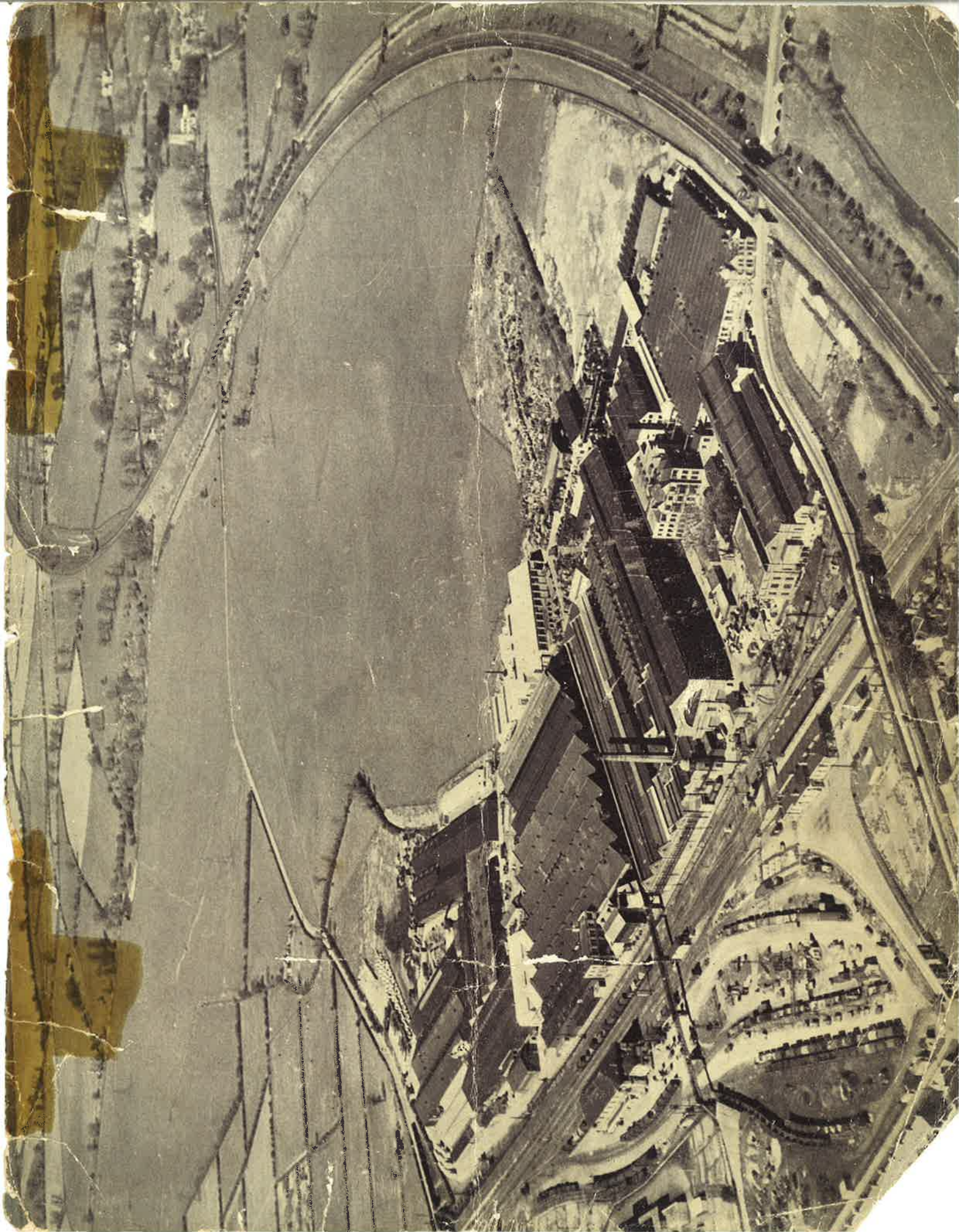
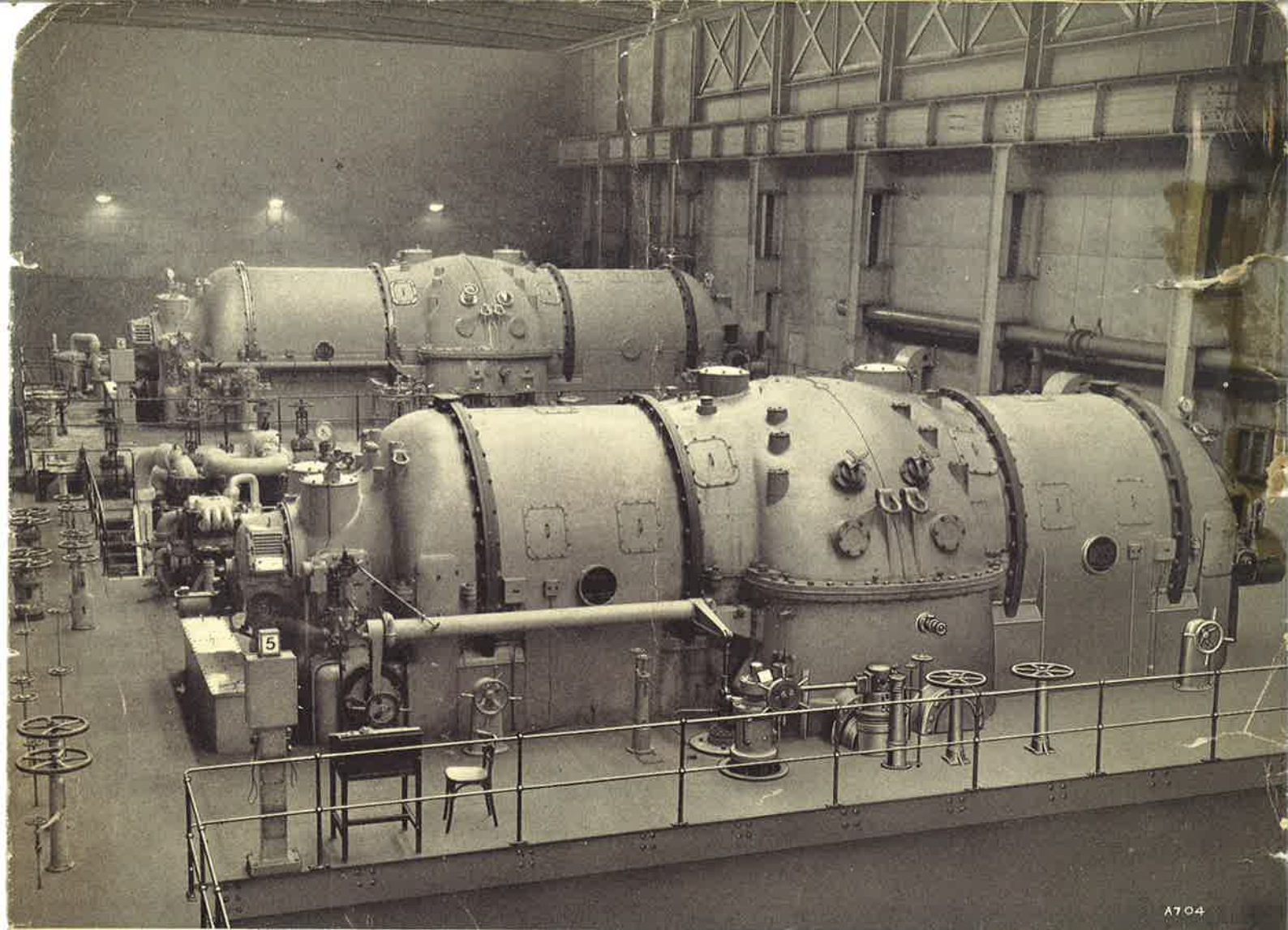


BRUSH

*Engineering
As a Career*





A704

Brush-Ljungström Turbo-Alternators employ the counter-rotation principle, with resulting increase in efficiency. The various shops employed in their production afford a valuable training ground.

Should you require further information after reading this brochure ; this can be obtained from :—

Chief Education Officer :

The Brush Electrical Engineering Co. Ltd.
Loughborough, England

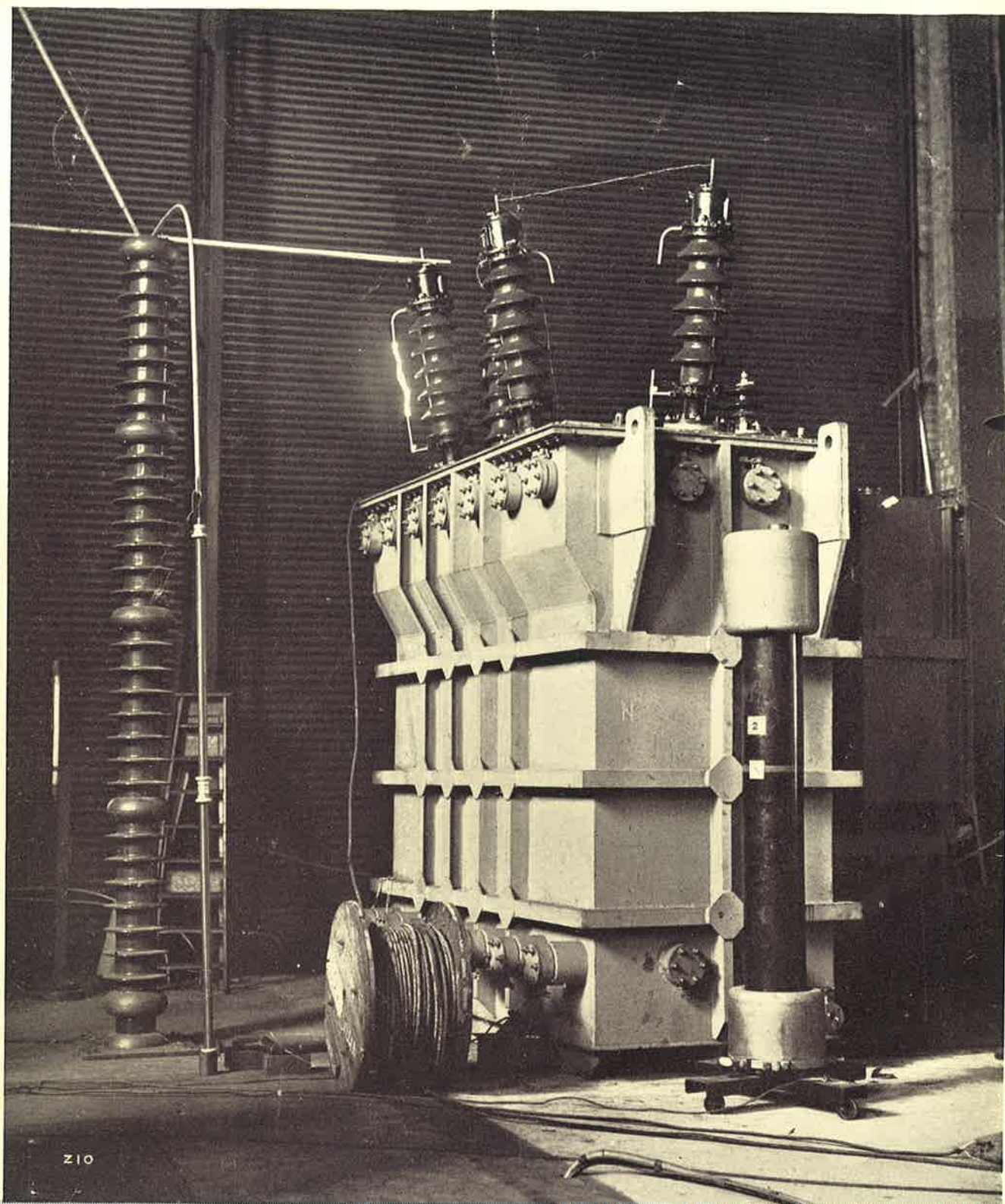
INTRODUCTION

DURING the 70 years of its existence The Brush Electrical Engineering Co., Ltd. has acquired a wide reputation for the high quality of its products. This reputation has been built on first class workmanship and design, and these in turn have resulted from the excellent training schemes operated by the Company. The education and training of all its Apprentices is an important feature of the Company's policy, and many prominent engineers have received their training within the Brush organisation.

This Brochure outlines the various schemes which exist for the training of Apprentices. It will be of interest to Graduates about to leave College, to boys and girls leaving school and to those concerned with advising them. Young people selected to take advantage of these courses will find ample opportunities for advancement in the large Brush organisation where there is a career for all who acquit themselves well. They will be able to take their place in a team which has a tradition of high quality, outstanding performance, and good workmanship over three generations.



Graduate Apprentices assisting to connect the ends of the stator windings of a 30,000 kilowatt Turbo-Alternator.



Impulse Test on a 4,000 kilovolt-ampere 66,000 11,000 Volt Transformer, showing flash over on high tension terminal under test. (By courtesy of the National Physical Laboratory.)

THE BRUSH ELECTRICAL ENGINEERING CO. LTD.

In 1879 The Anglo-Brush Electric Light Corporation was founded in Lambeth, London, to exploit the inventions of Charles Francis Brush of Cleveland, U.S.A., and the Corporation immediately began to take a leading part in the development and commercial application of electricity. Many of the earliest electric light installations in this country were manufactured by the Brush organisation.

With the acquisition of the Falcon Engine and Car Works at Loughborough in 1889, the enlarged undertaking changed its name to The Brush Electrical Engineering Company Limited. From then on, the Company continued to take an increasingly active part in the development of the Electrical Engineering Industry. Some years ago the manufacture of oil engines was also commenced, and towards the end of 1938 the Company strengthened its position in this field by acquiring the business of Petters Limited of Yeovil, Somerset. In 1949 the Brush Company merged with the various companies of the Associated British Oil Engines Group which manufactures petrol engines and oil engines of from $1\frac{1}{2}$ to 1,440 horsepower, the Brush/Associated British Oil Engine Group now being the largest manufacturers of these engines in the country. With this Group is associated a number of other engineering companies so that the Brush organisation offers unique scope for the training of young engineers and ample opportunities for subsequent careers at home and abroad.

The products manufactured at the present time at the Loughborough Works include :—

Brush-Ljungström Radial Flow Turbines.

Axial Flow Turbines.

Rotating Electrical Machines.

High and Low Voltage Switchgear.

Transformers for power and distribution networks.

Oil Engines.

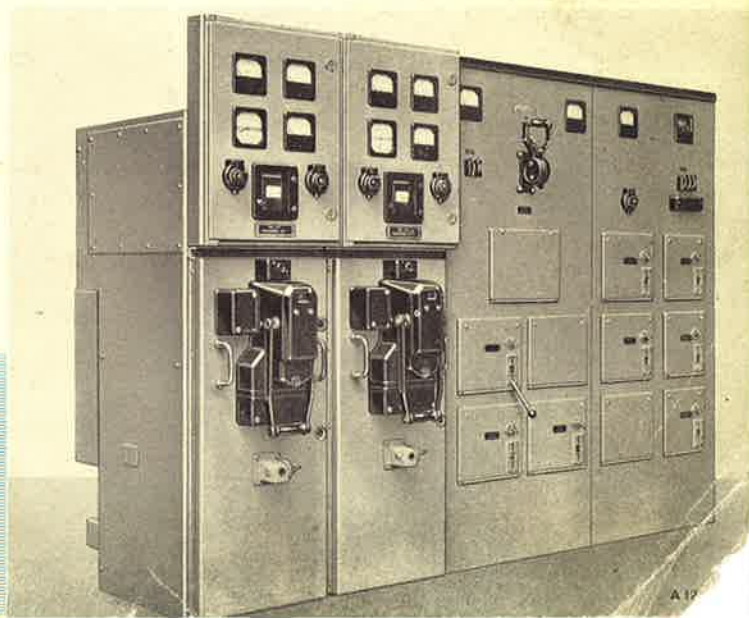
Diesel Driven Generating Sets.

Diesel Electric Locomotives.

Traction Equipment.

Complete Electric Power Plants.

440 volt Switchboard with two vertical draw-out transformer control panels and H.R.C. Fuse-Switchgear for feeder circuits.





A1489/G28

Above :—Apprentices assembling 400 ampere horizontal isolation type switchgear.

Apprentices work either individually with a skilled craftsman or in groups under an experienced supervisor.

Below :—Apprentices assembling control panels for 55 kilowatt diesel driven generating sets.



A1496/G35

The BRUSH APPRENTICE TRAINING SCHEMES

The technical personnel of the engineering industry comprises in the main professional engineers, technicians and craftsmen. The range of education and training required to cover these varying needs is a wide one. Brush Apprenticeship Schemes meet all these needs and are designed to ensure that Apprentices are happily placed in jobs suited to their capabilities.

The Schemes are grouped under six headings:—

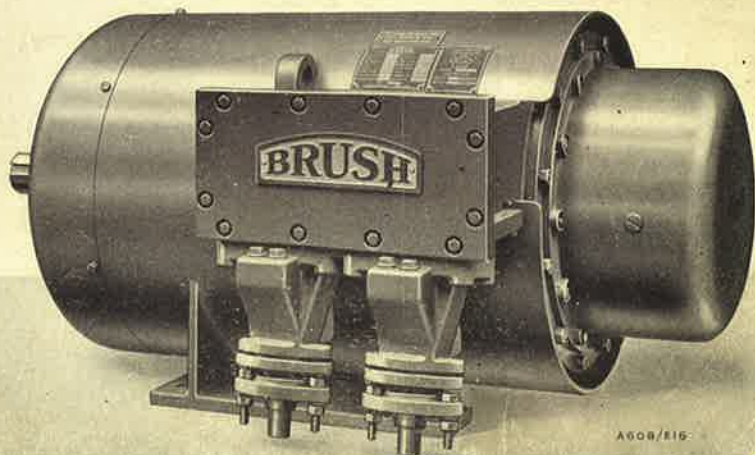
1. Craft Apprenticeship.
2. Drawing Office Student Apprenticeship.
3. Engineering Student Apprenticeship.
4. Engineering Graduate Apprenticeship.
5. Engineering Graduate Apprenticeship (Sandwich Course).
6. Vacation Training.

The pages which follow outline the general principles on which each of these Schemes is based.

Great care is taken to ensure that each individual accepted for training is placed in the Scheme most suited to his requirements. In certain cases special training programmes are arranged to take into account any previous experience which has been obtained or where the special requirements of the case would not be met by any one of the Schemes listed above.

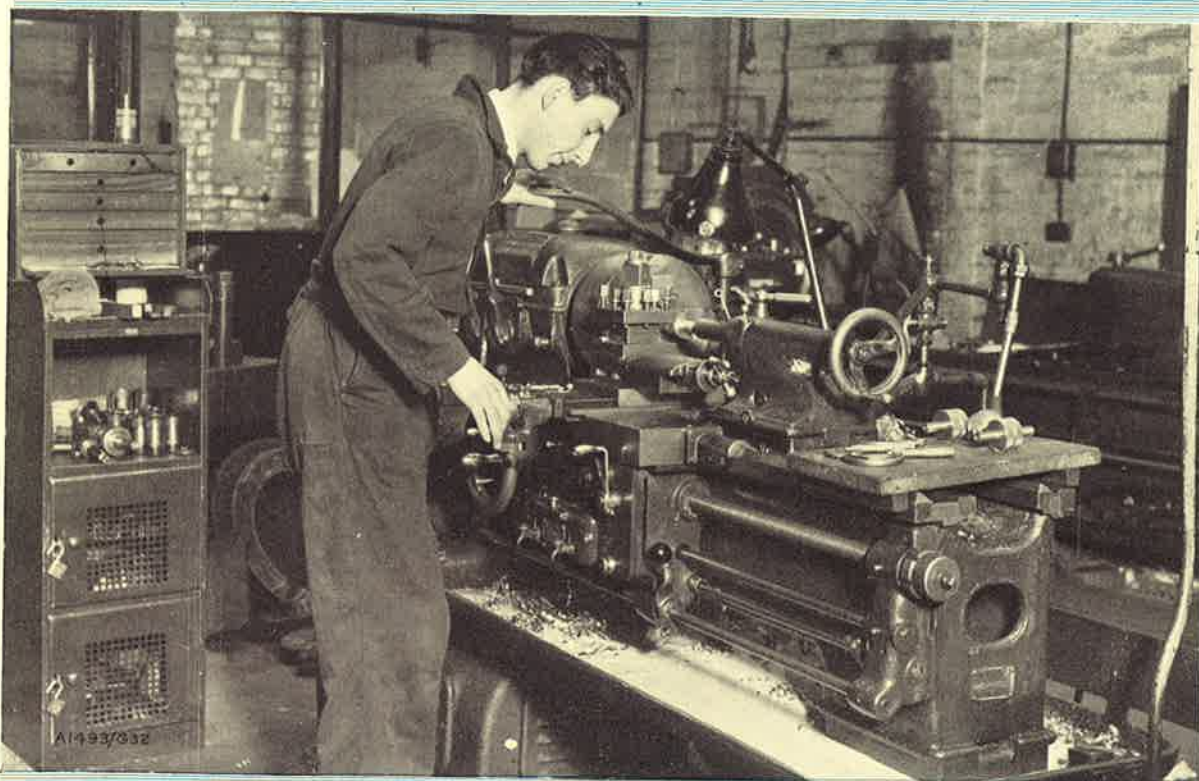
An important feature of all Brush training is that the Company acknowledges its responsibility for developing to the utmost the individual's personal qualities so as to enable him to take his place in the industrial community as a mature and responsible adult.

45 Horse Power
Flameproof
Slipring Induc-
tion Motor.





An Apprentice Tool Room Fitter scraping the bore of a coupling plate.



An Apprentice Turner operating a centre lathe.

CRAFT APPRENTICESHIP

Craft Apprentices are selected from applicants who are preferably between the ages of 15 and 16 but who are in any case not older than 17. They normally apply while still at school. Applications from Secondary Technical School pupils are specially welcomed. Applicants from Secondary Modern Schools should have attained a reasonable standard in Arithmetic and English Composition and they may be required to take a short educational test in these subjects when attending for interview. Candidates may be required to undergo an examination by the Works Medical Officer.

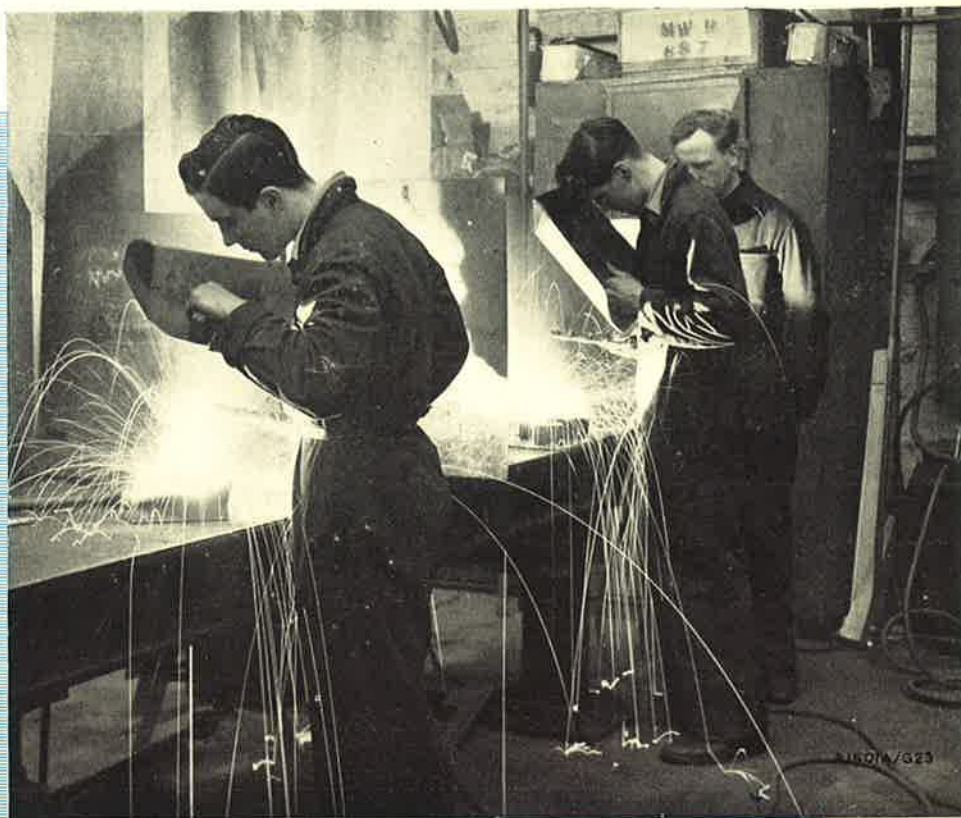
Successful applicants are appointed for a probationary period of six months during which their records are examined and a decision is taken as to the trade in which each apprentice is to be trained. In making this decision the boy's wishes, the number of vacancies and the policy of the Company are all considered.

At the end of the probationary period the Apprentice, if accepted, is required to sign, with his parent or guardian and the Company, an Agreement or indenture for training in the selected trade. The indenture may be endorsed or amended at a later stage should conditions make it desirable. The Apprenticeship normally terminates at the age of 21, and a Brush Certificate is presented to the Apprentice outlining the experience he has gained.

It is a condition of employment of Craft Apprentices that they attend appropriate technical courses held during the day as part of their training throughout their apprenticeship. The actual course selected depends in each case upon the standard of education already attained by the Apprentice, and upon his abilities and needs.

Craft Apprentices may in certain circumstances be eligible for reclassification as Drawing Office Student Apprentices or Engineering Student Apprentices.

Craft Apprentices
welding brackets for
"Petter" Oil Engines.



An Apprentice
making the pattern
for a bearing.



Among the trades in which a systematic course of training is given are :—

Electrical Machine Winders.

Fitters and Erectors.

Machinist.

Maintenance Electrician.

Moulder and Core Maker.

Pattern Maker.

Plater.

Tool Maker.

Transformer Winder.

Turner.

Welder.

In all cases Craft Apprentices spend the first six months of their Apprenticeship at the Craft Training Centre where they are in the care of skilled Instructors. At the Craft Training Centre they not only acquire knowledge of the basic skills of their chosen craft, but also receive instruction in the technology of that craft. Great importance is also attached to the development of character and to the fostering of a sense of community. The Apprentice Supervisor and his Instructors take a personal interest in this aspect of their work.

The Company give no undertaking to provide employment at the end of their training, but Craft Apprentices are normally offered such employment in an appropriate department.

Apprentice assembling
400 amp. Low
Tension Circuit Breaker.





A1498/G37



00183/G40

A Graduate Appren-
tice engaged on gas
turbine design.

View of one of main
Drawing Offices.

DRAWING OFFICE STUDENT APPRENTICESHIP

Drawing Office Student Apprentices are selected from applicants who have, as a necessary minimum, obtained the School Certificate with Credits in Mathematics, English, and Physics or General Science. Applicants should be interested in drawing and have mechanical interests. When attending for interview they may be required to take a short test of general ability, and may be required to undergo an examination by the Works Medical Officer. Drawing Office Student Apprentices are also selected from Craft Apprentices by reclassification.

The first six months are spent at the Craft Training Centre, and during this time suitable candidates are selected to spend a further six months in a Drawing Office. After successful completion of the probationary period the Apprentice is required to sign, with his parent or guardian and the Company, an Agreement or indenture for training as a draughtsman. The Apprenticeship lasts four years, or until the Apprentice attains the age of 21 years, whichever is the longer.

A Drawing Office Student Apprentice attends National Certificate classes on one day a week at the Loughborough College until the end of his Apprenticeship.

Brush Diesel-Electric
Shunting Locomotive
in operation on
British Railways.





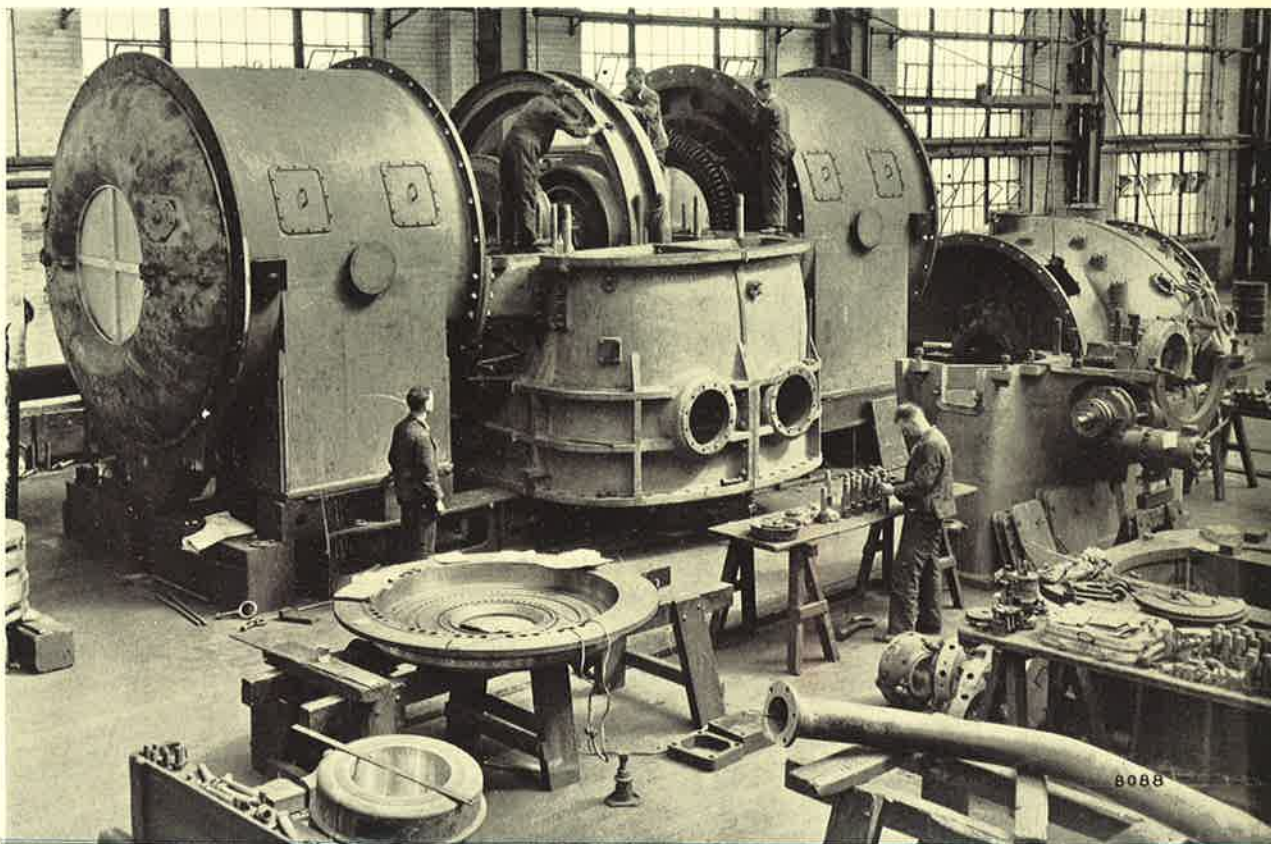
(Above)
Winding rotor coils for 400 kilowatt
Alternators.

(Below)
Fitting and assembly of a 1,200
ampere 11,000 volt Oil Circuit Breaker.

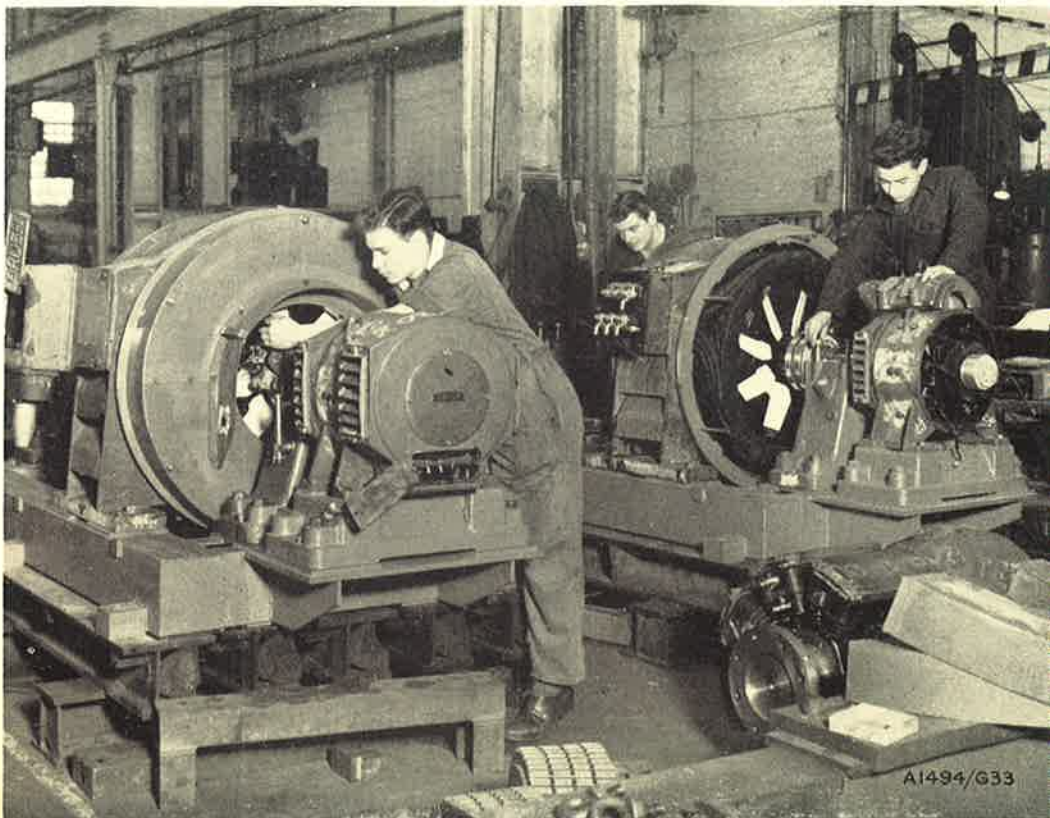


The first year of training is divided equally between the Craft Training Centre and one of the Drawing Offices. During the second year, the basic mechanical training is extended in the foundry and pattern shop, in the fabrication department and in fitting and assembly of small parts. During the third year the Apprentice gains experience of the manufacturing, development and test of the products with which his Drawing Office is associated. The remainder of his training is spent in the Drawing Office itself.

The wage scale for Drawing Office Student Apprentices is given at the back of this brochure. At the end of the training, apprentices are normally employed as junior draughtsmen although the Company does not undertake to provide such employment. Those who are engaged on the staff are given opportunities of acquiring further experience, and of subsequent advancement according to aptitude and ability.



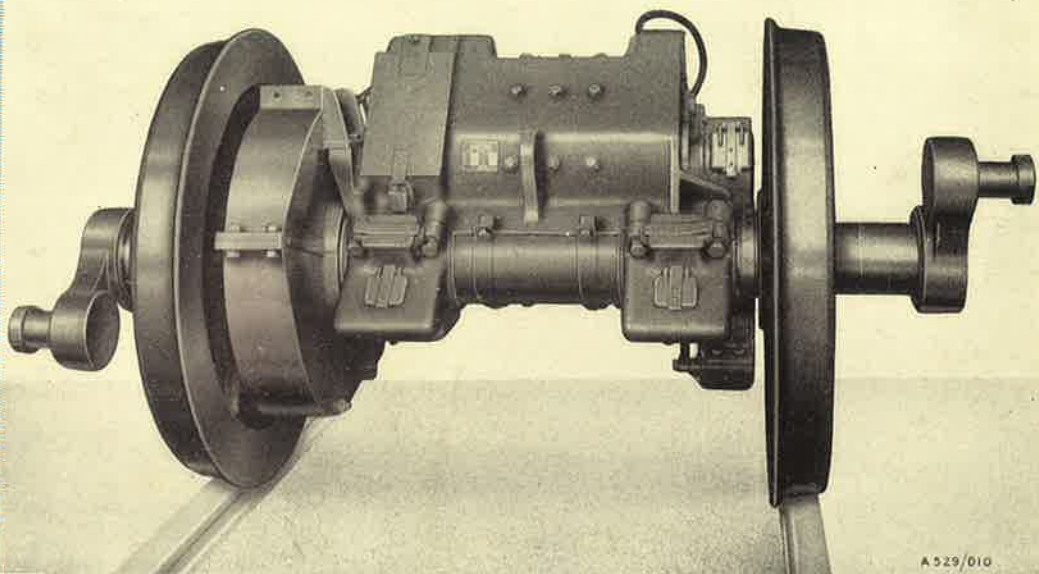
Apprentices assist in the erection of a 30,000 kilowatt Turbo-Alternator Set.



Erection
of 200 Kilowatt
Alternators for
diesel - electric
generating sets.

A1494/G33

116 Horse Power
Traction Motor
mounted on a
locomotive axle
with wheels.



A529/D10

ENGINEERING STUDENT APPRENTICESHIP

Engineering Student Apprentices are selected from boys who have attained a high educational level. Possession of a Higher School Certificate with principal subjects of Pure and Applied Mathematics, Physics and Chemistry is desirable, and the necessary minimum is a School Certificate giving Matriculation exemption with Credits in Mathematics, English and Physics or General Science. When the General Certificate of Education replaces the existing School and Higher Certificate, a standard equivalent to that outlined above will be required. Evidence of engineering interests is required. Membership of sports teams and of youth clubs or school societies is desirable. When attending for interview they may be required to undergo an examination by the Works Medical Officer. Engineering Student Apprentices are also selected from Craft Apprentices by reclassification.

Successful applicants are appointed for a probationary period of six months which is spent at the Craft Training Centre. When this has been completed and the Apprentice is confirmed as suitable as an Engineering Student Apprentice he is required to sign, with his parent or guardian and the Company, an Agreement or indenture. The Engineering Student Apprenticeship, including probation, lasts four years or until the age of 21 years, whichever is the longer.

An Engineering Student Apprentice attends National Certificate classes on one day a week at the Loughborough College, commencing at the second year, and taking extra engineering drawing usually on one evening a week. He is expected to attain Higher National Certificate in either Mechanical or Electrical Engineering in the four years.

After the first six months in the Craft Training Centre, Engineering Student Apprentices spend twelve months extending their basic mechanical training in the Pattern Shop and Foundry and in Fabrication, Machining, Fitting and Small Assembly. The next twelve months are spent on basic electrical training on Electrical Machines, Switchgear and Transformers, and also on Turbines. Towards the end of this basic training there is a series of



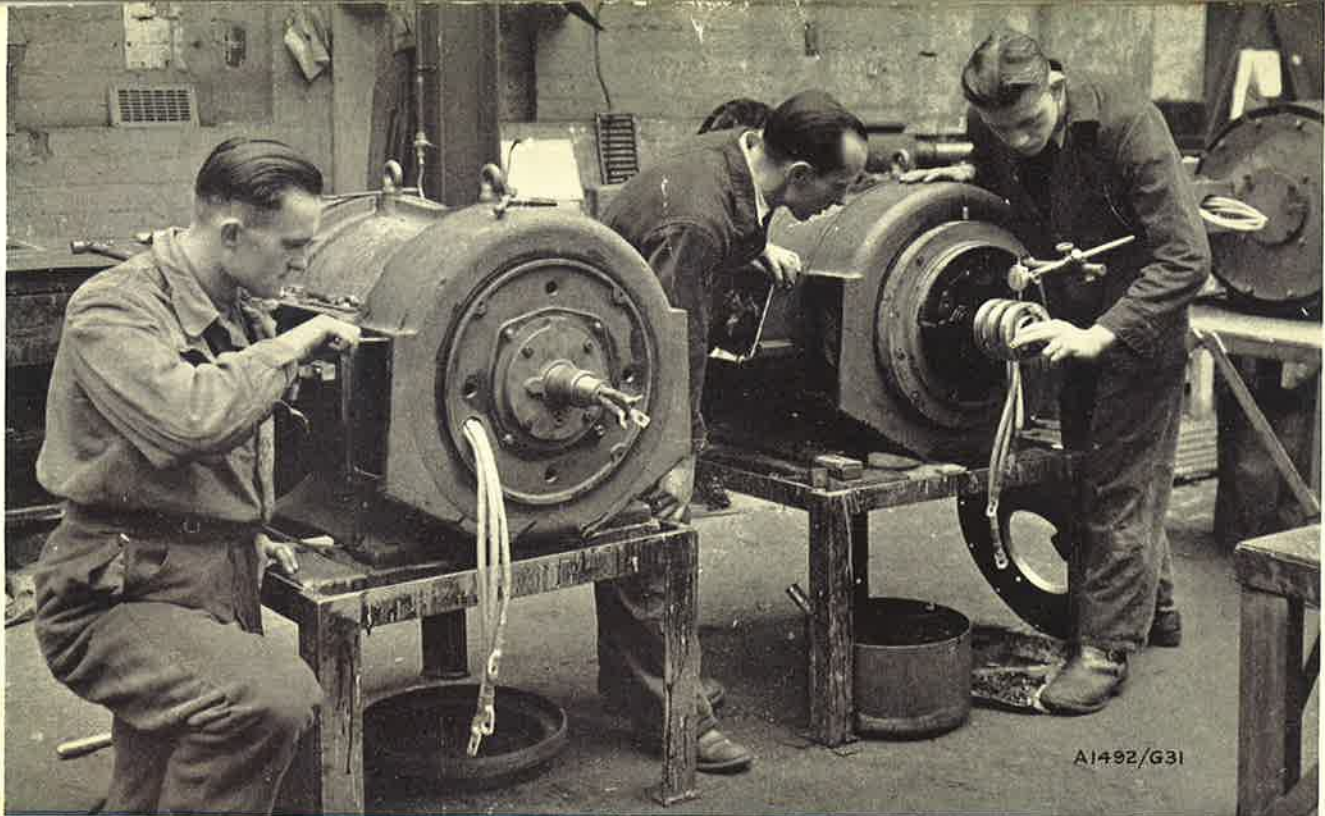
AI488/G27

Apprentices assisting in assembly



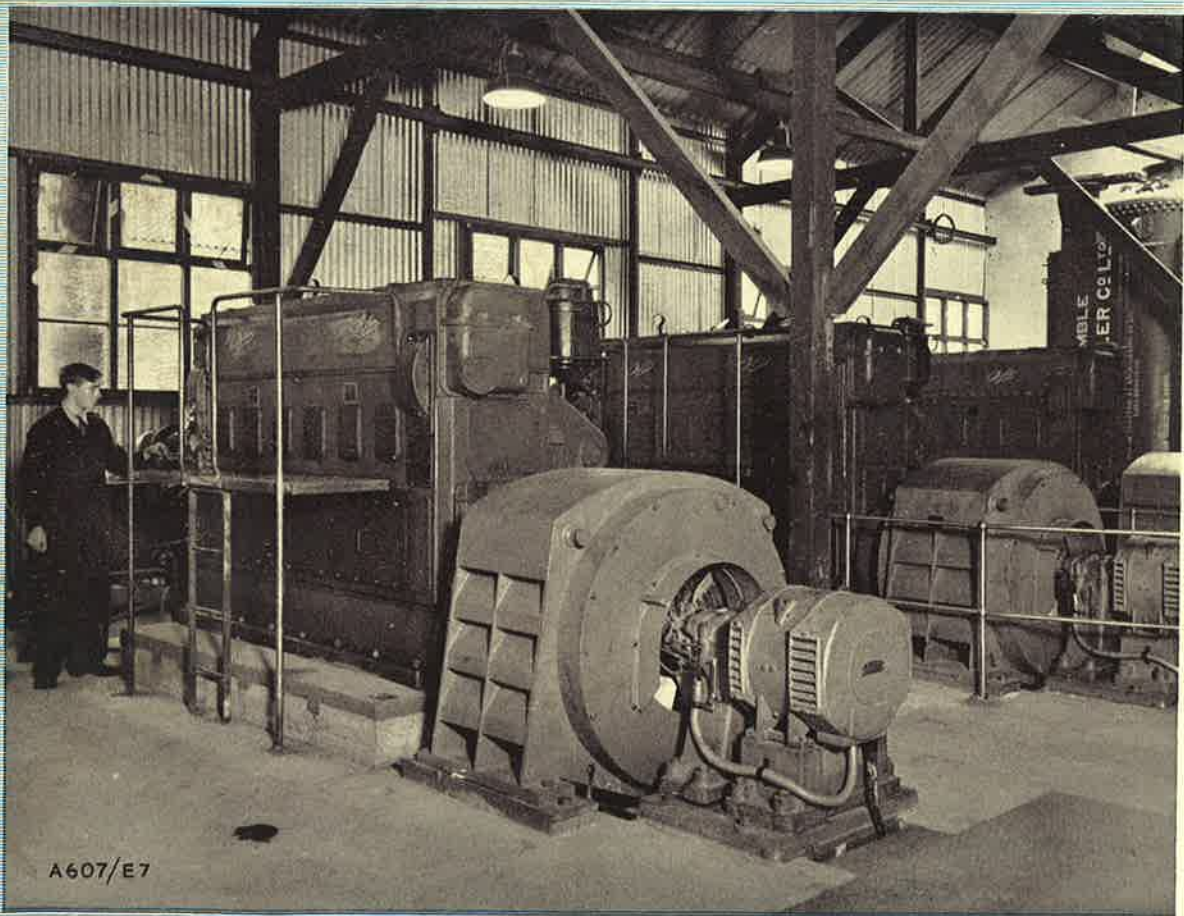
A1488/G27

of 150 kilovolt-ampere Transformers.



A1492/G31

Assembly of Induction Motors.



A607/E7

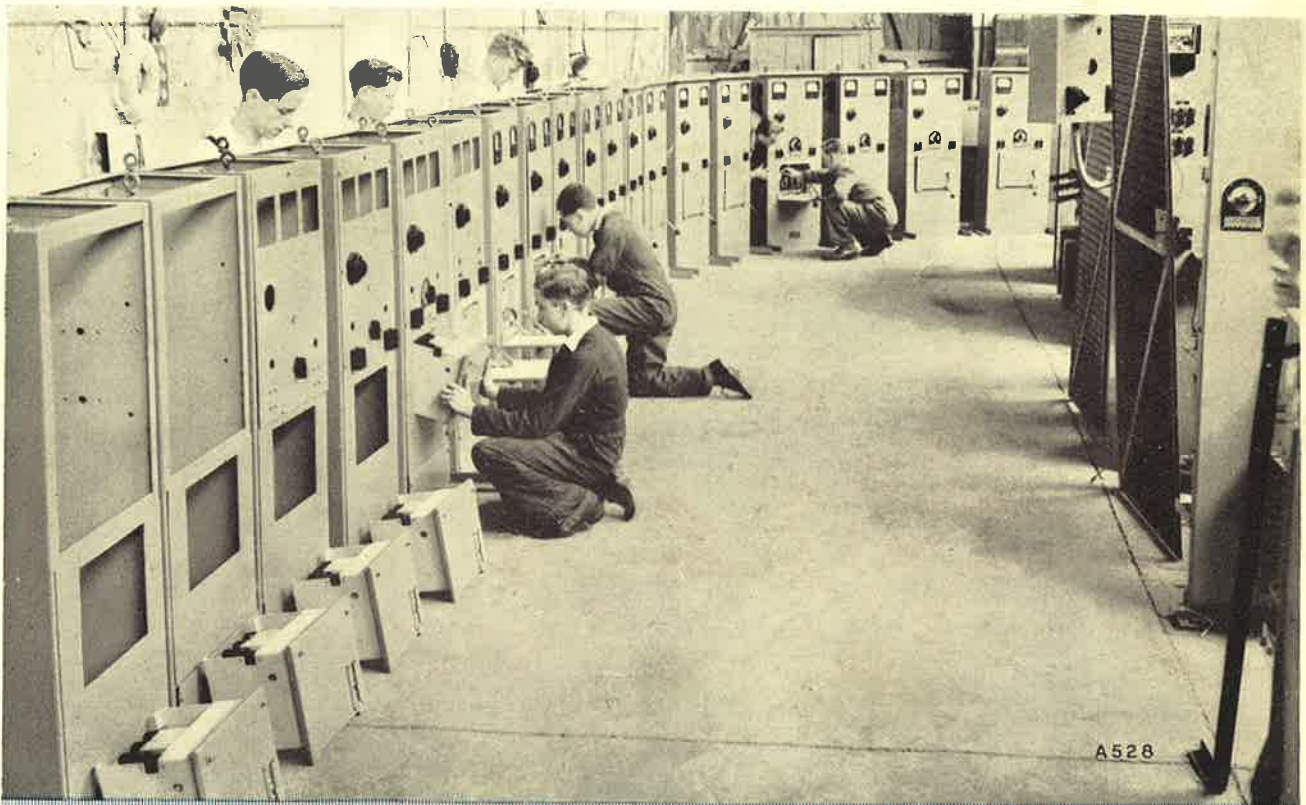
A "Petter/Brush" Diesel-Electric generating plant installation in one of the Company's power houses.

interviews and it is decided in which of three main branches the Engineering Student Apprentice will complete his course. He may elect to be trained as :—

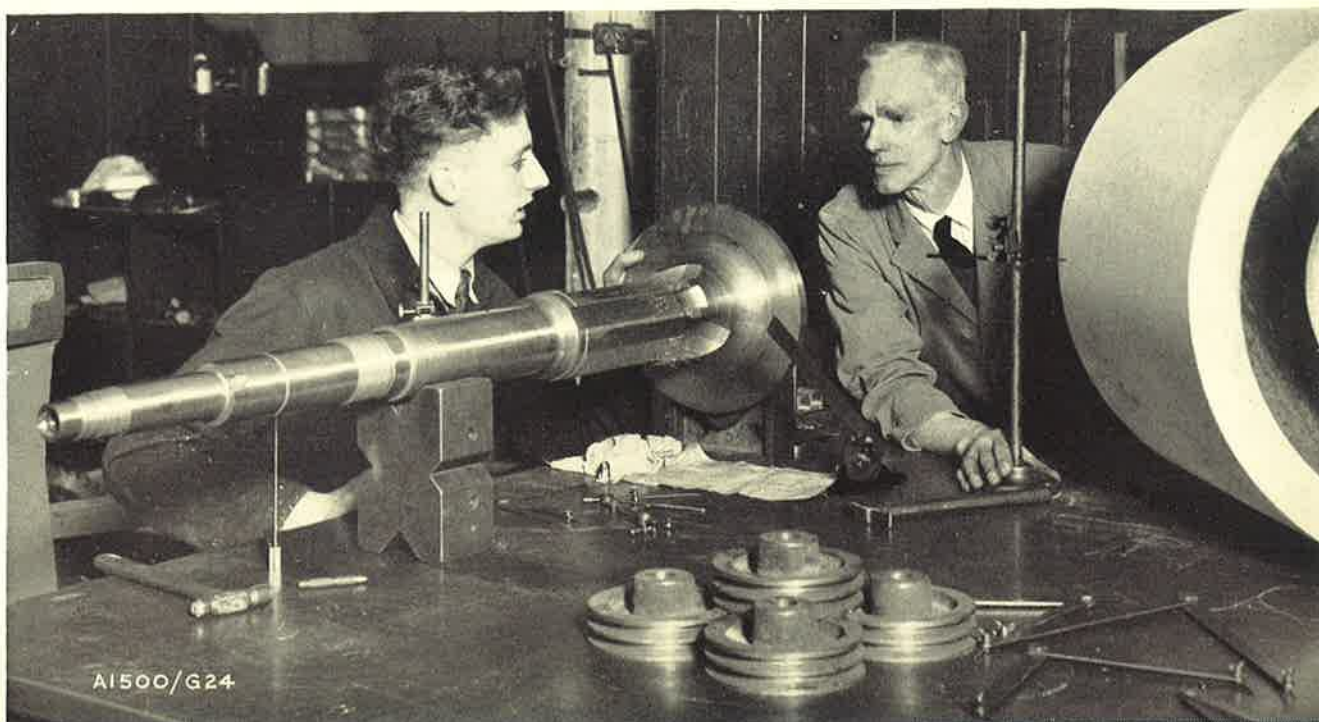
- (a) a Product Engineer, specialising on technical work which may include design and development on one or more of the main products, e.g., turbines, or electrical machines, or switchgear, or transformers, or traction.
- (b) a Sales Engineer, or
- (c) a Production Engineer.

In all three courses at least six months of the remaining eighteen months of Apprenticeship is spent in a Drawing Office. Preference is given to Student Apprentices who have completed their training when filling vacancies on the staff although the Company gives no undertaking to provide such employment. Staff engineers are encouraged to continue their studies in practical subjects associated with their work, and so qualify for subsequent advancement to positions of responsibility.

The wages applicable to Engineering Student Apprentices are given at the back of this brochure.



Apprentices working on a line of Switchgear Cubicles.



Graduate Apprentice marking out keyways in a turbo-alternator exciter shaft.



Corner of Electrical Machine Test Department.

ENGINEERING GRADUATE APPRENTICESHIP

Applications for Engineering Graduate Apprenticeships are received from students in their last year at College. Preference is given to applicants from a residential University who have shown an active interest in the athletic and social side of college life. An honours degree in engineering subjects is an additional recommendation, and provisional appointments are made until examination results are received. Candidates may be required to undergo a medical examination by the Works Medical Officer.

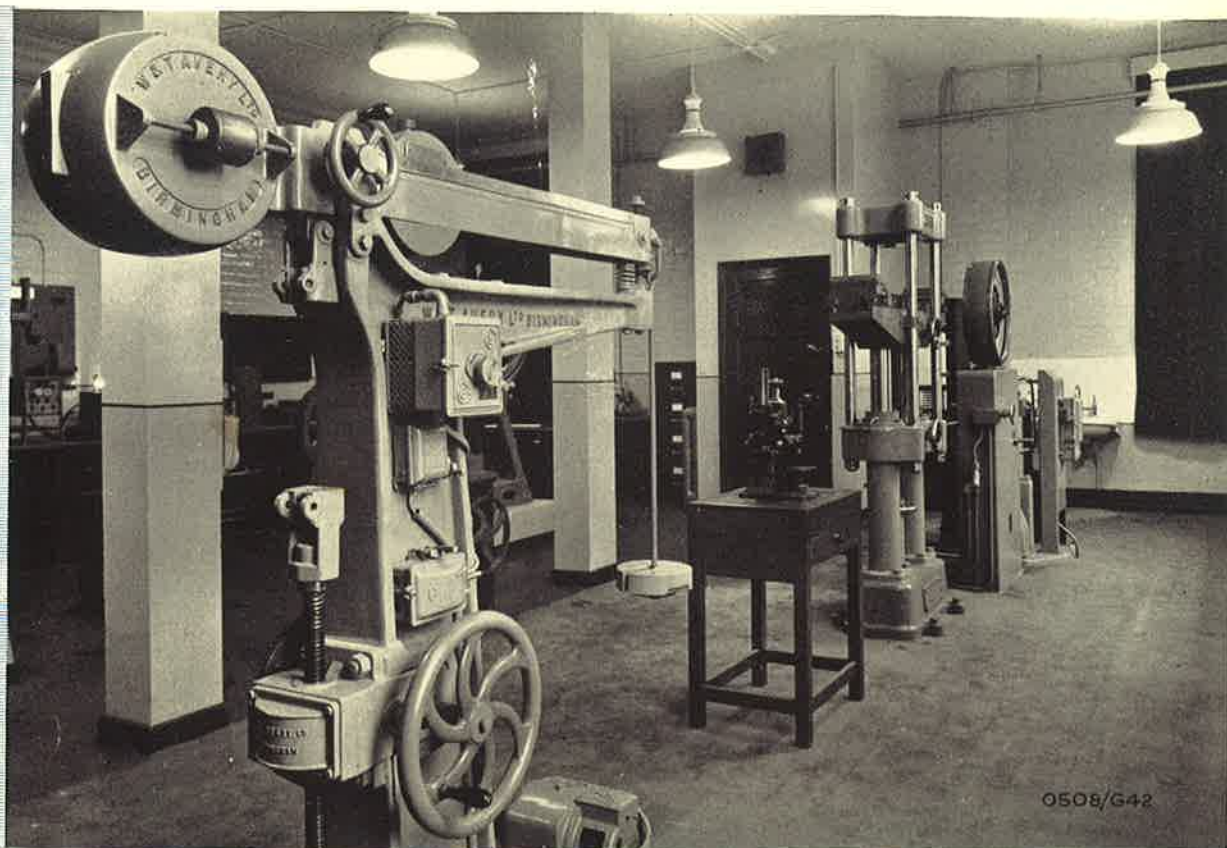
Engineering Graduate Apprentices are appointed for a probationary period of three months and when this has been successfully completed they will be required to sign a service agreement to cover the remainder of the two-year training period.

An Engineering Graduate Apprentice may be required to undertake to offer his services to the Company during the whole of the first two years after the termination of his two years Apprenticeship.

Engineering Graduate Apprentices are encouraged to become members of the Institution of Electrical or Mechanical Engineers and to attend the meetings of the local branch of the Institution. The two-year course of Apprenticeship is designed to give University Graduates the practical training required by the Institution of Electrical Engineers and the Institution of Mechanical Engineers as one of the qualifications of Associate Membership.

Part of the Electrical
Laboratory.





0508/G42

(Above)
A section of the mechanical
testing Laboratory.

(Below)
A section of one of the design
and development departments.



00593/G41

Advanced lectures are given on the various technical aspects of the Company's activities, and Engineering Graduate Apprentices are expected to attend these. Other lectures are organised by Loughborough College, and there is an evening course in industrial administration. Graduate Apprentices are expected to continue their technical reading to include the theory underlying their work.

In planning the training course for a Graduate Apprentice, consideration is given to any previous practical experience. Normally, the first year is spent in basic training including Foundry, Pattern Shop, Fabrication, Machining, Fitting and erection of the Company's main products, electrical machines, turbines, switchgear, transformers and oil engines.

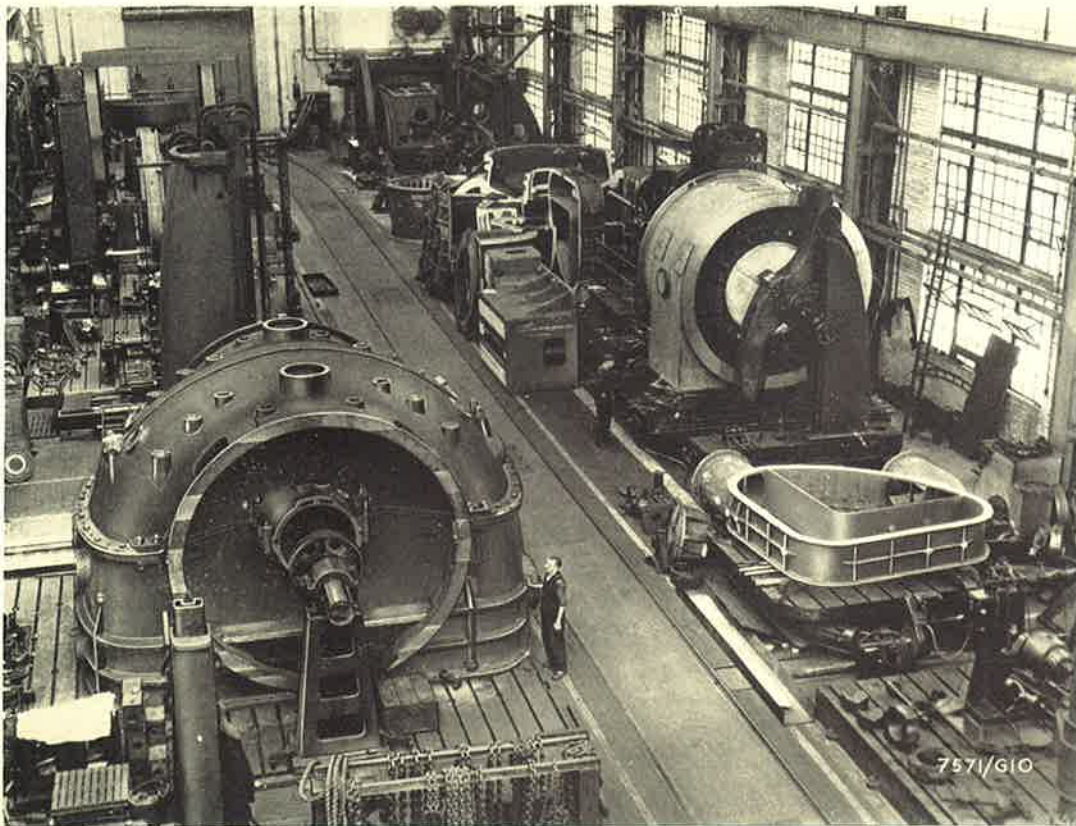
At the end of the first year, the Apprentice's future career is discussed and his further training arranged according to whether he is to be a Designer, Production Engineer or Sales Engineer.

The wages applicable to Engineering Graduate Apprentices are given at the back of this brochure. Preference will be given to Graduate Apprentices when filling vacancies on the staff, but the Company does not undertake to find such employment. Staff engineers are given opportunities of acquiring experience that will qualify them for positions of responsibility.

VACATION TRAINING

A limited number of Vacation Apprentices are taken each year on the recommendation of the head of the faculty or department of the college where the student is pursuing his degree studies. The course normally begins early in July, lasts for 6-8 weeks, and gives practical experience in one or two of the production departments.

A programme of lectures is arranged on technical subjects and on works organisation and administration, and every Vacation Apprentice is given the opportunity to make a tour of the works and offices. Vacation Apprentices are able to become honorary members of the Student Section of the Apprentice Association, and to take part in the sports and social activities, but they cannot be accommodated in the hostels. A maintenance wage is paid to them as detailed at the back of this brochure.



Part of the
Main Tur-
bine Assembly
Shop.

7571/G10

A section of
one of the
Transformer
Shops.



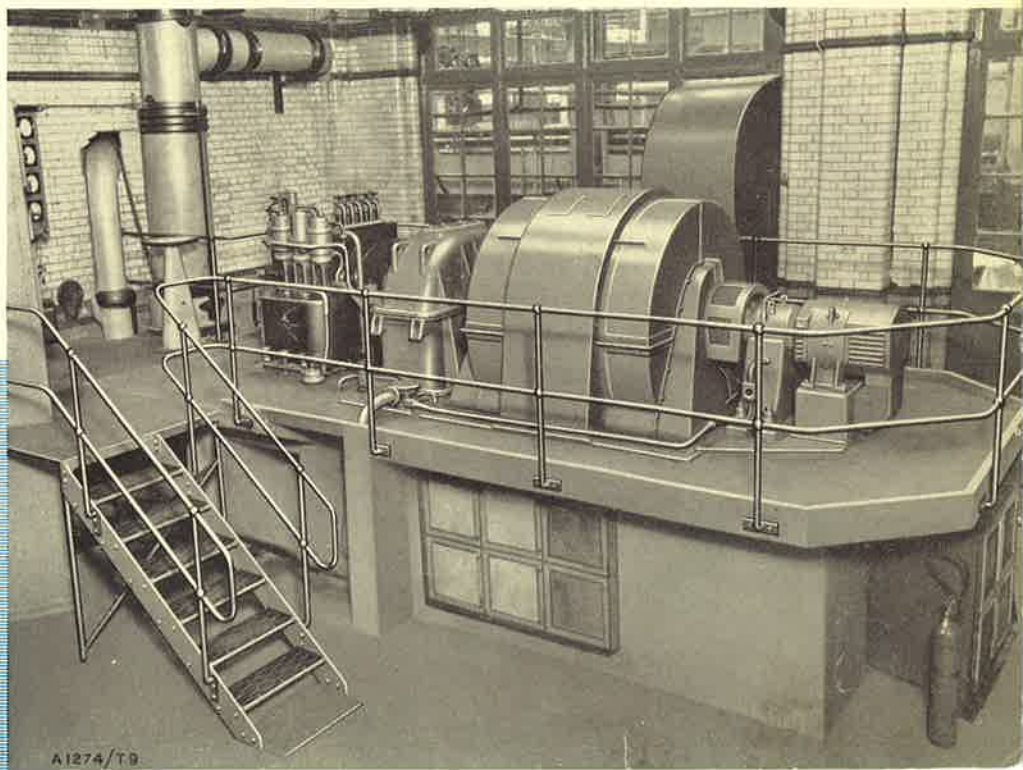
0578/G9

ENGINEERING GRADUATE APPRENTICE SANDWICH COURSE

Some young men who are intending to graduate in Engineering prefer to enter industry for a year before proceeding to the University. The Company is prepared to train suitable applicants for such a Sandwich Course. Candidates should have obtained a Higher School Certificate in Pure and Applied Mathematics, Physics and Chemistry. A good record in non-academic activities is also required. Sandwich Apprentices spend the first year gaining experience of a general nature, and during this year they attend Loughborough College for one day each week. They spend their long vacations in gaining further experience approved by the Company, and carry out the second year of their training after graduating.

The wages paid during the first year and during vacations are those paid to Engineering Student Apprentices of the same age. The wage paid in the last year is the same as that paid to a second year Graduate Apprentice. Conditions concerning subsequent employment are similar to those which apply to ordinary Graduate Apprentices.

"Brush" 1,250 kilowatt
Axial-flow, Back-pressure
Turbo-Alternator Set.





A1706

Winner of Brush Scholarship 1950



A1852

Winner of 1950 Brush Research Fellowship



A1706

Winner of Brush Scholarship 1950



A1853

Chairman, Students' Section Apprentice Association



A1851

Chairman Craft Section Apprentice Association



A1697/G16

Apprentices at Craft Training Centre enjoy mid-morning break.

BRUSH SCHOLARSHIPS

The Company awards each year one or more Scholarships which are tenable at a British University. The award enables the holder to study for an Honours Degree in Electrical or Mechanical Engineering.

Applications for the Scholarship are considered from Apprentices who have attained a high standard of general education. Normally, the possession of a Higher School Certificate is required, and candidates must exhibit high personal qualities and must possess a good record of work done during the period they have been with the Company. Their conduct and time-keeping must be exemplary. Applications must be submitted in writing to the Education Department before the end of March each year.

The Brush Scholarship was first awarded in 1941. Holders of the Scholarship since its inception are listed below :—

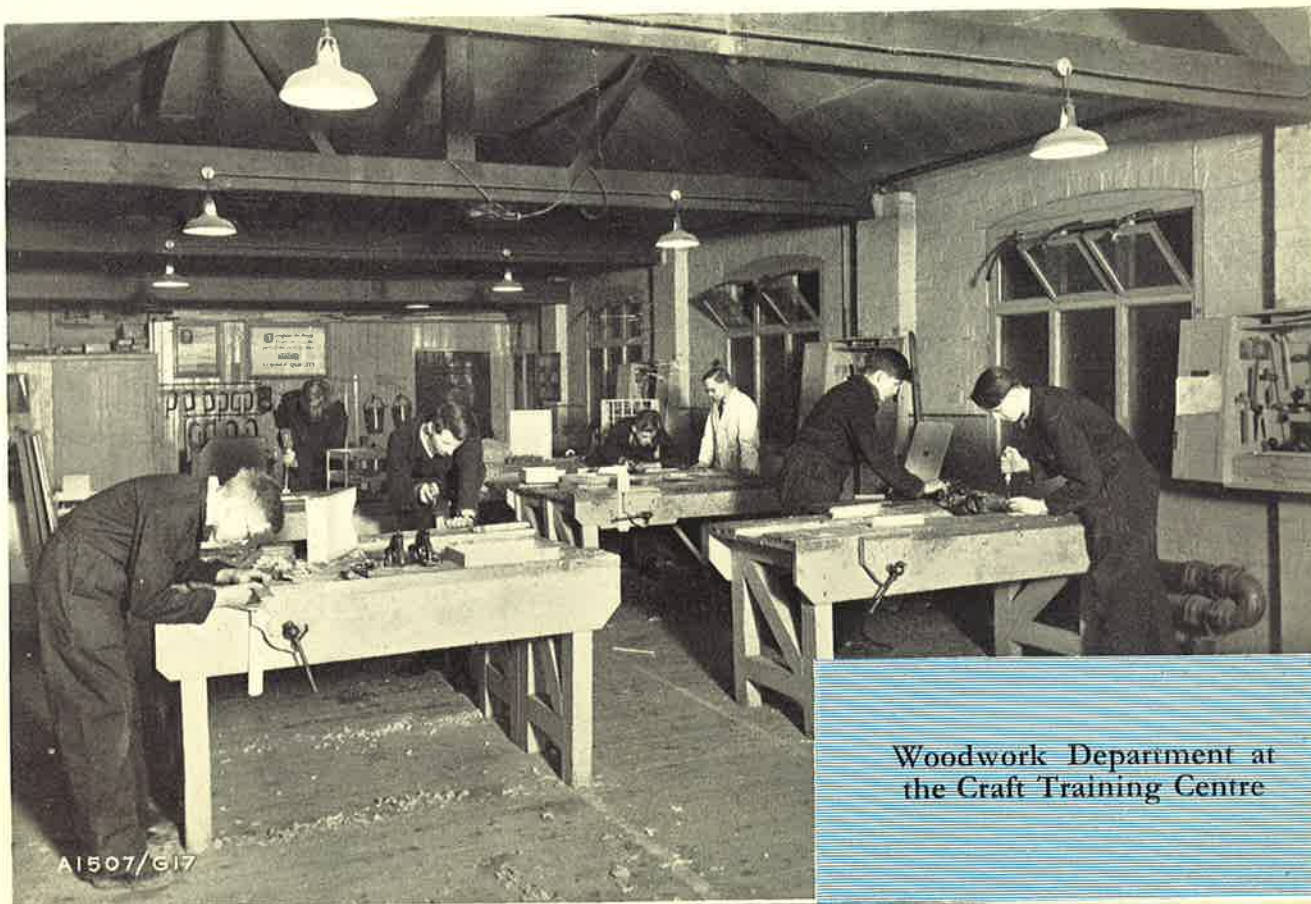
R. Pennington	..	..	..	..	1941	Leeds University.
R. Parker	..	..	..	..	1942	Swansea University.
J. B. Wilcox	..	..	..	..	1942	Bradford Technical College.
D. J. Cockrill	..	..	..	..	1943	London University, City & Guilds.
T. J. Hayden	..	..	..	..	1944	City & Guilds.
D. Davis	..	..	..	..	1944	Liverpool University.
A. N. Sharvell	..	..	..	..	1945	University of Nottingham.
R. A. Bevan	..	..	..	..	1945	Swansea University.
W. J. Willis (Miss)	..	..	..	..	1946	Loughborough College.
M. D. Dwek	..	..	..	..	1947	Loughborough College.
W. H. Joce	..	..	..	..	1948	Plymouth Technical College.
B. J. Cooper (Exhibition Award)	..	..	..	..	1948	Leicester Technical College.
G. M. Bayley	..	..	..	..	1949	University of Nottingham.
J. R. French (Special Scholarship)	..	..	..	..	1949	University of Nottingham.
W. S. Tunnicliffe	..	..	..	..	1950	University of Nottingham.
B. M. Grime	..	..	..	..	1950	University College, London.

THE BRUSH RESEARCH FELLOWSHIP

The Company have recently decided to award each year a Research Fellowship tenable at a British University. The Fellowship will extend over two years and it is expected the holder will obtain the degree of Doctor of Philosophy.

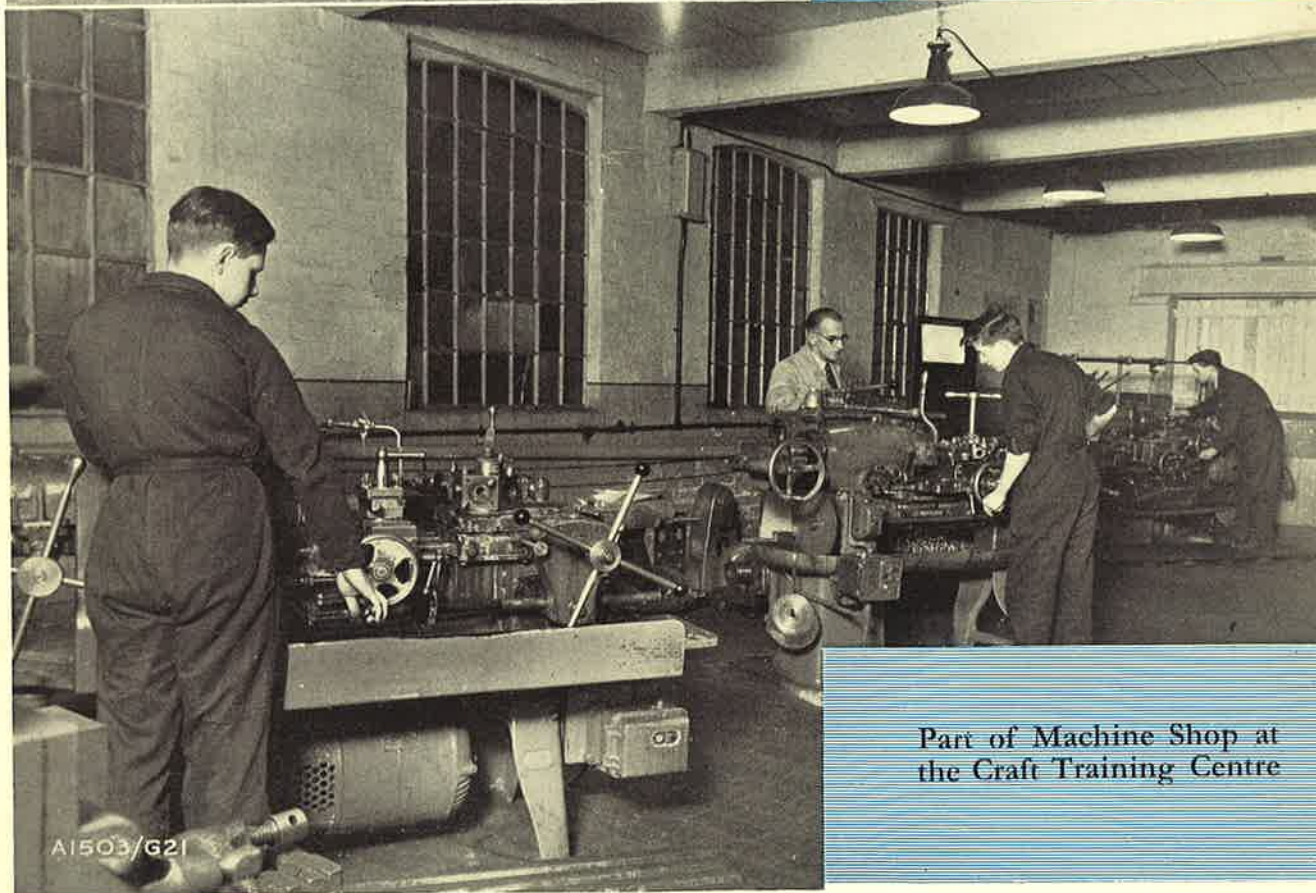
The successful applicant will be chosen from those of the Company's Graduate Apprentices who have obtained an Honours Degree in Engineering. A minimum of eighteen months practical experience will be required, and a very high standard of all-round performance on the part of the successful candidate will be demanded.

The Research Fellow for 1950 is Mr. D. G. Wilson who was educated at Birmingham University where he obtained the B.Sc. degree with First Class Honours in Mechanical Engineering.



A1507/G17

Woodwork Department at
the Craft Training Centre



A1503/G21

Part of Machine Shop at
the Craft Training Centre

CRAFT TRAINING CENTRE

This centre is in a separate building away from the main works, in Regent Street near the centre of Loughborough. It is in charge of a Chief Instructor who, with a staff of instructors is responsible to the Apprentice Supervisor. The school aims at bridging the gap between school and factory life, in giving a short course of basic practical training in various crafts including the care and use of tools, and in assisting in the decision as to which craft or branch of engineering the Apprentice should continue his training.

Normally, a period of six months is spent at the Training Centre and during this time the Probationary Apprentice spends some time on each of the following :—

1. Machine Tool Operating.
2. Bench Fitting and Sheet Metal Work.
3. Electrical Machine Winding.

While some of the work takes the form of standard exercises, most of it consists of production jobs which are passed through the main Inspection Department and used as components in the works.

The Instructors watch and record the progress of the boys in the various crafts, while

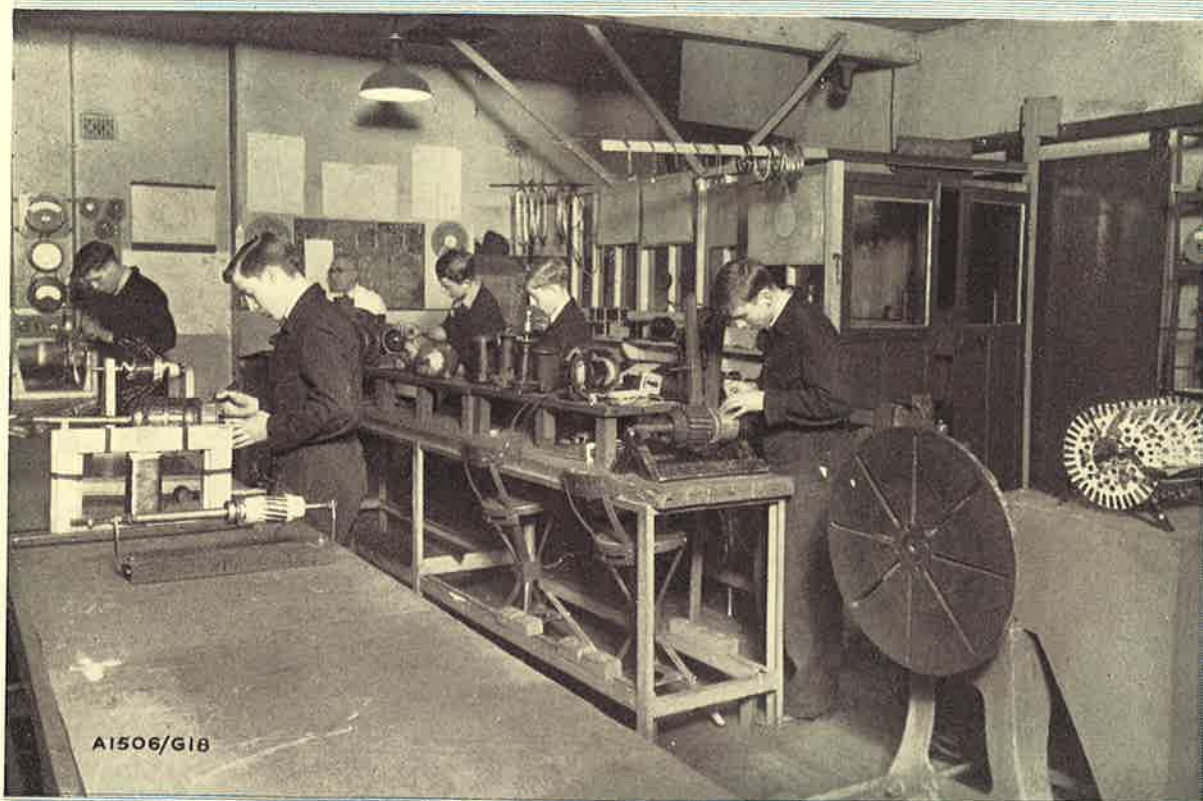
Another section
of the Machine
Shop at the Craft
Training Centre.





A1505/G19

Apprentices learning to become proficient in the handling of tools.



A1506/G18

Electric Section—Craft Training Centre.

the boys themselves keep a record book of work done, tools used and operations practised. The Chief Instructor constantly reviews these records and the rate of progress in the various crafts. If it is considered that a boy is unsuited to engineering work, his parents will be consulted and the boy may be offered alternative employment.

Strict discipline is maintained, with no smoking. A 44-hour week is worked, with hours of 7:30 a.m.-5:15 p.m. on Monday, Wednesday, Thursday and Friday, and 7:30 a.m.-5:30 p.m. on Tuesday. There are light refreshments in the morning and afternoon breaks, and a mid-day meal is served. Boys wear overalls and there is a scheme by which they are issued with overalls that are cleaned and maintained.

At about the middle of the six months period in the school there is an open day on which parents are invited to visit the school to see the work done and to meet the staff.

During the period at the Craft Training Centre the Probationary Apprentice attends part-time classes at Loughborough College. He also receives lectures on the different products and activities of the Company. An important feature is a series of talks given by superintendents and engineers in charge of departments explaining the type of work carried out in each department and the types of jobs available, each talk being followed by a visit to the department in the main works specially arranged by the departmental head.



Part of the Medical Centre.



Section of Main Works
Canteen.



View of cricket match
in progress.

0056/c11

View of football
match in pro-
gress.



A1682/G12

THE LOUGHBOROUGH COLLEGE

Loughborough College is within a mile of the Works. It has a large and well-equipped Engineering Department. Part-time day courses in Mechanical, Electrical and Production Engineering are organised in the Department of Continued Education. The course for the Ordinary National Certificate extends over three years, and the Higher National Certificate can be obtained after two further years' study.

Probationary Apprentices possessing appropriate qualifications and aptitudes join one of these National Certificate Courses. In certain cases they are able to gain exemption from the first year of the course on certain conditions.

If a sufficiently high standard is reached in the examination in certain subjects, it is possible for students gaining Higher National Certificates to obtain exemption from the professional Institution concerned.

THE UNIVERSITY OF NOTTINGHAM

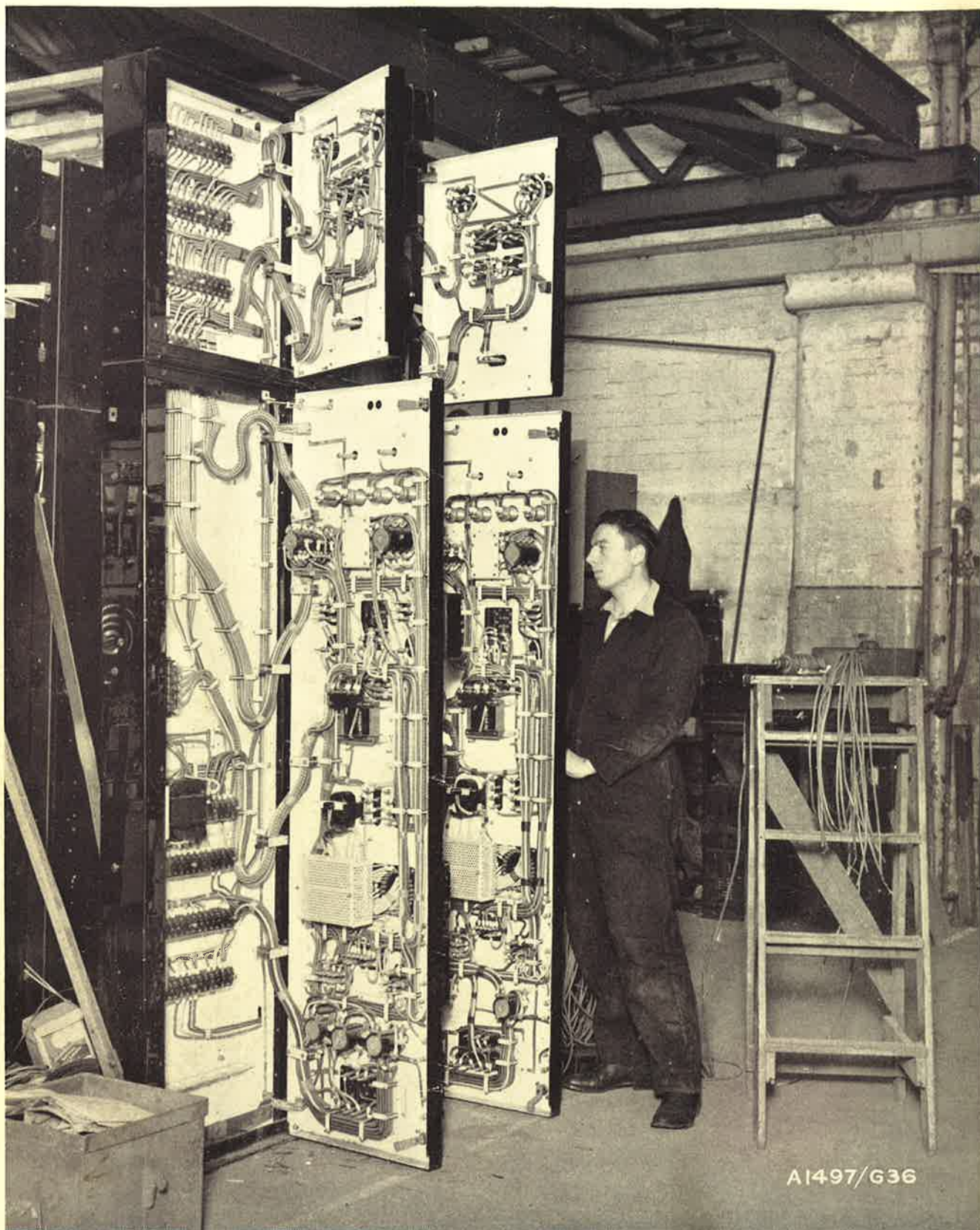
The Company co-operates closely with Nottingham University in the field of advanced studies and research in Electrical and Mechanical Engineering. Arrangements for participation in these schemes of advanced studies are made on an individual basis for selected Apprentices.

APPRENTICE ASSOCIATION

The Apprentice Association is regarded by the Company as an integral part of the Apprentice's training, and all Apprentices are required to join. By taking part in the various activities of the Association, Apprentices learn to develop an easy, friendly manner in mixing with colleagues, and they acquire a broadminded and tolerant outlook. The Association also provides opportunities for leadership and organising ability. Senior Apprentices are encouraged to help and guide their younger colleagues.

For some purposes, the Association is divided into separate groups with sub-committees of Craft Apprentices and of Student and Graduate Apprentices to organise the various social, intellectual and sporting activities. Facilities are provided for rugby, soccer, hockey, tennis and cricket. Visits to other works are arranged, and dances and socials are held. There is a Music Society, and many other interests are catered for. A club room is provided, and the fine Brush Sports Fields are available for use by the Apprentices.

An important activity of the Association is the publication quarterly of the Apprentice Journal, "Contact". This Journal has achieved a high standard through the efforts of the editorial staff supported by past and present members of the Association. All former Apprentices are eligible for membership of the Association.



A1497/G36

An Apprentice in the Switchgear Department, who has almost completed his training, completes the wiring of control panels used for automatic tap-changing on transformers.

HOSTELS

The Company has two hostels, "The Gables" and "Brooklands", which are reserved for accommodation of Apprentices. Both are adjacent to the playing fields of the Brush Sports and Social Club. Many Apprentices are taking advantage of the Ministry of Labour scheme by which financial assistance is available for boys to train for skilled jobs away from home. As a result there is a heavy demand for places in the hostels.

Boys who do not live in the district are expected to live in one of the hostels for their first year of apprenticeship, during which time they get to know each other and form friendships. At the end of the first year, Apprentices may expect to be moved into approved lodgings in the town, usually in pairs but never alone.

The hostels are in charge of wardens and are administered by the Apprentice Supervisor. The current charge for accommodation is given at the back of this brochure. It excludes the mid-day meal, which is taken in the works canteen, but includes a dinner in the evening.

THE FALCON ASSOCIATION

This Association exists to keep former Brush Apprentices and Trainees in touch with each other, and to preserve the ties of friendship between members of the Association and the Company.

Membership is open to all who have received their training with the Company. The Committee is elected at the Annual General Meeting which is arranged to coincide with the Annual Dinner of the Association.

View of "The Gables."



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