVILLE BUILDINGS WERE USED FOR WAR-WORK

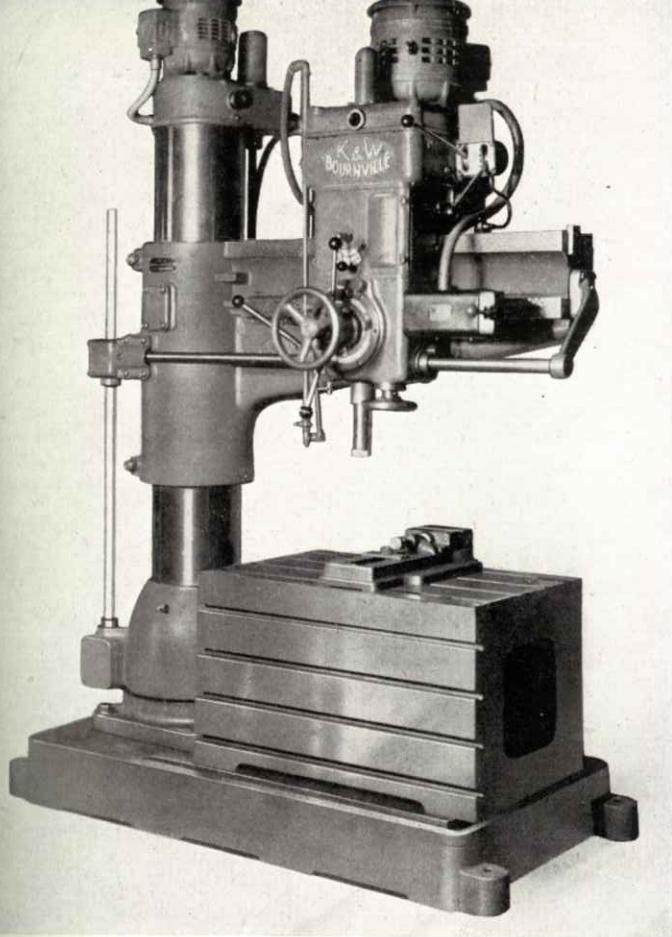
In addition to the area allocated to Bournville Utilities Ltd., other firms occupied a large portion of the factory, and many buildings (including some outside this plan) were used for the storage of important commodities and agricultural implements.



BOURNVILLE IN BATTLE DRESS

The factory endeavoured to make itself less visible to enemy bombers. The camouflage netting with which the buildings were covered was made by our own workers from coloured strips of hessian fastened to wire netting, while the flat roofs were covered with small coal and broken brick, in a pattern of red, black and green, which linked up with the disguise of the walls.





One of the 3 ft. 6 in. Radial Drills which were machined and assembled.

THE WORK OF BOURNVILLE ENGINEERS

Machine Tools, Jigs and Spare Parts

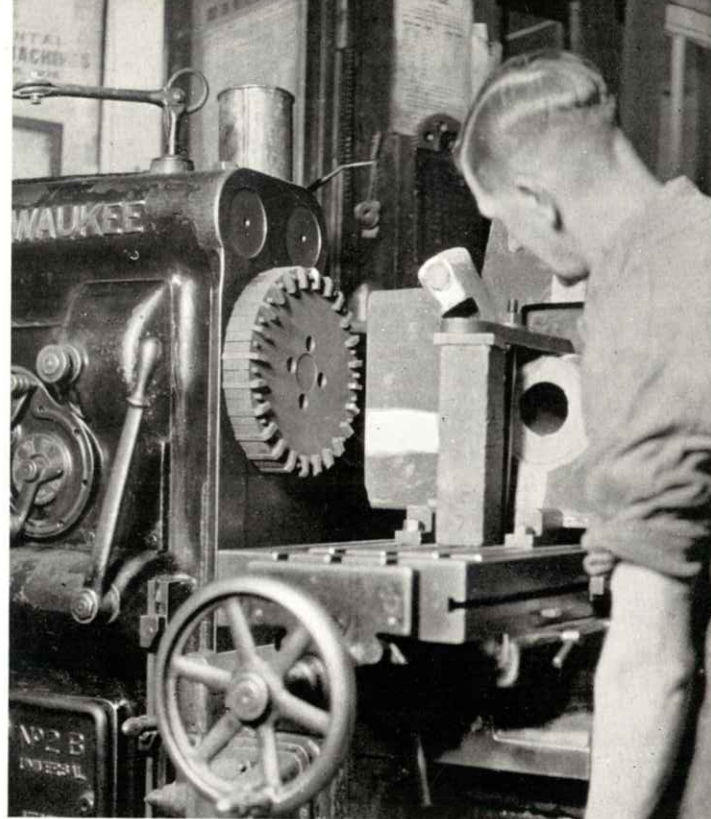
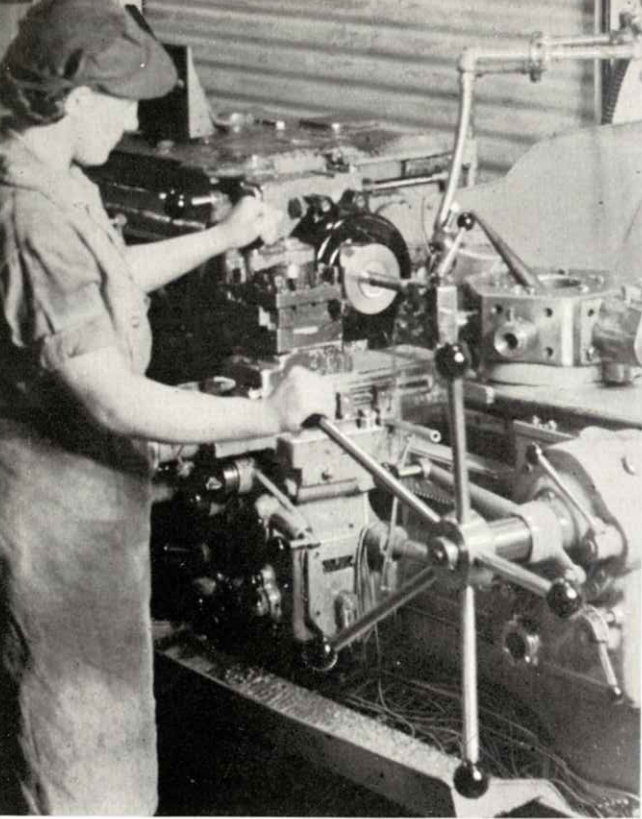
AMONG the thousand tradesmen normally employed at Bournville on maintenance, constructional, and experimental work are a large number of skilled mechanics of all types.

One fitting and machining job may be very like another, but few if any Bournville workers thought they would ever be applying their ingenuity and skill to the type of work which they carried out between 1940 and 1945. Nor did the designing, draughtsmen's and organising sections of the Engineers' Office ever expect to be working overtime on problems set by such organisations as the war-time Ministry of Supply and the Machine Tool Control. Yet such was the case when Bournville Utilities got going and secured contracts for making Machine Tools.

The first job, undertaken in May, 1940, was the building of 53 Vertical Milling Machines for the Government's new rifle factories.

By January, 1941, Bournville Utilities was turning out a quantity of specially-designed machines for Messrs. Lucas—who themselves occupied part of the factory floor space for the construction of sub-structures for Spitfires—and overhauling worn-out and blitzed machines from various factories. Between then and "VE Day" some 150 were made and repaired.

The Fitting Shop was extended by moving part of it to a less vulnerable position, and a number of additional machine tools were installed in order to



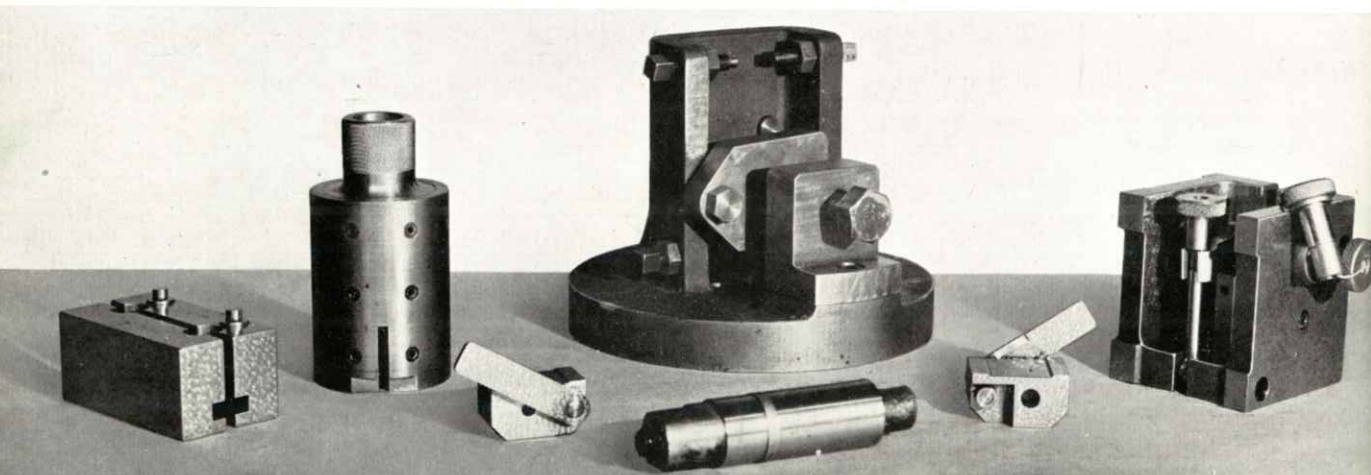
(Left.) An ex-chocolate maker turning Hydraulic Jack Ram Spindles for "Tempests." (Right.) Milling Gear Box with inserted tooth-cutter.

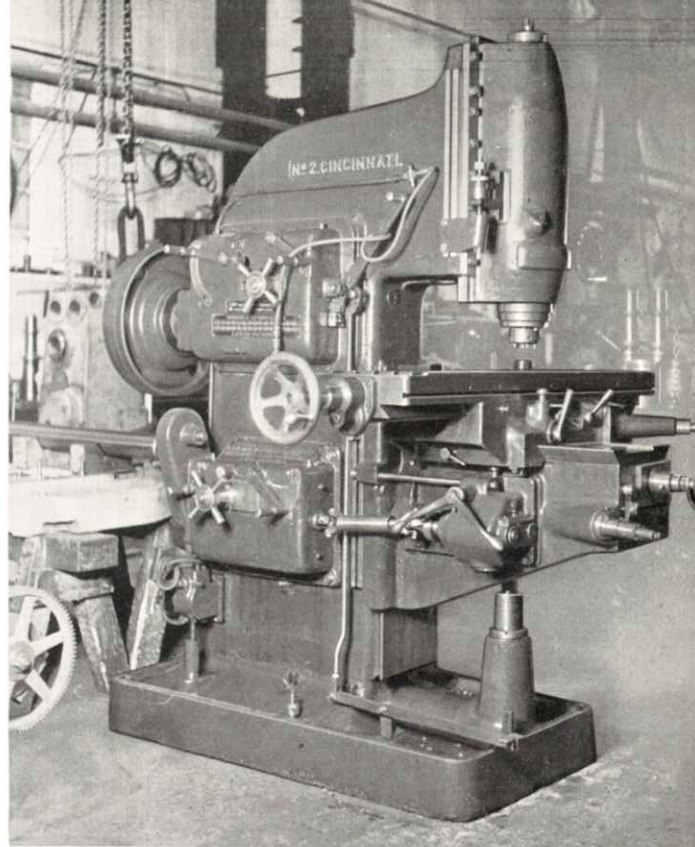
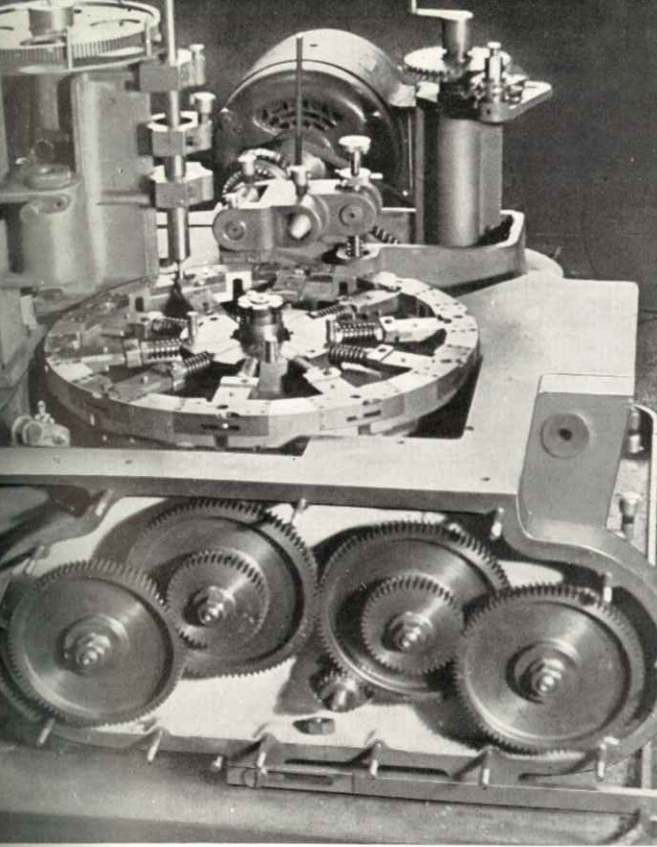
undertake the making of parts of guns and aeroplanes. This was largely repetition work and the machines were ultimately operated by girls as well as men transferred from chocolate and confectionery departments. They made altogether 29,000 Hydraulic Pressure Bodies, 51,000 Cylinder Bodies, 1,050 Radiator Flap Jacks and 320 Dive Brake Flaps, besides large numbers of spare parts—all jobs demanding extreme accuracy of workmanship and a very high finish.

Another job of which the Department was very proud was the Case Striker for the firing mechanism of 6-pdr. guns. Here, again, accuracy and high finish were all-important, particularly in the machining and assembly of this intricate piece of mechanism, of which 750 were made.

Besides the Vertical Millers, referred to above, the main parts of 200 Horizontal Milling Machines were made, together with 200 sets of parts for Turret

A few of the thousand figs which were made for use at Bournville and for other firms on war production.





(Left.) A Lock-nut Slitting Machine—one of the many special purpose tools assembled by Bournville craftsmen. (Right). One of the 150 blitzed and worn-out machines built or re-conditioned at Bournville.

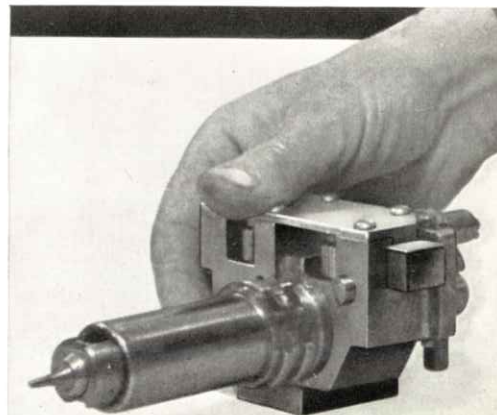
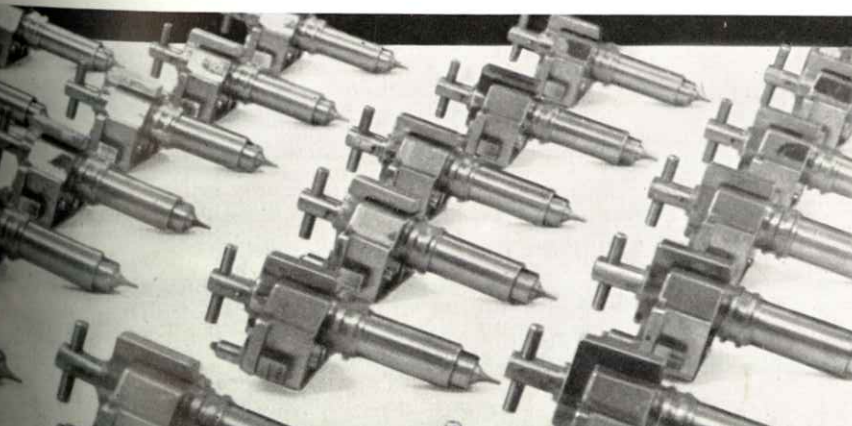
Lathes, and fifty 3 ft. 6 in. Radial Drilling Machines, of which thirty were assembled.

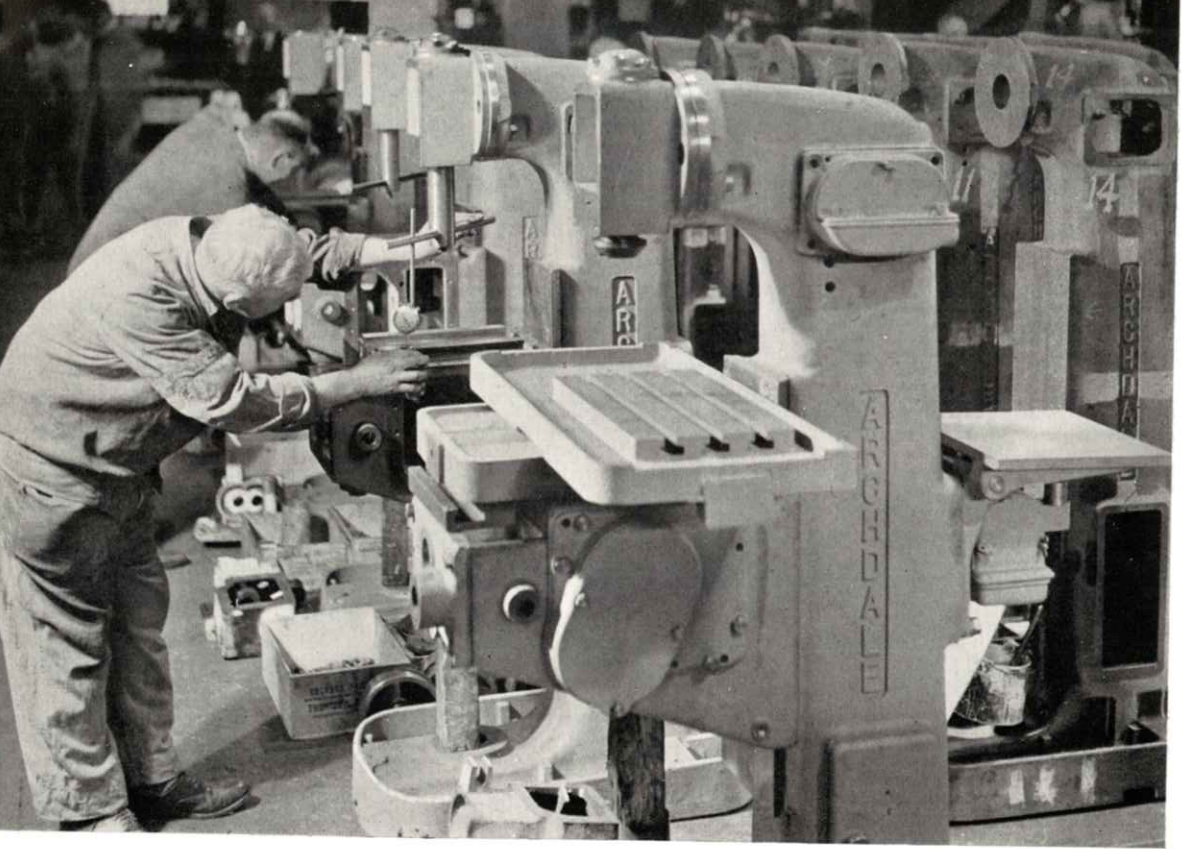
Over a thousand Jigs and Special Tools were made for various firms and Ministries, and also a large number of Special Purpose Machines, *e.g.*, Drill Grinding and Fluting Machines, Coil Winding Machines, Gun Turret Turning Lathes, Thread Chasing Machines, etc., together with machines employed by Bournville Utilities itself for making aeroplane parts, A.A. rockets, respirators and jerricans, and for use in tank covering.

Altogether, from first to last, some 24 girls and 150 men and youths were employed in this section.

A feature of the work was the readiness—characteristic of the people of the whole country—with which Bournville employees adapted themselves to jobs

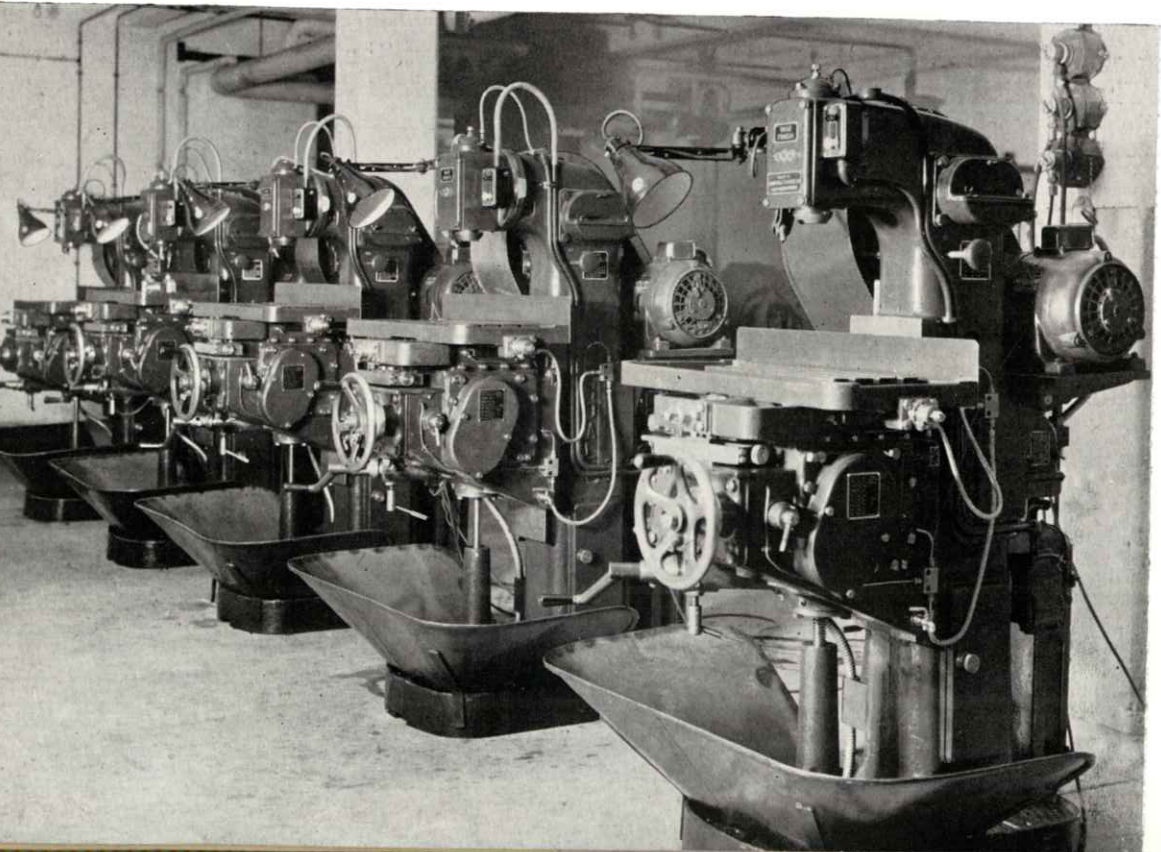
Some of the 750 6-pounder Case-Strikers.

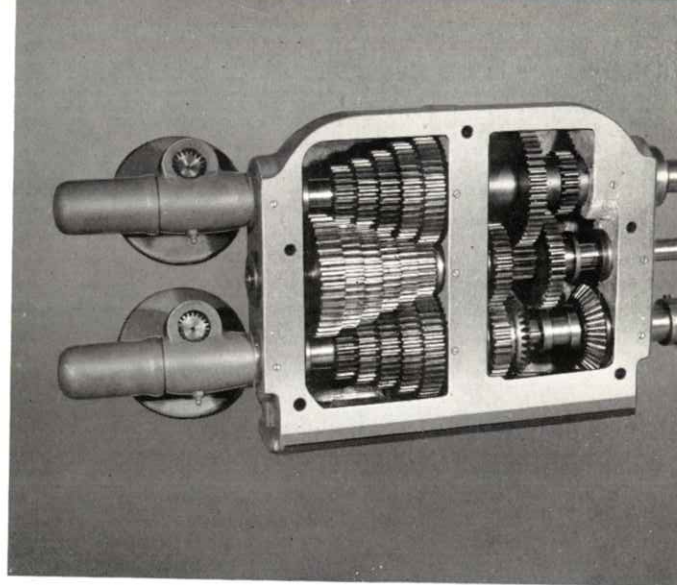
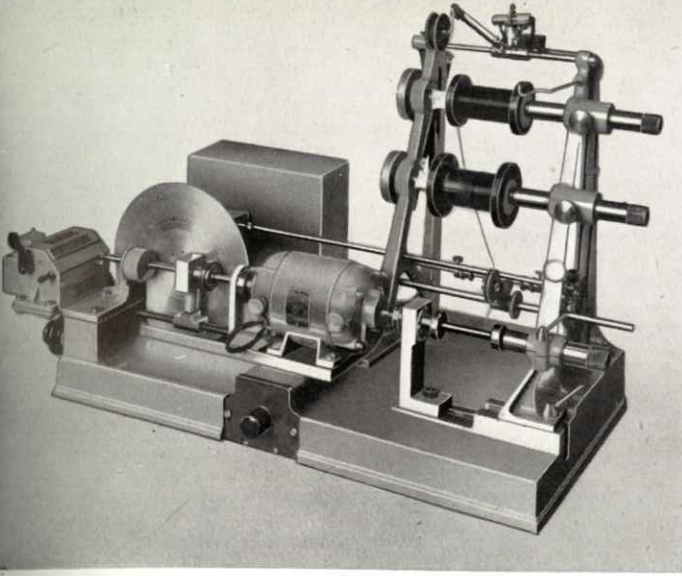




Inspecting Bournville-built Milling Machines.

A batch of completed Milling Machines.



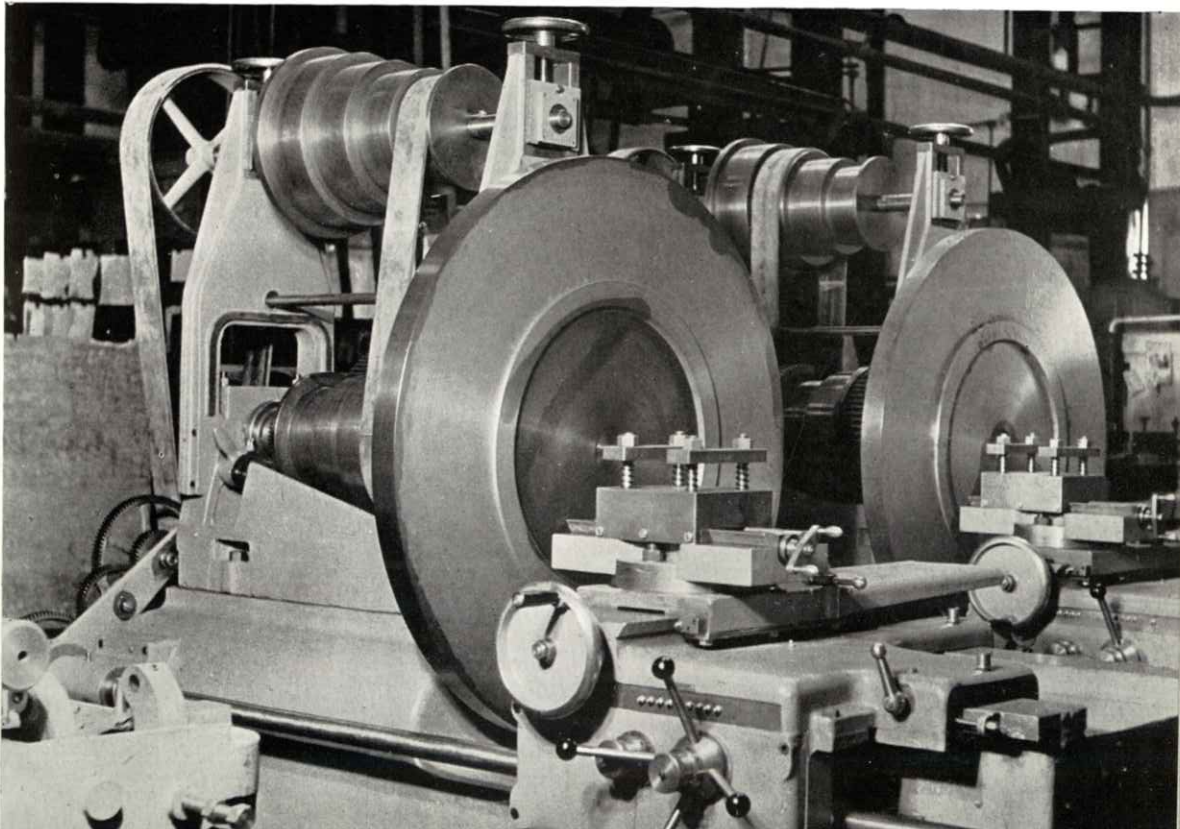


(Left.) *Coil-winding Machine for automatic telephones.* (Right.) *Gear Box for Turret Lathe.*

very different from their peacetime avocations. Girls normally employed as chocolate coverers, packers, decorators, etc., many of whom had been accustomed to simple work on belt-conveyor processes, undertook mechanical operations requiring a very different technique and, often, considerable physical strength; men and youths, too, were up-graded from unskilled and semi-skilled jobs.

These articles and the light metal work described and illustrated in these pages were supplied to ninety different firms.

Two Bournville-built Lathes of special design.





A Barracuda in flight. Bournville Utilities made many of the component parts and fittings of this naval torpedo-carrying dive bomber and reconnaissance 'plane.

12

Lancaster Wing Rib. Riveting boom on to stiffener.





Wing Rib Stores.

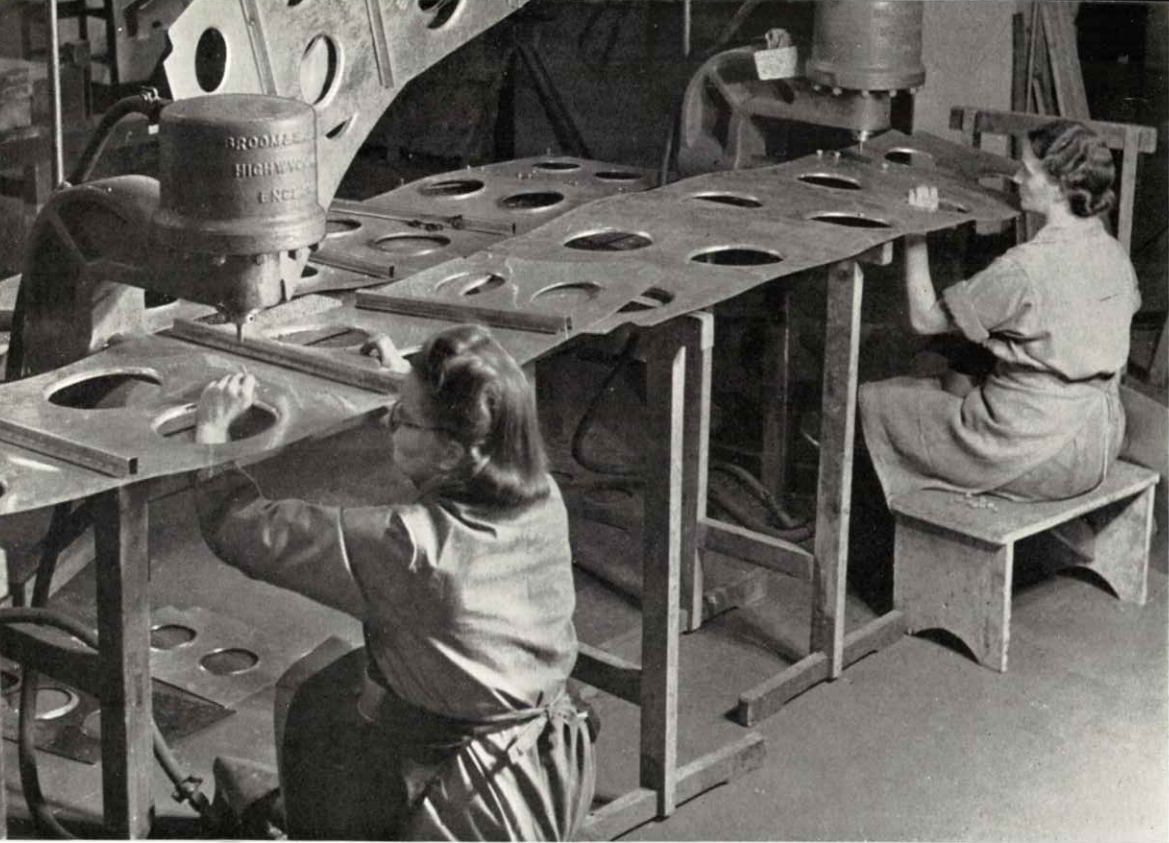
FROM CHOCOLATE MOULDS TO AERO PARTS

Bournville uses 30 million rivets

Two of the many Trades Sections of the Bournville factory are the Sheet Metal and Mould-making departments. In the former, in peace-time, many ingenious pieces of work are turned out, such as ventilator ducts, cowls, and special utensils for use in the manufacturing departments, while the name of the latter department explains itself.

The first job undertaken by the Sheet Metal Department was the manufacture of Pilots' Seats for Defiant Fighters, followed by Forward Junction Boxes for Wellington Bombers and a large quantity of Upper-Mid-Gun Turrets for Stirlings.

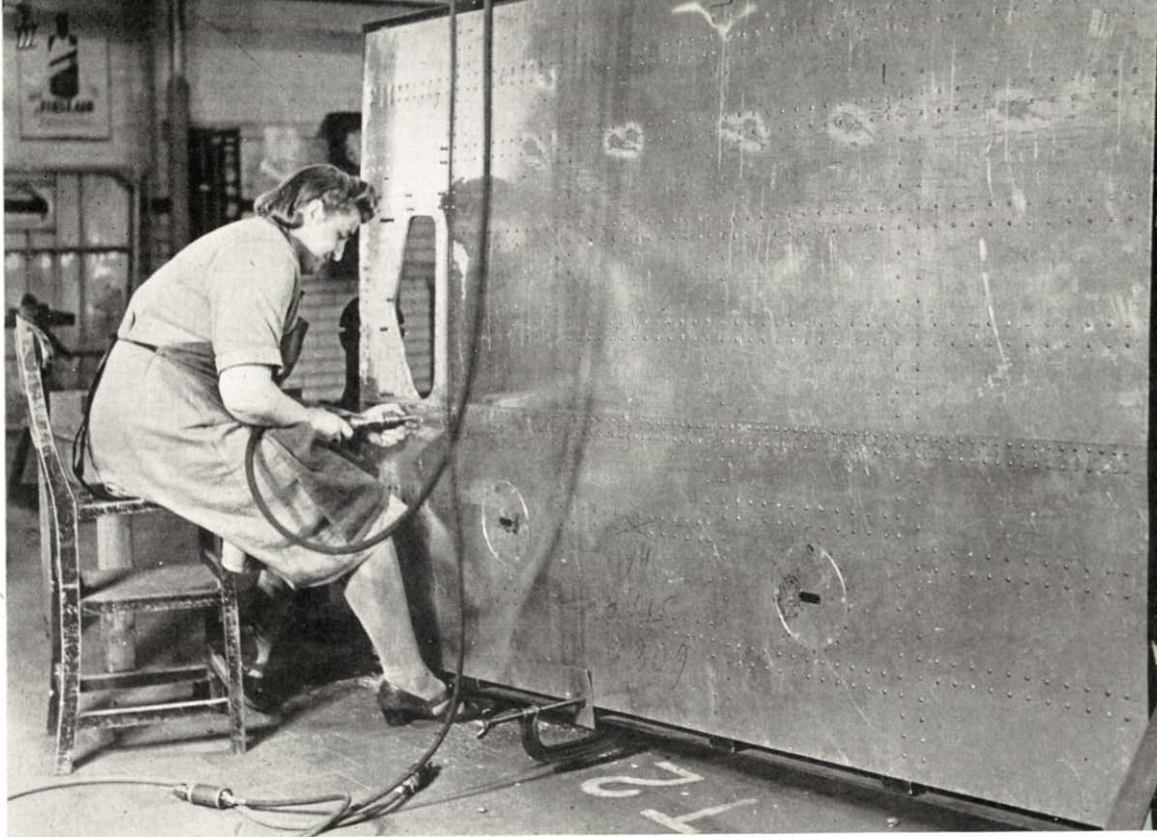
At the same time the Mould Making Department commenced their war work with the production of cases for Aeroplane Flares, Ribs for Spitfires, and "Paraffin



Lancaster Wing Ribs. Riveting stiffeners to webs for flat ribs.

Drilling and riveting skins to large tank ribs.





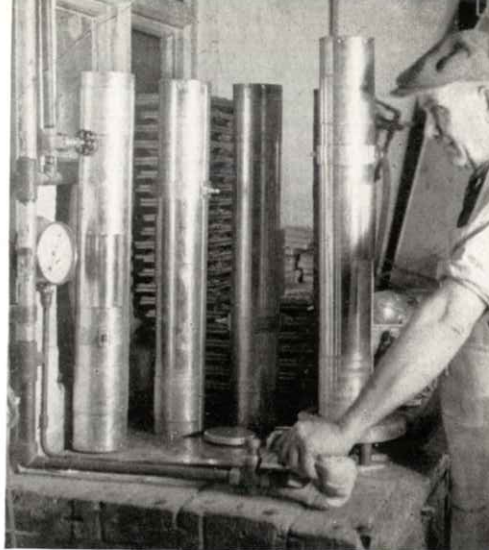
*Riveting Lancaster Fuel Tank Door.
This type was used for medium Tanks holding 380 gallons.*

Cans" (a name given to a "hush-hush" piece of apparatus). Finally this Department concentrated on the manufacture of Air-intake and Super-charger Controls for Stirlings, which involved highly skilled sheet metal and machining work and were required to pass extremely stringent Air Ministry tests. The work increased until it became necessary to make extensions involving the setting up of a new department, which was named Light Metals.

This was in effect an extension of the Mould Makers' Department, and started with youths and men from chocolate and allied departments, with personnel supplied by the Mould Makers for training purposes and supervision. Further extensions became necessary; girls were trained for the work and fully justified the confidence placed in them. The results as a whole revealed once more the innate skill and adaptability of English men and women.

The work of the Light Metals Department consisted mostly of the manufacture of Stirling Sub-Assemblies of many different types, each one requiring special jigs and tools and special instructions to the operators by the departmental staff.

At a later date further types of jobs were started for the Halifax. These comprised Sparking-Plug Cooling Ducts which, in addition to the usual assembly



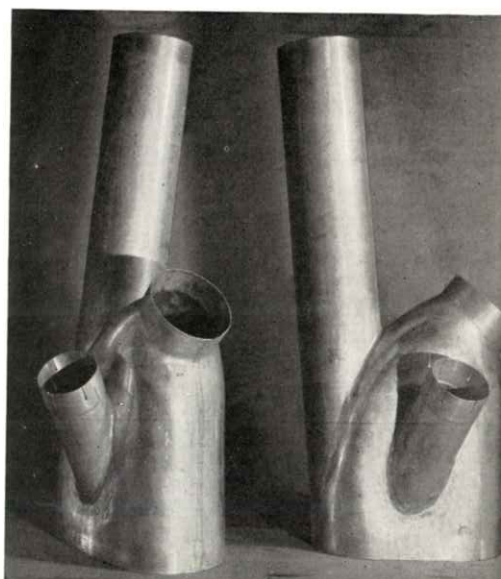
(Left.) Soldering vanes to Parachute Flares. (Right.) Testing bodies of Parachute Flares for leaks. This Mould-maker's job was one of the first that Bournville Utilities undertook.

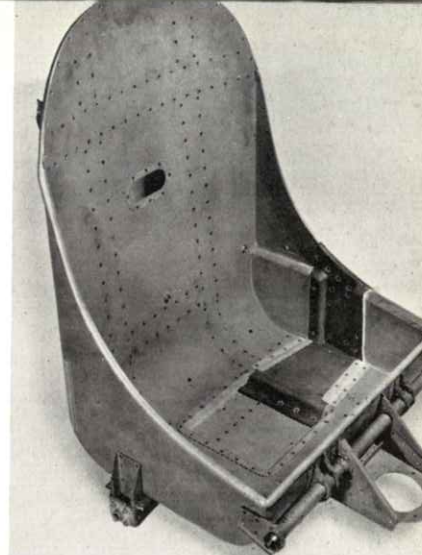
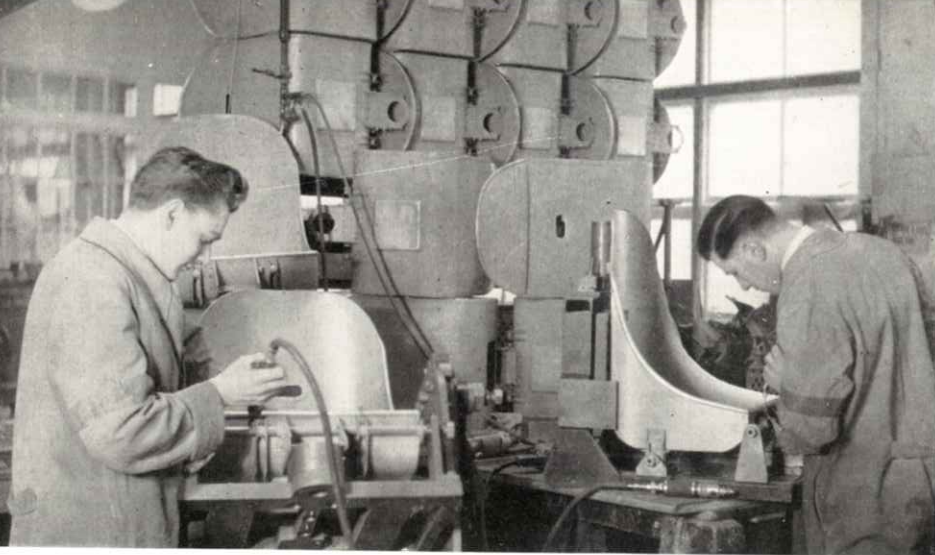
work, entailed the training of girl welders, and Engine Cowling Assemblies which called for a new type of riveting requiring girls to work in pairs, one riveting and the other using the "dolly" at the back (see page 19).

Lancaster details were now being asked for, and we undertook the manufacture in this department of a large number of sub-assemblies for this aircraft.

As the Stirling aircraft was gradually being superseded by other types, we undertook the manufacture of a number of sub-assemblies for Barracuda sea-planes. This was in many respects very different work from that carried out for the other machines, as it required more bolting-up and accurate drilling of the components.

We were next asked to manufacture the Gun-Door Assembly for the Spitfire. This required an arrangement of the details and operations that would allow the work to flow through the section until finally assembled, completed, and passed





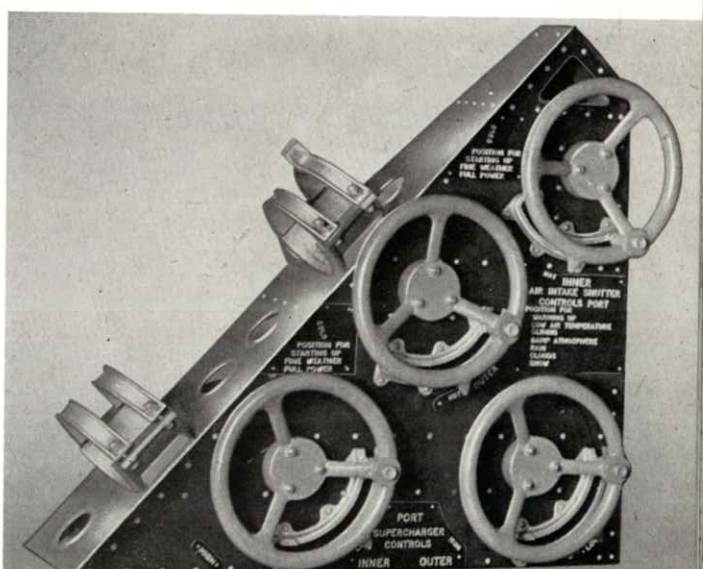
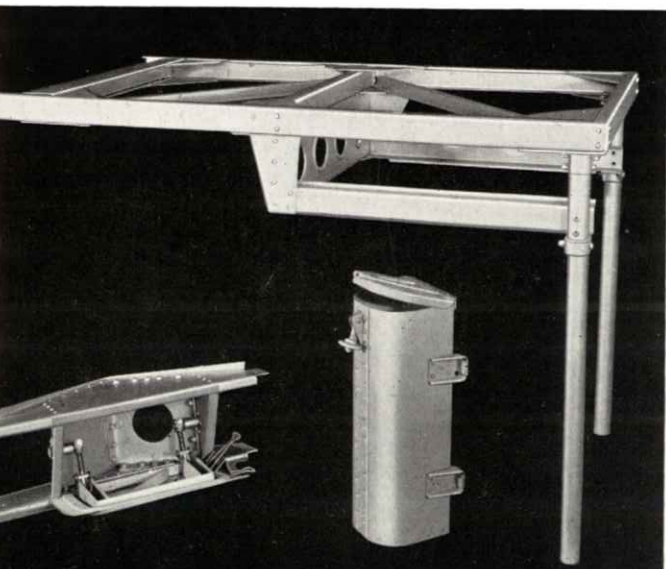
Another Sheet-metal job was the Pilot's Seat for the Defiant.

by the inspectors. The jigs and the workmanship had to be specially accurate, as the Gun Doors were made to very close limits and had to be interchangeable with details made in other factories in different parts of the country.

Further developments caused an increase in the Aeroplane Section of Bournville Utilities' activities, and another new department, under the same control, was laid out for the manufacture of Lancaster Fuel-Tank Doors and Wing Ribs. These layouts were self-contained and were for manufacturing these details only. In all, 4,500 Fuel-Tank Doors, sufficient for 1,200 machines, and 25,000 Wing Ribs, sufficient for 700 machines, were produced.

The work done by Bournville Utilities' Aero Sections as a whole covered details and sub-assemblies for embodiment in a dozen different types of aircraft. Over 30,000,000 rivets were used in aero work alone.

(Left.) Wireless Table Support for Stirling, Vevy Pistol Mounting, and Oxygen Bottle Stowage. (Right.) Super-charger and Air-intake Controls for Stirlings. The illustration shows the port panel. Bournville made 1,838 pairs (port and starboard).



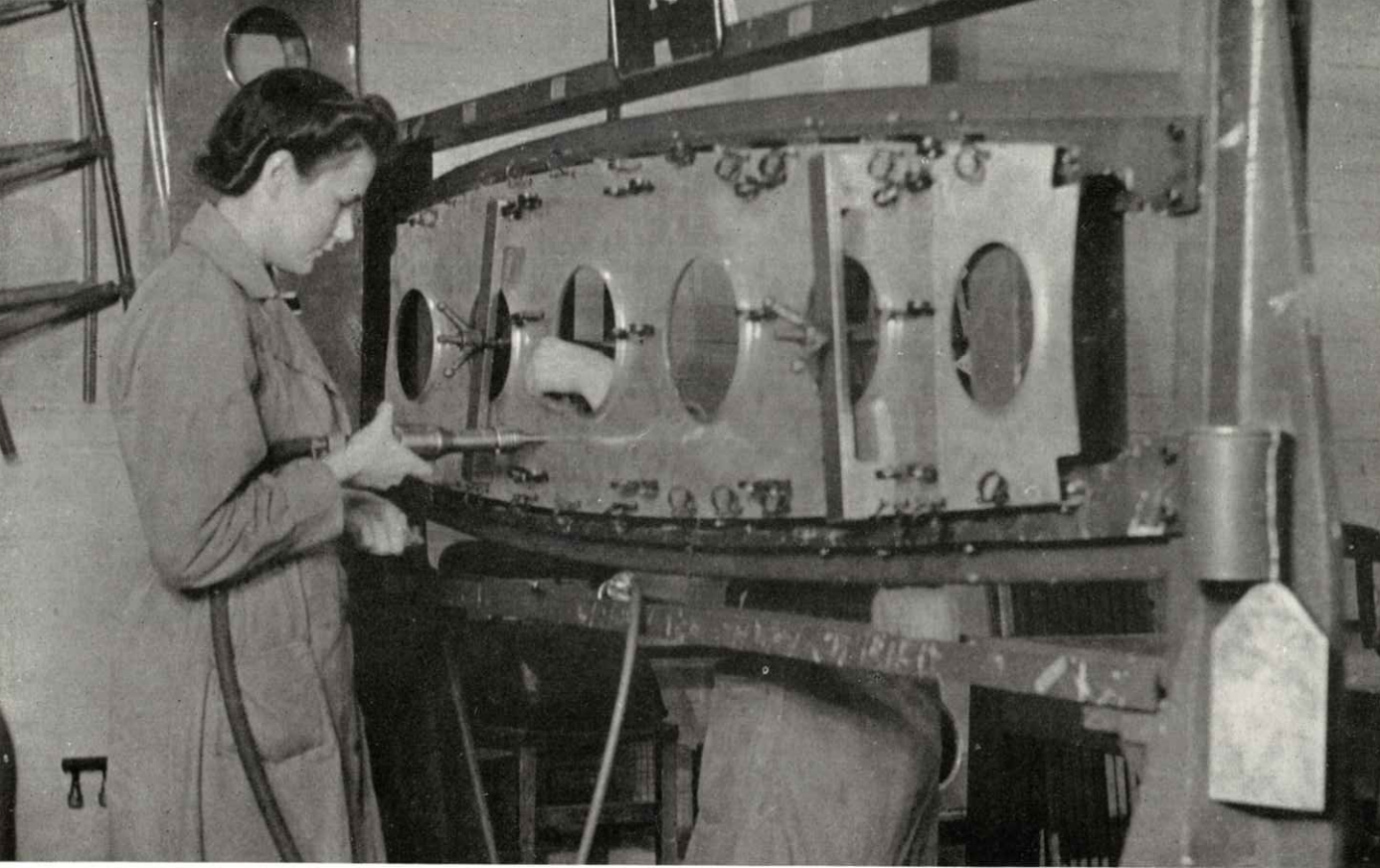


Sir Stafford Cripps (Minister of Aircraft Production) with the Joint Production Committee of the Light Metals Department of Bournville Utilities Ltd. (December 1944).

The Lord Mayor of London (Sir Frank Newsome-Smith) inspects a display of Bournville Utilities' products (July 1944).

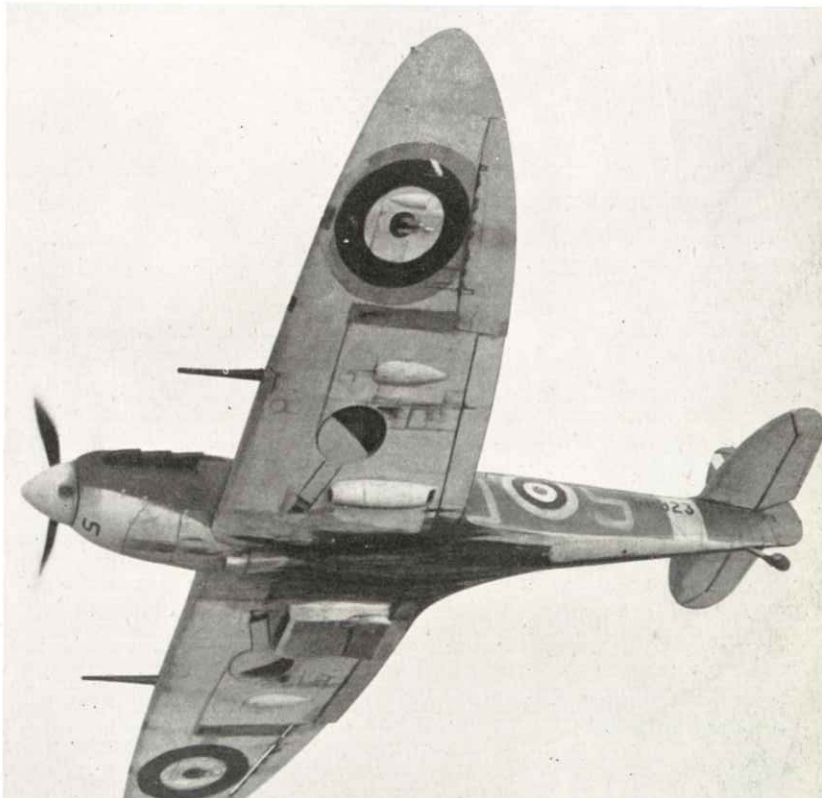
In front (left to right) are Mr. Laurence Cadbury, Chairman of Bournville Utilities Ltd.; the Lord Mayor, Alderman Walter Lewis (Deputy Lord Mayor of Birmingham) and Mr. W. N. Hallett, Director, Bournville Utilities Ltd.





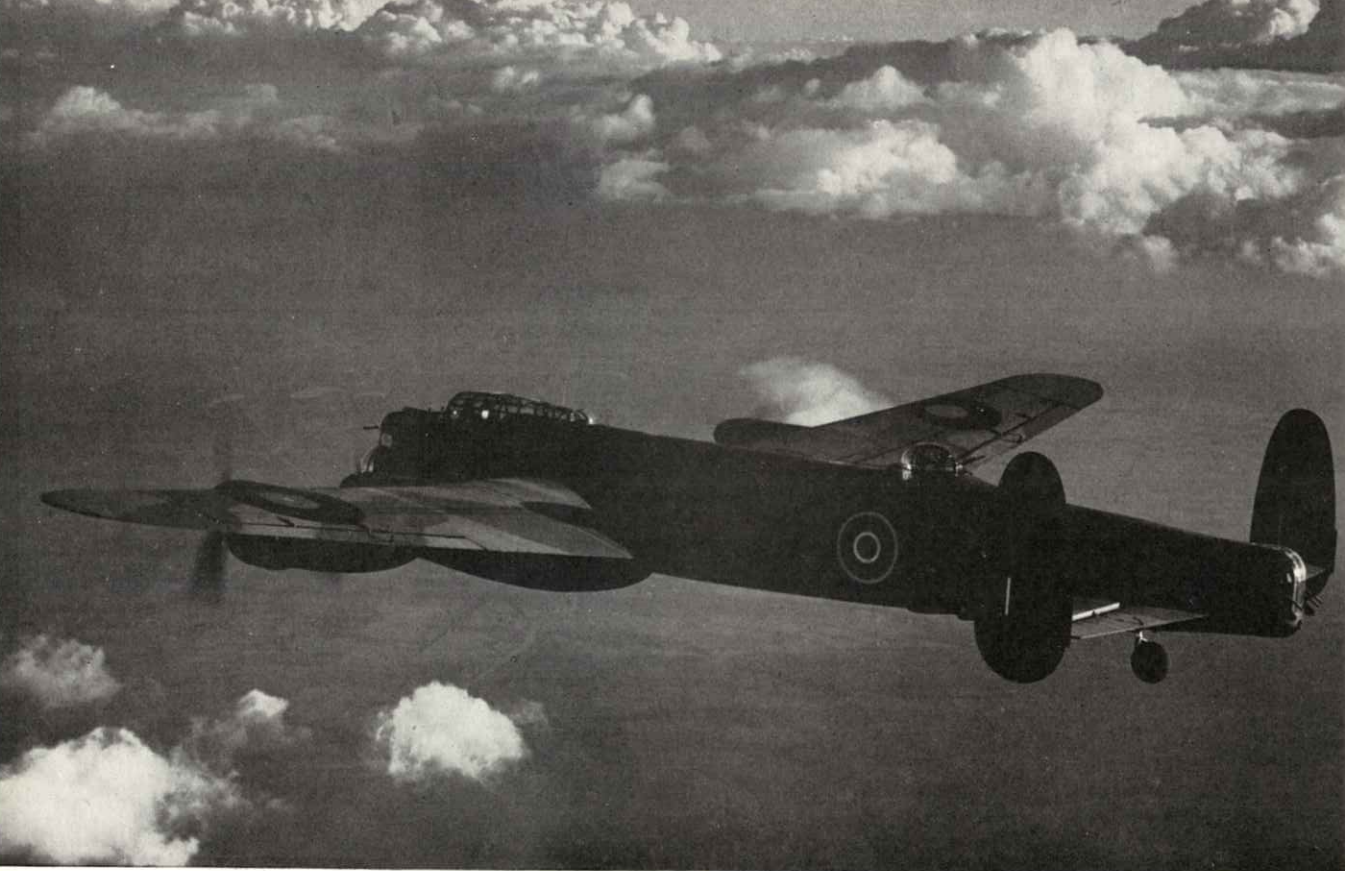
Drilling and riveting Lancaster Wing Ribs.

(Below left.) Former for Cowling for Halifax bomber. (Below right.) Spitfire in flight. The photograph clearly shows the Bournville-made gun-fairings and gun-doors.



(Below) Gun-doors for Spitfires. The girl on the left is riveting while her companion holds the "dolly."





A Lancaster in flight.

SELF-SEALING AIRCRAFT TANKS

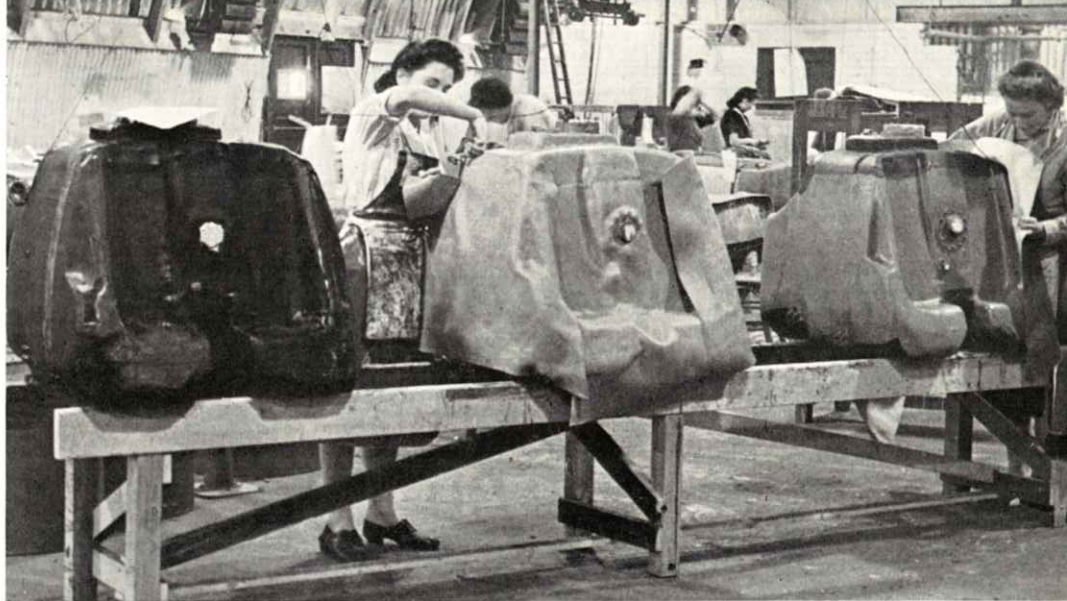
Saved Many Airmen's Lives

A DANGER ever-present in the mind of the airman in war-time is loss of petrol due to piercing of the 'plane's tanks by A.A., machine-gun or cannon fire. A few extra gallons of petrol may make all the difference between a safe return home and a prisoner-of-war camp, between a happy landing and getting "ditched in the drink." Too often, also, a leaking tank means that the 'plane becomes a gigantic flaming torch, and only those members of the crew lucky enough to bale out have a chance of safety.

To help to overcome this danger, tanks are covered with layers of rubber and rubberised material which render perforations self-sealing. The rubber swells when it comes in contact with petrol spirit and the hole is quickly closed. The rubberised material keeps the rubber itself in position and restricts the size of the hole.

Bournville Utilities took on a contract for this type of work when Messrs. Dunlop had to concentrate on tyres. The premises rendered vacant by the cessation of the rocket contract (see page 24) were made available, and the staff were initiated into the job by Messrs. Dunlop.

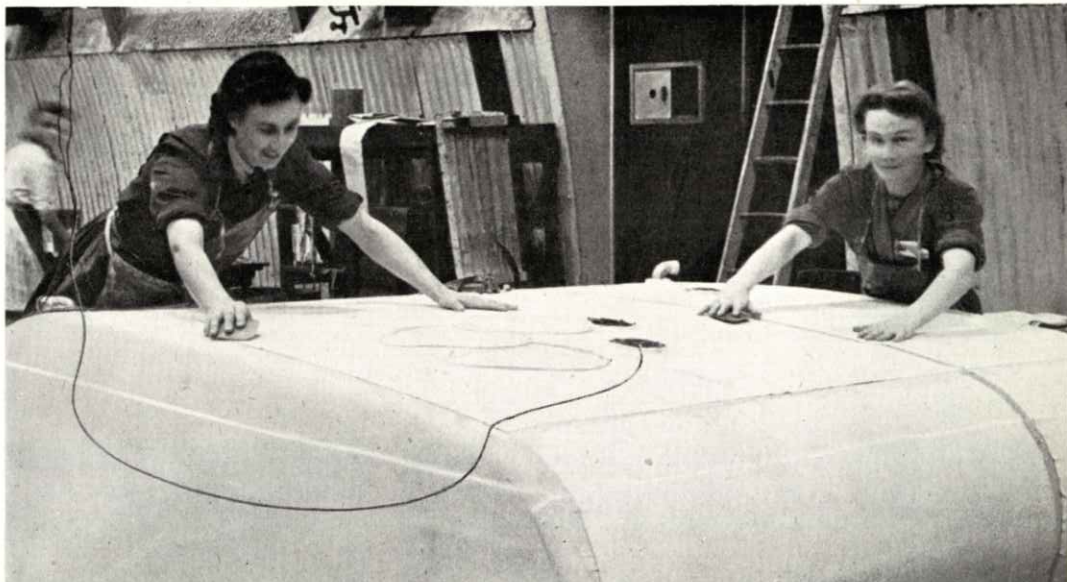
The photograph shows three of the stages in the covering of a Spitfire tank.



Covering a Lancaster tank with rubberized fabric: shaping the end.



Smoothing out the creases: this process is known as "sleeking."



One of the problems was the shortage of rubber through the loss of Malaya, but certain synthetic rubbers were found satisfactory. After initial difficulties were overcome a high standard of efficiency was reached, and a particularly happy spirit was engendered among the workers, who numbered 110 girls and 18 men at the peak period.

The following is a brief outline of the processes :

The covering materials are received in large rolls and stacked on shelves like suit-lengths in a tailor's shop. They are then taken to tables and cut out in exactly the same way as a tailor cuts out a dress, costume or suit. All the cut materials necessary to cover a particular type of tank, say a Lancaster Main, or a Spitfire, are then tied together and placed ready for use. The tanks to be covered, which are generally of aluminium, are delivered on special padded vehicles. The tank to be dealt with is placed on a cradle and the girls, after cleaning and priming the surface, proceed to apply "dope"—an adhesive solution—to secure the first coating to the metal of the tank. It is a difficult and exacting job to make quite sure that the edges of the cut material come in right relation with the edges of the tank; fittings have to be cleared, there is surplus material at the corners which has to be cut away. Altogether it is a tailoring-cum-upholstering job.

When one layer of material has been put on further layers of solution are applied, and then further layers of material in due order, all according to the specification, are stuck on the tank. Finally, the whole is nicely finished off into a snug well-fitting job. There are no loose ends and no bits peeping out.

Afterwards the tank is taken into another room where it is sprayed with a finishing dope. This room presents a gay appearance with its rows of tanks in different colours according to the stage of finish and the kind of solution being applied. For this reason Bournville Utilities Limited engaged the well-known

(Left.) *Marking-out from templates and cutting patterns.* (Right.) *Applying solution to first felt layer before application of layer of rubber.*





General view of Covering Room, showing Lancaster main tanks and Lancaster inboard oil tanks.

painter, Mr. Frank Dobson, to make a painting of this operation, a colour-print of which appears as a frontispiece to this booklet.

Like the A.A. rocket-filling (page 24), the tank-covering was an extremely dangerous fire risk. It was found that static electricity was built up in the layers of material, and several fires actually occurred. Fortunately, through the calm behaviour of the operators and the careful training they had received, the flames were put out without serious damage to the materials or injury to the workers. Research in collaboration with scientific experts led to the adoption of measures which considerably reduced the risk of fire and of shock to the operators.

The materials used in covering the tanks were extremely expensive and the greatest economy had to be exercised in their use.

Some twenty-five types of fuel or oil tanks were covered, ranging from 16-gallon tanks for Beaufighters to huge 1,150-gallon tanks for Vosper motor torpedo boats. Tanks were also covered for Lincolns, long-range Wellingtons, Blenheims, Spitfires, Sunderlands and Warwicks. In the first twelve months over 10,000 tanks were dealt with, including some sent in for repair after damage in action or by mishandling.

Bournville Utilities Limited took this job on with some reluctance because they had tackled some diverse contracts, and felt that they were being called upon to start up another one at a very difficult time. However, once more everyone rallied round and the job was a great success, earning high praise from the Ministry of Aircraft Production and all concerned with it.



Multiple Rocket Projectors in action from Sherman tanks.

BOURNVILLE ROCKETS HELPED TO DEFEND BIRMINGHAM

THE filling of Anti-Aircraft Rockets seems most remote from Bournville's peace-time jobs. And yet it was not so very remote after all. It was just the packing of a new kind of Assortment Box. But the contents were dangerous, and they had to be so accurately packed that they were X-rayed to see if all the components were present and correct before they left the premises.

The particular type of Rocket was on the secret list. The dangerous nature of the materials set up a whole series of production problems with which Bournville has never had to contend in the ordinary way. This meant special rules and regulations about cleanliness, temperature, and humidity, about the maximum quantity of stuff which could be stored, either as a component or as part of the finished article, about matches and torches, metal-shod shoes, and clothing generally, about the comings and goings of all and sundry.

And of course there was a separate First-Aid Fire Fighting Squad which could hold an outbreak in check until adequate help arrived, special A.R.P. precautions had to be instituted, and the Home Guard and the Fire Watchers provided additional nightly protection. A member of the Bournville Staff was appointed Danger Building Inspector, and another was Security Officer.



General View of the A.A. Rocket-Filling Shop.

Fortunately, there were only three raids during the period the night shift was at work. Did the girls go to their shelters? Not a bit of it—they stood outside and cheered as the rockets they had helped to make soared skywards in defence of Birmingham.

The job began in 1941 in four Nissen huts on the canal bank. These huts were divided by partitions to minimise danger to life in the event of an explosion, but the fact that they were largish buildings enabled Bournville to obtain a much more efficient layout than is usual in the smaller buildings at Ordnance Factories.

Members of the Engineers' Office and Production Department staffs visited other factories and personally learnt how to perform every process. Early in October, 1941, the first batch of prospective workers began training on wooden dummies, and on the 13th of the month they moved over to the new factory. On November 3rd—three weeks after the factory opened—the first five tons of ammunition were despatched with due ceremony. Production was slow at first—supplies did not always arrive in time and the Management was ultra-careful in its handling of stocks, but experience gave confidence, and in time the rockets were handled with as little concern as if they had been cocoa beans! By December 8th, a night shift was working and by February 16th output had reached 75 per cent. of schedule. One thing that helped was the introduction of a Group Bonus



Testing Anti-Aircraft Rockets after filling. Before the war the same worker tested eggs for Bourn-vita.

Scheme—a new thing in explosives production, but afterwards widely adopted—and output and efficiency steadily rose. By August, 1942, the factory was producing 40 per cent. in excess of schedule.

A new and more complicated type of rocket, involving more labour, was subsequently filled, and the factory was able to assist in the development of special apparatus for this purpose. Owing to the transfer of capacity to Royal Ordnance Factories production was reduced in 1943 and ceased in July of that year.

One of the rooms in the main factory, where the original training was done, had been carrying out some of the non-dangerous fuse operations, and this continued on a contract to supply some of the other factories. A group of girls from the Card Box Department were engaged, at first in “ V ” Block and then in “ Q ” Block, in the making of paper fuse cases.

Only one small accident occurred during the whole period, when one girl suffered burns to her hands, from which she recovered without permanent injury in a few weeks.

Keeping production level as between the various components was something of a headache, and here the Joint Production Committee operated usefully. Ideas were frequently exchanged with other factories, and Bournville was respon-

sible for introducing a number of improved methods and for designing and making some machines which materially stepped-up production. Some machines continued to be supplied to other factories from Bournville after our own contract ceased.

Altogether, some 350 girls and 75 men were directly engaged, and at the peak period over 300 tons of ammunition were leaving Bournville each week.

The urgency of the occasion which called "C.X." (as the factory was known) into being bred a team spirit which had a marked effect on output and smoothness of working, and Management and Workers look back with satisfaction on a job well done.



Filling Igniters ; screen protects worker's face.



Another stage in Rocket assembly.

Filling Rockets with cordite on a "Roundabout."





A practice Gas Attack.

FIVE MILLION RESPIRATORS— ready, but never used

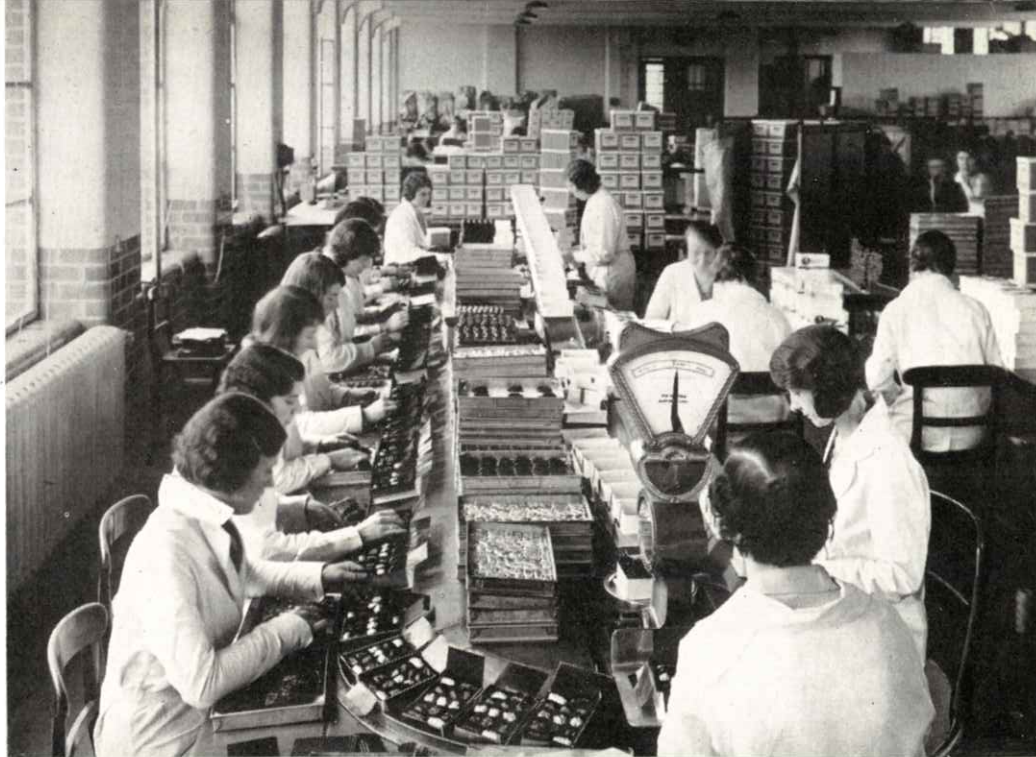
BOURNVILLE'S biggest War job—as regards the number of completed units turned out—was the assembly of 5,117,039 Service Respirators and 6,335,454 Canisters. These were more than enough to equip all the British Forces, but, fortunately, hostilities with Germany ended before the enemy dared to start gas warfare. We can regard the cost of this defensive weapon as an insurance premium for a risk which never materialised.

Undoubtedly, the knowledge that we were so thoroughly prepared to meet any attempt to use poison gas was a major factor in preventing the enemy's use of this weapon.

It was the first job Bournville Utilities undertook which employed women in considerable numbers. We were first approached by the Ministry of Supply in September, 1940, and by the middle of October our order for plant installation was issued.

A TRANSFORMATION
SCENE.

*In 1939 Chocolate
Assortments were
packed in this
room—*



*—then it was
cleared—*



*—and in 1940
Respirator Canis-
ters were filled and
assembled.*





Inserting pad into liner.

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Soldering lid on to canister.



Charcoal filling.



fixing of the harness, and “ marrying ” the facepiece to the canister.

In the original type of Service Respirator there were 40 separate operations, all to be carried out with great care and thoroughness, and subject to the most rigid inspection.

The first mask was completed in December, 1940, and the same type was turned out continuously until early 1942, when a gradual change was made to a light-weight or “ Commando ” type. This was simpler and involved



Cutting out 'flash' for eyepiece.

Fitting harness to facepiece.



Screwing-up clip of eyepiece.





Miss M. Homer.



Mr. B. Henderson.

These two employees were awarded the British Empire Medal. Miss Homer trained most of the girls and Mr. Henderson was the chief maintenance mechanic.



Assembling eyepieces.

fewer operations, but some were more difficult to control. In consultation with the Ministry the layout for this later type was put down in accordance with our own schemes, and it may be mentioned that Bournville ingenuity introduced various machines and improved mechanism which materially increased output. At the peak of production we were turning out some 50,000 masks a week.

About 25 per cent. of the total labour was engaged on inspection. Only 15—including some of the Management—out of the 600 workers employed were men. Eighty solderers were trained for the assembly of the canisters. Some 100,000 square feet of floor space was involved in assembly and in the storage of components and finished units.

Our relations with the other firms concerned, with the Ministry and its officials, and between Management and Labour were of the happiest throughout. There was the freest exchange of views and information, and in all the factories engaged on the work production was quickly placed on the most efficient basis. There were in four years only two delays of a few hours due to lack of components. The work was arduous, but complaints from the operatives on that score were negligible, and not one of the specially trained girls had had any previous experience.



One of the larger Assembly Plants.

33

A rehearsal : armourers in gas suits make a dash to a 'plane.





THE JERRICAN.

The 4-gallon container which made "Desert Victory" possible.

THEY HELPED TO BEAT ROMMEL

JERRICANS TO THE RESCUE

ONE of the biggest difficulties of modern rapidly-moving mechanised warfare is the problem of supply and transport. Men and machines must be fed, often hundreds of miles from their bases. Rations, equipment, spares, replace-

ments, ammunition, and a thousand and one other items must all be moved from distant points of delivery to depots and dumps close behind the troops, to say nothing of moving the men themselves, with their guns, armoured vehicles, and so forth. When those troops are operating overseas and most of the coast line is held by the enemy, the problem is infinitely greater. Movement of machines requires petrol and lubricating oil, movement of men requires not only food but water, while petrol, oil and water must themselves be moved when the battlefield is a desert extending across a Continent.

If we cast our minds back to the North African campaign of 1942, we shall remember that, after capturing places like Bardia, Sollum, and "Hell Fire" in January, the British forces were driven out, and by July were standing uneasily on guard over the gateway to Egypt and Suez at El Alamein. A year later they had swept again across the desert, having driven the enemy out of Cyrenaica, Tripolitania and Tunisia, and were setting foot for the first time on the shores of Europe.

Until overshadowed by the greater events of "D Day" and the invasion of Germany, this North African campaign was perhaps the greatest organising feat of the war, when it is remembered that the troops, the guns and the tanks—all that vast weight of men, metal and munitions which the Government risked the invasion of Britain to send—had to be taken several weeks' journey by sea round the Cape in order to reach Egypt.



Air crews being briefed. The Briefing Officer is using a dump of Jerricans as a platform.

35

The Jerrican carried water as well as petrol and oil.





Spot-welding the two halves of a Ferrican before seam-welding.

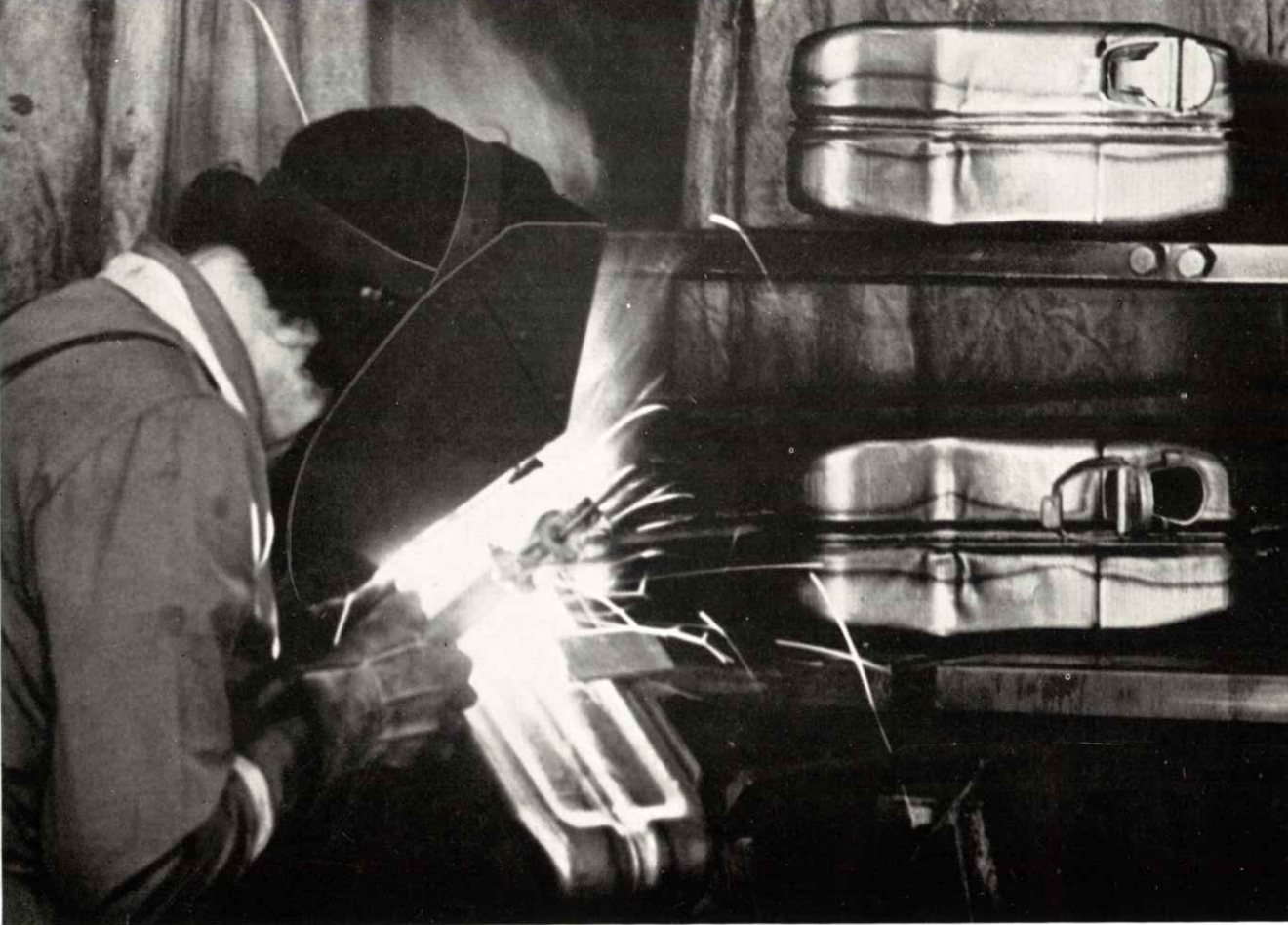
One of the difficulties was petrol. There was and could be no pipe-line; tankers meant vulnerable storage depots ashore, with, at best, the additional equipment and men and the delay incidental to re-handling. So the vital spirit was sent out in 4-gallon cans. These were soldered and proved hopelessly inadequate for shipping and desert conditions. One ship had to turn back with several feet of petrol flooding her hold. Not much more than half the petrol sent to North Africa actually reached the mechanised vehicles.

In September, 1942, representatives of Bournville Utilities were called at short notice to a meeting with the Director of Supplies (Special) at the Ministry of Supply. He displayed a sample of the container used by the enemy—the “Jerry Can”—and told the meeting that several millions must be made during

the next few months. His problem was to squeeze the enormous amount of work involved out of an industry already taxed to the uttermost. Every contractor present was asked how many parts or final assemblies he could undertake. Bournville was expecting the rocket contract (see page 24) to come to an end and estimated that it could assemble 25,000 cans a week. This substantial offer was received with enthusiasm, but the Ministry of Labour decreed that,

(Left.) Welding on the handle. (Right.) Testing for leaks by air pressure.



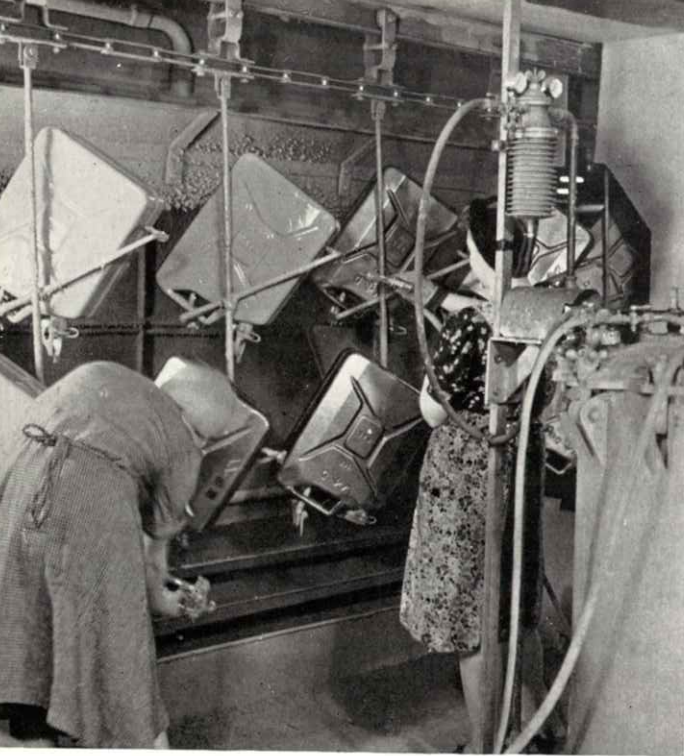


An Electric Arc Welder at work.

even for one of the highest priority jobs, labour for assembly work in the Birmingham area could not be allowed. It was therefore decided to undertake the work at our Battersea Depot. A number of our chocolate packing conveyors were ripped out from the Bournville workrooms and re-erected at Battersea and three welding lines were laid down, together with water tanks for testing the finished cans for leaks under pressure. An oven, like a tunnel fitted with scores of infra-red lamps, for drying the cans when painted, was also installed. The inside painting was done by flooding the interior from a jet and the external painting by spraying. The cans were carried through the oven on a continuous conveyor.

The job consisted of de-greasing the parts supplied, welding together the two halves of the body, and welding on a handle and a filler cap fitted with a rubber ring.

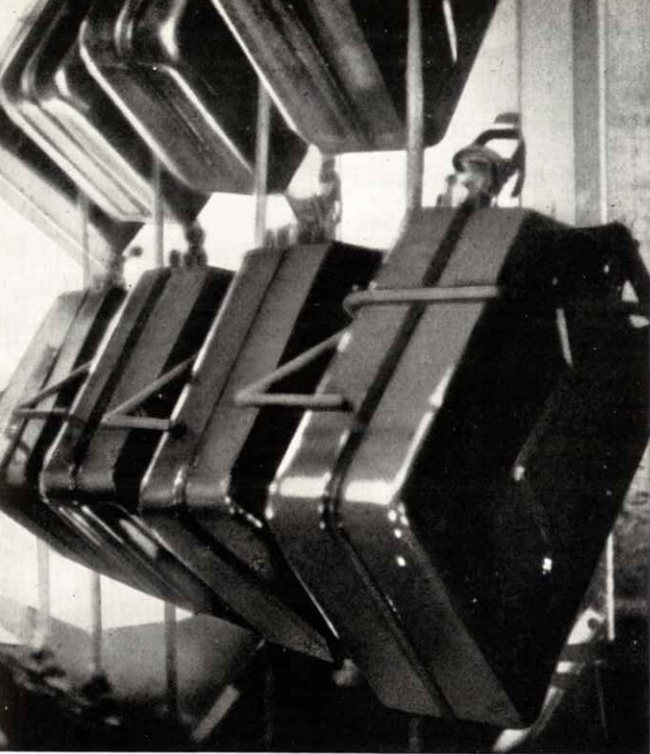
The work was full of snags. Labour at Battersea was limited, lacking in factory experience, and of a type different from that with which we had been accustomed to work in the Midlands. We also had problems with components; we could not even get delivery of nozzles for the welding torches. However, the administrative and supervisory staff soon learned a new technique of tackling labour problems, the plant was erected in quick time, and 120 welders—gas and electric—were trained and put on in two shifts. In a couple of months a dribble of cans was coming off the assembly lines, and then, after further disappointments,



(Left.) Spray-painting completed Jerricans. They were carried through the painting booths on an endless belt conveyor to the drying oven. (See opposite page.) (Right.) Sucking out surplus paint from the inside. The girl on the right is inserting spring clips for hanging the can on the conveyor.

the work got into its swing, and soon the cans were being turned out in great quantities.

As so often happens, however, in war jobs where urgency is the keynote, soon after things had begun to go well, the need for the product diminished. By September, 1943, when the technical staff were in the throes of installing new plant for improving the method of painting and economising in the amount of paint used, output was reduced and came to an end in February, 1944, just robbing us of the achievement of completing 900,000 cans.



(Left.) Painted cans passing through an infra-red drying oven. Those intended for desert use were sand-coloured and others dark green. (Right.) Government inspection of completed containers.

Filling Jerricans from a Fuel Transporter.





Discharging stores on a tropical beach.

PACKING—IDENTIFICATION—PRESERVATION

How Spare Parts Reach the Fighting Fronts

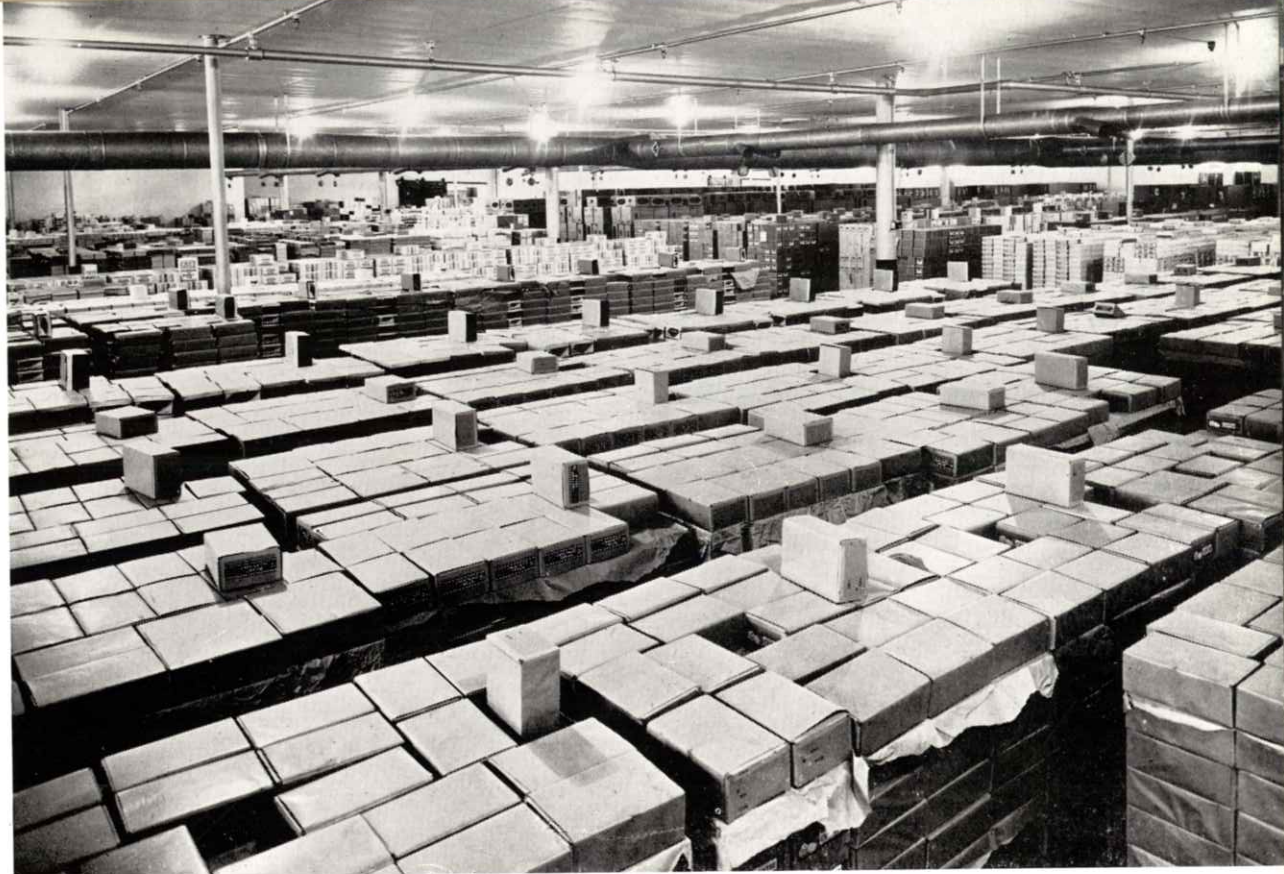
THE first essential of packing—whether it be chocolates or cigarettes, eggs or gunpowder—is that the articles packed shall arrive at their destination. They must arrive *where* they are wanted, *when* they are wanted, and be usable when they get there. Think how many different items a fighting army uses, multiply the ordinary hazards of transport by the dangers which beset it in wartime—especially when the destination may be an African desert, a frozen Russian port, or a steamy, insect-ridden Malayan jungle—and you have some idea of the problem facing the Ordnance Departments and the factories which supply them. The Signals and Radar section of the Army alone uses something like 80,000 different items.

Breaking down the problem into its components, we can see that there are three—Packaging, Identification, Preservation.

The goods must be packed so that they can be easily handled, so that the receiver shall know where to find any single item, and so that insects or microbes, heat or cold, dust or water, shall not have rendered them unusable when he has got it.

This is where Pre-Packing comes in.

Briefly, it means to assemble certain articles in safe and convenient packages

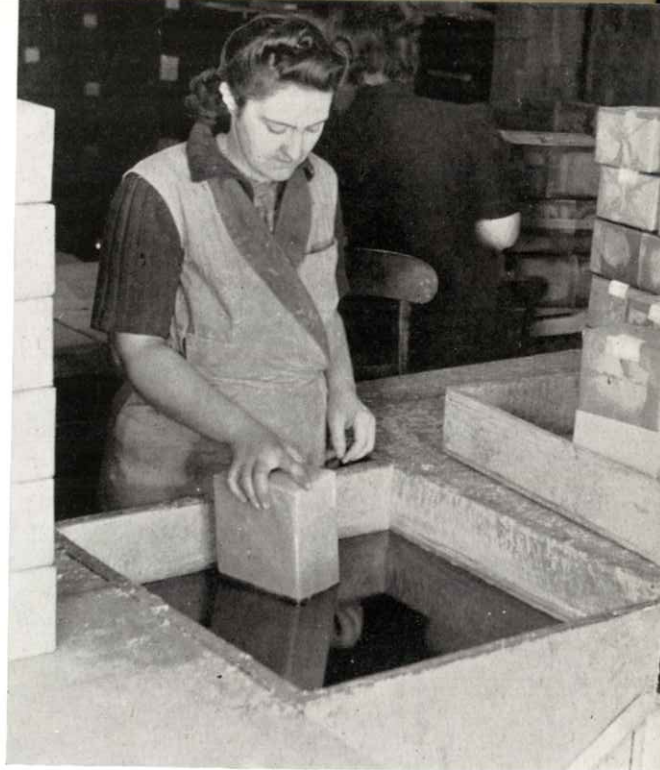


Battersea Depot in peacetime ; chocolate for London customers.

Battersea Depot in wartime ; after the Ferricam contract finished, workers turned to the packing of Radar and Signal spares.

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(Left). Some delicate components were sealed in cellulose tubes. (Right.) The completed carton was dipped in a resistant wax solution.

adapted to the particular nature of the article packed, to the distance it has to travel, to the kind of journey it has to take, and the kind of country in which it is going to be used. It means putting on labels which neither mildew nor sea-water can destroy nor move. It means taking into account damaged or non-existent port installations—so that cases may have to be man-handled down rickety gang-planks—whether the goods are to be transported smoothly by air, “humped” over rocky roads, or carried on men’s heads through jungle paths.

Account must be taken of the fact that it is not always wise to make up cargoes of one type of article. If they are lost, an army may have to go without a vital replacement. It may be the old story of the battle being lost for want of a horse-shoe nail.

When the Jerrican contract at Battersea was about to end, Bournville Utilities looked round for something to take its place which would utilise the same space and employ the same labour. The Ministry of Supply suggested the Pre-Packing of Army Signals and Radar spares, with the idea of supplying them to front line repair units cartoned in quantities suitable either for stock or immediate use. Quantities too large would tie up stock, but if too small might put a vehicle or a weapon out of use at a critical moment.

The chief difficulty in organising the job at Battersea was that we were only packing spares, so that suppliers sent only what they did not want for their main contracts. Consequently, no one knew what was coming in during any particular period from any of the 300 contractors, or in what quantities. Organised planning on Bournville lines was therefore impossible.

However, when it was known of what any set of consignments consisted, they were made up into prototypes or patterns which served as models for the job.



(Left.) Packing stay-plates, etc., for radio masts. (Right.) Labels for components and containers.

According to the nature of the article—it might be a delicate wireless valve or some minute fitting—so the method of packing varied, while protection against the climatic conditions and the many pests of the Far East added new operations to the ordinary schedule.

There was a carton for each component or definite quantity of components, which had to be folded or stitched and assembled, and the components themselves might have to be wrapped. The carton needed two labels and one component in each carton must be labelled. Then all must be packed in a way which would prevent movement; and finally the carton had to be sealed with adhesive tape, and itself packed into large cases for despatch to depot. Some components, e.g., condensers, going to the Far East, might have to be completely sealed in cellulose phials to ensure that they were microbe proof, and other things had to be wrapped and sealed separately. Then the whole carton must be dipped in molten wax at a specific temperature and finally wrapped in special paper.

Between April, 1944, and the end of the contract we packed something like 39 million components, involving the use of $9\frac{3}{4}$ million cartons and 38 million labels.

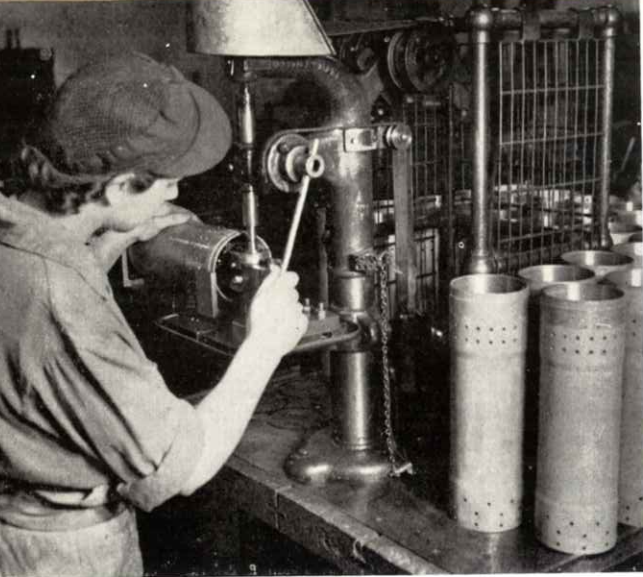
It is perhaps interesting to note that, although there was no compulsion by us or the Ministry of Labour, every girl employed on Jerricans came over to pre-packing, although they knew their wages would be lower so long as the job was on a day-work basis. Despite the fact that the district suffered very badly from V.1 and V.2 attacks—being one of the worst affected areas—the output per employee showed little if any falling off, though there was some absenteeism due to the fact that the homes of about half the workpeople were damaged in one way or another. Altogether, 180 women and 22 men were employed full-time and 55 women part-time.



Teleprinter paper rolls were enclosed in cylindrical tins and flat packs in cardboard containers, which were specially wrapped in bitumen paper and sealed with Bostic C. cement. Tins and packs were then packed in wooden cases.

Where there are no mechanical handling facilities, a portable roller conveyor carries supplies ashore from barges.





(Left.) *Gun Mountings for Hispano cannon (Spitfire).* (Right.) *Checking Signal Spares for Pre-Packing (Battersea Factory).*

THE aeroplane fittings and structural units described on pages 13 to 19 were not all in metal. Many were the work of Bournville carpenters, who also made a large number of cases for contractors engaged on pre-packing motor-car parts. Each case was specially designed for whatever was its individual purpose, and constructed to stand up to the most rigorous conditions of travel by sea, land, and air.

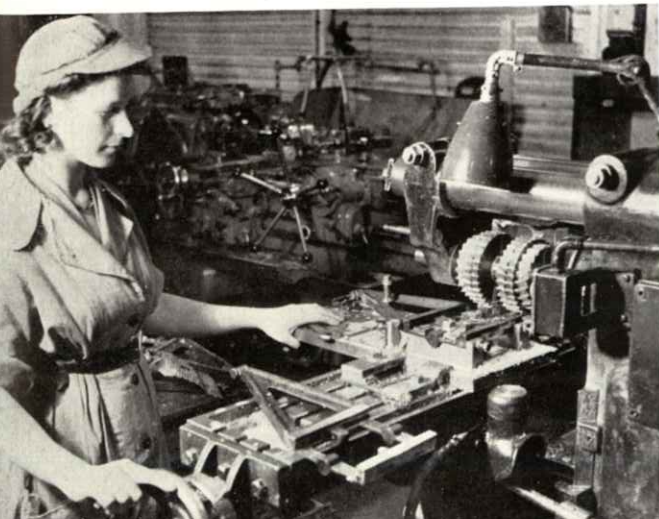
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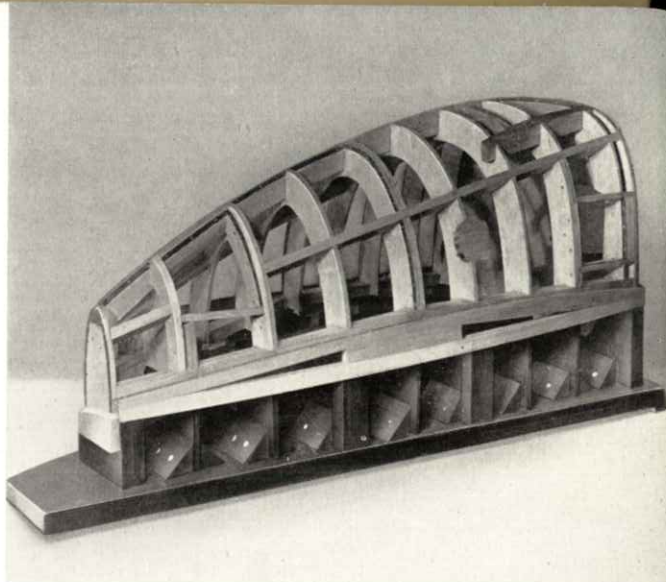
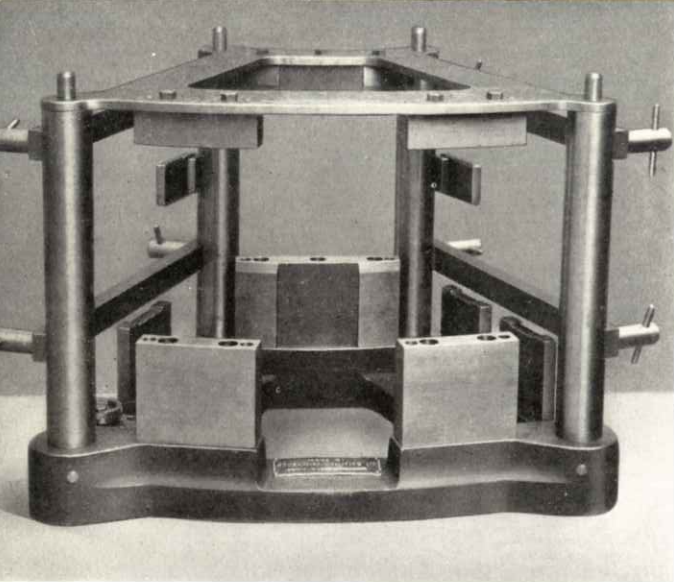
The Bournville Printing Department printed all the labels for the components pre-packed at Battersea. There were 40,000 different sorts and they took 10 tons of paper—though each label measured only 1-in. by 1½-ins. The same department also printed the tapes for the whole Service Respirator industry, turning out 90,000 a week cut into 22-ins. lengths.

* * *

Some of the work connected with respirator assembly was done by “out-workers.” This included the tying of cork plugs to “Commando” type respirators for use when the wearer was under water, and was performed by voluntary workers at the Red Cross Depot, organised at the house of Lady Bird, Solihull.

(Left.) *Bomb Sight Brackets for Lancaster.* (Right.) *Sealing ends of cellulose tubes (Battersea Factory).*





(Left.) *Assembly Jig for Aircraft Component.* (Right.) *Wood Skeleton Former for Halifax Cowling.*

Bournville engineers and draughtsmen were called in by the Ministry of Fuel and Power to act as consultants and advisers at other Midland factories in connection with the Fuel Economy Campaign.

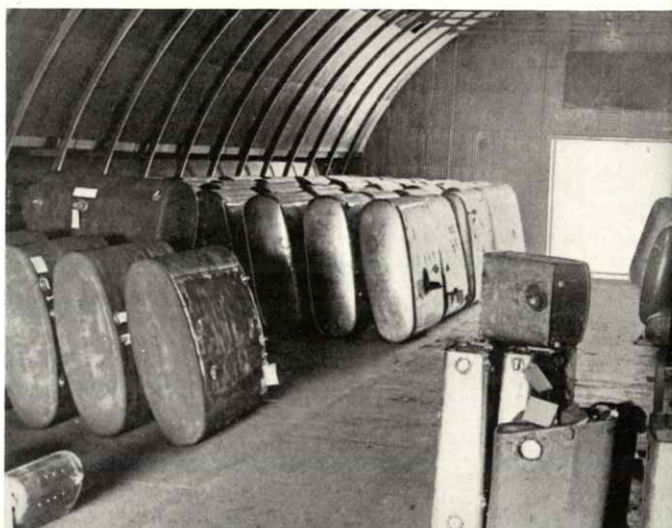
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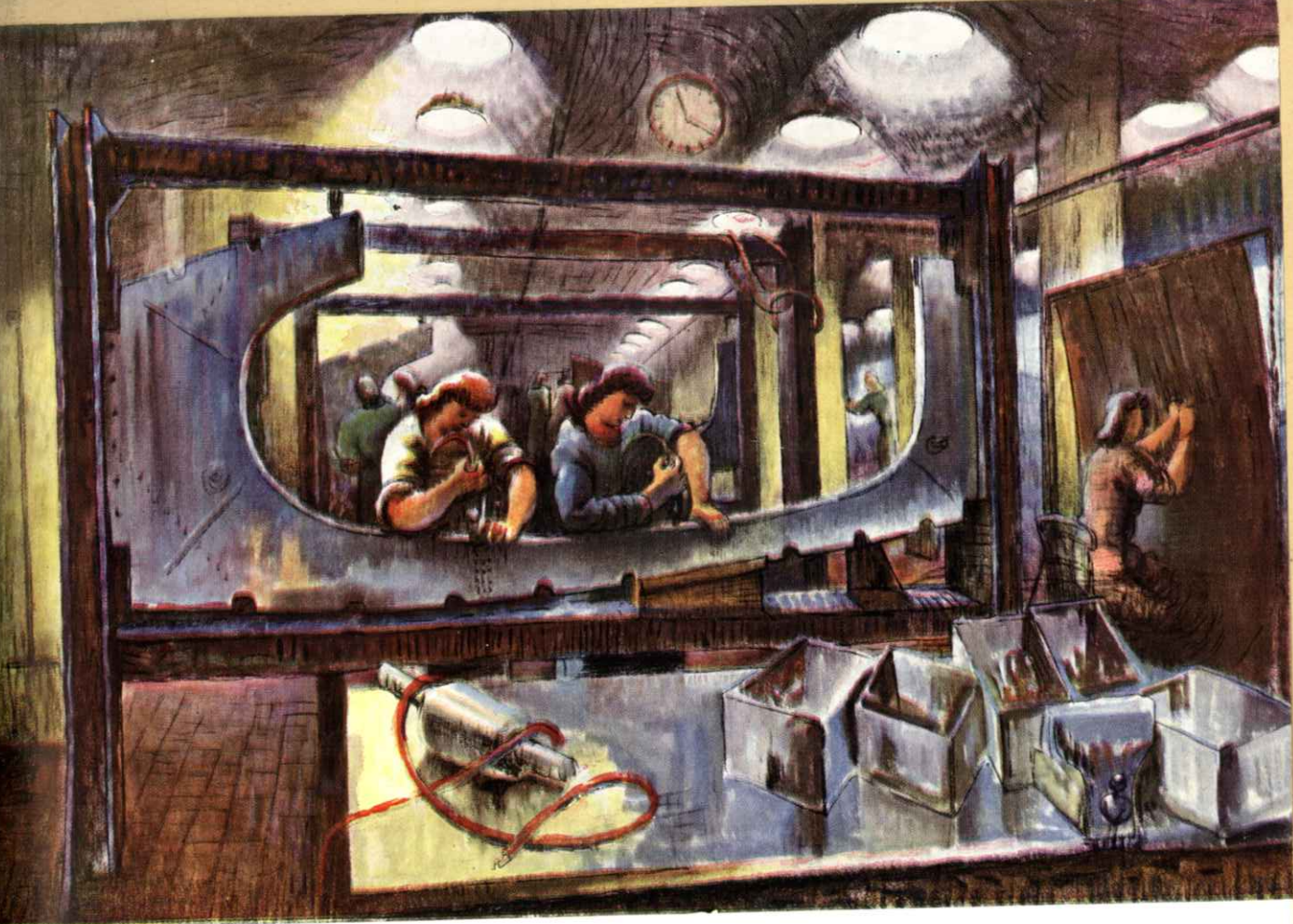
Two members of the Staff—one of whom was an amateur ciné enthusiast—made a film for the Ministry of Aircraft Production, with the idea of inducing large concerns to get some of their repetition work done by outworkers in country districts where there were untapped sources of willing and teachable labour. Copies of the film were shown all over the Midlands and elsewhere.

* * *

The Joint Production Committees (see page 18) set up by Bournville Utilities Ltd. were highly successful and were considered by the Management to be invaluable in the smooth running of the contracts. In Bournville's own business the tradition of employer-employee co-operation has long been established. A personal letter from Sir Stafford Cripps (then Minister of Aircraft Production) expressed official appreciation of the way in which the work of the departments concerned was carried out.

(Left.) *A corner of the Issuing Stores, Battersea.* (Right.) *Uncovered Tank Stores.*





RIVETING LANCASTER WING RIBS
From a Colour Sketch by Frank Dobson, A.R.A.



BOURNVILLE IN PEACETIME

Acknowledgment is made to *Illustrated* for the upper photograph on page 35. Other pictures were supplied by the Associated Press, Charles E. Brown, Fox Photos, the Topical Press and *The New York Times*. The photographs taken at Bournville and Battersea are the work of the Bournville Works Studio.