

Ministry of Munitions of War.

LOUGHBOROUGH
TECHNICAL INSTITUTE



INSTRUCTIONAL
FACTORY.

Price 2/6 Net.

Ministry of Munitions of War.

NOT TO BE TAKEN AWAY

Loughborough Library
Granby Street
Loughborough LE11 3DZ
Tel: 0116 305 2420

LOUGHBOROUGH
TECHNICAL INSTITUTE

Instructional Factory.

H. SCHOFIELD, M.B.E., B.Sc., (Hons) Lond., A.R.C.Sc., Lond.,
D.I.C., Assoc. M. Inst., C.E.,
General Manager.

J. F. DRIVER, A.M.I.E.E., A.M.I. Mech., E.,
Works Manager.

W. BIRRELL, Works Superintendent.

First Edition.

Instructional Factory.

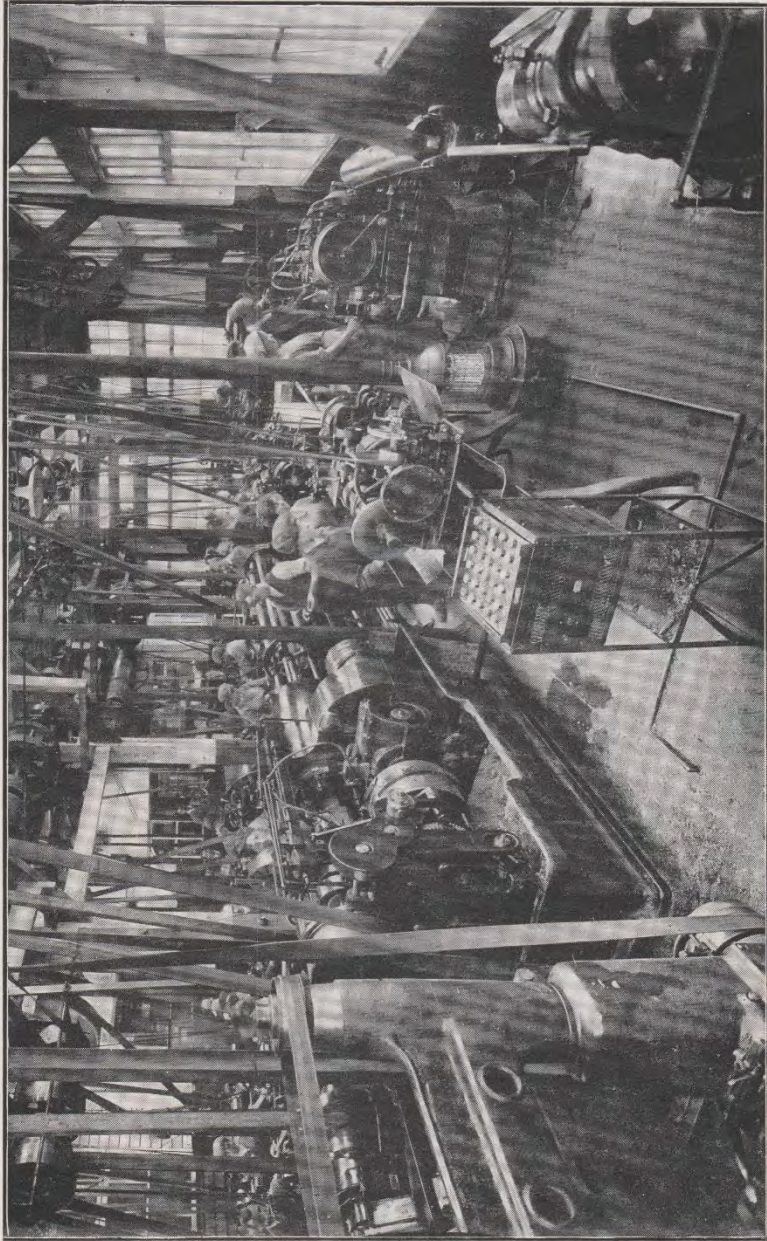
STAFF.

GENERAL MANAGER :

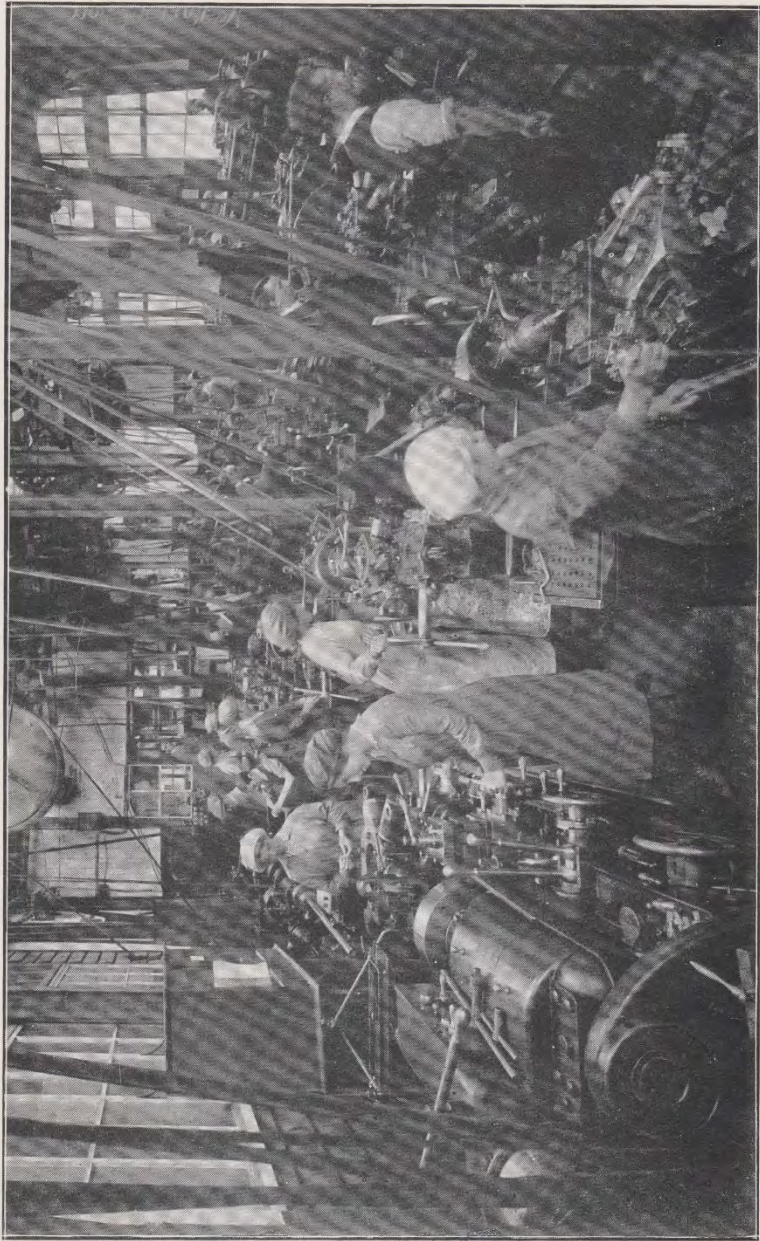
**H. SCHOFIELD, M.B.E., B.Sc. (Hons.) Lond.,
A.R.C.Sc. Lond., Assoc. M.Inst. C.E.,
A.M.I.Mech. E.**

Principal of the Technical Institute.

Works' Manager	-	-	-	J. F. DRIVER, A.M.I.E.E. A.M.I.MECH.E.
Works' Superintendent	-	-	-	W. BIRRELL.
Departmental Superintendents :—				
1. General Machine Shop	-	-	-	H. H. BAKER.
2. Automatic Machine Shop	-	-	-	J. BROWN.
3. Gauge Shop	-	-	-	E. G. BROWN.
4. Turning Shop	-	-	-	H. PRINCE.
5. Grinding Shop	-	-	-	H. PICKARD.
6. Milling Machine Shop	-	-	-	J. F. EVANS.
7. Tool Room	-	-	-	J. H. MAKEY.
8. Aero Engine Testing Laboratory	-	-	-	W. P. JOHNSON, A.R.C.Sc (Lond.), ASSOC.M.INST.C.E.
9. Drawing Office	-	-	-	T. A. DOUGHTY.
10. Pattern and Aircraft Woodwork Shop	-	-	-	E. W. HADDON, F.B.I.C.C.
11. Foundry	-	-	-	H. WAKERLEY.
12. Smiths' Shop	-	-	-	W. WATSON.
13. Oxy-Acetylene and Electric Welding Shop	-	-	-	A. PARKER.
14. Aircraft Sheet Metal Work Shop	-	-	-	H. C. J. WIX.
15. Inspection Department	-	-	-	E. S. BADGER.
16. Stores	-	-	-	T. G. LAND.
17. Canteen	-	-	-	Miss E. M FOGG.
Lady Supervisor & Welfare Matron	-	-	-	Mrs. E. B. MOORE, Cert. of Central Midwives Board, Royal San. Inst. Certs., Health Visitors & School Nurses, Ins. of Nuisances.
Medical Officer	-	-	-	J. REID FOULDS, M.D.
Buildings' Superintendent	-	-	-	E. T. ALLCOCK, A.R.I.B.A.



AUTOMATIC SHOP FROM NORTH END.



AUTOMATIC SHOP FROM SOUTH END.

Ministry of Munitions Instructional Factory.

Works Hours: 7-30 a.m. to 12-30 p.m.

1-30 p.m. to 6-0 p.m.

Saturday 7-30 a.m. to 12-30 p.m.

The Instructional Factory is directly controlled by the Ministry of Munitions, and its chief function is to train male and female labour in the different branches of Engineering as specified below.

The Factory provides accommodation for between 400 and 500 regular employees, and it is maintained entirely as a productive organisation. The Trainees are, as far as possible, trained on the particular type of work for which they are required, thus rendering the training as short as possible compatible with efficiency; the educational side being of secondary consideration in comparison with the output of trained operatives.

Instruction is given in the branches of Shell Turning, Tool Setting, Capstan Tool Setting, Milling, Grinding, Fitting, Gauge Making, Smiths' Work, Capstan and Automatic Machine Operating, Oxy-Acetylene Welding, Pattern Making, Light Woodwork, and Metalwork for Aeroplane Construction, Drawing and Tracing, Inspecting and Viewing, Aero-Engine Testing, and all classes of Foundry Practice.

For the simpler classes of work, it is usual for the period of training to extend over two or three weeks; but this time must necessarily depend upon the work for which the student is being prepared, and it may be as much as six or eight months in the more highly skilled operations.

There is no charge for training, and payment of a maintenance allowance is made during the period of training. This payment, which varies in amount according to the particular case considered, is made only to those students who exhibit aptitude for the work after a week's probation; and the Ministry of Munitions require that paid students in training shall be prepared to work in such places as are necessary, though, as far as possible, workers will be placed in the districts they select; but this is subject to the demand in such areas.

Generally, male applicants are interviewed by the Works' Superintendent, and female applicants by the Welfare Supervisor, but the General Manager can be seen at any time by appointment, if an applicant wishes to make any special arrangement.

Male workers are advised to come equipped with suitable overalls. Female workers are provided with the necessary overalls and caps. All other necessary apparatus and material are supplied by the authorities.

Full particulars of the equipment of the various Departments will be found in the following pages.

The Training of Discharged Soldiers for the Production of Munitions of War.

The Ministry of Munitions desire to bring to the attention of all Committees and Sub-Committees under the Naval and Military War Pensions, etc., Act, the importance of training discharged and disabled soldiers for the production of munitions of war. There is at the present time a large demand for men so trained.

Disabled men found suitable for training will be enrolled at the Loughborough Instructional Factory, where there is accommodation for from 400 to 500 full-time workers. Such men will receive remuneration from the Ministry of Munitions. The scale of remuneration, even during the period of training, will enable a disabled man to maintain himself and his family in comfort. Before enrolment, the man will be medically examined by the Medical Officer attached to the Loughborough Instructional Factory.

It should be understood that this scheme of training is concerned directly with the *preparation of war material*. The men are trained strictly by working upon production. Permanent employment after the war cannot be guaranteed, but the experience received in Fitting, Turning, and the manipulation of Automatic Machines, should stand the disabled man in good stead subsequently.



OPERATOR ON "HERBERT" No. 9 COMBINATION LATHE.



SHELL TURNING (18 POUNDER H.E.)

Similar training for the Allied Governments has been conducted at this Training School under Military control. Training for the British Government is not under military control.

All applications for training and employment should be sent direct to the Principal, who will supply the necessary particulars and conduct correspondence in reference to each case.

General Equipment.

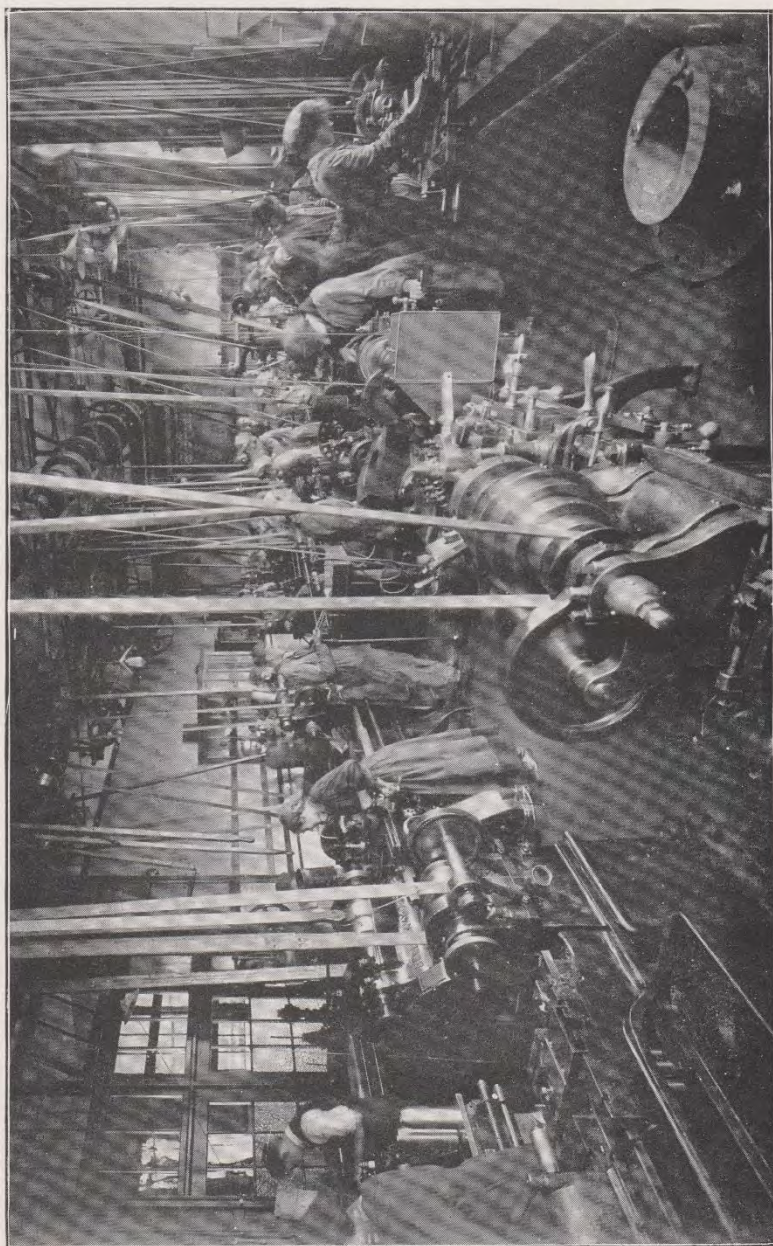
The Workshops are complete in every respect, and are equipped with the most modern and up-to-date Tools and Appliances, so that the Students may obtain a thorough insight into all the branches of practical Engineering. They comprise:—

1. GENERAL MACHINE SHOP, equipped with about twenty Centre Lathes, with swings of from six to thirty-six inches, and comprising machines by all the leading English and American manufacturers. Also an assortment of Milling and Shaping Machines, and Capstan Lathes equipped for bar and chuck work.
2. AUTOMATIC MACHINE SHOP.—This contains examples of all types of Semi-automatic and Full Automatic Lathes for bar and chuck work, Universal Grinding Machines, and Lumsden Tool Grinder, etc.
3. GAUGE SHOP, equipped with machines and appliances for the manufacture of all types of Flat, Screw and Plug Gauges.
4. TURNING SHOP.—This shop is equipped with twenty Lathes ranging from 5½" to 21" centres. These Lathes are representative of all classes of American Tools.
5. GRINDING SHOP, equipped with Plain, Universal, and Surface Grinders of various capacities to deal with work from the different Machine Shops.

6. MILLING MACHINE SHOP.—This shop contains examples of most of the well-known makes of both Plain and Universal Milling Machines, illustrating vertical as well as horizontal types.
7. TOOL ROOM, equipped with Precision and Backing-off Lathes, Universal Grinding Machine, Milling and Profiling Machines, etc.
8. AERO ENGINE TESTING LABORATORY, with Heenan Froude, Electric Dynamometer, and Air Brakes, capable of measuring the Brake Horse power of all types of Aero Engines up to 300 B.H.P., at speeds up to 2,000 R.P.M.
The Laboratory is equipped with Optical Indicators, Exhaust Gas Analysis Apparatus, etc.
9. DRAWING OFFICE, with accommodation for 25 Students, having a large size Electric Copying Machine for taking blue prints.
10. PATTERN AND AIRCRAFT WOODWORK SHOP, with all classes of woodworking machinery and pattern makers' tools and appliances.
11. FOUNDRY, with facilities for producing Iron, Brass, and Aluminium Castings, and complete with Hand, Hydraulic, and Compressed Air Moulding Machines, Sand Blast Apparatus, etc.
12. SMITHS' SHOP, having three Forges, 1 cwt. Pneumatic Hammer, etc., with full sets of tools for twelve Students.
13. OXY-ACETYLENE AND ELECTRIC WELDING SHOP, with accommodation for ten pairs of workers, and equipped with appliances for Welding, Cutting, Brazing, Lead Burning, etc.
14. AIRCRAFT SHEET METAL WORK SHOP.—This department provides bench accommodation for 30 students.
15. INSPECTION DEPARTMENT, equipped with various devices for the rapid checking of repetition parts.
16. STORES.—
17. CANTEEN.—



GENERAL MACHINE SHOP—LOOKING NORTH.



GENERAL MACHINE SHOP—LOOKING SOUTH.

General Machine Shop.

Superintendent: H. H. Baker.
Assistant Instructors: F. L. Driver.
C. A. Parkinson.
A. Fisher.

DETAILS OF EQUIPMENT.

Twenty-five Centre Lathes of modern design with facilities for sliding, surfacing, and screwcutting, and having capacities of 6in. to 36in. swing, with beds from six to ten feet long.

These include :—

Three Step Cone Double Back Gear 9in. Centre " Putman " Lathe ;

" Bell " Heavy Duty 9in. Centre Lathe ;

Four Fish & Co. 7in. Centre Lathes, with interlocked gears and profiling attachments ;

Two 10-in. by 10ft. Centre Lathes, by Mitchell, Keighley ;

Three Capstan Lathes, by Southworth Machine Co., U.S.A., having separate stops to each tool-post, hand travelling Chasing Saddle, and capable of taking bar up to 1 $\frac{1}{4}$ in. diameter ;

1 $\frac{1}{4}$ in. Capstan Lathe, by Windsor Machine Tool Co. ;

$\frac{3}{4}$ in. Capstan Lathe, by " Purden," Birmingham ;

" Alfred Herbert " No. 4 Capstan, equipped for bar and chuck work ;

" Jones " Shell Boring Lathe ;

Two Spindle Ball Bearing Drilling Machine, by Alfred Herbert, Ltd. ;

12in. Shaping Machine, by Butler, Halifax ;

Two " Denbigh " Horizontal Milling Machines ;

4in. " Whitton " Centring Machine, etc.

Bench Accommodation for Six Fitters.

Automatic Machine Shop.

Superintendent : J. Brown.
Assistant Instructors : S. E. Newbold.
J. B. Piggott.
A. Mason.

The Department contains examples of all types of Full and Semi-Automatic Machines for bar and chuck work.

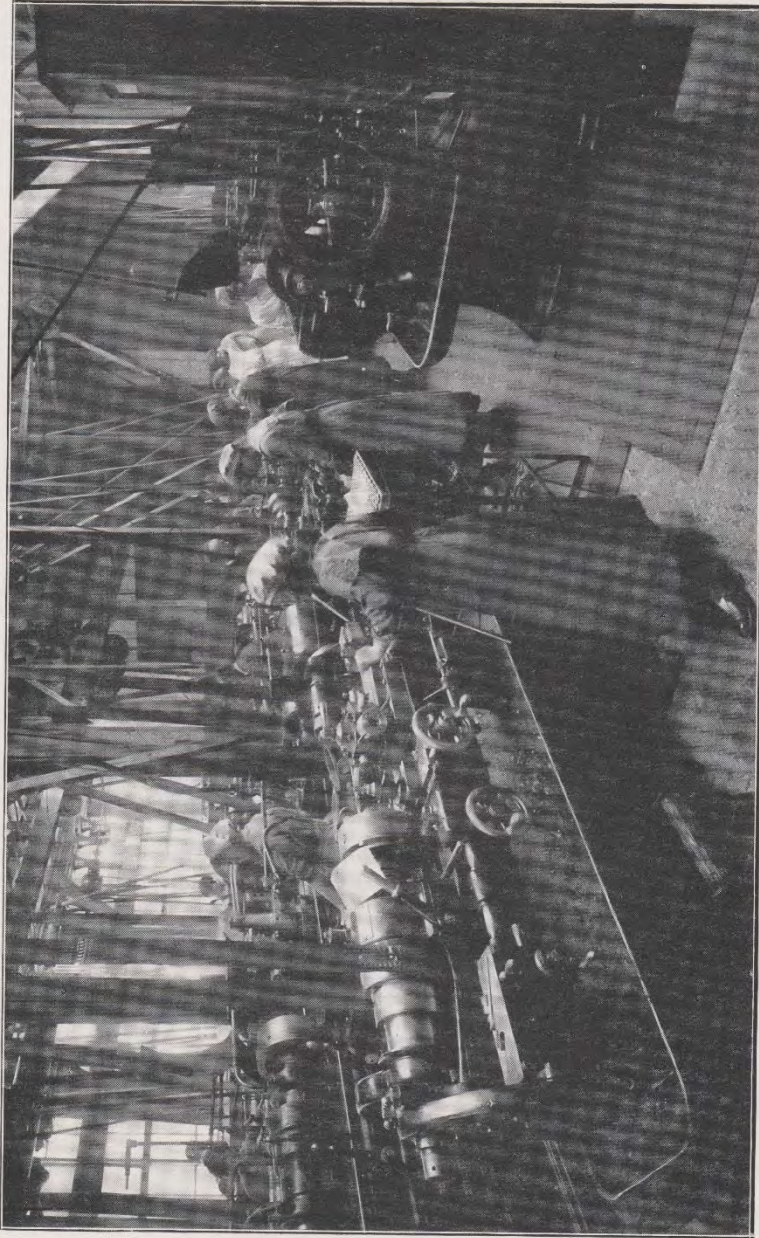
The Equipment Consists of :—

FULL AUTOMATICS :

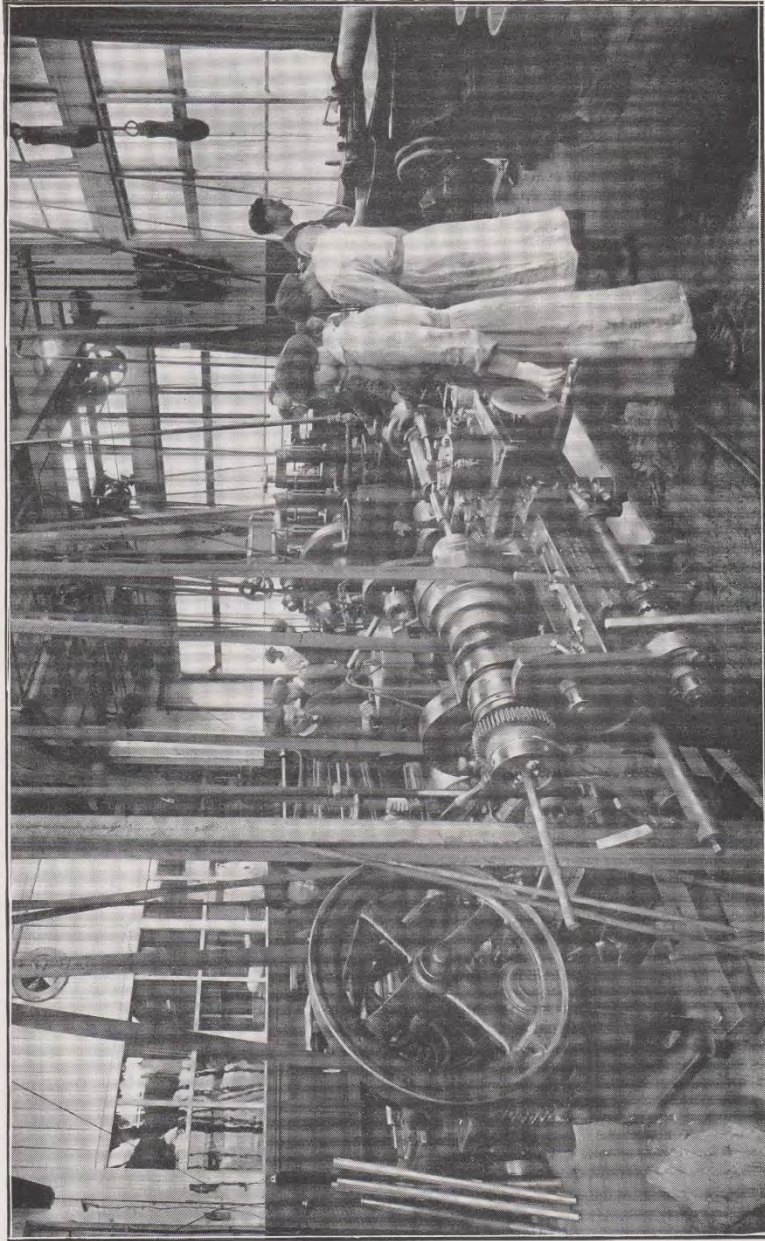
- “ Potter & Johnson ” 6A with backfacer gear ;
- “ Gridley ” Four Spindle Auto. for $1\frac{3}{4}$ in. bar ;
- “ Acme ” Four Spindle Auto. for 1in. bar, with cross drilling and milling attachments ;
- “ Cleveland ” Auto. with slot sawing attachment for $\frac{3}{4}$ in. bar ;
- “ Pratt & Whitney ” Auto. for $\frac{3}{4}$ in. bar ;
- “ Gridley ” Single Spindle Auto. for $4\frac{1}{4}$ in. bar ;
- Three Tool “ Cleveland ” Auto. for $\frac{3}{4}$ in. bar ;
- Four Spindle “ Gridley ” Auto. for $\frac{3}{4}$ in. bar ;
- “ Cleveland ” Five Hole Automatic for $2\frac{1}{4}$ in. bar, equipped with magazine attachment, conveyor, etc. ;
- “ Brown & Sharpe ” No. 0 Automatic Screw Machine with slotting, stabbing, and counting attachments.

SEMI AUTOMATICS :

- “ Jones & Lamson ” Three Step for 2in. bar ;
- $14\frac{1}{4}$ in. Centre “ Lang ” Boring and Chucking Lathe ;
- 13in. Centre “ Lang ” Heavy Duty Centre Lathe with Single Pulley Drive ;
- $8\frac{1}{4}$ in. Centre “ Lang ” Centre Lathe with Single Pulley Drive ;
- Two “ Gisholt ” Chucking Lathes, with contour attachments ;
- “ Robertson & Orcher ” Capstan for $2\frac{1}{2}$ in. bar ;
- “ Centaur ” Capstan for $1\frac{1}{4}$ in. bar ;
- “ Ryerson ” Capstan or $1\frac{1}{4}$ in. bar ;
- “ Warner & Swasey ” Capstan for 2in. bar ;



AUTOMATIC SHOOP FROM SOUTH WEST.



AUTOMATIC SHOP FROM NORTH WEST.

SEMI AUTOMATICS *(continued)*:

- " Warner & Swasey " Capstan for 1½ in. bar ;
- " Butler " Screwmaking Machine ;
- Two " Alfred Herbert " No. 9 Combination Turret Lathes ;
- " Putnam " 10in. Centre Lathe, with interlocked gear for sliding, surfacing, screwcutting ;
- " Alfred Herbert " No. 4 Capstan Lathe for bar and chuck work.

GRINDING MACHINES :

- " Landis " Universal Grinder, 8in. capacity ;
- " McGee " Universal Grinder, 18in. capacity ;
- " Jones & Shipman " Grinder, 6in. capacity ;
- " Lumsden " Oscillating Tool Grinder ;
- Table Pattern Surface Grinder.

GENERAL TOOLS :

- ¾ in. " Richert-Shafer " Tapping Machine ;
- " Fellows " Gear Shaping Machine ;
- No. 4 36in. " Cincinnatti " Auto. Gear Cutting Machine ;
- " Cincinnatti " Tool and Cutter Grinder ;
- 6in. Slotting Machine, with rotary and canting table ;
- Two Spindle, " Alfred Herbert " Ball Bearing Drill ;
- Four Spindle, and Radial Drilling Machines, etc ;
- Centrifugal Separator for cleaning swarf ;
- Bench Accommodation for Five Fitters.



Gauge Shop.

Superintendent : E. G. Brown.
Assistant Instructors : A. Bridgland.
J. H. Brearley.
Miss M. Tranter.
Miss E. Davies.
D. M. Llewellyn.

The Department is fully equipped with all the machines and appliances for the manufacture and accurate measurement of Flat, Screw, and Plug Gauges.

The Equipment Consists of :—

Two " Taylor, Taylor, & Hobson " Engraving Machines ;
" American " Surface Grinder ;
" Bath " Universal Grinder ;
16in. " Milwaukee " Shaping Machine ;
Two 9in. Centre " Springfield " Lathes ;
" Drummond " Precision Lathe ;
Two 5in. Centre " Alfred Herbert " Precision Screw Thread
Cutting Lathes ;
" Jones " Screw Thread Grinding Lathe ;
Two 5in. Centre " Spencer " Precision Lathes ;
" Lorch " 3in. Centre Precision Lathe ;
" Denbigh " Horizontal Milling Machine ;
11ft. by 4ft. Marking-Out Table ;
Two Spindle " Herbert " Drill with automatic feed and tapping
attachment ;
" Taylor & Mudford " Magnetic Hardening Muffle Furnace ;
Surface Grinder, Polisher, Drilling Machines, etc. ;
Micrometers, Optical, Microscopic, and Direct Measuring
Machines, capable of measuring to one hundred thousandth
part of an inch ;
" Newhall " Standard Measuring Machine, equipped with Metric
and English Heads ;

Bench Accommodation for 49 Gauge Makers and Lappers.



GAUGE SHOP FROM SOUTH EAST.



GAUGE SHOP FROM NORTH EAST.



GAUGE SHOP (INSPECTION TABLE).



GAUGE SHOP FROM NORTH WEST.

Turning Shop.

Superintendent: H. Prince

Details of Equipment:—

- One 13½in. Centre “Springfield” Lathe;
- Two 12in. „ “Bradford” Lathes;
- Two 12in. „ “Boye Emmes” Lathes;
- One 10in. „ “Springfield” Lathe;
- One 10in. „ “Lodge & Shipley” Lathe;
- One 9in. „ “Meuller” Lathe;
- One 9in. „ “Putnam” Lathe;
- One 9in. „ “Chard” Lathe;
- One 8in. „ “Lodge & Shipley” Lathe;
- One 8in. „ “Fay & Egan” Lathe;
- One 8in. „ “Holroyd” Backing-off Lathe;
- Two 7in. „ “Reed” Lathes, with all geared heads;
- One 7in. „ “Walcott” Lathe;
- Two 7in. „ “Le Blond” Lathes;
- Two 5½in. „ “Vernon” Lathes;
- “Denbigh” Wet Grinder;
- 7in. “Walker” Globe Tool Grinder;
- “Utile” Hardening Furnace and Blow Pipe Hearth;
- 48in. Radial Drill by D. Mitchell & Co., Keighley.

Grinding Shop.

Responsible Instructor: H. Pickard.

This shop is so equipped that it is capable of dealing with all work which can be produced in the various machine shops, and which afterwards require grinding.

The Equipment Consists of:—

- 18in. by 96in. “Norton” Plain Grinder;
- 14in. by 72in. “Norton” Plain Grinder;
- “McGee” Cylindrical Grinder;
- “Heald” Surface Grinder;
- “Taft-Pierce” Universal Grinder;
- “Heald” Universal Grinder;
- “Heald” Internal Ring Grinder;
- “Landis” Universal Grinder;
- “Steinle” Grinder.

Milling Machine Shop.

Responsible Instructor: J. F. Evans.

Details of Equipment:—

- One "Cincinnati" Full Universal Horizontal Miller;
- Two "Becker" Vertical Millers;
- One "Rockford" Horizontal Milling Machine;
- Four "Pratt & Whitney" "Lincoln" type Millers;
- "Putnam" Semi-Automatic Miller;
- One "Pratt & Whitney" Thread Milling Machine;
- Two "Pick" Thread Milling Machines.

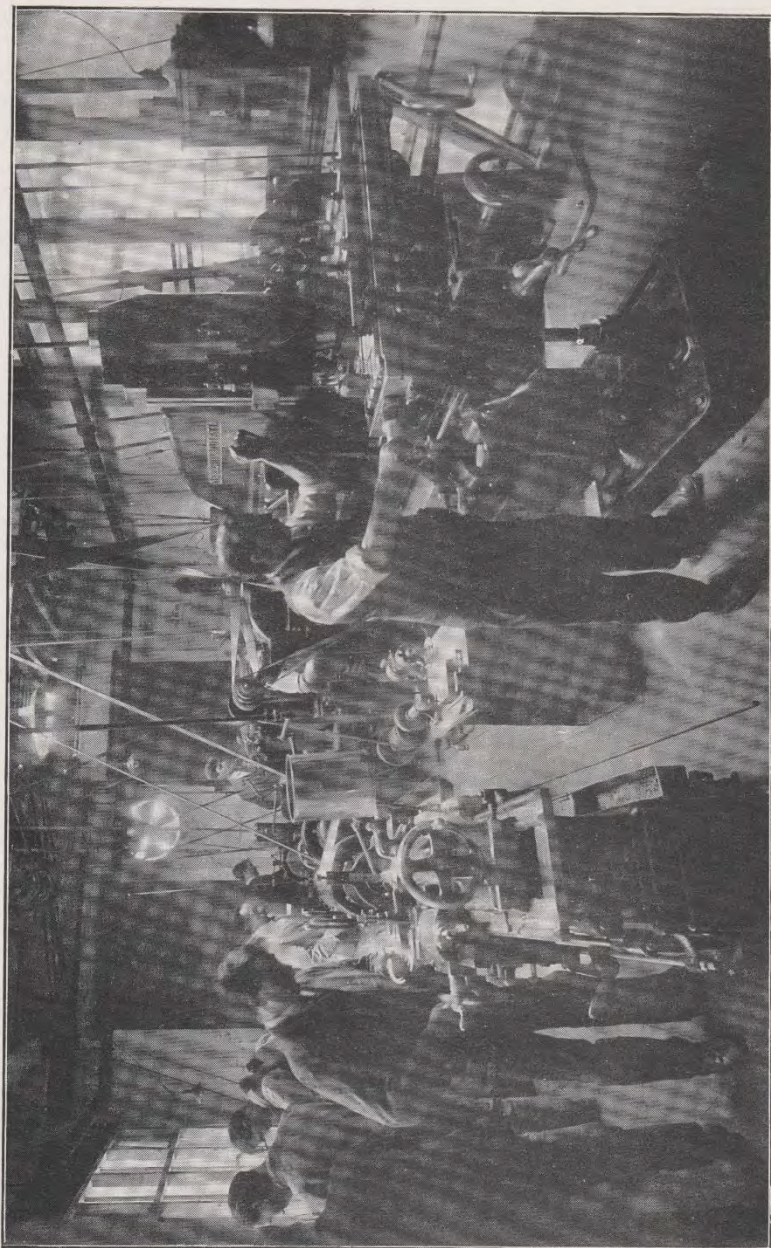
Tool Room.

Responsible Instructor: J. H. Makey.

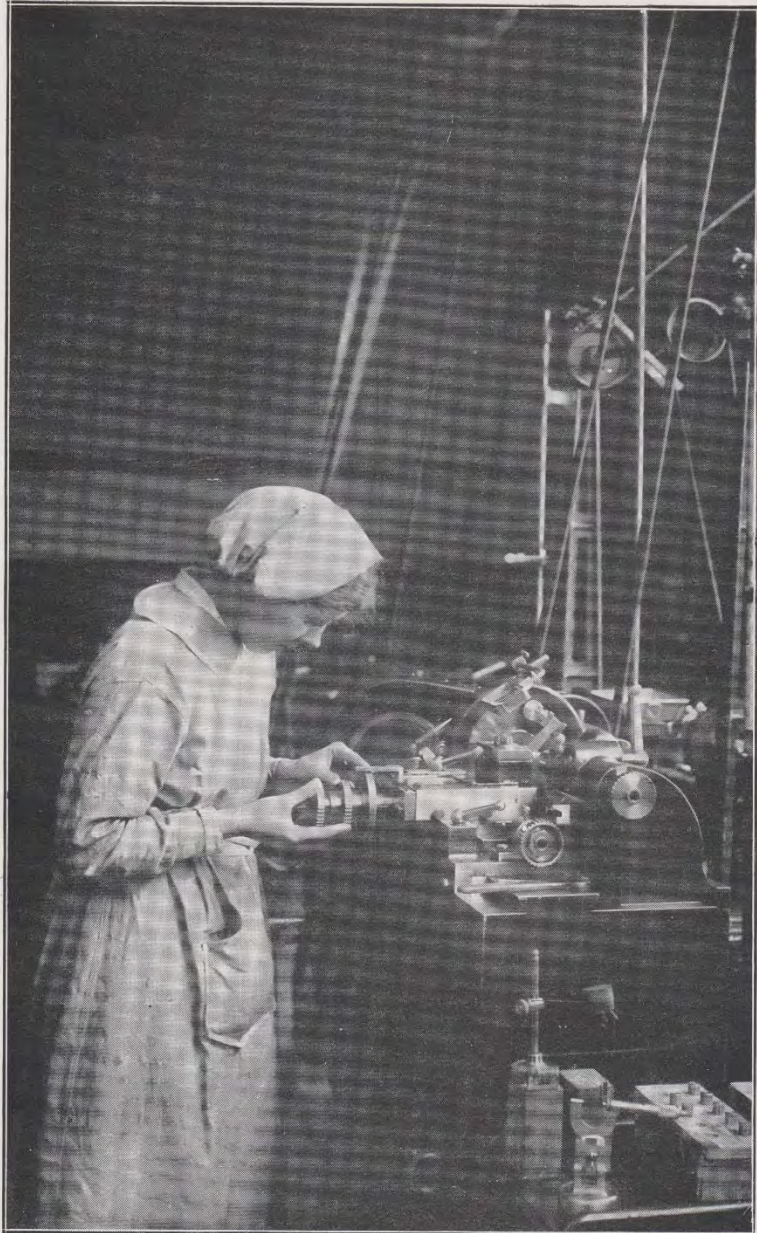
Details of Equipment:—

- 16in. "Kelly" Shaping Machine;
- "Greenwood & Batley" 12in. Profiling Machine;
- "Cincinnati" Full Universal Vertical Miller;
- "Jones & Shipman" Universal Grinder;
- 7in. "Walker" Globe Tool Grinder;
- 3in. Centre "Van Norman" Precision Lathe;
- "Alfred Herbert" Sensitive Drill;
- 8in. Centre "American Tool Works" Lathe.
- 6in. Centre "Reed Prentice" Lathe with all geared head.

Bench Accommodation for 12 Tool Makers.



TOOL ROOM.



OPERATOR ON "ALFRED HERBERT" PRECISION LATHE.

Aero Engine Testing and Research Laboratory.

Superintendent : W. P. Johnson, A.R.C.Sc. (Lond.),
Assoc. M. Inst. C.E.

Assistant Instructor : A. T. Guinevan, B.Sc. (Lond.)

Details of Equipment :—

The Laboratory is equipped for testing and research work on Aero Engines. Facilities are provided for training either men or women for Aero Engine testing, and opportunities are given for selected trainees to assist in research work on such Engines. The Laboratory is exceptionally well lighted, and ample window opening is arranged to allow of the entry of fresh air while the engines are under test, the exhaust gases being drawn from the building by powerful exhaust fans. Current at either 220 or 440 volts is supplied to suitable tapping boards, and large gas and water mains are led into the building for testing and for cooling the engines on coal gas respectively.

The Building is heated by overhead water pipes. All lights can be darkened by roller blinds for optical work. Eight optical indicators are available for fitting to any engine and all appliances for the analysis of exhaust gases. The equipment includes a 30 cwt. travelling crane.

The plant is arranged with a view to testing engines of widely varying type, such as the rotary and radial, or the more conventional types. The engines at present available for testing comprise two Beardmore, two Le Rhone and one Curtiss Aero Engines, and a J.A.P. Motor Cycle Engine. These are installed on the testing sets as follows :—

120 HORSE-POWER BEARDMORE WATER COOLED AERO ENGINE coupled up to a Heenan Froude Water Dynamometer. This set is arranged to run on either liquid fuel or coal gas, and instruments are provided for determining accurately the Indicated and Brake Horse-power, the Mechanical and Thermal Efficiency, the petrol per Brake Horse-power, and the mixture strength from an analysis of the exhaust gases. The engine is started by a 10 Horse-power Westinghouse motor, which is automatically cut out immediately the engine starts.

80 HORSE-POWER LE RHONE ROTARY AIR COOLED ENGINE.—

This Engine is fitted with a propeller for absorbing the power, both engine and propeller being arranged to run in a casing. The exhaust gases are ejected by the action of the propeller through the roof of the Laboratory. The engine is fixed in a frame mounted on ball bearings, supported by a fixed table. A torque arm forms part of the engine frame, on which a sliding weight enables the Horse-power of the engine to be ascertained.

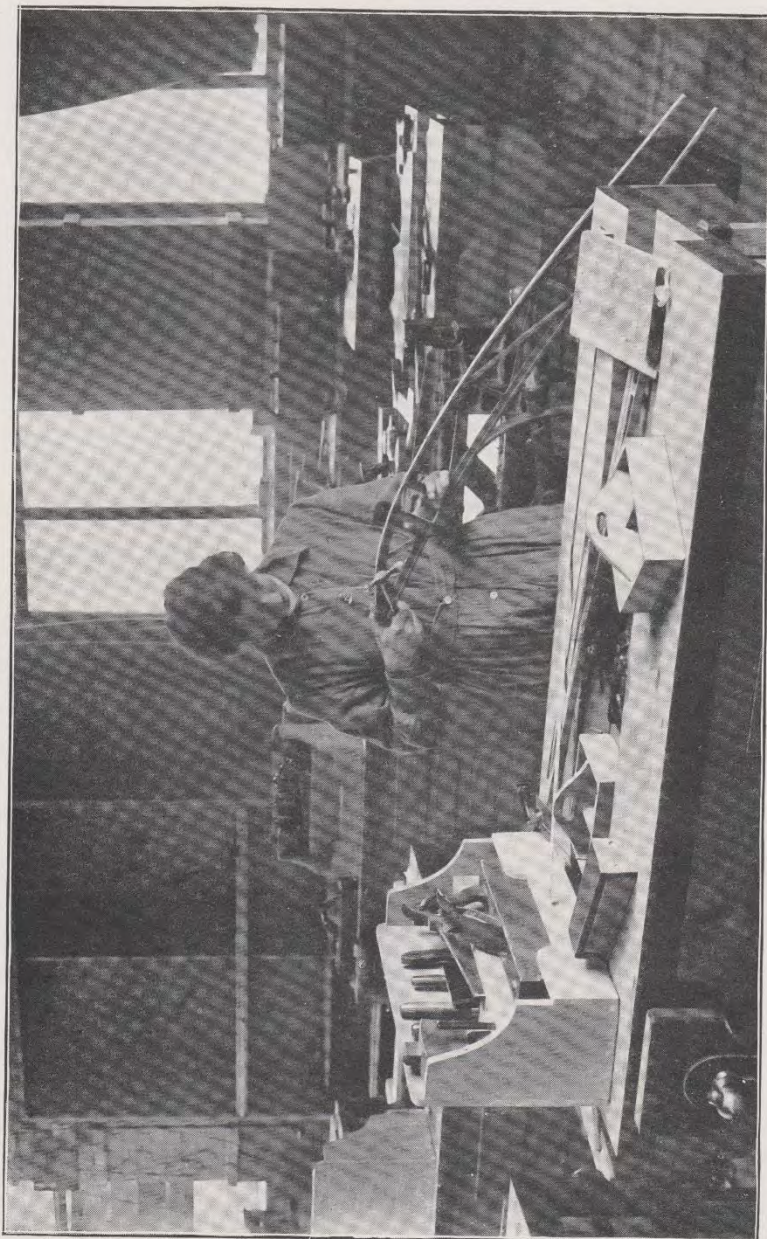
250 HORSE-POWER ELECTRIC CRADLE DYNAMOMETER SET.—

This set is specially arranged for research work on various aero engines. It consists of a balanced cradle mounted on knife edges, and containing two 100 Horse-power Special "Brush" Dynamos. The power of the engine is absorbed by driving one or both of these Dynamos, the current generated being absorbed by suitable resistances situated on the roof of the building. The power is accurately measured by sliding balance weights on two torque arms attached to the cradle, which are adjusted until the torque exerted by the engine is exactly balanced. Optical indicators can be fitted to the engine under test for determining the Indicated Horse-power.

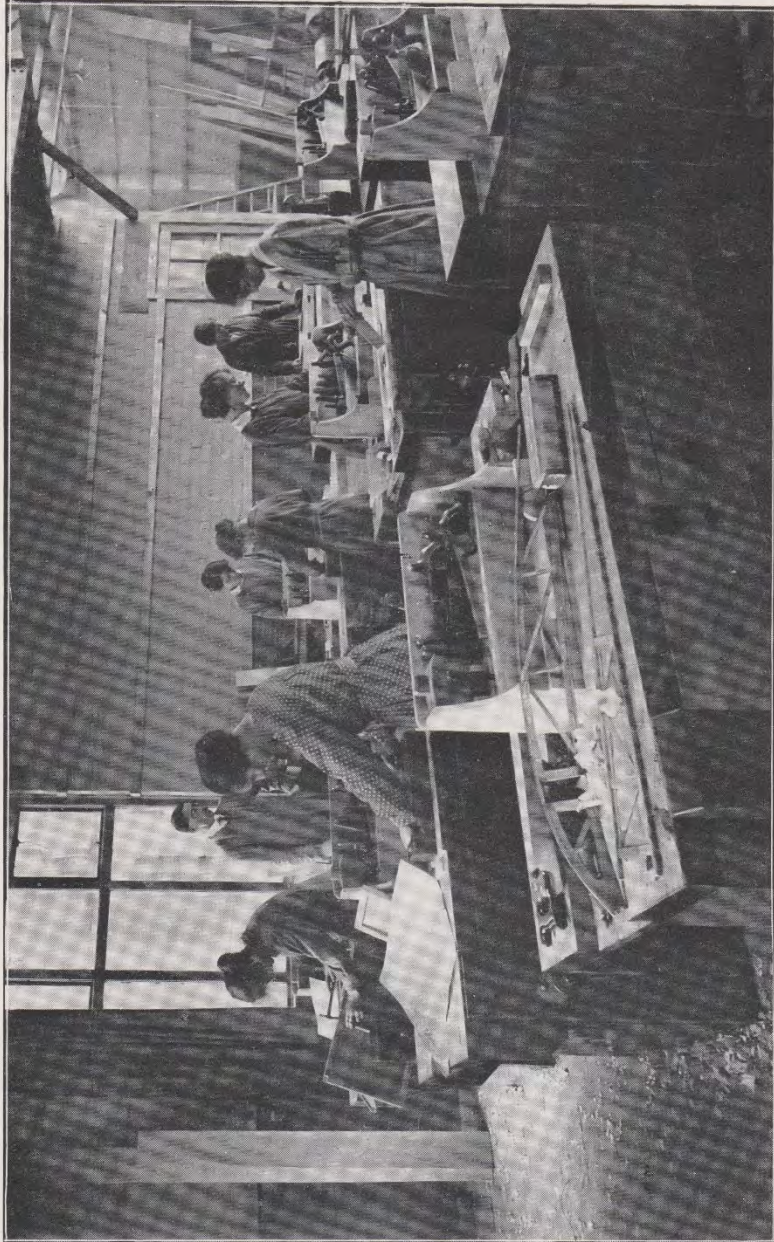
4 HORSE-POWER J.A.P. WATER-COOLED MOTOR CYCLE ENGINE,

coupled by flexible coupling and shaft to a Crypts Dynamo. This set has been specially set up for research work. This engine is equipped with an optical indicator and special arrangement for ascertaining the exact quantity of petrol consumed over a given period. A variable jet carburetter allows the effect of the strength of the mixture on the Indicated Horse-power to be investigated; and arrangements are available for the analysis of the exhaust gas. The Brake Horse-power can be accurately measured electrically, specially accurate instruments being provided for the purpose. The load is variable from zero to the full power of the engine. The set is particularly suitable for experimental work on optical indicators.

A FUEL RESEARCH LABORATORY AND A DARK ROOM are conveniently situated adjacent to the Testing Laboratory. In the Fuel Laboratory suitable trainees have an opportunity of investigating the properties of liquid fuels and coal gas. The equipment includes special apparatus for determining the calorific value of liquid fuel, and both Boys' and Simmace-Abady Calorimeters are available for the determination of the calorific value of coal gas. Two sets of Macfarlane's apparatus are provided for analysing exhaust gases.



PATTERN AND AIRCRAFT WOODWORK SHOP.
Manufacture of Ribs for Aeroplane Wings.



PATTERN AND AIRCRAFT WOODWORK SHOP.

The dark room has been specially built with a view to the elimination of dust as far as possible and the complete exclusion of light. It is fitted with every convenience and is large enough to accommodate several students at the same time without crowding. Wall plugs are provided for electric ruby lamps and equipment is available for enlarging by the use of the arc lamp.

Drawing Office.

Chief Draughtsman : T. A. Doughty.

The Drawing Office has been designed on most modern lines as regards lighting and accommodation.

A glazed cupboard runs the whole length of the Office and contains models and machine parts of all kinds, and a large demonstration blackboard with balanced sliding T square is fitted at the front.

A commodious printing room is arranged as an annexe and contains an Electric Copier, Developing Sink, Dark Room for paper storage, etc.

There is also ample accommodation for the storage of Drawings and Tracings.



Pattern and Aircraft Woodwork Shop.

Superintendent: E. W. Haddon, F.B.I.C.C.,
(Gold Medallist Carpenters' Co.)

Assistant Instructors: H. E. Copelin, A.B.I.C.C.
G. A. Harbidge.
J. W. Harbidge.
J. T. Bostock.

The Department is equipped with the most modern woodworking tools, comprising :—

MECHANICAL WOODWORKER with attachments for cutting Spur, Bevel, Mitre, Helical, Worm and Spiral Wheels, Dovetailing, Tenoning, Spiral Turning, Panel Raising, Parallel and Taper Slotting, Recessing, Square and Slot Morticing, Chamfering and various Core Box work.

30in. CIRCULAR SAW, with rising table.

16in. DOUBLE DIMENSION CIRCULAR SAW, with canting table and guard.

20in. SURFACE PLANER AND THICKNESSER, with canting front table, and balanced guards.

6in. WOOD TURNING LATHE, with Travelling Rack Slide Rest, and Extended Spindle with Face Plate for turning up to 4ft. diameter.

36in. BAND SAW, with canting table, anti-friction guides, and guards.

JIG SAW, with canting table.

22in. DISC and 10in. VERTICAL RECIPROCATING BOBBIN SANDER, with two canting tables.

VERTICAL SPINDLE MOULDER, with eccentric fence and two guards.

VERTICAL BORER, equipped with bits up to 2in. diameter.

6 STONE GRINDER, with drip taps.

24in. PLANE IRON GRINDER.

HAND MORTICING MACHINE.

CAPSTAN STAND TRIMMER.

THREE BENCH TRIMMERS.

28 SETS BENCH TOOLS in portable racks on benches.

TOOLS FOR SPECIAL WORK, in cupboards with glazed sliding doors.

TWO 3-POT GLUE HEATERS.



GENERAL MACHINE SHOP.
Operators on "Southworth" Turret Lathes.



OXY-ACETYLENE AND ELECTRIC WELDING SHOP.

The Shop is provided with a complete Dust Extractor Plant, which conveys all wood refuse directly to the central heating chamber, there to be used in a hot water heating system. This provision not only ensures efficiency and safety from fire risks, but greatly enhances the comfort of the workers.

Foundry.

Responsible Instructor: H. Wakerley.

The Foundry is completely equipped in every respect for the manufacture of all types of castings, large or small; the depth of sand varying from one to five feet in order that pit work may be undertaken. The Equipment Consists of the following Apparatus :—

- Five ton "Whiting" Cupola, complete with charging platform;
- One ton "Whiting" Tilting Cupola;
- 300lbs. "Morgan" Gas Fired Tilting Crucible Furnace;
- High Pressure Air Blast Steel Furnace;
- Gas Fired "Wright" Pit type Aluminium Furnace;
- Two "Carr" Crucible Furnaces for Brass;
- Melting Pot for low temperature alloys;
- Two annealing Furnaces for Heat Treatment of Castings and Steel;
- Malleable Iron Oven;
- "Ajax" Jolt Ram Moulding Machine with rapping, turn over, and drawing attachments;
- "Mumford" Jolt Ram Moulding Machine;
- "Farwell" Moulding Machine;
- "Adaptable" Moulding Machine;
- "Pridmore" Moulding Machine;
- Fettling Bench with Pneumatic Exhauster;
- Oscillating Sand Sifting Machine;
- "Alfred Herbert" Sand Mixing Machine;
- Tumbling Barrel;
- Sand Blast Apparatus;
- Twin Norton Grinder;
- "Ingersoll Rand" Air Compressor, with air receiver and supply pipes to all parts of the Foundry, so that Dusting Nozzles, Pneumatic Rammers, Drills, Chipping Hammers, Plate Rappers, etc., may be used when required.

Smiths' Shop.

Responsible Instructor: W. Watson.

Details of Equipment :—

- Two "Alldays and Onions " Double Hearths, with self-contained Electric Blowers;
- One small Hearth for Tool Work;
- 1 cwt. Pneumatic Hammer, with Electrically driven Compressor;
- Belt driven Tilt Hammer;
- " Meker " Hardening Furnace for High Speed Steel;
- " Utile " Blowpipe Hearth;
- Four Anvils;
- " Lumsden " Oscillating Tool Grinder;
- Equipment of Swages, Fullers, etc., for hand and power use;
- A " Herbert Morris " 10 ton Travelling Crane runs over the shop, so that heavy work may be portered whilst forging.

Oxy-Acetylene and Electric Welding Shop.

Responsible Instructor: A. Parker.

Equipment :—

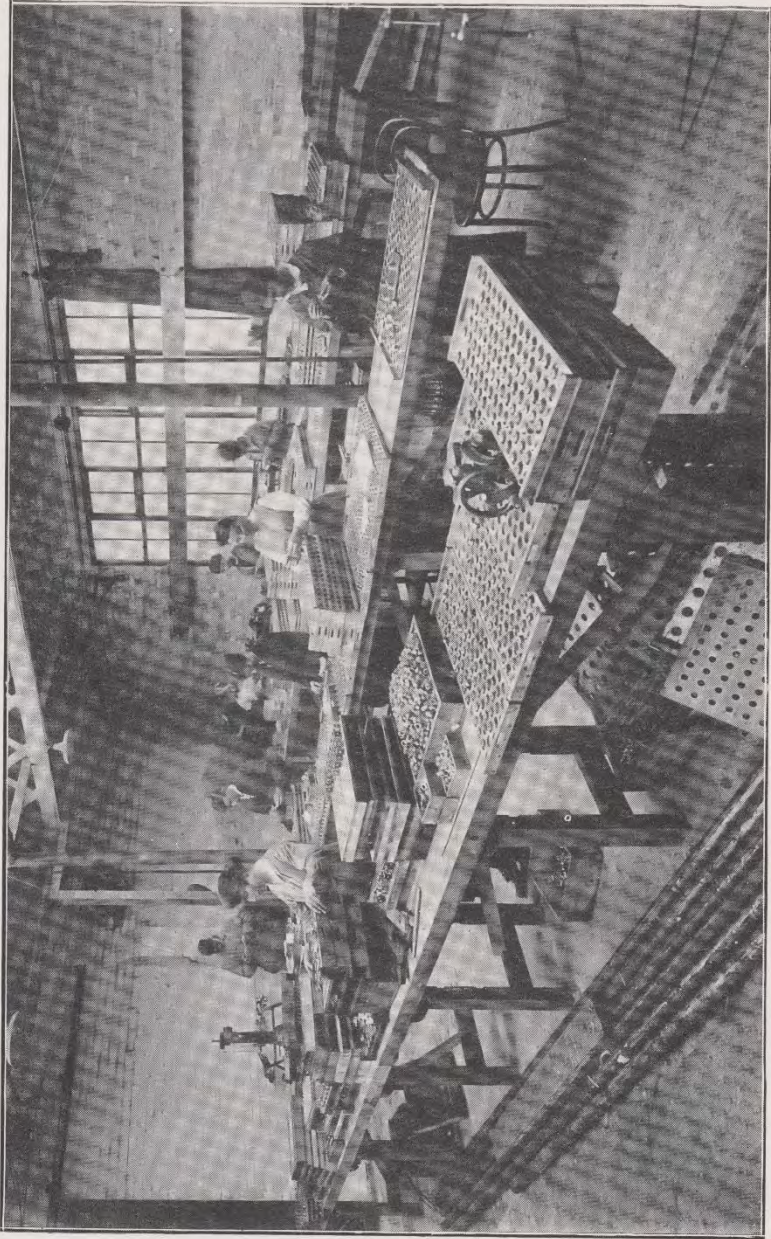
The Welding Shop is equipped on the most modern lines, with benches so arranged that the fumes pass directly away from the operator, and thus give no injurious effect after continued working.

Ten Blow Pipes are supplied, attached at different points round the room to the incoming Acetylene supply pipe. The Acetylene is either used on the high pressure system from cylinders of dissolved Acetylene, or on the low pressure system from a complete Acetylene generating plant set up in an adjoining building.

Workers are thus made quite familiar with the characteristic action of both systems.

In addition to the ordinary blow pipes, full apparatus is provided for Cutting, Brazing, and Lead Burning.

Complete " Quasi-Arc " Electric Welding Apparatus with Electrodes, Welding Screws, Shields, Instruments, etc.



INSPECTION DEPARTMENT.



CANTEEN FROM NORTH EAST.
(Workers at Afternoon Tea).

Aero Sheet Metal Work.

Responsible Instructor: H. C. J. Wix.

This Shop was designed to train workers in the manufacture of small fittings for Aircraft work, such as Fish Plates, Control Wire Guides, Fuselage Sockets, etc.

Presses, Bending Stakes, Drilling Machines, Marking-out Tables, and other appliances are provided for the use of the workers.

Inspection Department.

Senior Viewer: E. S. Badger.

All work before leaving the shop in which it is made, is carefully inspected, and the Inspector's report recorded on the worker's time sheet.

The work is then passed on to the Inspection Room, where it is again examined, and if satisfactory, receives the Inspector's stamp.

In the case of repetition jobs from the Automatics, all the more modern appliances for rapidly measuring articles are provided, so that viewers receive an excellent training in workshop methods. Drilling Machines, Hand Tapping Machines, and a number of Centre Lathes are provided for finishing off parts where required after they leave the Automatics.

Canteen.

Superintendent : Miss E. M. Fogg.
Assistant Superintendent : Miss M. J. Moseley.
Assistants : Miss N. Foster.
Miss D. Hoares.
Miss F. Bailey.

The Works' Canteen is a separate building, designed to seat about 100 workers in a shift in addition to the Staff.

It is open from 11 a.m. to 10 p.m. though workers can only be served with refreshments outside work hours, with the exception of a rest period of fifteen minutes during the afternoon shift, when all workpeople are allowed free access to the Canteen.

A full dinner is provided at a cost of 1s., whilst a good meal consisting of soup and pudding may be obtained for 6d. If workers bringing their own dinner require this heated, a minimum charge of twopence per person is made.

Tea and supper is served "A la carte" according to menu, from 6 p.m. onwards.

The Canteen is licensed for the sale of Tobacco and Cigarettes, and smoking is permitted at any time.



The Welfare and Social Side of the Factory.

It is fully realised that a large proportion of the Students in training come from a distance, and consequently find themselves without the usual home comforts, and the companionship of friends in the town.

This being so, every effort is being made to make the "out of work" hours as pleasant as possible, and to this end, a club room has been built and fully equipped on a scale commensurate with the rest of the factory.

The Club Room which adjoins the Canteen, is provided with a piano and full sized billiard table. The Room is made comfortable by carpets and lounge chairs, and is open every evening (including Sunday) until 10 p.m. Supper can be obtained after 8-30 p.m. and social evenings are regularly organised by the Workers Committee, the Trainees providing from amongst themselves an excellent variety of Artistes.

On the same floor, in fact forming part of the same suite of rooms, is a well furnished rest room for use during working hours when necessary, and a first aid room equipped with every appliance for rendering immediate attention in case of accident.

As far as is possible, arrangements are made by the Welfare Supervisor for trainees to have good apartments in homes in the town, but as, of late, this has become increasingly difficult it has been thought better to open a special Hostel in connection with the Factory.

A large house with extensive grounds has been acquired, and is being fitted up with every convenience for the housing of upwards of thirty male workers. Should this prove a success the management will consider the extension of the scheme with a view to providing similar accommodation for women workers. The charges will be based on a very moderate scale, just sufficient to defray working expenses, and full accommodation for mid-day meals will be made at the Canteen.



CANTEEN FROM NORTH WEST.
(Workers at Afternoon Tea).



CANTEEN KITCHEN.



GENERAL OFFICE.

General Note.

A study of the general arrangement and lay-out of the Factory will shew that it is designed to be self-supporting, and to duplicate on a fair scale a complete Engineering Works. Its equipment enables the management to undertake contracts involving all the work usually required from a productive firm. That is to say, a job can be carried right through the various processes required from the Drawing Office, Pattern Shop, Foundry and Machine Shop, with the auxiliary assistance usually required from the Precision Gauge Department and the Tool Room until, before finally leaving the Works it receives the stamp of approval in the Inspection Room.

By this system a Trainee is brought into touch with actual working conditions as a definite producer; and the peculiar experience gained thereby is invaluable, and cannot be attained by any system of graded exercises however carefully controlled.

The Factory was inaugurated in January, 1916, and since that date 1,340 workers of both sexes have been trained and placed in various Munition Works throughout the country.

In addition to the productive munition work carried out by the various departments of the Instructional Factory, both the Mechanical and Electrical Engineering Laboratories of the Technical Institute are actively engaged upon testing work for the Air Board and Admiralty. The Laboratories are well equipped with testing plant and specialised attention has been devoted to the testing of Aeroplane Timber.

The attention of Employers is particularly directed to the facilities offered by the Training system of the Factory. The General Manager is always pleased to give any information regarding the work, and to visit firms with a view to assisting in the provision of suitably trained labour. In many cases considerable success has resulted from firms sending their own unskilled labour to the Factory for the particular type of training required, sometimes even placing suitable sub-contracts for the exact work upon which the training is to be given. This system obviates any possible difficulty in drafting workers to a district with which they are not familiar. Maintenance allowance will be paid to all such approved workers in accordance with the previously stated scale, and there is no charge of any kind made to the Employer.

January, 1918.



