

# ELECTRICAL REVIEW

VOL. CXXXIX.

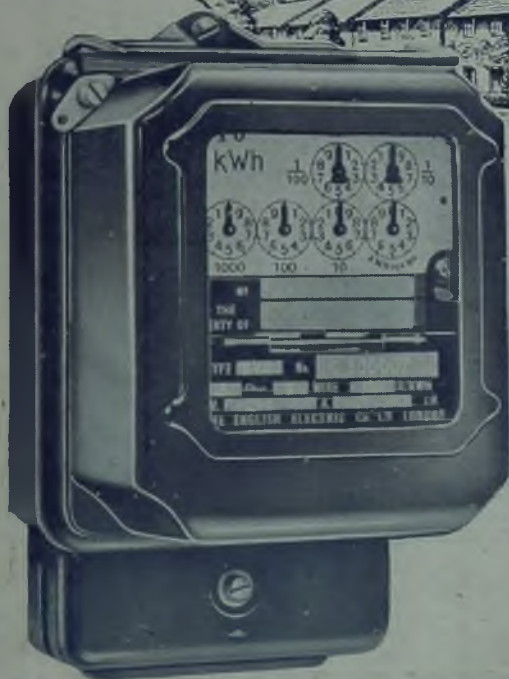
DECEMBER 20, 1946

244/1720

NO. 3604

## "English Electric" Meters

*for House Service* 127



THE manufacturing capacity of the Instrument Department has now reverted from the production of special instruments for the Services to that of meeting the National Housing programme.

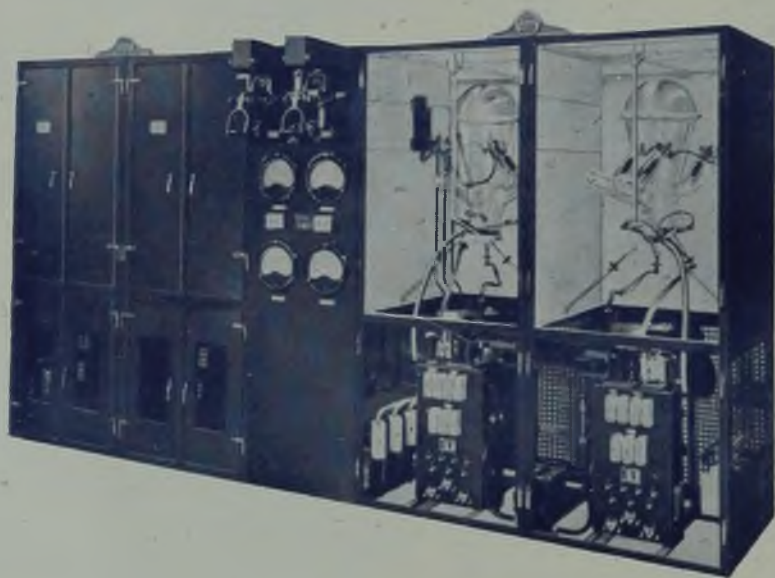
**THE ENGLISH ELECTRIC COMPANY LIMITED**

London Office: QUEEN'S HOUSE, KINGSWAY, LONDON, W.C.2

WORKS: STAFFORD - PRESTON - RUGBY - BRADFORD - LIVERPOOL



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**GLASS BULB  
MERCURY ARC RECTIFIERS**

**'Nevelin' ELECTRIC · CO · LTD**  
PURLEY WAY · CROYDON · SURREY  
TELEPHONE: CROYDON 2268      TELEGRAMS: NEVELIN, CROYDON



# Christmas "Heatwave" by Heatrae

For a few days at Christmastide we shall cease producing Electrical apparatus for giving physical warmth to human bodies.

Surely that's an appropriate occasion to concentrate all our calorific energy into **WARMEST WISHES** to our friends everywhere for

**A TRULY HAPPY CHRISTMAS**



*leaders in electric water heaters*

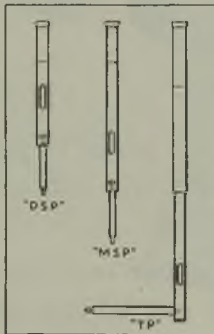
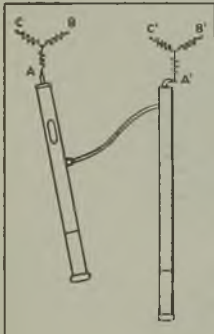
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PHONE HEATRAE 25131

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**PHASING RODS VACUUM TUBE DETECTORS**  
to locate interconnections between two A.C. systems  
Range 6,600 to 35,000 V.



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"PARTRIDGE" DETECTORS }  
VACUUM TUBE DETECTORS }  
EARTHING RODS

No earth  
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A

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Send for Prices  
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Terminals

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ASHBROOK ROAD, LONDON, N.19

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to the specific requirements of our customers

Makers of all types of repetition products from the bar in all metals



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*Precision* **MOULDINGS**  
**FOR THE**  
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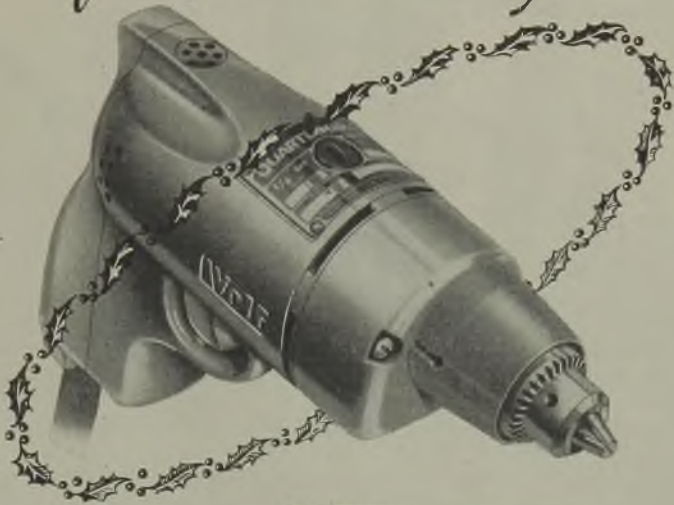
For current insulation and oil sealing we can apply specialised knowledge gained by long experience, constant research and concentrated study of war-time problems.

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# Enrich every Season of the Production Year



*Greetings to  
all our friends  
throughout  
the World*

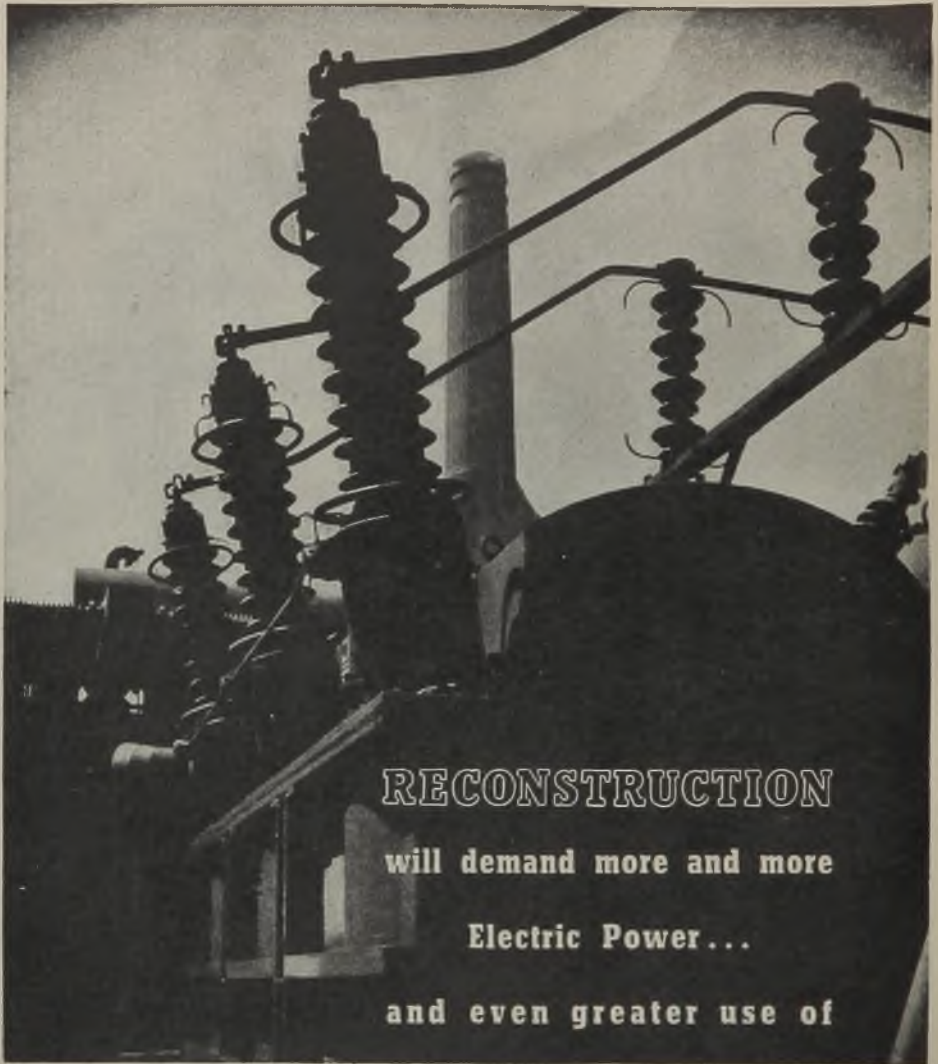


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will demand more and more

Electric Power...

and even greater use of



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## CABLE INSULATING PAPER

*Tullis Russell & Co. Ltd.*

AUCHMUTY &  
ROTHES PAPER  
MILLS, MAFKINCH  
SCOTLAND

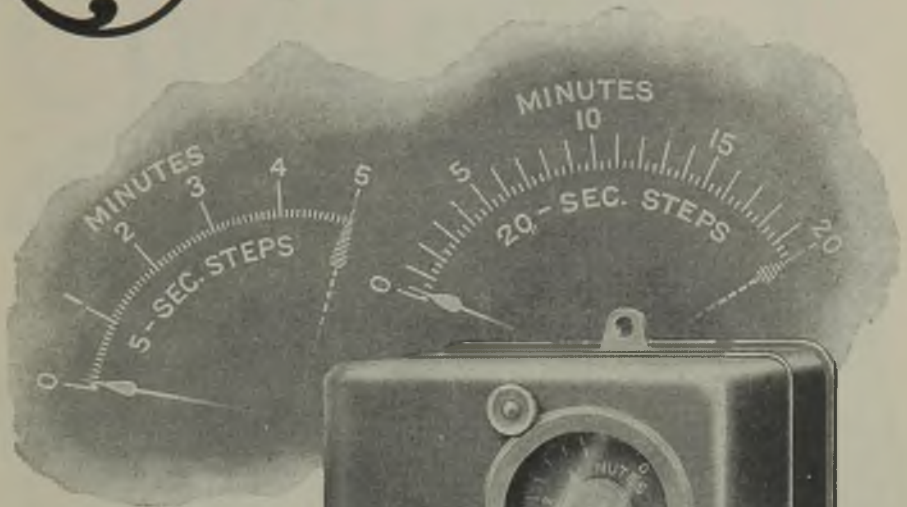
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E.C.4

MANCHESTER  
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Coronation Street

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116  
Colmore Row

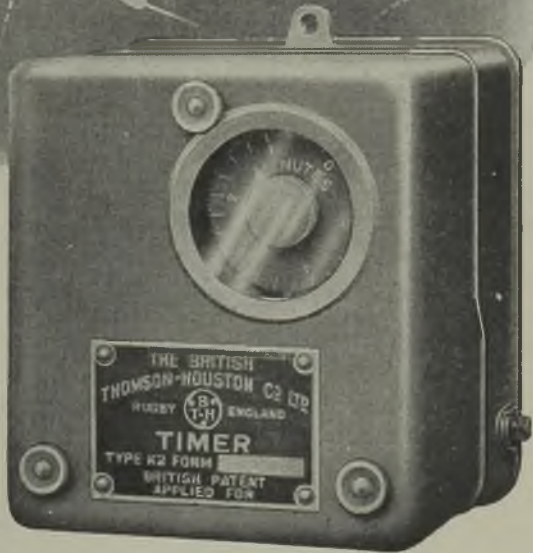


# INDUSTRIAL ELECTRIC TIMER



Designed to withstand frequent and arduous service in industry, the BTH Timer has two ranges, namely from 5 seconds to 5 minutes (in 5 sec. steps) and 20 seconds to 20 minutes (in 20 sec. steps).

It is controlled by any form of pilot switch or push button and will give lasting, trouble-free service.



Write for list No. 5642-5

# BTH

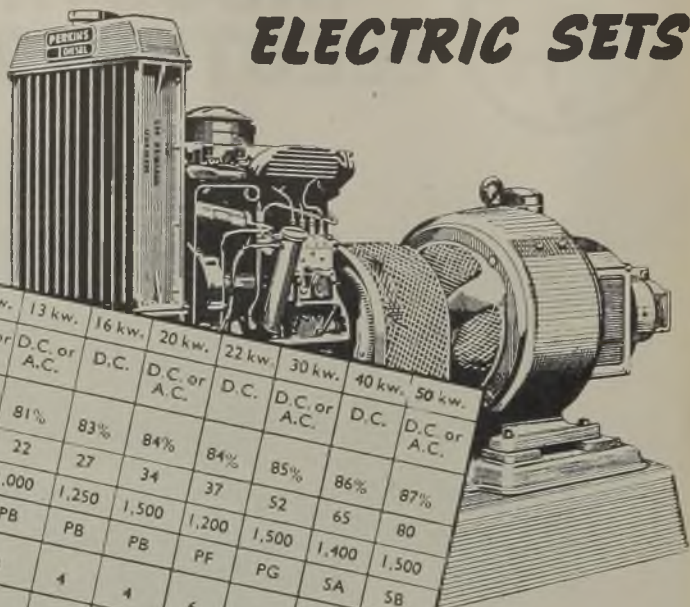
# RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND

A3566



# A RANGE OF Perkins DIESEL ELECTRIC SETS



Current	10 kw.	13 kw.	16 kw.	20 kw.	22 kw.	30 kw.	40 kw.	50 kw.
Generator Efficiency	D.C. or A.C.	D.C. or A.C.	D.C.	D.C. or A.C.	D.C.	D.C. or A.C.	D.C.	D.C. or A.C.
Engine B.H.P.	80%	81%	83%	84%	84%	85%	86%	87%
R.P.M.	18	22	27	34	37	52	65	80
Perkins Engine	PA	1,000	1,250	1,500	1,200	1,500	1,400	1,500
No. of cylinders	PB	PB	PB	PB	PF	PG	SA	SB
Approx. full load fuel consumption Galls. per hr.	4	4	4	4	6	6	6	6
	.9	1.1	1.4	1.7	1.8	2.4	3.1	3.9

❖ F. Perkins Ltd., maintain a highly trained technical electrical staff whose services are at the disposal of enquirers.

❖ Perkins Engines are designed for much higher speeds and much higher ratings than those used in their Generating Sets.

❖ Perkins Diesel Electrical Sets are light in weight and thereby easily transportable.

❖ Starting can be by hand, electric motor, or automatic.



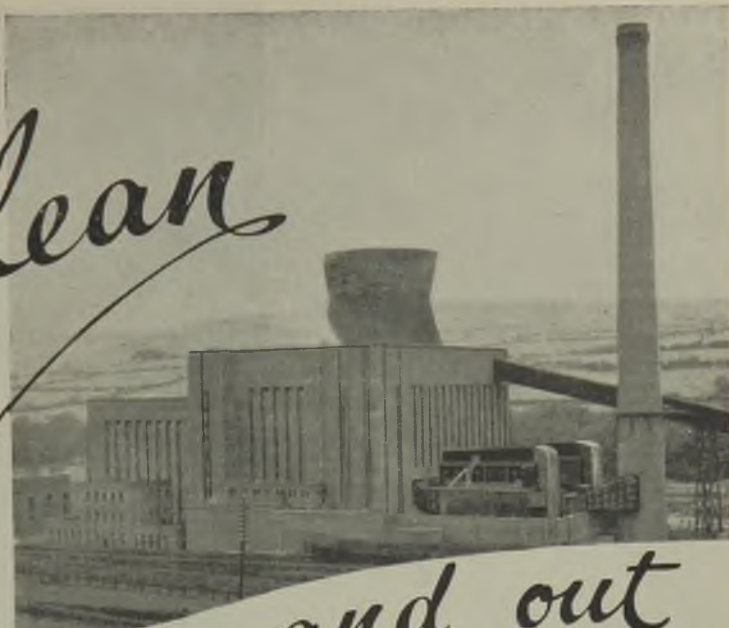
## Perkins DIESEL ENGINES

FOR GOODS AND PASSENGER VEHICLES, INDUSTRIAL AND MARINE APPLICATIONS

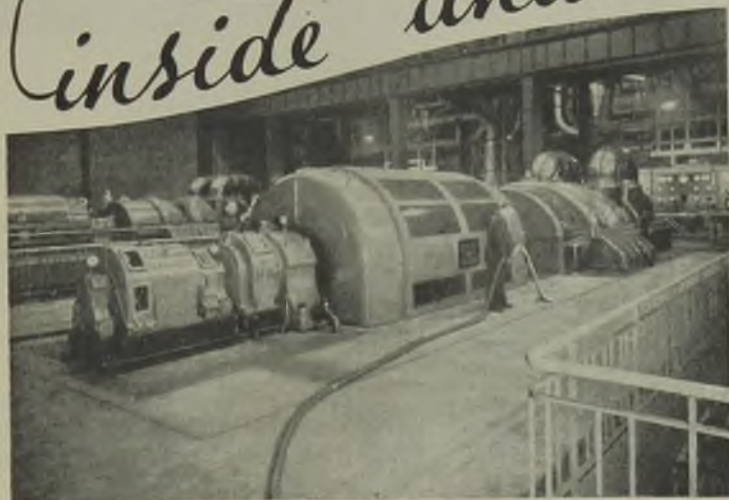
F. Perkins Ltd., Dept. E.R., 73 Lincoln Road, Peterborough. Phone: 4201



*Clean*



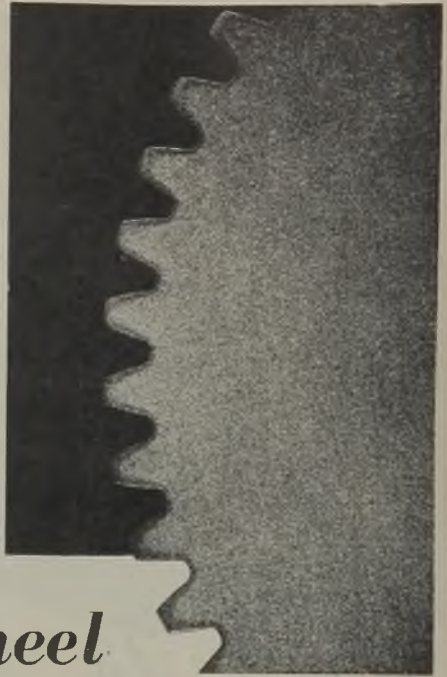
*inside and out*



Llynfi Power Station where a Sturtevant Central Turbine Vacuum Cleaner installation allows the whole interior to be kept clean and Sturtevant Electrostatic Precipitators ensure only clean gases pass up the stack

STURTEVANT ENGINEERING CO. LTD., 25 WORCESTER RD., SUTTON, SURREY.  
LONDON OFFICE: VICTORIA STATION HOUSE, VICTORIA ST., S.W.1

*An actual untouched magnified photograph of the teeth of a 2-inch gear wheel after hardening by Redifon Heating*



## *2-in. gear wheel case-hardened in $2\frac{1}{2}$ seconds by Redifon Heating*

USING a 25kW Redifon Model R.H.4 radio heating set, it is possible to place a hardened "skin" over the bearing surfaces on the teeth of a 2-inch gear wheel in  $2\frac{1}{2}$  seconds. The teeth, approximately  $\frac{1}{8}$  in. by  $\frac{1}{8}$  in. cross-section and  $\frac{3}{8}$  in. long, are water-quenched.

An outstanding advantage of the Redifon Heating process is its ability with suitable steels to control the depth of the case-hardened "skin" applied, without carburizing. The high speed of heating so reduces scaling and the consequent grinding or cleaning off, that Redifon Heating can increase the output of perfectly finished articles very considerably.

Redifon Heating can also be used for special drying processes, the setting of glued

joints, the plasticizing of moulding powders and preforms, and many other applications where heat has to be applied either, in the case of metals, to the outer surface, or, in the case of non-conductors, throughout the entire thickness of the material.

Full details of the process and advice as to its suitability for use in any particular industry can be obtained from our Industrial Electronics Sales Division.

## **Redifon Heating** **BY REDIFFUSION LTD.**

*Designers and Manufacturers of  
Industrial Electronic and  
Radio Communication Equipment*

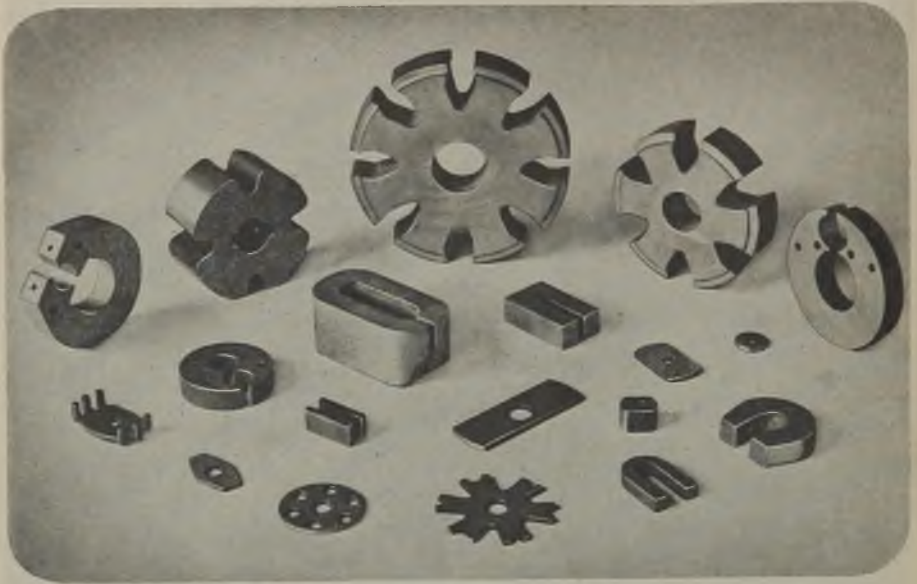
**BROOMHILL ROAD, LONDON, S.W.18**



# **RUBBER INSULATED CABLES**

The results of unrivalled research and manufacturing experience are embodied in B.I. Callender's post-war types of rubber insulated cables now at the service of the electrical industry.

**BRITISH INSULATED CALLENDER'S CABLES LIMITED**  
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For over 40 years we have been making permanent magnet alloys. To-day we are equipped to handle competently any problem of magnet design, manufacture and supply. A comprehensive research and advisory department exists at our works, and is at the service of those with specific magnet application problems.

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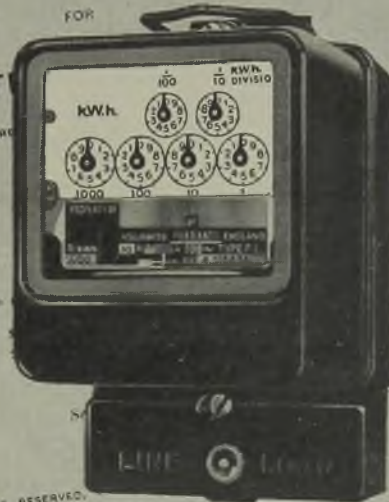
British Standards Institution  
Incorporated by Royal Charter

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE  
INCORPORATED IN 1919 AS THE BRITISH ENGINEERING STANDARDS ASSOCIATION

BRITISH STANDARD  
SPECIFICATION

FOR

ELECTRIC



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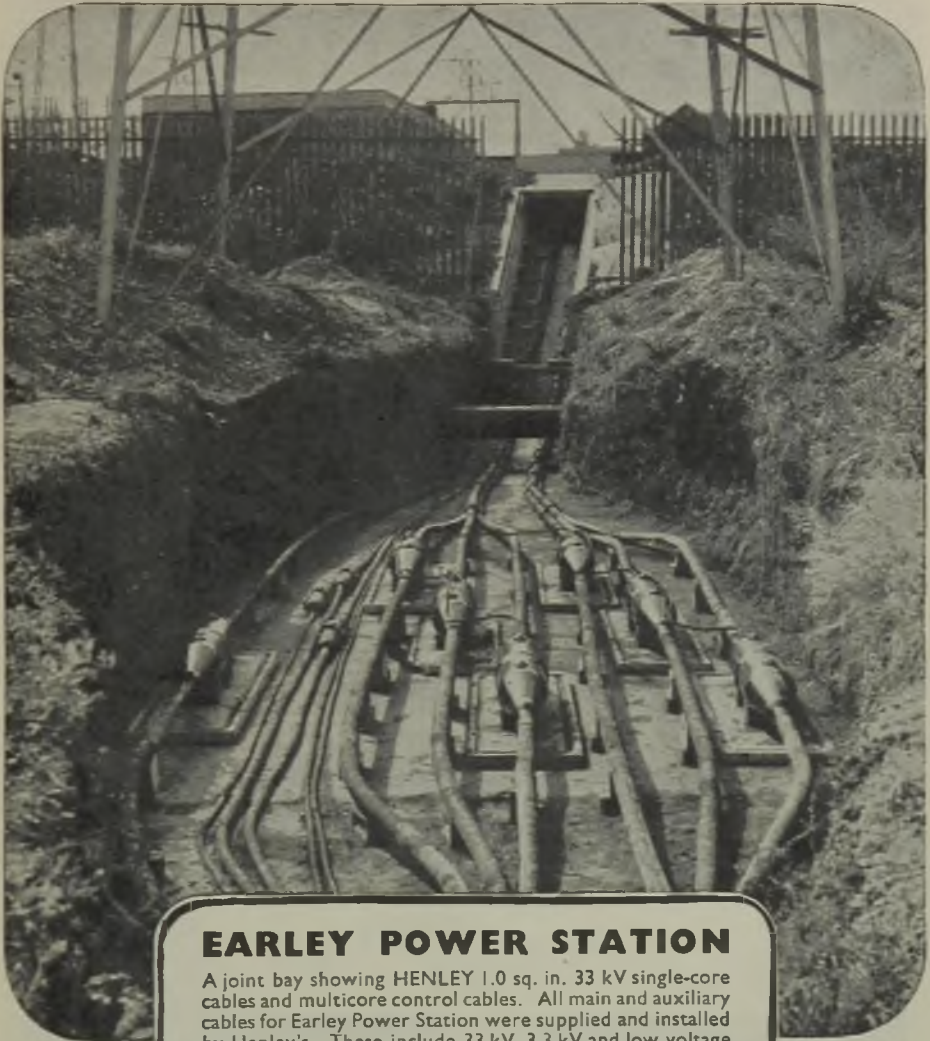
# FERRANTI Meters

FM78

FERRANTI LTD., Hollinwood, LANCs.

London Office, Eern House, Kingsway, W.C.2.





## EARLEY POWER STATION

A joint bay showing HENLEY 1.0 sq. in. 33 kV single-core cables and multicore control cables. All main and auxiliary cables for Earley Power Station were supplied and installed by Henley's. These include 33 kV, 3.3 kV and low voltage cables, together with sealing ends, straight through joints and specially designed terminal boxes, for auxiliary and control circuits.

*(Photo by courtesy of C.E.B.)*

# HENLEY CABLES

FAMOUS FOR OVER A CENTURY

**W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.**  
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# PREMIER

*Fine Quality*

## ELECTRIC HEATING APPLIANCES

Supplies are still limited but distribution is being carried out as fairly as possible.



PREMIER ELECTRIC HEATERS LTD., BIRMINGHAM, 9



# *Planning* **PROTOTYPES?**

*YES!*  
*but...*

**BE SURE IT'S AN  
"ENGLISH ELECTRIC"  
FRACTIONAL HORSEPOWER  
MOTOR**

*Before you "standardize"  
your Designs*

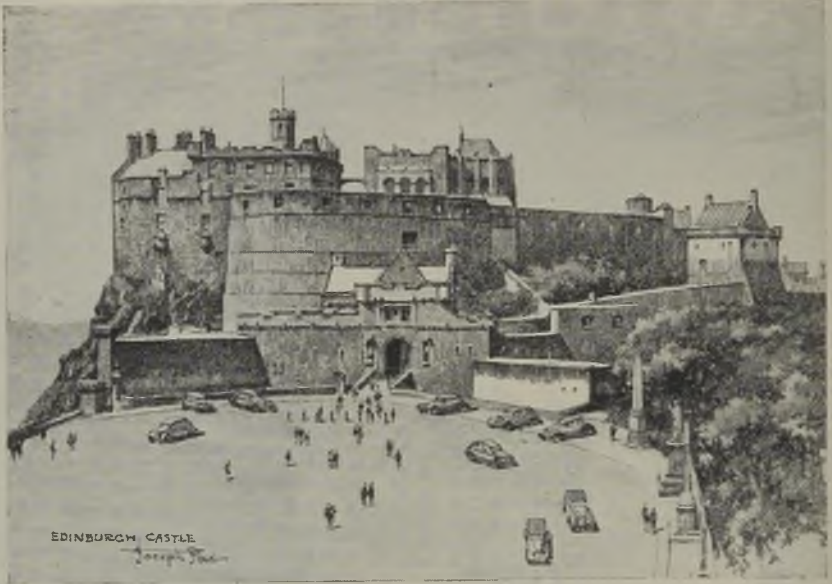


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London Office: QUEEN'S HOUSE, KINGSWAY, LONDON, W.C.2

**INDUSTRIAL MOTOR WORKS . . . BRADFORD**

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## EDINBURGH CASTLE

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MADE IN ENGLAND



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*Hurry, hurry, the Xcel Iron is on the way —*



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THERE HE STANDS—symbol of authority in an orderly World — controlling — directing — obeyed because absolutely trustworthy and reliable. What a fitting comparison with BIRCH RESISTANCES, *Arms of the Ohm's Law*. Backed by many years of practical experience in which their reliability has been tested under all conditions, BIRCH RESISTANCES, in their various applications, stand up to their job and can always be depended upon to provide specified service because of their first-class workmanship.



**Birch**

*Please call upon us to help you solve any Resistance problem.*

# Resistances

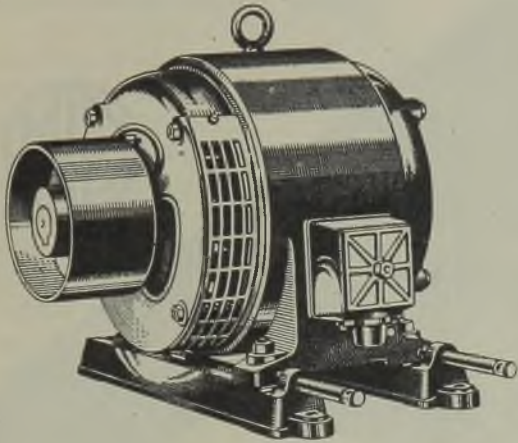
**ARMS OF THE OHM'S LAW**

May we quote you for any of the following:—

**DIMMERS** — REGULATORS (Field, Shunt, Voltage) — RESISTANCES (Arc Lamp, Charging, Regulating, Sliding) — RHEOSTATS — ELEMENTS and SPIRALS.  
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efficient, silent  
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power unit, giving  
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## Do you want to save costs, labour and trouble ?

*Bring your electricity to the machine and not your machine to the electricity. Our*

*B.B.T. Trunking System is the modern method of supplying electric power to motorised machinery.*



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● B.B.T. Trunking is adaptable to any machine area and provides electric power every two feet.

● ELECTRIC SUPPLY is brought to any desired position through enclosed Bus-Bars and fused tapping-boxes.

● MOTORISED MACHINERY fed from B.B.T. can be re-arranged at will to suit prevailing production requirements.

● B.B.T. Trunking is built on the unit principle and can be extended readily.

● B.B.T. Trunking can be installed well ahead of motorised machinery since the precise position of machinery need not be known in advance.



H.R.C. fuse units  
30, 60 or 100 amps.  
Loading up to 300 amps.

● B.B.T. Trunking is standardised in 12 ft. lengths:

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3 Ph. 3 wire . . .  $9\frac{3}{8}'' \times 3\frac{3}{8}''$   
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● B.B.T. Trunking is approved and used by Government Departments.



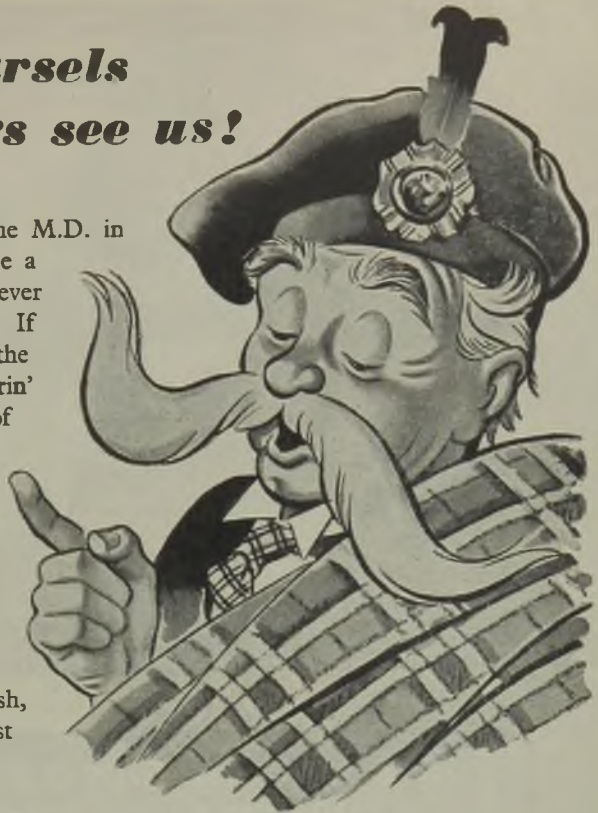
*Switchgear Manufacturers*

*Mechanical Engineers*

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## *To see ourselves as others see us!*

Hoots Toots! (says the M.D. in what he imagines to be a Scots accent). A gey clever laddie was oor Rabbie. If ye could see yersel' the noo, ditherin' and mitherin' wi' that auld puddock of a tool and michty pleased wi' yersel', nae doot! D'ye no ken that there are fine wee toolies workin' wi' electricity and such that wad dae your work in hauf the time at a huge savin' o' bawbees! Losh, mon, if ye could juist see yersel' . . . !



*Cor, stone the crows mate!  
If you could take a gander  
at yerself you'd take a runnin'  
jump into the Frith of Froth!*

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C.R.C.165

DURAWIRES                      DURACABLES

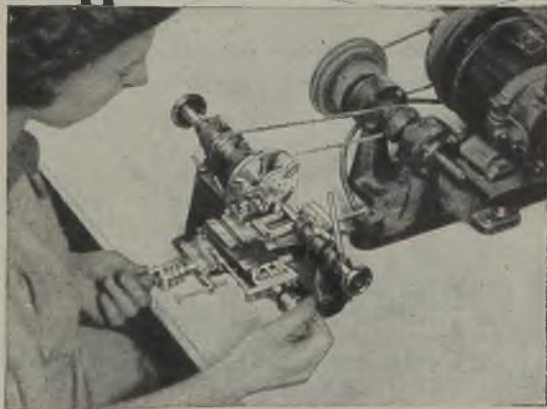
*The Future Generation depends on Us*

BE UP-TO-DATE

DURAWIRE  
YOUR ELECTRICAL WORK AND BE SURE

Sole Manufacturers: DURATUBE & WIRE LTD., FELTHAM, MIDDLESEX

*It's possible to turn a hair on a*  
**PULTRA MICRO-LATHE**



The ability to perform such a delicate operation is evidence of the efficiency and versatility of Pultra Lathes and their equipment.

They are ideal for all small work calling for maximum accuracy.

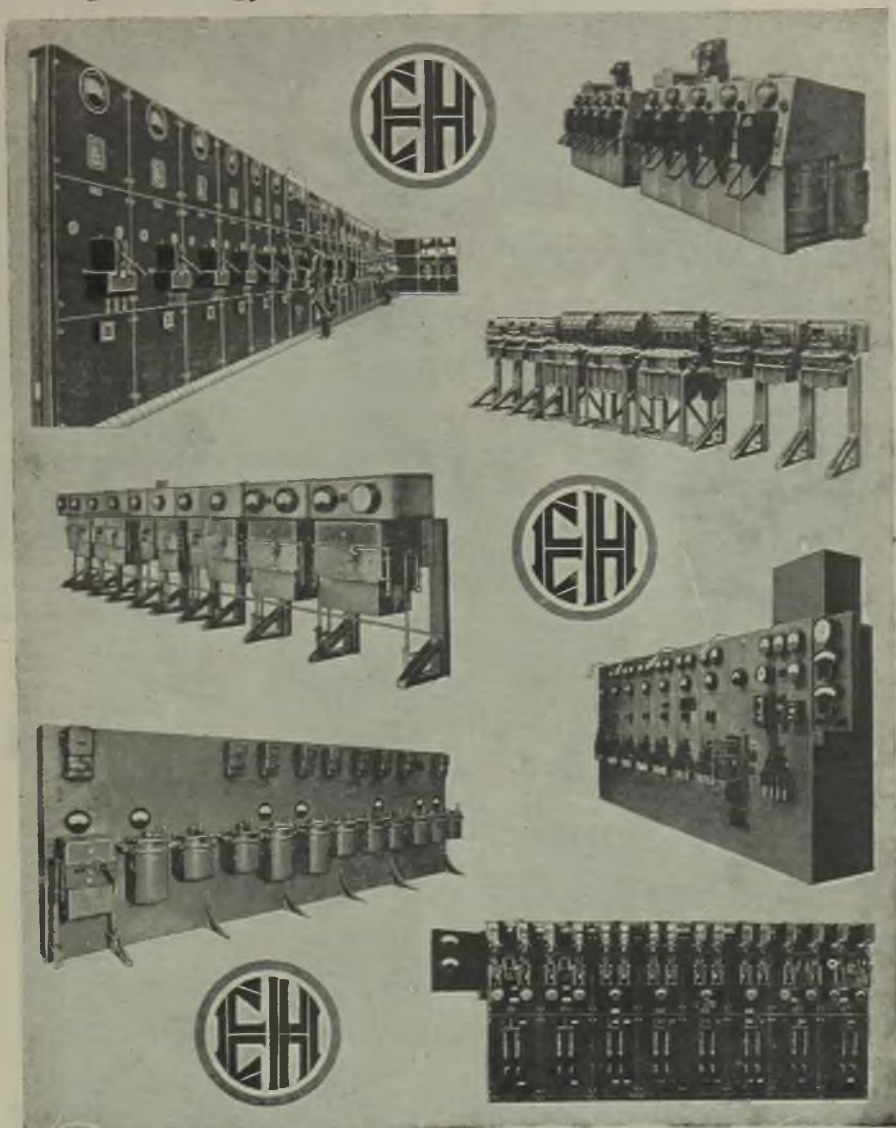
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*handy,*  
*quick-fitting,*  
*no solder or tools,*  
*no baring of wire.*

### HT terminals

These 7 mm Terminals are available in re-sale or workshop packs. Price List sent on request. Enquiries for bulk supplies are invited.

Standard equipment for Morris and many other well-known motor vehicles

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**VOLTAGE DISTRIBUTION**

AND PUBLIC SUPPLY

By E. J. BARROWS, A.M.I.E.E.

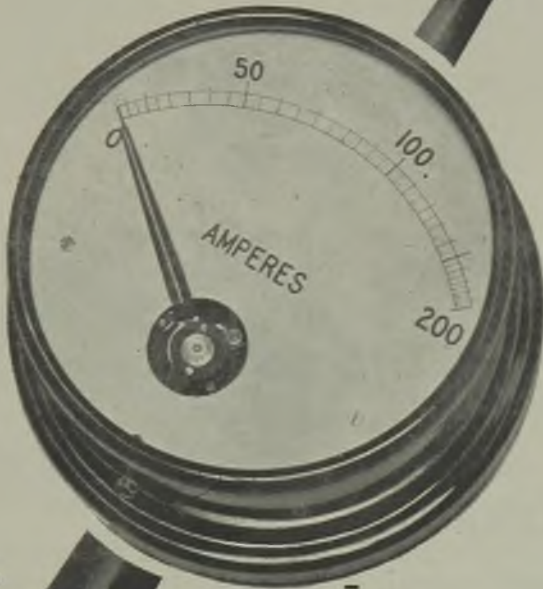
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MOVING IRON  
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work explain  
high volap  
and how the  
values can be  
ble system the  
schematics. I  
ve to work  
age-hand in

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OW. W.C.

ELECTRICAL APPLIANCES

# Dowsing's

EST. 1898

In the months to come there are many obstacles to be surmounted before our production will meet the demand for our goods. During this difficult period we will keep faith with our friends in the industry by ensuring as fair a distribution as possible.

**DOWSING COMPANY (ELECTRICAL MANUFACTURERS) LTD.**  
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Pulley wheel to carry control cables for rudder and ailerons on Horsa glider, machined from Bakelite Laminated.



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TREPOIL



REGD. TRADE MARKS

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*Pioneers in the Plastics World*

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T59

## FRACTIONAL HORSEPOWER MOTORS



TILLING-STEVENS  
FABRICATED  
1 H.P. (E.V.)  
MOTOR

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### INCREASING DEMAND

and the present man-power problem are responsible for some delay in delivery of these efficient power units. But every endeavour is being made to speed up manufacture and our customers can be assured that prompt delivery will be resumed at the earliest possible moment.

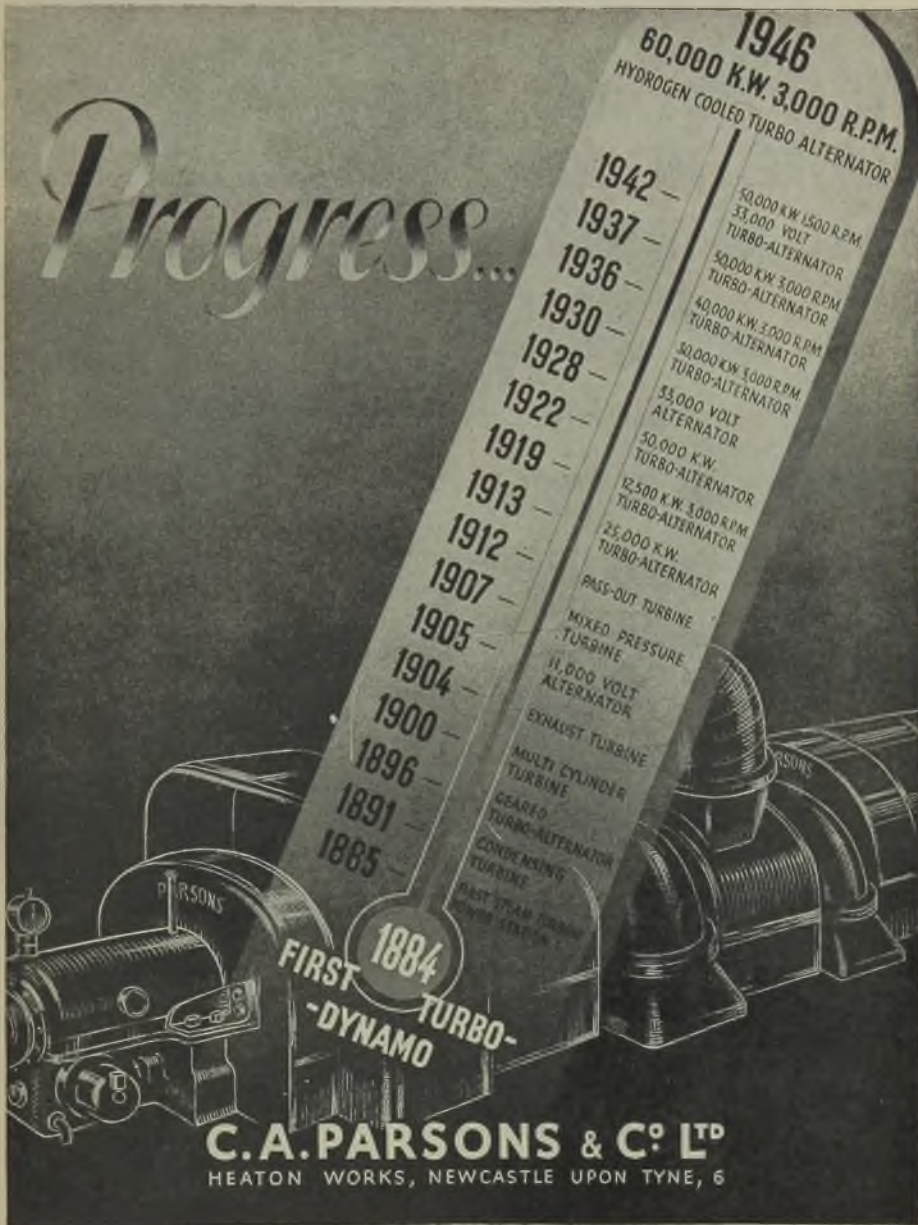
## TILLING-STEVENS

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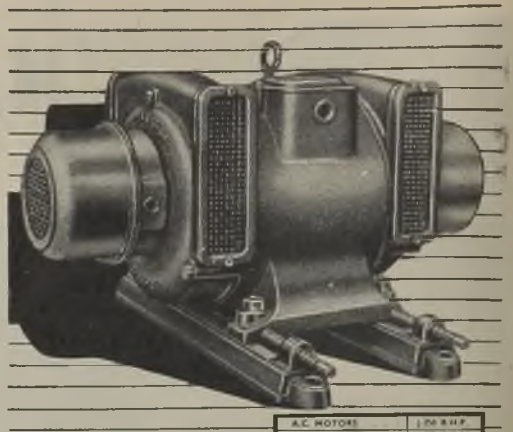
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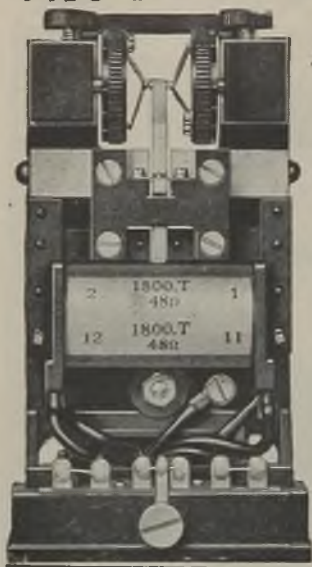
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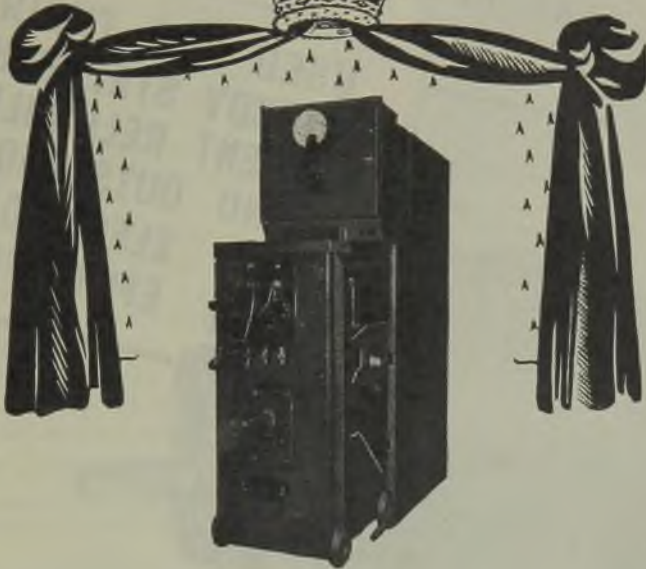
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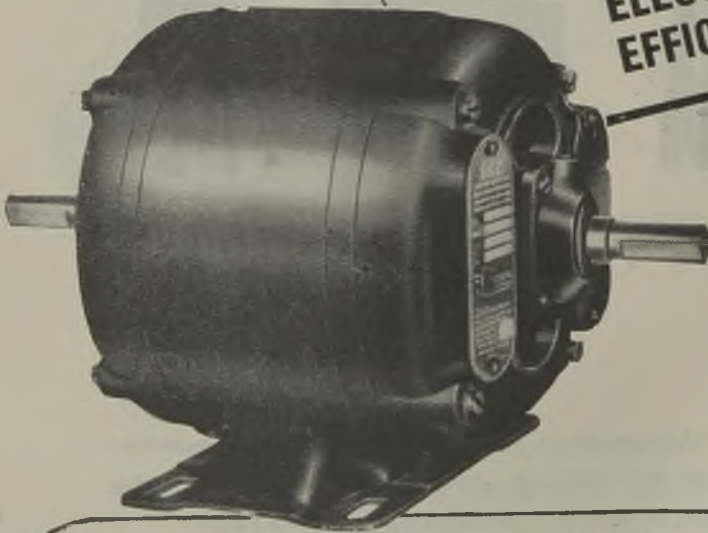
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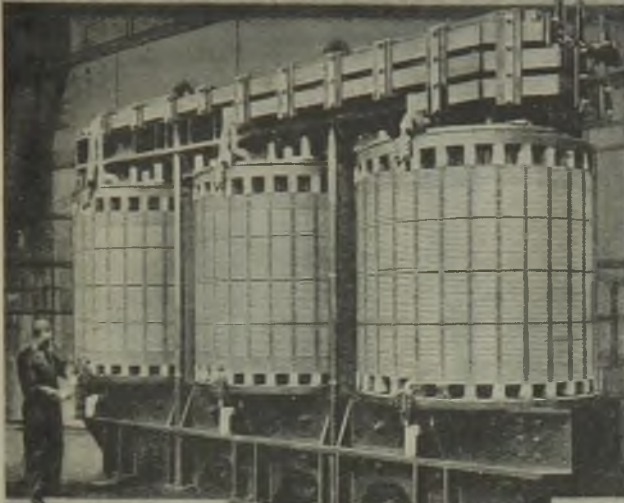


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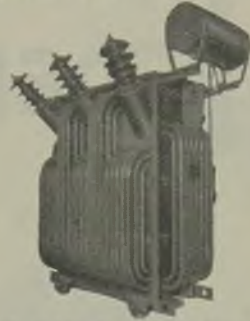
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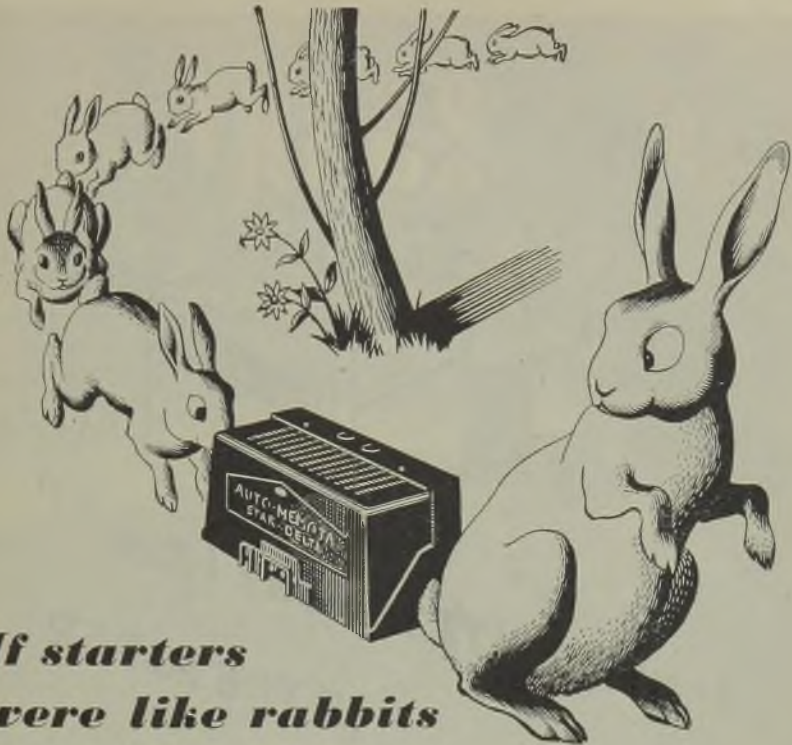
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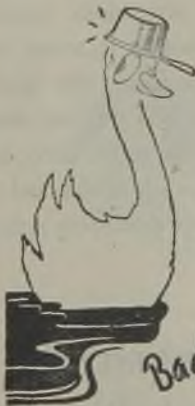
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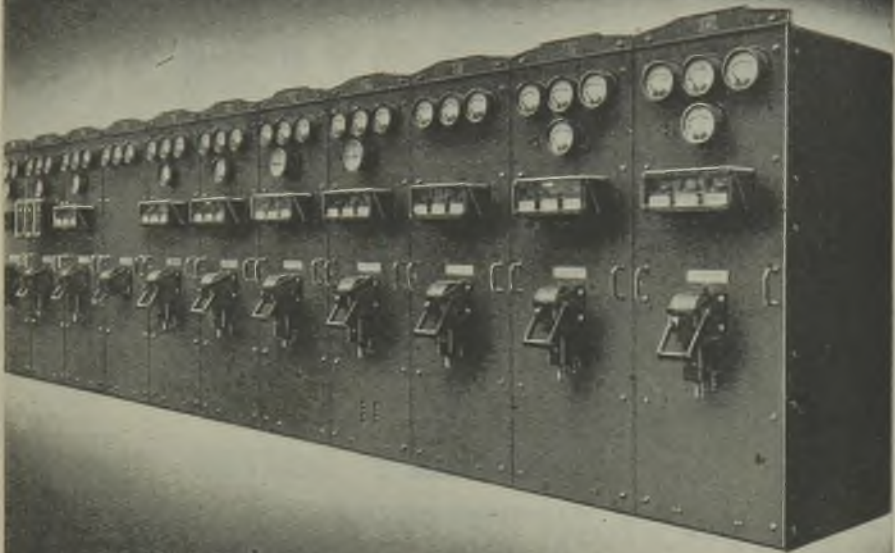




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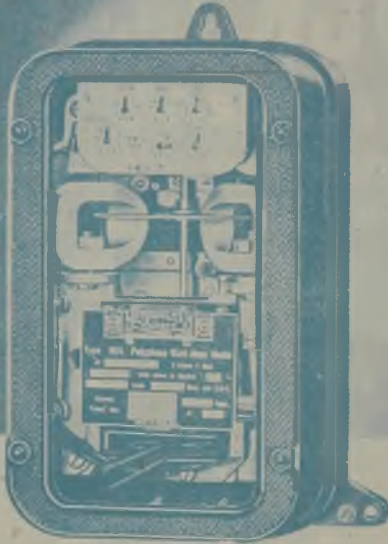


*Multi-panel  
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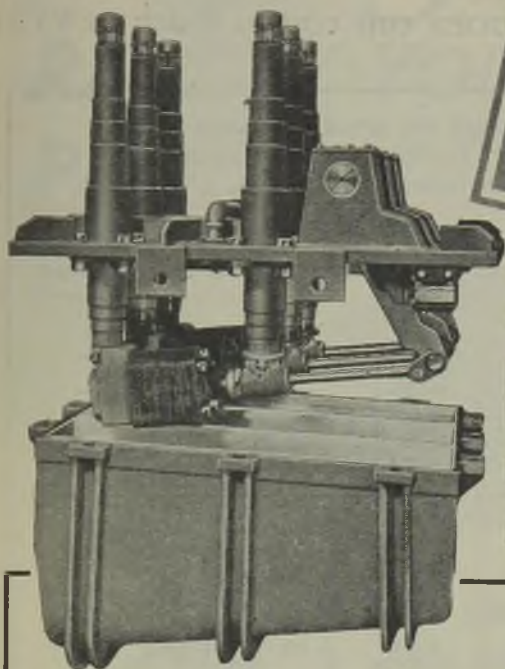
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750 and 1,000 MVA  
22 and 33 kV  
400—800 Amp.

**Fully tested and Certificated in  
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(Note - All figures in parts per 100,000.)

Plant	No. 1		No. 2		No. 3	
	Crude	Treated	Crude	Treated	Crude	Treated
<b>Cations</b>						
Calcium Ca	3.2	-	9.4	-	10.7	-
Magnesium Mg	0.8	-	0.36	-	1.09	-
Sodium Na	0.46	0.23	1.0	0.31	1.66	0.44
<b>Total</b>	<b>4.46</b>	<b>0.23</b>	<b>10.76</b>	<b>0.31</b>	<b>13.45</b>	<b>0.44</b>
<b>Anions</b>						
Carbonate CO <sub>3</sub>	4.2	0.24	12.4	0.29	10.5	0.57
Chloride Cl	1.8	0.06	2.5	0.12	2.84	0.30
Sulphate SO <sub>4</sub>	1.35	-	3.48	0.03	11.95	-
Nitrate NO <sub>3</sub>	-	-	-	-	1.15	-
<b>Total</b>	<b>7.35</b>	<b>0.30</b>	<b>18.38</b>	<b>0.44</b>	<b>26.44</b>	<b>0.87</b>
<b>Total ions in solution</b>	<b>11.81</b>	<b>0.53</b>	<b>29.14</b>	<b>0.75</b>	<b>39.89</b>	<b>1.31</b>
<b>COST per 1000 gallons</b>	<b>5.22d</b>		<b>9.83d</b>		<b>16.5d</b>	

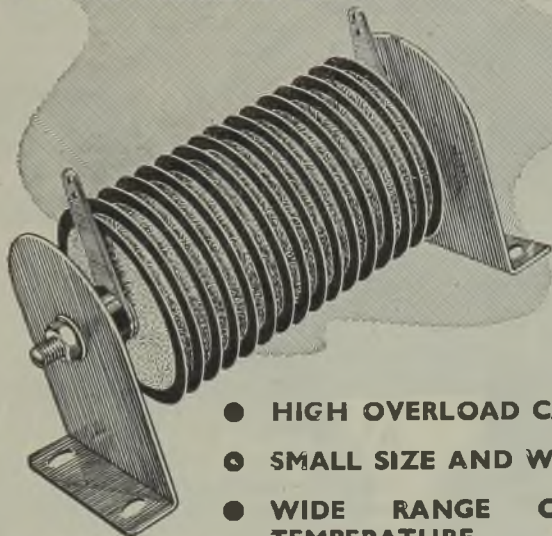
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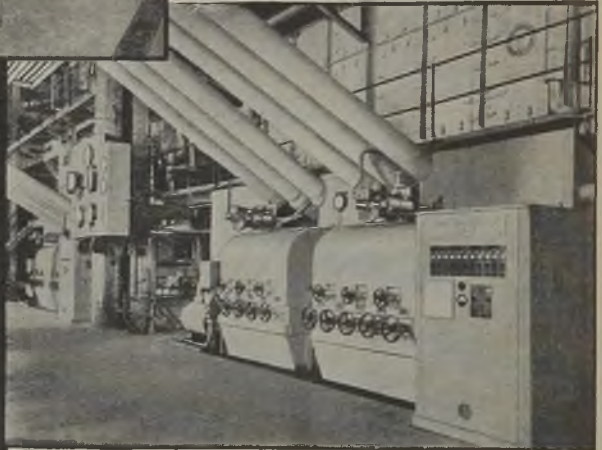
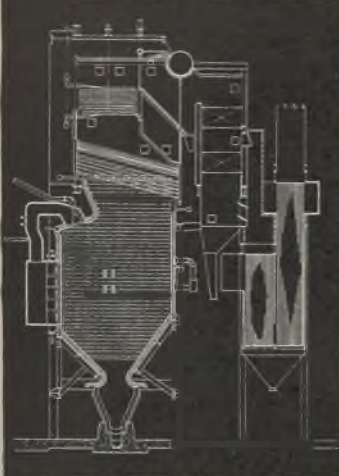
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# BABCOCK BOILERS

at *NORTH TEES*  
*Power Station*



THE ILLUSTRATIONS SHOW —

**TOP.** A view of the B. & W. Type "E" Mills in the basement.

**RIGHT.**—A view in the firing aisle showing the burner controls and some of the automatic electrically operated soot blowers with the

soot blower control panel.

**LEFT.**—A side sectional elevation through the boiler.

**BOTTOM.**—One of the boiler control panels.

**BABCOCK & WILCOX LTD., BABCOCK HOUSE, FARRINGDON ST., E.C.4**



# ELECTRICAL REVIEW

December 20, 1946

Managing Editor :  
Hugh S. Pocock, M.I.E.E.

Technical Editor : Commercial Editor :  
C. O. Brettelle, M.I.E.E. J. H. Cosens

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**EDITORIAL, ADVERTISING & PUBLISHING OFFICES :** Dorset House, Stamford St., London, S.E.1  
Telegraphic Address : "Elecrev, Sedist, London." Code : ABC. Telephone No. : Waterloo 3333 (50 lines).  
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter  
at the New York, U.S.A., Post Office.

Annual Subscription, post free : Great Britain and elsewhere (except Canada), £2 7s. 8d. ; Canada, £2 3s. 4d.  
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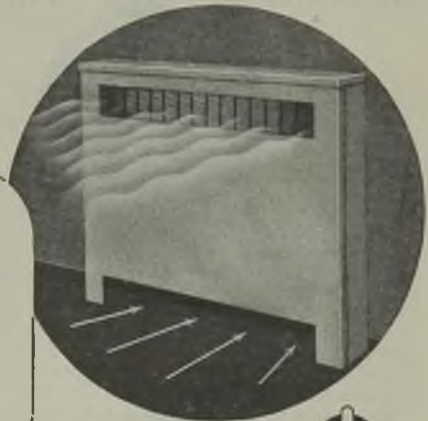
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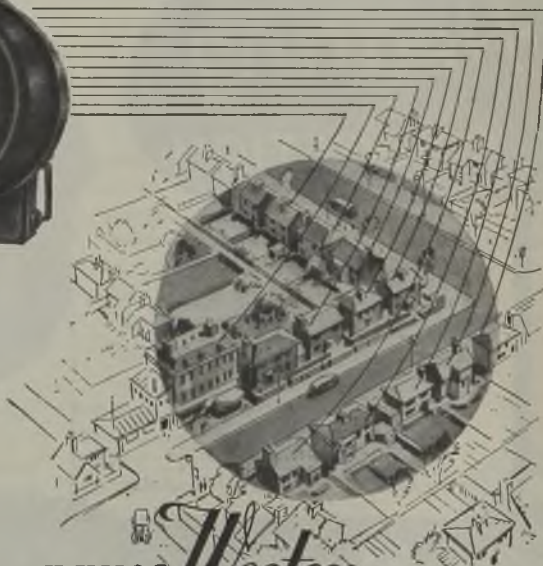
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# ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXIX. No. 3604.

DECEMBER 20, 1946

9d. WEEKLY

## Youth and Age

### Vigour of the Electricity Supply Industry

**T**HERE have been several jubilees of recent years in the electricity supply industry. This has seemingly led to an impression on the part of those controlling its political fortunes that it consequently suffers from the disabilities of age—a viewpoint that is possibly based upon a conception of the industry as a technically static body, as many other industries are, rather than as a robust and still vigorously growing entity.

It is, of course, true that its present advanced state owes very much to the work of pioneers—men who reached positions of responsibility early in life and devoted their main energies to the development of the industry. They started from scratch without receiving the same aid as their successors from well worked out academic curricula or from still unwritten textbooks and institution papers.

#### Evolutionary Years

Taking up their duties when, for the most part, d.c. was predominant, they had to learn to think vectorially by force of the circumstances that their own labours helped to create. The inevitable defects in their technical education they turned to advantage, since the need to fill in the gaps called for an exercise of imaginative powers that enabled them to make the utmost use of the knowledge they did possess. This kept their minds on the alert for new developments and their outlook youthful. The large number of separate undertakings was not without its merits then in enabling them to work out a diversity of practices from which the

fittest for their purpose have survived. In addition the small margin (if any) of revenue over expenditure in those days was a constant stimulus to the economic sense that is indispensable to engineers.

In the fullness of time these men were succeeded by others trained in the same hard school, but better equipped theoretically and with more conventionally demonstrable technical qualifications (to which insufficient weight was formerly attached), but not more than the increasing complexities of their work demanded.

#### Later Achievements

With the wider field catered for by electricity, the need was for a thorough grasp of technical and administrative principles in order to co-ordinate the work of subordinates specializing in the details appropriate to divers branches. That the younger men of all grades have proved equal to their heavy though somewhat different responsibilities has been proved by the accelerating rate of progress, and by the diminishing cost of electricity for many years before the war. Great as was the scope in the early days for the exercise of their abilities, the potentialities are still greater now, since each new development opens up further vistas to provide expanding opportunities.

Young engineers to-day have a vantage point, as it were, from the shoulders of their seniors, whose experience and judgment are placed freely at their disposal. Probably, they are often surprised as well as pleased at the trouble taken to aid and encourage their efforts by those of high

standing in the engineering world. The reason is twofold: First there is natural solicitude for the future of the profession; secondly, it is the only way known to the older men of repaying the debt they themselves owe on the same account to their mentors of the past. In this way the youth of the electrical industry is continuously being renewed on stable foundations.

### Faith Justified

SOME measure of the advance of the all-electric idea may be obtained from Professor Parker Smith's article in this issue. His decision, little more than a score of years ago, to rely entirely on electricity for heating, cooking and other domestic services, was an act of faith in his calling which was not by any means general at that time. In view of the present public demand for electricity in the home—a demand that owes much to such wholly satisfactory experience—the author would hardly find it necessary now to defend his faith as he did, even in the precincts of the Institution of Electrical Engineers, and to “glory” in the charge of being an “enthusiast.”

### Plastic Insulants

IT has been the good fortune of the electrical industry to have been able to rely upon such ready-to-hand, relatively inexpensive, multi-purpose dielectrics as paper and natural rubber. The range of their characteristics is wide enough for most applications, but it should ultimately be possible to call upon the chemist to produce insulating materials having the characteristics required for specific duties. This is one of the inferences to be drawn from the “integrating” paper on Plastics in Electrical Industry which Dr. Guido Haefely presented before the I.E.E. Installations Section last week.

### Boiler Availability

SOME hope of an appreciable reduction in generating troubles due to fouling of boiler exterior heating surfaces was held out by Mr. Robert Foot in his presidential address to the British Coal Utilisation Research Association. If tests now being carried out fulfil expectations, there should be material improvement in regard to the loss of steaming capacity from this cause. The seriousness of the position was discussed by us in

connection with the “Fuel and the Future Conference” in October and is indicated by a loss of some 15 per cent of boiler capacity which was out of commission at the time of last winter's maximum demand on the grid.

### Atomic Energy

Too much optimism in expecting rapid results from any new scientific development may easily retard progress by damping down the urge to make the most of what can be used now. In the *Fuel Economy Review* for 1946 Professor M. L. Oliphant utters a warning against neglect to exploit all existing sources of power on the assumption that nuclear energy will soon make them obsolete. While emphasising that the British Commonwealth should play a major part in the development of atomic energy, he points to the likelihood of a lapse of fifteen to twenty years before it becomes a serious rival of fuel and then only in large plants whence it would be distributed as electricity. The possibility of this also depends on the absence of restrictions on account of military considerations.

### Undertakings' Trainees

SOME anxiety exists about the inflow into electricity supply of enough engineers with good technical qualifications. The proposal of Mr. H. Pryce-Jones to offer men with previous good educational and workshop training a two-years' course with the Brighton undertaking seems a step in the right direction. His scheme is encouraged by the Central Electricity Board, which even before the war itself afforded promising juniors opportunities in its various departments, as Sir Johnstone Wright (general manager, C.E.B.) has long been interested in the subject. The Board is not only authorizing the charging of the salaries of the two Brighton trainees (E.P.E.A. Schedule, Class J, Grade 10) to its monthly generating station account but is also considering a national scheme on similar lines.

WE thank the many people who have sent us **Compliments of the Season** seasonal greetings and wish all of our readers a very happy Christmas and a much-improved New Year.



### Large-scale Use of Ultra-Violet-Ray Air Sterilization

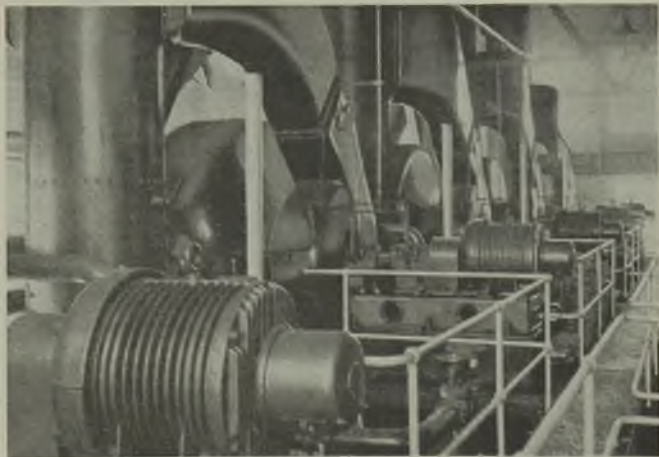
**P**ENICILLIN has been described as the greatest medical advance since anaesthetics. Its discovery would, however, have been of only limited value if means had not been developed for making available sufficiently large quantities to allow its general use. Such large-scale production requires the aid of electricity, not only for power but also for the provision of those sterile conditions which are essential to its manufacture.

The largest penicillin factory in the world, that which the Distillers Co. has established at the request of the Ministry of Supply at Speke, near Liverpool, has in fact a maximum demand of 1,200 kVA and a monthly consumption of about 670,000 kWh. The supply from the Liverpool City Electric Supply Department is stepped down from 11 kV to 400 V by two 1,500-kVA English Electric transformers fitted with Buchholz safety devices. The h.v. and l.v. switchboards, which were also made by the English Electric Co., have been attractively finished in eau de nil.

Apart from the

boiler plant utilized to supply superheated steam at 150 lb pressure for sterilization of the fermentation plant, for the operation of the distillation and recovery units used in the purification of penicillin and for general factory heating, hot water supplies and canteen services, all the plant is electrically operated.

The five 10,000 lb per hr Edwin Danks boilers too are equipped with electrically operated Hodgkinson stoker gear, Sirocco induced draught fans (driven by five 20-H.P. motors) and one 30-H.P. water pump.

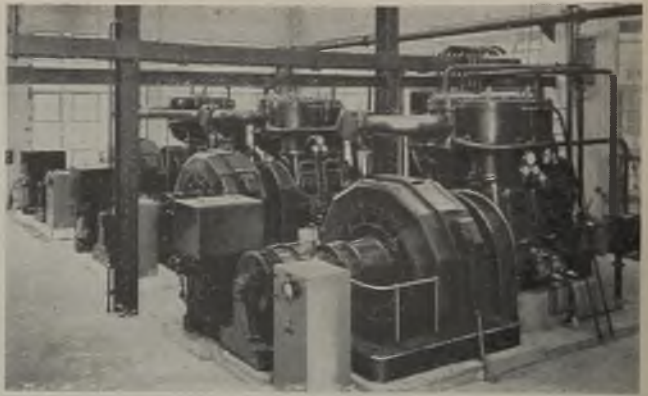


Induced draught fan layout in the boiler house. Our title picture at the top of the page shows a view looking through a plate-glass window into the sterile area. Under the glass hood and stainless steel screen, bottles are filled with penicillin solution by hypodermic syringe. Note the ultra-violet discharge tubes fitted into the glass ceiling

The culture of penicillin is commenced in test tubes, the selected strain now used at Speke having been developed by treating an existing culture with X-rays and having the power to produce penicillin in much greater quantities than its parent. This culture (kept until required in fine sand) is mixed with a broth prepared from corn-steep liquor and a nutrient (lactose), the former being a by-product obtained when whole maize is digested in water in the manufacture of starch.

As the culture multiplies it is transferred to larger and larger glass flasks, which have to be kept in a continuous state of agitation, an electrically driven shaking machine being used for this purpose. When growth of the culture is sufficiently advanced, the flasks are stored in refrigerators until required.

Sterilizers, hot-plates for evaporating solvents, drying ovens, vacuum ovens for estimating moisture content, furnaces for ashing various materials, photo-electric tur-

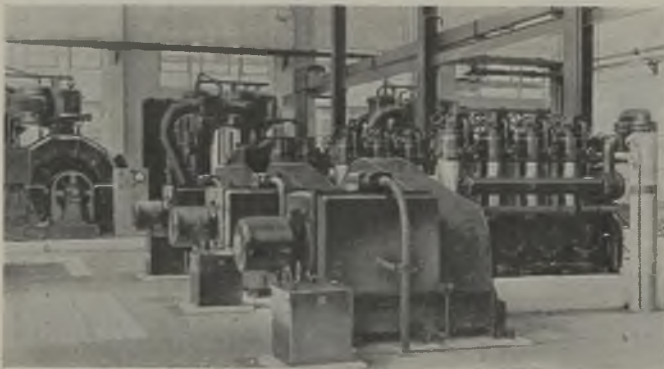


These air compressors produce half a million cu ft per hr of compressed air for fermentation purposes

to 300-gal seed tanks containing more corn-steep liquor. These tanks are water jacketed to maintain the temperature at the optimum for fermentation and are provided with air lines to give the continuous supply of sterilized air which is essential to the growth of the moulds of this type without contamination. Cambridge instruments record the pressure and temperature.

The corn-steep broth is sterilized in two 10,000-gal steam cookers fitted with agitators

(20-H.P. motors) and pumped (by 10-H.P. motors), together with the culture from the seed tanks, to fourteen 10,000-gal water-jacketed fermenters, where the mixture is maintained at a temperature of 75 deg F. Besides the removal of the carbon dioxide formed, large quantities of sterilized air have to be passed through the broth during fermentation, and for this purpose four Belliss & Morcom air compressors, driven



Ammonia compressors for circulating chilled water round the fermenters and seed tanks are driven by 175-H.P. motors

bidometers for testing the concentration of penicillin, stirrers, pH meters, centrifuges and refrigerators are among other electrical equipment of the laboratories, which are air-conditioned, electrically heated and lighted by fluorescent tubes.

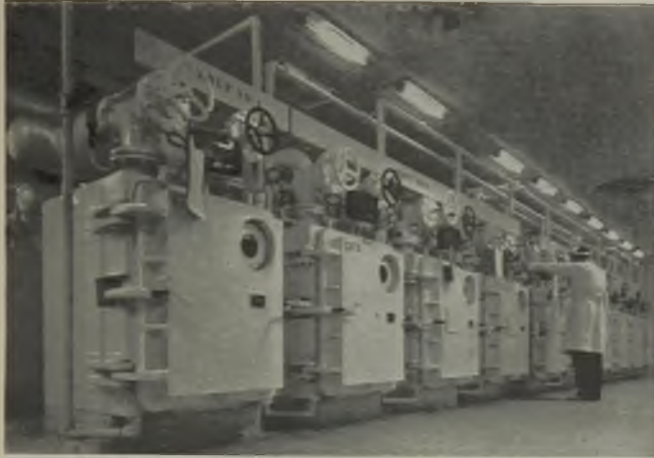
The contents of the flasks are transferred

by 550-H.P., 6,600-V, 250-r.p.m. Bruce Peebles autosynchronous motors fitted with Metro-Vick liquid starters each furnish 2,400 cu ft of free air a minute.

All the air for fermentation is scrubbed in a series of steel towers 62 ft high. Air for the sterile area, after scrubbing, is

sterilized by batteries of Hanovia ultra-violet lamps inserted in the trunking system. Chilled water compressors for circulating round the fermenters and seed tanks are driven by three 175-H.P. motors.

After several days, when the fermentation



In these vacuum ovens the frozen solution of penicillin is dried at extremely low temperatures.

Armour-plated doors are needed to resist the terrific pull of the vacuum which is applied

bulk container holding about 10 gal (the proceeds of one 10,000-gal fermenter) to the sterile area where after final filtration it is filled into bottles and

is complete, the fermenter contains approximately 30 tons of liquid broth in which is floating a large amount of spongy mycelium. Dissolved in this large quantity of broth is a mere 3 to 4 lb of penicillin. Pumps (10-H.P. motors) bring the broth to a novel type of rotary filter (1-H.P. variable-speed motor) from which the mycelium is removed as a continuous felt and the clear broth passes on to a large stainless steel tank fitted with high-speed agitators with 10-H.P. motors. Then a small quantity of finely divided activated carbon is added which rapidly absorbs the penicillin.

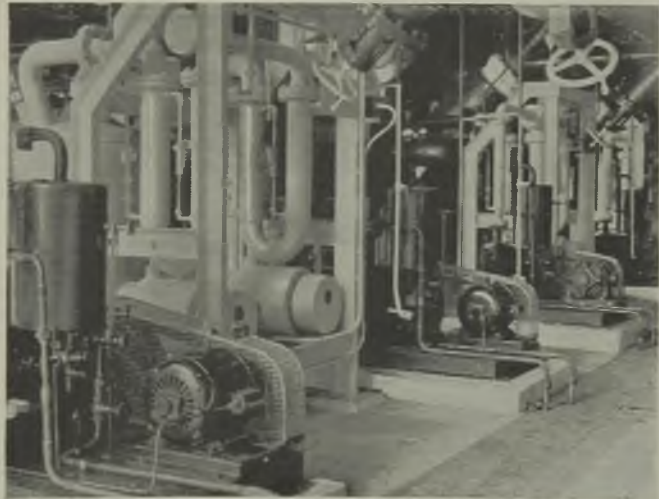
Filter presses (3-H.P. motors) remove the exhausted broth and the carbon containing the penicillin goes to a further stainless steel vessel where acetone is added

to dissolve the penicillin from the carbon. The solution of penicillin and acetone passes on to a concentrator, where various acid and alkali solutions, used in conjunction with 15,000-r.p.m. centrifuges, eliminate the solvent. All the motors employed in this

section of the factory are of flameproof design and the wiring is all carried out with Pyrotanax mineral-insulated cable.

After filtration the penicillin goes in a

dehydrated before distribution to the user. Automatic machines under a glass hood fill the bottles (previously treated in an electric sterilizer) to an accuracy of 0.01 cm at a rate of 2,500-3,000 an hour, each bottle containing, after drying, 100,000 units of penicillin



Section of the high vacuum diffusion system

salt. A centrifugal switch varies the flow to the pipettes used for filling.

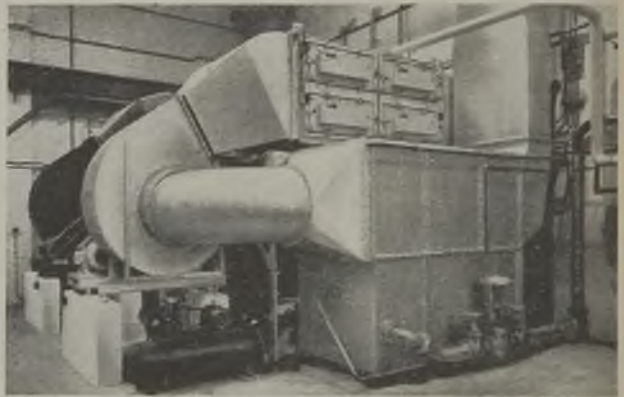
The bottles in trays then go to freezers, which reduce the temperature of the solution to  $-74$  deg F and so transform it to a block of ice. On transfer to high-vacuum ovens, of which there are twenty, the ice is evaporated directly without going through the liquid stage, this being necessary since penicillin in solution is very unstable to heat. The ovens are evacuated down to about 300 microns within five minutes by means of single-stage pumps of the oil-sealed rotary type. After this rough evacuation, the dryers are connected to the high-vacuum manifold serving the diffusion pumps. These further reduce the pressure until dehydration is accomplished. Each dryer is fitted with a McLeod vacuum gauge.

To relieve the strain on the diffusion pumps, vapours leaving the high-vacuum manifold go through a pair of cold traps or low-temperature condensers in parallel. These are jacketed steel cylindrical chambers set at an angle, provided with revolving scrapers and refrigerated with ammonia to about  $-80-90$  deg F. Ice that collects on the walls is scraped off and falls into an ice receiver at the same temperature.

Serving the two batteries of dryers are eleven sets of diffusion pumps consisting of 4-in. diameter units of a multi-jet design and built of welded steel. Chlorinated hydro-carbons, having a lower vapour pressure than mercury, are used as the pumping fluid and are condensed on the walls of the pumps and re-used. These diffusion pumps discharge to oil-sealed, rotary high-vacuum pumps which compress the exhausted gas to atmospheric pressure and discharge it, thus enabling the diffusion pumps to take hold. An important feature of the backing-up pumps is the oil-purification system which continuously recirculates all sealing oil to remove condensed water and other contamination. Otherwise, these would flash back into the system and raise the fore-pressure to a point where the diffusion pumps could not operate.

Bottles of penicillin salt remain in the vacuum ovens until the moisture has been

reduced to the specified content. Sterilized vacuum-dry rubber stoppers are then inserted as quickly as possible in another room of the sterile area. An aluminium cover is then machine-seamed over the rubber stopper and the bottles are ready for normal handling. From the moment the bottles are washed and until they reach



Air for the sterile area is scrubbed and sterilized in this unit, passing on through large ducts at a strictly controlled temperature and humidity

this point they are wholly untouched by hand.

The sterile area in which the bottling and dehydration are carried out comprises eight rooms with a floor area of 10,000 sq ft. Access is reached through a single door and no one is allowed to enter without taking all the precautions normally practised before entering a hospital operating theatre. The whole of the ceilings and walls are glass-lined and the floors are of impervious terrazzo.

The area is fed through overhead ducts with air, controlled for temperature and humidity, and sterilized by batteries of special Hanovia ultra-violet discharge tubes lining anodized aluminium irradiation chambers in enlarged segments of the ducts. The air maintains a slight positive pressure to ensure that no unsterilized air is admitted through the single-entrance door. In every room and corridor numbers of similar Hanovia tubes fitted into the glass ceilings give direct ultra-violet irradiation to the entire volume of air in the rooms, thus dealing with any new infection which might be introduced by the occupants. All conduit, supply ducts, etc., are run above the dummy ceiling, and switches are fitted outside the sterile area. Ultra-violet tubes are also provided in the dressing rooms.

Testing of the finished product takes five days, and to ensure that no contaminating bacteria are present, injections are made in rabbits and mice. The animal house where these are kept is also supplied with air controlled for temperature and humidity, and sterilized by ultra-violet discharge tubes in the duct, as for the main sterile area. The equipment here includes a Frigidaire refrigerator for storing penicillin, an electric instrument sterilizer and sterilizing ovens. After final approval the bottled penicillin is packed in cartons and placed in a cold room with a temperature of 35 deg F until dispatch, the refrigeration plant comprising

three 4-cylinder ammonia compressors, and three low temperature compound ammonia compressors. At this temperature the material will retain its potency for at least a year.

The high-voltage electrical installation was carried out by the English Electric Co., Ltd., the power and lighting equipment being installed by the Phoenix Electrical Co. (London), Ltd. The main power cables were supplied by the Liverpool Electric Cable Co., Ltd.

We should like to thank the various members of the Speke staff for their help in preparing this article.

## Lightning Protection

### Investigations in Eire

**T**HE degree of protection against lightning to be afforded to any system of overhead power lines is determined by economic considerations, based upon the frequency and severity of thunderstorms in the particular locality. Proper assessment of the risk to be guarded against is thus dependent upon the availability of adequate local data.

It was to obtain such information that an investigation was carried out by the Electricity Supply Board in Eire, an account of which is given in the paper presented by MR. R. C. CUFFE (E.S.B.) last week in London to the Transmission Section of the Institution of Electrical Engineers.

Average lightning faults per 100 miles of line per year (110-, 38- and 10-kV systems) derived from ten-year records have enabled the author to map the variation of disturbances in different localities of Southern Ireland. Observations appear to indicate that a large proportion of (38 kV line) arrester discharges have values below 1,000 A. Since it is usual to mount magnetic links so that only discharges in excess of 3,000 A are recorded, it seems that many arrester discharges escape detection and could therefore cause erroneous conception of the frequency of operation.

In 1938 the E.S.B. prepared estimates and obtained prices for the provision of overhead earth-wires above the last half mile of all its 110 kV lines adjacent to stations and, alternatively, for the installation of sets of arrestors at the terminations of those lines. The costs of the two schemes would have been approximately the same.

For 70 per cent of that cost it would have been possible to provide standby transformers and some switchgear in respect of more than 10 per cent of the total 110-kV transformer capacity in service at that time. The economic aspect is still more forcibly emphasized by the fact that during the ten-year period in which

records were kept the average annual total cost of station damage due to lightning surges on the 110-kV system was less than 1.25 per cent of the cost of either of the protective schemes mentioned.

These facts do not mean that protective measures are entirely unjustified; they are stressed merely to show that each case needs to be examined on its own merits and that local data about the prevalence of lightning disturbance are essential.

Induced surges do cause trouble on lower voltage lines (38 and 10 kV) and arrestors protect plant that would otherwise be damaged, but the frequency of occurrence and crest-current magnitudes are not known because surge-recording devices are usually arranged to collect information about surges resulting from direct lightning strokes.

### Rectifiers and Variable-Speed Drives

**M**ERCURY arc rectifiers, with particular reference to their use for furnishing power to d.c. motors for variable drives, is the subject of a paper prepared by MR. P. T. COWLEY for the Association of Supervising Electrical Engineers.

The paper first describes the following types: glass bulb for 5 to 5,000 A, pumpless air-cooled steel for 500 to 10,000 A, water-cooled steel tank for 2,000 to 20,000 A and more, single anode steel Ignitron for 1,000 to 20,000 A.

The author then comments on the more common methods of coupling the input transformer to the rectifier, briefly differentiating between methods of regulating the speed of d.c. motors, and indicates how the output voltage of a rectifier can be varied by grid control and phase shift. Diagrams illustrating the paper included a circuit outline of a complete single-phase rectifier motor starter and speed controller.

# Neutral-Displacement Protection

## New Type of Relay Equipment

**T**HE neutral of a three-phase high-voltage system is usually earthed, either directly or through a current-limiting impedance. Earthing should be at one place only, generally the point of supply. Where the neutral is earthed solidly, its voltage cannot vary appreciably from that of "earth" or zero potential, either under normal or earth-fault conditions. Where the neutral is earthed through a current-limiting impedance, with a reasonably symmetrical system under healthy conditions there is little or no current in the earth connection, and the voltage of the neutral point is likewise practically zero with respect to earth.

Under earth-fault conditions, owing to the impedance, the voltage between the neutral point and earth rises to a value normally not greater than the phase-to-neutral voltage (Fig. 1). This value is usually referred to as 100 per cent neutral displacement.

The displacement occurs for earth faults on any part of the system and by itself cannot normally be utilized for the selective disconnection of any particular faulty section. Certain circuit and system conditions, how-

By **E. A. Burton,**  
A.M.I.E.E.

ever, can arise as shown in Fig. 2a, when the supply end of a circuit has been disconnected by selective protection but remains alive due to back feeds from the receiving end. The supply end being disconnected from the neutral of the system, no heavy earth-fault currents can flow. The condition, particularly in the case of a broken conductor, however, constitutes a hazard which

should be cleared as soon as possible by disconnecting at the far end. The conditions shown in Fig. 2b are rather more difficult owing to the lower percentage displacement, and special provision must be made for disconnecting the supply end.

The method usually adopted to bring about the disconnection of the far end (Fig. 2a) is the provision at that end of an additional or artificial neutral point of high impedance to earth. The voltage rise mentioned above can then be utilized, as the need for selectivity does not arise after the sending end has been opened. It is very important, however, to introduce a time lag between the incidence of the neutral-voltage rise or displacement and the tripping of the associated switch, in order to allow the

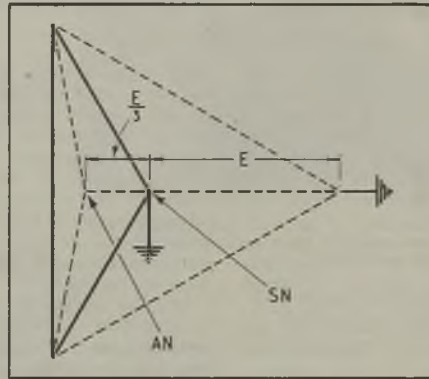


Fig. 1.—Vectorial relationship between system neutral, SN, and artificial neutral, AN, displaced by  $E/3$  or  $33\frac{1}{3}$  per cent.

CIRCUIT CONDITIONS	NATURE OF FAULT	NEUTRAL DISPLACEMENT	SWITCH OPERATIONS
Transformer feeders in parallel on h.v. side at sending end only. L.v. sides paralleled. Fig. 2a	Earth on one h.v. phase. If conductor broken, both sides of break earthed.	per cent 100	Sending-end PS <sub>1</sub> trips instantaneously on earth-fault protection. SS <sub>1</sub> trips on neutral displacement protection after 10 sec.; circuit dead.
Transformer feeder (one circuit only)	One conductor broken but not earthed.	50	No current in sending-end earth-fault relay. PS <sub>1</sub> does not trip. SS <sub>1</sub> trips if N.D. set suitably.
Transformer feeder (one circuit only) Fig. 2b	One conductor broken and earthed on side remote from supply.	33.3	As above for PS <sub>1</sub> and SS <sub>1</sub> .



selective protection on that or any other faulty section of the network to clear. The impedance to earth of this additional neutral-earth connection must be high, otherwise multiple neutral-earthing conditions would arise. The position is summarized in the table on the opposite page.

The additional or artificial neutral point can be established in one of three ways:—

(1) The step-down transformer may be star-connected on the higher-voltage side. The neutral point thus made available is connected to earth through a high impedance, which may be either

a voltage transformer or a low-capacitance condenser. If the former is used, the 110-V secondary supplies a standard induction relay in series with an appropriate resistance. This type of relay has an inherent and adjustable time delay. If the low-capacitance condenser is used, the current flowing in the lower potential connection to earth operates a sensitive relay of a type to be described later.

(2) An earthing transformer or compensator of high leakage impedance (or alternatively an earthing transformer

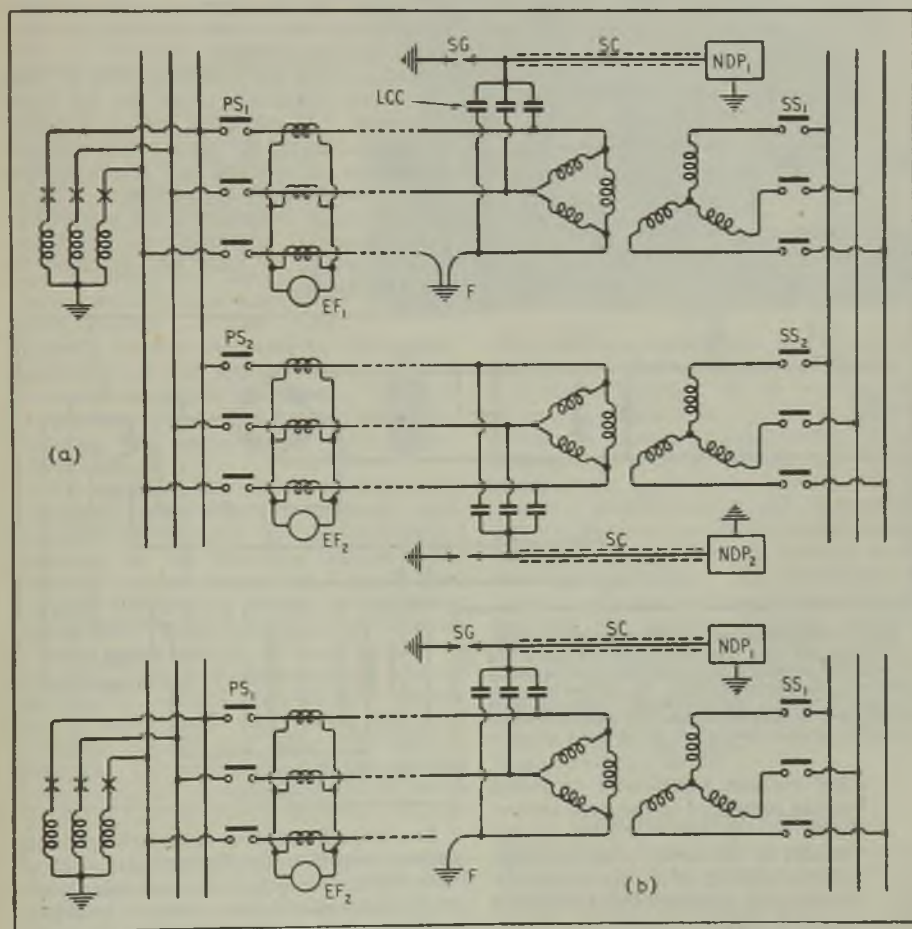


Fig. 2.—Circuit conditions with one high-voltage conductor broken at both ends and earthed at F in (a) and on side remote from supply in (b). PS<sub>1</sub> and PS<sub>2</sub>, switches at supply end; SS<sub>1</sub> and SS<sub>2</sub>, switches at far end of circuit; LCC, low-capacity condensers, forming artificial neutral point; SC, screened cable; SG, safety spark gap; NDP<sub>1</sub> and NDP<sub>2</sub>, neutral-displacement protective relays—NDP<sub>1</sub> trips SS<sub>1</sub> after 10 sec. and NDP<sub>2</sub> starts up but resets after PS<sub>1</sub> trips; EF<sub>1</sub>, earth-fault relay to trip PS<sub>1</sub> instantly; no fault current in EF<sub>2</sub>.

of normal leakage impedance but with a high resistance in each phase connection) may be connected to the supply side of the main transformer, and the neutral point, thus available, connected directly to earth. The secondary of a current transformer in this connection can then be used to supply a standard induction relay as mentioned in (1).

- (3) Three equal high impedances may be connected in star to the high-voltage side of the power transformer. These impedances usually take the form of low-capacitance outdoor condensers, which are comparatively easy to construct and no less reliable than any

as only standard and well tried components are used. The use of a low-capacitance condenser in the earth connection is less expensive and with later relay developments should prove no less reliable. However, power transformers are not always star-connected on the higher-voltage side and in the majority of cases consideration must be given to methods (2) and (3). Of these, the connection of an additional transformer unit of special design to the higher-voltage side of the circuit can be justified technically only from the reliability of the secondary relay equipment. It is usually more costly, particularly if the windings and resistances are continuously rated under maximum neutral-displacement conditions.

Method (3) is the least costly and no less satisfactory technically except for the relay equipment. At maximum voltage between neutral and earth, the value of the primary impedances are such that only approximately 1 mA flows in the earth connection. This is too low a value to permit the use of standard induction relays. A type of relay which has been developed to meet this condition is described below.

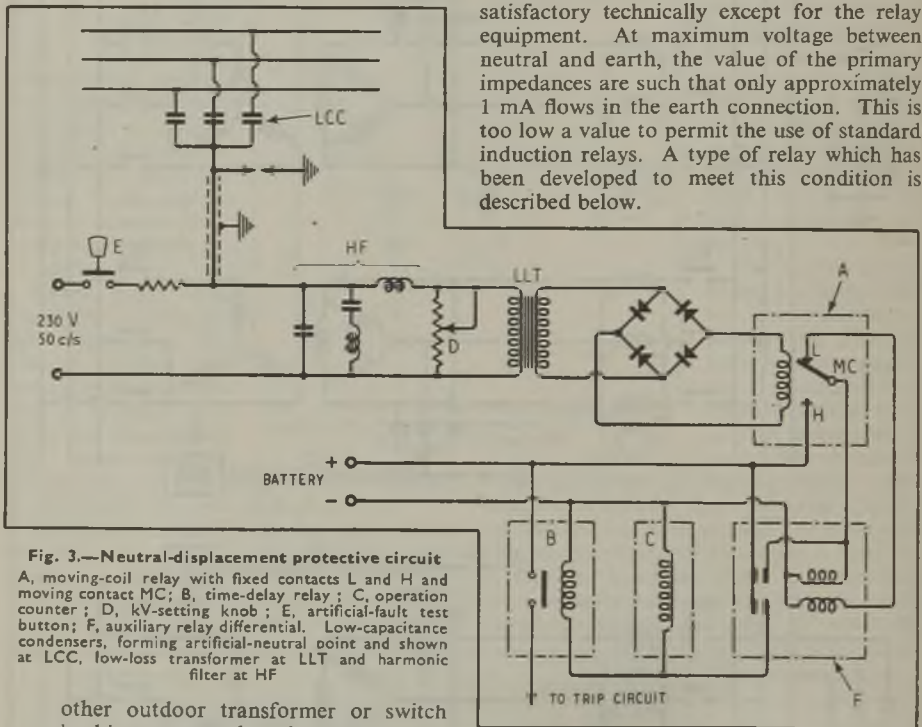


Fig. 3.—Neutral-displacement protective circuit

A, moving-coil relay with fixed contacts L and H and moving contact MC; B, time-delay relay; C, operation counter; D, kV-setting knob; E, artificial-fault test button; F, auxiliary relay differential. Low-capacitance condensers, forming artificial-neutral point and shown at LCC, low-loss transformer at LLT and harmonic filter at HF

other outdoor transformer or switch bushing connected to the same system. Owing to the low value of current available in the earth connection, even under conditions of maximum neutral displacement, standard induction relays cannot be used.

Of the three alternatives, method (1), using a potential transformer between the power-transformer neutral and earth, is probably the most satisfactory and reliable,

In view of the low value of operating current, attention was directed to a relay of the rectifier-operated moving-coil type. While a moving coil of the required sensitivity (minimum operating current 0.25 mA) was available, the construction of the coil and particularly of the contacting arrangements was not considered sufficiently reliable for protective-relay duty; a low-loss transformer

giving an output of 2.0 mA with input of 0.25 mA was therefore designed. The input was governed by the use of existing low-capacitance condenser neutrals provided for other equipments. The higher output enabled a more robust coil construction and contacting arrangements to be employed.

A circuit diagram for this equipment is shown in Fig. 3. The current in the neutral earth connection is passed through the input of the low-loss transformer. Harmonic filtering, with particular reference to the third

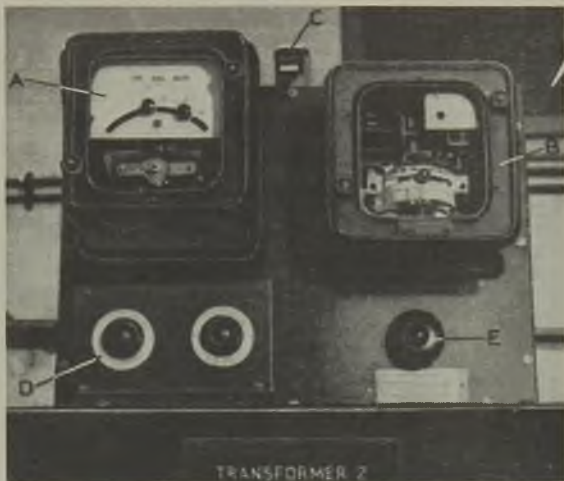
Fig. 4.—Prototype equipment in service; reference letters as in Fig. 3

harmonic—the harmonic likely to be most prominent in the neutral of three-phase systems—is provided across the primary winding. The output from the transformer is rectified to energize the moving-coil relay, which has a contact arm moving between two adjustable fixed contacts, H and L, “high” and “low.” 1.5 mA is required for “full-scale” deflection of the moving contact arm or about 60 deg angular movement. This gives ample contact separation between the moving contact MC and “high” and “low” fixed contacts.

An auxiliary relay of the double-wound telephone type with two normally open contacts is operated by the moving-coil contacts in the following manner:—The moving contact leaves the “low” fixed contact without any change to the circuit conditions, but on making contact with the “high” fixed contact a circuit is made to one coil of the auxiliary relay which operates to close its contacts. One of these contacts is in parallel with the moving and fixed “high” contact and seals the auxiliary relay in. The other contact on the auxiliary relay energizes the definite-time relay, which closes its contacts to trip the circuit breaker in accordance with its time setting.

When the moving coil is de-energized, the moving contact leaves the “high” fixed contact, but no change takes place in the circuit conditions owing to the “sealing” contact on the auxiliary relay. On making contact with the “low” fixed contact, however, the other coil of the auxiliary relay which is equal and in opposition to the first

coil, is energized and the relay drops off, thus interrupting the sealing and time-delay coil circuits. The contacts of the moving-coil relay therefore perform making duty only. A photograph of an experimental prototype equipment in service is reproduced as Fig. 4.



The low-loss transformer and harmonic filter are in a case in the back of the panel.

Setting adjustment of the moving coil element is obtained by a variable resistance across the primary of the transformer and calibrated from 20 to 100 per cent neutral displacement. Provision is made for an overall “artificial-fault” test by applying 230 V at 50 cycles through a suitable resistance and push button across the primary of the low-loss transformer. An electromagnetic counter connected across the delay-relay coil indicates the number of times operation occurs (with or without tripping), which is also an indication of the number of times the system neutral has been displaced. An equipment of this type has proved stable and reliable for more than six months on an important 33-kV circuit.

### Artificial Light Exposure

THE “A.P. Guide to Exposure by Artificial Light” (published at 6d. net, postage 1d. for *Amateur Photographer* by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1) contains exposure tables based on the additive factor system. The guide, which is in “waistcoat pocket” form, includes tables dealing with plate and film speeds, light intensity, distance of light, angle of main lighting, etc.

# Views on the News

## Reflections on Current Topics

ONE of my readers has sent me some cuttings from the American magazine *Life* with others from the advertisement pages of the *Electrical Review* to back his contention that British electrical manufacturers are lagging behind their American counterparts in design. He also sends a *Life* advertisement of a typical American automobile. He has scored a point, but I think that he has done this by comparing superior examples of American appliances with what are not front-rank British products. But I still have to admit that it is most undesirable that these same British products should go overseas if they are likely to be compared with better foreign designs at about the same price.

\* \* \*

My correspondent reiterates the view now so often expressed that while liberties may be taken in the present seller's market the effect is likely to be very detrimental when the buyer is able to call the tune again. He also considers that people at home should not be imposed upon—a sentiment with which I heartily agree. Too much junk is being sold under the shield of "austerity."

\* \* \*

Bridlington Chamber of Trade thought that it had hit on a sound idea when it suggested that the prohibition of shop-window lighting might be relaxed in favour of battery-operated lamps. Unfortunately the Ministry of Fuel and Power has ruled this out as batteries need power from the mains for charging. Vehicle batteries are (or once were) considered a desirable off-peak load; surely lighting batteries might be similarly regarded.

\* \* \*

This reminds me of the varying views on electric advertising signs held in different parts of Europe. In this country the power situation has led to a total ban—a ban which looks like a "long-term policy." In France, where power is even shorter than it is here, they are also generally prohibited but may be used on the occasion of festivals. Eire's electricity supply is barely sufficient for ordinary needs but electric signs are still allowed to operate. Questioned on the subject in the Dail recently Mr. Lemass, Minister for Industry and Commerce, said

that this was a matter to be decided by the Electricity Supply Board but he expressed the view that the small amount of energy consumed by these signs, mainly during off-peak hours, made restrictive measures unnecessary.

\* \* \*

What must surely be the biggest flood-lighting job ever undertaken has just undergone tests. It is the illumination of Table Mountain for the visit of the Royal Family to South Africa next year. The searchlight equipment used for the purpose is provided by the Union Defence Force.

\* \* \*

I have previously commented on the debt owed by the gas industry to electrical designers and this was impressed strongly upon me at a recent exhibition arranged at the London Building Centre by the British Gas Council. Cookers now have those fine lines and fittings formerly associated with electric cookers after they broke away from the practice of slavishly copying gas models. Even the taps look like switches. The inset fires particularly reminded me of their electric forerunners; they are now free from the continuous hiss which once characterized all gas fires. Of course they still need ventilation, as do the other appliances, but there is a tendency to make a virtue of this necessity.

\* \* \*

One point which I noticed in connection with the recent coal strike in the United States was the state of the electric power utilities' "stockpiles." These were reported to be equivalent to 74 days' supply, which makes our ten days' margin (or whatever it is) look very narrow. Last year at the same time the American position was even better; they then had sufficient supply for 92 days.

\* \* \*

Last year at this time I expressed the hope that 1946 would be brighter and better than the preceding six years—a hope that was hardly satisfied. Nevertheless I propose to try again and in wishing my readers the compliments of the season, look forward to greatly improved conditions in the coming year.

—REFLECTOR.

# PERSONAL and SOCIAL

## News of Men and Women of the Industry

ON the occasion of the visit of the Public Utilities Panel to England the delegates were entertained to luncheon at the Café Royal on December 9th by the Council of the British Electrical and Allied Manufacturers' Association and the Executive Committee of the British National Committee of the World Power Conference. Sir Harold Hartley, chairman of the Conference, presided. Among those present were:—B.E.A.M.A.: Mr. G. L. Wates, Mr. H. W. Bosworth, Mr. J. R. Cox, Mr. D. Z. de Ferranti, Mr. S. C. Hurry, Mr. T. F. Lister, Mr. J. S. Ramsden, Mr. D. D. Walker, Mr. B. H. Leeson, Mr. V. Watlington and the Hon. J. R. Rea. World Power Conference:—Col. C. M. Croft, Sir Johnstone Wright, Dr. C. H. Lander, Dr. A. Parker and Mr. C. H. Gray. Delegates:—M. Varlet, M. Grezel, M. Bardou, M. Crescent, Mr. G. J. T. Bakker, Mr. Van Dam Van Isselt, Lt. Col. D. W. Thorpe, M. Smits, M. de Heem, Mr. V. Bodson, Mr. Tresch, Mr. Simon, M. E. H. Etienne, Mr. Hamerschlag, Mr. C. B. Blydt, Mr. Tuxen, Mr. J. H. Angus, Capitaine and Mme. de Fargues, Mr. C. W. Jeffers, Mr. R. Asher, Mrs. K. H. Munro. Mr. R. P. letter and Wing Cdr. C. A. Francis.

**Mr. K. Hall** recently resigned the managing directorship of the Indian Aluminium Co., to become managing director of the Northern Aluminium Co., Ltd.

**Mr. E. G. Batt** has been appointed director of the British Refrigeration Association with effect from March 1st, 1947.

**Dr. C. F. Bareford**, M.Sc., Ph.D., has been appointed manager and head of the new Mullard Electronics Research Laboratory at Cross Oak Lane, Salfords, near Horley, Surrey. Dr. Bareford took a first-class honours B.Sc. in physics in 1930. One year later he was awarded the M.Sc. degree, and in 1933 the Ph.D. degree for work on the spark discharge in vacuo. He worked in this field until 1934 when he joined the B.T.H. Co. as a vacuum physicist. There he worked on the



**Dr. C. F. Bareford**

design of radio valves and other electronic devices. In 1936 he went to the Royal Naval Signal School at Portsmouth, which later became the Admiralty Signal Establishment. In these two establishments he has been engaged on research and development work connected with radio-location, direction finding and

telecommunications. He has joined the Mullard Radio Valve Co., Ltd., direct from the Admiralty and will be closely connected with the development of electronics as applied to industry.

The directors of Crompton Parkinson, Ltd., announce the appointment of **Mr. Arthur Parkinson** as an executive director. Mr. Parkinson



**Mr. Arthur Parkinson**

is the son of the late Mr. Frank Parkinson, chairman of the company. He has been with the company since 1936 apart from a period of service with the R.E.M.E. at Home and in the Middle East during which he attained the rank of captain. Mr. Parkinson is sales manager for lamps and lighting equipment.

**Mr. L. Raven**, B.Sc., A.M.I.E.E., deputy borough electrical engineer with the Brentford and Chiswick Council, has been appointed borough electrical engineer at Sutton Coldfield. Mr. Raven was born at Salford and educated at Manchester University (Engineering Department), receiving his practical training with the Automatic Telephone Manufacturing Co., Ltd., and Manchester Corporation Electricity Department. Between 1932 and 1941 he held appointments in the Manchester, Wallasey and Cardiff undertakings and from then until taking up his present position in March, 1945, he was consumers' engineer at Harrogate. In this issue the Brentford and Chiswick Electricity Department is advertising for a successor to Mr. Raven.

**Mr. R. L. Axford**, A.M.I.Mech.E., chief technical assistant at Newport (Mon.), has been promoted to the position of deputy borough electrical engineer of Newport, consequent upon the retirement of Mr. R. Dimmack on superannuation after forty-three years' service with the undertaking.

The employees of the Telegraph Construction & Maintenance Co., Ltd., are accomplished in other things beside cable production, and the "Telcon" Concert Party last week gave an excellent concert at the company's Greenwich works. The occasion was the Telcon Social & Athletic Club's annual presentation of trophies and prizes. Tap dancers, vocalists and instrumentalists served up a programme which was very much to the taste of a large and appreciative audience which included Lord Colgrain (chairman), Sir Geoffrey Clarke (managing director), Mr. B. H. Musgrave (secretary), and Messrs. F. Leighton, J. N. Dean and W. F. Randall.

At the conclusion of the concert **Lord Colgrain** presented the trophies and prizes and in a brief speech said that the past year had been a difficult one and he thanked all the workers for what they had done. The company had acquired a ground at Kidbrooke which was being prepared as a sports ground, and it was hoped that this would be ready for use in about six months' time. After the presentations there was dancing with music by Al Tallack's band.

On one of her return journeys from the United States, the passengers on the *Queen Elizabeth* included several well-known men in the electrical industry. In the accompanying picture, which is reproduced by courtesy of



Electrical men on board the *Queen Elizabeth*

"Ocean Pictures," we show a party on board which consists of Mr. Geoffrey Falk and Mr. W. Thurner (Falk, Stadelmann & Co., Ltd.), Mr. J. A. Fraser and Mr. M. C. Lawson Brown (English Electric Co., Ltd.), and Mr. C. A. Turner and Mr. G. H. F. Walton ("Diamond H" Switches, Ltd.).

Mr. J. Lawton has been appointed area manager, Eastern Counties, of Ferranti, Ltd., vice Mr. R. J. Hebbert, whose duties at Hollinwood now occupy his whole time. Mr. Lawton has been in the company's service since 1917, and is an expert in the subject of large-scale metering.

Professor G. W. O. Howe, who was presented with a cheque for £200 on his retirement from the James Watt Chair of Electrical Engineering in the University of Glasgow, has handed over the gift to the principal of the University for the endowment of a prize for the most outstanding graduate in electrical engineering. The presentation ceremony was performed by Professor Bernard Hague, who succeeded Professor Howe when the latter retired on September 30th.

On Saturday last the Social Club of Berry's Electric, Ltd., arranged a party for about 120 children of employees at the Magicoal Works, Wembley. Arriving at about 3 p.m. the children had tea and then there was an hour's film show followed by a concert, community singing and competitions. Shortly after 6 p.m. Father Christmas looked in to distribute toys and afterwards the children left with gifts of sweets, fruit and pocket money.

Mr. C. G. Renold, chairman of the Renold & Coventry Chain Co., Ltd., has been appointed chairman of the newly-formed British Institute of Management. Mr. Renold is this year's chairman of the Manchester Engineers' Club.

Mr. F. B. Walker, 21, Morningside Gardens, Edinburgh, 10, who, for the past eight years has represented the Hotpoint Electrical Appliance Co., is joining the sales staff of Trustful Products, Ltd., Scottish Branch, on January 6th.

A semi-social evening was organized by the N.W. Students' Sections of the I.E.E. and I.Mech.E. on December 9th. The first half of this new venture, which proved to be both entertaining and instructive, was devoted to a "Brains Trust" consisting of a panel of six senior members, three from each Institution. Under the chairmanship of Mr. R. A. S. Thwaites they discussed a wide range of subjects. The second half of the evening consisted of a "Quiz" Competition.

The I.Mech.E. carried off the honours by 36 points to 30, and were presented with a "mallet": Mr. Thwaites acted as question-master. It is proposed to make this "Quiz" an annual event.

Mr. H. Goodrich, J.P., M.P., whose election as chairman of the London and Home Counties J.E.A. was reported in our last issue, served on the Electricity Committee of the Hackney Borough Council from 1926 to 1945. He was elected a member of the J.E.A. in 1937 as a representative of those Metropolitan Borough Councils who are authorized electricity undertakers. After serving on the Local Distribution, Finance, and General Purposes Committees for two years, he became vice-chair-



Mr. H. Goodrich

man and then chairman of the General Purposes Committee, holding office until his present election as chairman of the Authority.

Mr. Dudley Stuart, M.I.E.E., the retiring chairman (who was formerly an alderman of the borough of Wimbledon) did not seek re-election as a member of the J.E.A., on which he has served for twenty-one years. Councillor W. H. Shaw, of Walthamstow, who has been a member of the Authority since 1928, has been re-elected vice-chairman.

**Alderman W. L. Lorkin**, A.M.I.E.E., who has been elected Mayor of Reigate, has served as chairman of the Corporation Electricity Committee for the past sixteen years. He is joint managing director of the Equipment & Engineering Co., Ltd., the senior British member of the International Transport Organization, silver medallist of the Royal Society of Arts, Freeman of the City of London, and a member of the Livery Company of Carmen. Alderman Lorkin took an active part in the pioneer stage of electric welding and in connection with magnetic crack detectors.



Ald. W. L. Lorkin

**A.B. Metal Products, Ltd.**, held a staff dinner on December 6th at the Savoy Hotel, London. Mr. S. Marks, managing director, said that the change from war production to peace had been smooth and the splendid financial position was a direct result of the enthusiasm and energy of the workers.

**Mr. J. R. Taylor**, A.M.I.E.E., has been appointed deputy borough electrical engineer of St. Helens in place of Mr. J. Mills who was recently appointed borough electrical engineer of Bury. Mr. Taylor went to St. Helens about two years ago as power station superintendent, having previously served with the Hull Electricity Department, the County of London Electric Supply Co., and the Kent Electric Power Co.

**Mr. F. L. Parkin**, B.Sc., A.M.I.E.E., has resigned the position of Midlands regional manager for the Harland Engineering Co., Ltd., to take up an appointment on the staff of the chief engineer of Steel, Peech & Tozer as from December 30th. He will be succeeded by **Mr. S. A. Hamer**, B.Sc.Tech., A.M.I.E.E., of the company's Manchester branch.

## Obituary

**Mr. F. K. Jewson**.—We regret to hear from Standard Telephones & Cables, Ltd., of the death of Mr. Frank Knight Jewson, A.M.I.E.E., who had been associated with the telecommunications industry for forty-nine years. He died in London, suddenly, from a heart attack on December 4th, in his sixty-seventh year. Mr. Jewson was educated at Finsbury Technical College under Professor Silvanus Thompson, and joined the Western Electric Co. (predecessor of Standard Telephones & Cables) in 1897 and was concerned successively with apparatus and cable testing and telephone installations. He installed the first equipment in England for marshalling the troops at the Diamond Jubilee Review. He also gave the first demonstration to the G.P.O., and the National Telephone Co. of the use of loading coils and assisted the

National Telephone Co. in equipping the first loaded cable in Europe (between London and Croydon). From 1907 onwards he occupied the positions of export sales manager, assistant general sales manager and assistant to the managing director. In 1928 he transferred to the International Standard Electric Corporation, of which he became an assistant vice-president. During the war he returned to Standard Telephones & Cables, Ltd. The funeral was at the North Watford Cemetery on December 11th.

**Mr. G. O. H. Horstmann**.—We regret to report the death, on December 10th at the age of eighty-three, of Mr. G. O. H. Horstmann a founder of the Horstmann Gear Co., Ltd. He was the eldest son of the late Mr. Gustav Horstmann and upon the completion of an apprenticeship with his father spent several years in London before returning to Bath. There he opened a watch and clock makers' business and in 1904 established the Horstmann Gear Co. to develop the inventions of himself and one of his brothers. He was the chairman of the company and held that position until about two years ago when he was forced to retire on account of ill-health.

**Will**.—Mr. W. S. Smith, former managing director of the Telegraph Construction & Maintenance Co., Ltd., left £178,730.

## I.E.E. Benevolent Fund

**T**HE president of the Institution of Electrical Engineers, Mr. V. Z. de Ferranti, has made an appeal for contributions to the Institution's Benevolent Fund. In addition to appealing for new subscribers, he asks existing contributors to consider increasing their subscriptions and expresses the hope that this, the silver jubilee year of the Royal Charter of the Institution, will be celebrated by a record rise in the income of the Fund.

The report of the Committee of Management for the year ended September 30th, 1945, showed that the number of subscribers during that period was 11,859 and that their total donations were £8,498. As the membership of the Institution was 30,225 at September 30th, 1945, the average amount contributed per member was 5s. 7d.

Subscribers who have not already completed deeds of covenant are urged to do so. At present there are 996 covenanted subscribers, with the result that the Fund is able to recover £1,100 from the Inland Revenue Commissioners. If all subscribers and donors who pay income tax at the full standard rate in Great Britain and Northern Ireland were good enough to complete covenant forms a further £5,000 would be obtained without any obligation to the contributors beyond the promise to pay for seven years. The agreement automatically ceases in the event of death and does not involve the executors in any liability. Forms can be obtained from the hon. secretary of the Benevolent Fund.

## E.I.B.A. Home

### Munificence of a Non-Electrical Donor

**F**OR some little time past the Electrical Industries Benevolent Association has been looking out for a suitable house as a home for old people, and one estate which came to its attention was Broome Park, Betchworth, Surrey. This comprises about 25 acres of gardens, orchards, park and woodland in which stands a fine Georgian mansion in magnificent condition.

The estate lies just south of the junction of Reigate Hill and Box Hill, has easy access to Dorking, Reigate and Redhill, and is within five minutes' walk of Betchworth Station which is less than an hour's journey by train from Victoria Station.

The owners are Mr. Joseph Cunning, a retired Harley Street surgeon, and his wife, who when they were told of the E.I.B.A.'s work, particularly its social service, decided to give the estate to the Association as a memorial to their son, Mr. James Erskine Cunning, who lost his life during a raid over Essen in 1941. Neither Mr. nor Mrs. Cunning have any association with the electrical industry.

The home will have no institutional flavour and there will be the fullest respect for the privacy of the individual. The residents will have their own separate quarters while enjoying the communal advantages of generous common rooms, care during illness, etc., facilities for a library, hobbies and music, and the ability to organize concerts, whist drives and other social events, to which they will be able to invite visitors in accordance with the idea of helping the residents to foster friendships with people in the neighbourhood. The residents will also be encouraged to do as much as they can in the actual running of the estate, and everything possible will be done to enable them to take part in, and to contribute to, the life of the neighbourhood.

## Radio Interference

**A** MEETING of the group of experts of the special committee on radio interference (C.I.S.P.R.) of the International Electro-technical Commission has been held in London at the invitation of the British Standards Institution. The last meeting of the C.I.S.P.R. (which was set up in 1934) was held in Paris in 1939. At the present proceedings, which were opened by Sir Clifford Paterson (chairman, British National Committee of the I.E.C.), Dr. S. Whitehead (Director, E.R.A.) was elected chairman.

Just before the war the C.I.S.P.R. drew up a detailed specification for a standard measuring set, designed for frequencies between 150 to 300 and 550 to 1,500 kc per sec, which has, however, become inadequate with the introduction of high-frequency apparatus for medical, industrial, communication and control purposes.

The same principles have, however, been applied in modified form in Great Britain and the United States to frequencies up to 20 to 30 Mc per sec and the technique of measurement above that range is to be discussed at the next meeting. In the meantime information will be gathered regarding measurement in relation to items that give rise directly to interfering fields.

Interference from telephone plants is to be discussed in conjunction with the C.C.I.F. and the question of including radio receivers within the scope of the committee will be considered. Designs of interference generators in use will be investigated with a view to proposing international standard types, one for random noise and a second for impulses. The Belgian National Committee is to prepare a revised specification incorporating modifications to the C.I.S.P.R. measuring set for the range up to 1,600-kc per sec.

A further conference of the Export Group has been provisionally arranged for Zurich in September next year, when a number of Advisory Committees of the I.E.C. are expected to meet. This will be followed by a meeting of the full C.I.S.P.R. to discuss wider aspects. A luncheon was given by the B.S.I. to the delegates, who afterwards visited the B.B.C. studio to witness demonstrations of interference with television and an exhibition of standard measuring equipment.

## Junior Institution of Engineers

**F**OR most of the war period Maj. Gen. A. W. Sproull was responsible for the inspection of engineering, telecommunication and radar equipment as well as of mechanical transport vehicles, so he made that theme the subject of his presidential address to the Junior Institution of Engineers.

After naming the several inspectorates of the Ministry of Supply, the organization of the Chief Inspector, Electrical and Mechanical Equipment, formerly termed Engineer and Signal Stores, was outlined with brief comments on a few examples of the work done by the three divisions, including the tropicalization of electrical stores and testing of radio and radar components. Some 50 per cent of the staff employed on inspection of signal equipment consisted of women.

## Northampton Polytechnic

**T**O mark the fiftieth anniversary of the opening of the Northampton Polytechnic, London, E.C.1, scientific experiments and an exhibition of students' work were arranged at the Polytechnic on Friday last. The display included workshop demonstrations and experiments and demonstrations in the Senior Communications and Electrical Engineering Laboratories. There were also exhibits of electrical installations and cable jointing by the students.



# PARLIAMENTARY NEWS

By Our Special Reporter

**D**URING a House of Lords debate on agriculture last week the Earl of Huntingdon, Parliamentary Secretary to the Ministry of Agriculture, said that the Government had received and discussed the programme agreed with the National Farmers' Union and the supply companies for the extension of electricity in rural areas. They were trying to get over the difficulties created by the very great shortage of generating capacity and the supply of poles and other matters. The proposal to bring the electricity supply industry under national ownership would, he was sure, have an important effect on those plans. The same might be said with regard to the inland transport services. Generally, the Government policy regarding housing, water supplies, electricity, transport, education, and other services and amenities was on a national basis; but it was adapted where necessary to meet the special requirements of rural areas.

### Lighting and Cooking Appliances

At question time in the House of Commons Commander Galbraith asked the Minister of Works what percentages of total United Kingdom production of electric lighting appliances, accessories and fittings and electrical cooking and heating apparatus were being taken by his Department for the housing programme; and what proportions, respectively, had been installed and placed in stock to date.

Mr. Tomlinson said that approximate figures were available for a number of the items, as given in the following table:—

Type of Appliance.	Percentage of total production acquired for housing by Ministry of Works, October, 1946.	Percentage of total acquisition installed at November 16th, 1946.
Wash Boilers	17	90
Immersion Heaters	21	85
Electric Cookers	14	90
Thermostats	8	89

Figures were not available for other electrical items, but the percentages acquired by the Ministry of Works in other cases were very much smaller.

### Diesel-electric Locomotives

Mr. Erroll asked the Minister of Transport what steps the main line railway companies were taking to introduce Diesel-electric locomotives for long-distance passenger and freight services.

Mr. Barnes said that the railway companies were giving this matter close attention. The L.M.S. had two Diesel locomotives on order

for experimental purposes. The Southern Railway proposed to carry out trials, and the G.W.R. had placed orders for two gas turbine locomotives for use on long-distance services.

### Neasden Station Conversion

Mr. Erroll asked the Minister of Fuel and Power what improvements in operating efficiency were expected to result from the conversion of the L.P.T.B.'s Neasden power station to fuel-oil burning.

Mr. Shinwell said that the conversion of the station to oil-firing had been undertaken by the London Passenger Transport Board as a matter of expediency, to ease the coal position. It was impossible to predict the exact effect of the alteration in fuel on operational efficiency, but no great change was likely.

### Linseed Oil Supplies

Sir Stafford Cripps, replying to questions on the allocation of linseed oil, said that the Census of Production Reports for 1935 showed that the paint, varnish and white lead group of industries used in that year 47,900 tons of linseed oil and the linoleum and leathercloth industries 33,900 tons. The printing ink industry used 3,055 tons of vegetable oils of all kinds.

Mr. Erroll said he failed to detect any reference in the reply to the supply of linseed oil for the electrical insulation industry—the tonnage requirements of which were very small—which was absolutely vital for reconstruction. Small users were as important as large ones.

### House Warming

Mr. Driberg asked the Minister of Fuel and Power if, in view of the prospect of a steadily increased demand for electricity, he would investigate the results of the experiments now being conducted by the Chattanooga Electric Power Board, United States, in the heating of houses with well water which had a temperature of 58 deg F.

Mr. Shinwell said he was making inquiries about these experiments.

### Wind-Driven Generators

Sir William Darling asked the Minister of Fuel and Power if he was aware that under S.R. & O. 1942, No. 2510, Control of Fuel Order, the use of a wind-driven lighting set for house or shop had been forbidden by his Department in Edinburgh; and if he would reconsider the utilization of the considerable wind-power of Great Britain for the production of light for domestic and business purposes.

Mr. Shinwell said that the Order referred to prohibited the consumption of fuel, which

included electricity, for lighting or other fittings or appliances used for business advertisement purposes. He regretted the necessity for that prohibition, but he regarded it as important for indirect as well as direct fuel-saving purposes, and it would not be fair to traders generally to allow exceptions. The answer to the second part of the question was that his Department in consultation with other Departments concerned, was already looking into the matter.

#### Power Station Consents

Mr. Palmer asked the Minister of Fuel and Power if he would take steps to reduce the delays experienced in obtaining consent to the building of urgently required new power stations.

Mr. Shinwell said that close consultation was already taking place among the Departments concerned which it was hoped would expedite the issue of formal statutory consents.

#### Power Cuts

Replying to Col. J. Hutchison on December 12th, Mr. Shinwell said that since November 1st

the Central Electricity Board had found it necessary on eighteen days to issue instructions to electricity undertakings to shed 5 or 10 per cent of their load for periods averaging about half an hour. All seven areas of the Board had been involved but the districts most affected were the Midlands and South-East England. Load shedding did not necessarily involve cuts in electricity supplies. In many cases the strain on the plant was lightened by a reduction in voltage; in other cases large industrial consumers, on receiving an intimation, transferred part of their load to off-peak hours.

#### Gas and Electricity Production

In answer to Mr. Harold Davies, Mr. Shinwell said that gas production had risen from 165 million therms in November, 1945, to 186 million therms in November, 1946, an increase of 12.7 per cent. During the same period electricity production had risen from 3,463 million kWh to 3,938 million kWh, an increase of 13.7 per cent.

## Progress at Chester

### Golden Jubilee Celebrations

CHESTER Corporation electricity undertaking, which supplies an area of 144 sq miles and has 23,547 consumers, celebrated its golden jubilee by holding a historical exhibition of electrical equipment at the Town Hall from December 11th to 14th. Alderman R. Matthewson, chairman of the Electricity Committee, who presided at the opening ceremony, paid tribute to the part played in the development of the undertaking by the late Mr. S. E. Britton, who died last June after having been city electrical engineer since 1904, when the number of consumers was 778 and the kWh sold 1,273,213. To-day the consumers numbered 13,842 in the city and 9,705 in the rural area; electricity sold amounted to 55,549,275 kWh, the maximum demand, 19,228 kW, the cost per kWh generated 0.754d (1.433d) the price per kWh sold, 1.2d and the effective capital expenditure, £989,543.

The electricity works were opened on December 17th, 1896, and Chester was amongst the first undertakings in the country to open a showroom. The latter, which was extended to its present dimensions in 1931, was visited last year by nearly 100,000 people. Twenty-five per cent of the total sales of the showroom and contracting department represented goods supplied to contractors in the city on trade terms. In 1912 the hydro-electric station was opened and in 1923 the Queen's Ferry power station was purchased. The undertaking was noted for its pioneering work in rural development. There were 1,024 farms connected, and in the rural areas the consumption was 23½ million kWh.

Mr. C. T. S. Arnett, manager North-West

England, Central Electricity Board, who opened the exhibition, said the majority of people of this country took electricity as a matter of course. That was the measure of the service the engineers of the electricity undertakings had given to the country. The Minister of Fuel and Power was determined that rural areas should be electrified as far as possible. Chester had shown the way.

Developments in domestic equipment during the past fifty years were demonstrated by the comparison of the old and the new. Model kitchen equipment was accompanied by a model of the generating set installed at the Little Barford Station in 1944, and numerous photographs of the Chester power stations. Arrangements were made for members of the public to inspect the hydro-electric station and the Crane Bank substation.

Mr. S. C. Harling succeeded the late Mr. Britton as city electrical engineer.

### Pulverized-Fuel Conference

THE Institute of Fuel is to hold a conference on pulverized fuel at Harrogate from June 3rd to 6th, 1947. Over fifty papers are being contributed from various sources, British and foreign. The sessions will be devoted almost wholly to discussions, as the papers will not be read but will be issued in book form four weeks earlier. Each session will be opened by a rapporteur who will summarize the papers. A programme of social functions and works visits will be arranged. Membership of the conference will not be confined to members of the Institute.

## COMMERCE and INDUSTRY

### Electricity Output in November. National Apprenticeship Scheme.

**O**FFICIAL returns rendered to the Electricity Commissioners show that 3,938 million kWh was generated (3,722 sent out) by authorized undertakings in Great Britain during November, 1946, as compared with the revised figure of 3,463 million kWh in the corresponding month of 1945, representing an increase of 13.7 per cent.

Up to the end of November 36,868 million kWh was generated (34,782 million sent out) compared with 33,608 million for the corresponding period of 1945, representing an increase of 9.7 per cent.

#### Extensive Load-Shedding

During the past few days there have been regular stoppages in the supply of electricity in all areas of the country. On Wednesday last week they were spread over the period from 8 a.m. to 12.30 p.m. with a short interval at about 10 a.m. Scotland had its first "cut" on December 4th when the voltage was reduced by 5 per cent for a 45-minute period.

Mr. Shinwell, Minister of Fuel and Power, spent last week-end investigating the power plant manufacturing situation in the Manchester area. At a Press conference he suggested that more use might be made in industry of mobile generating sets which although intended for export might be held for a period. Mr. Shinwell said that he did not propose to urge further street lighting cuts which had little influence upon the situation. He placed the responsibility for "load shedding" on the Central Electricity Board which found it necessary to prevent plant breakdowns. It was not a deliberate policy of restrictions upon domestic consumers. Restrictions (to the extent of 2½ per cent) were being placed only on industrial establishments.

#### Parliamentary Bills

Among the Bills which will come before Parliament during the 1946-47 Session are the following:—

Nottinghamshire & Derbyshire Traction, empowering the Nottinghamshire & Derbyshire Traction Co. to run trolley vehicles on additional routes and for other purposes.

Dudley Corporation, providing *inter alia* for the supply of heat by means of hot water and steam.

#### Telling the Employees

Last year the West Gloucestershire Power Co. produced an elaborate "Report to Employees on the Financial Results for the Year"—the year being 1944. Now we have received the second of the series (not quite so ornate) covering 1945. This follows the same general lines,

showing the income (£583,161) and describing how it was absorbed. The analysis shows that "materials purchased and services rendered" (including the cost of energy) took 56 per cent, rates and taxes 16.2 per cent, wages and salaries 13.7 per cent, reserves and depreciation 7 per cent, and preference and ordinary dividends 4.6 per cent, leaving a balance of 2 per cent. Details are given of these items and much other useful information is included.

The competitive nature of the business is stressed and it is shown that the domestic consumer obtained his supply at a lower average rate than in the preceding year. Reference is made to the company's inability to expand its service as it would wish owing to inadequate labour and materials. Another point is that with practically the same number of employees operational wages have risen by 115 per cent since 1938. Towards the end the statement appears:—"Private enterprise may have had its faults but it is the 'goose that lays the golden eggs'" and the moral is:—"Don't cook your goose."

#### Contracting Work at Bath

Recently the Bath Housing Committee put forward a recommendation to the City Council that tenders for electrical work should be invited from contractors on the National Register of Electrical Installation Contractors only to specifications prepared by the city electrical engineer. This was accepted, but the Committee agreed that members of the Electrical Contractors' Association should be included.

#### Withdrawal from Essential Work Orders

The Ministry of Labour and National Service has recently informed organizations representing employers and workers concerned that the building and civil engineering industries will be withdrawn from the scope of the Essential Work Orders about March 31st next. Notices will be issued to all scheduled undertakings and sites giving them at least a month's notice. Until individual de-scheduling takes effect, the provisions of the Essential Work Orders remain in force for all employers and workers on scheduled sites and in scheduled undertakings.

#### Companies Bill

The text of the Companies Bill recently presented to Parliament is available from the Stationery Office (2s.). It is mainly based on the recommendations of the Cohen Committee appointed by the President of the Board of Trade, and is designed to bring the Companies Act, 1929, up to date. It comprises 109

and seven schedules and covers, in some detail, management and administration; share capital and debentures; constitution of companies; enforcement and registration of charges; winding up; offences and legal proceedings; and companies not registered under the 1929 Act.

### Fuel Economy

The 1946 issue of the "Fuel Economy Review" (2s. 6d.) is the silver jubilee number of this annual publication of the Federation of British Industries. Of the fourteen articles included, three are of especial electrical interest. In one of these Professor M. L. Oliphant discusses nuclear physics and the industrial future of atomic energy. Mr. J. R. Beard deals with electricity supply as a factor in securing fuel economy over the past twenty-five years and summarizes possible development in the years to come. The third article referred to is by Mr. W. Atkinson, who takes as his subject industrial electric lighting to-day.

### Argentine Import Control

The Argentine Central Bank has sent a circular to institutions and brokers authorized to operate in exchange setting out particulars of a prior permit system for foreign exchange for imports. The procedure differs for merchandise for which import quotas have been established and for goods whose importation is subject to "prior study." The quota goods (with the limit for the first half of 1947 shown in parentheses) include copper wire and cables (100 tons); lead-covered and armoured cables for underground use (500 tons); plates and resistances for electric cooking stoves (5,000 units); and incandescent and fluorescent lamps (1,500,000 units). Prior exchange permits will only be granted to firms in possession of the authorization of the Secretariat of Industry and Commerce. "Prior study" goods include electric motors and dynamos of over 0.25 H.P. and compressors.

### Diesel Generators for Argentina

British Oil Engines (Export), Ltd., the export sales division of Associated British Oil Engines, Ltd., announces that it has secured a contract for the supply of thirty-five Diesel electric generating sets to the Argentine Government, valued at more than £100,000. The sets comprise thirty-five Diesel engines, manufactured by Mirrlees Bickerton & Day, of Stockport, with electric generators and control gear built by the Brush Electrical Engineering Co., Ltd., of Loughborough.

The engines are all to be of the Mirrlees vertical four-stroke airless injection cold starting type, with a bore of 8½ in. and a stroke of 13½ in. Four of them are "TLB5" type five-cylinder engines, developing 262 B.H.P. at 600 r.p.m., each direct coupled to Brush protected type salient-pole revolving-field three-phase alternators, each of 220 kVA output at 0.8 p.f., 400/230 V, 50 cycles, with overhung exciters.

The remaining sets will be "TLB3" type three-cylinder engines, rated at 157 B.H.P. at 600 r.p.m., coupled to similar Brush machines but having an output of 125 kVA at the same voltage and conditions. Each set will be controlled by a Brush open flat-back type steel panel switchboard incorporating a manually operated oil circuit-breaker and automatic voltage regulator.

### New Diesel Engine Factory

The new factory which is being erected by F. Perkins, Ltd., at Newark, near Peterborough, for the construction of high-speed Diesel engines was recently visited by a party, which included Mr. S. Tiffany, the Member for Peterborough, and Councillor Wren. Mr. R. Ferguson, works director, explained to the visitors the plans of production, operating conditions and social welfare. The site covers an area of seventy acres and will eventually accommodate the factory, administrative offices and a sports ground. It will replace the present Queen Street works of the company.

### Dutch Buy British Equipment

Despite competition from American firms, the General Electric Co., Ltd., through its agents, N. V. Technische Handelsmaatschappij "Helga" of Curaçao, has secured orders for lighting schemes on two airfields which lie in the centre of the American zone of influence. The airfields, Hato and Dakota, are on Curaçao and Aruba respectively, two islands in the Netherlands West Indies. Air lines using this route include Pan American (Curaçao only) and K.L.M.

### Engineering Apprenticeship Scheme

An open competitive examination for engineering apprenticeships in the Royal Ordnance Factories and the Royal Aircraft Establishment at Farnborough, the first step in the Ministry of Supply's recently announced plan to recruit engineering apprentices on a national basis, will be held at local centres next March. The new national scheme has been adopted to encourage suitable youths to take up engineering as a career and to raise the standard of craftsmanship in Government factories and in industry generally. Hitherto only Woolwich, the Royal Ordnance Factory at Enfield and the Royal Aircraft Establishment have trained engineering apprentices. Now the scheme is to be extended to twelve factories in various parts of the country.

Candidates, who must be between the ages of sixteen and eighteen, will be expected to reach Higher National Certificate or equivalent standard by the end of their apprenticeship, which will last five years. There will be chances, during apprenticeship, for the boys to gain engineering scholarships to the universities. While it is hoped that the boys will afterwards stay on in Government factories, they will be

free to go where they please, and the scheme will thus serve the interests of the engineering industry as a whole. The latest date for receipt of applications for the examination is January 31st. Copies of regulations and forms of application are available from the Secretary, Ministry of Supply, Room 268 (Exam.), Shell Mex House, Strand, London, W.C.2. Craft apprentices will also come under the new scheme. They will be chosen at interviews with local apprenticeship boards.

### British Industries Fair

The President of the Board of Trade has appointed a panel of architects to co-ordinate the general layout and to approve and prepare stand designs for the London sections of next May's British Industries Fair at Olympia and Earl's Court.

### Reports on German Industry

Latest reports upon German industry prepared by British and Allied investigating teams include the following:—B.I.O.S.779. "Production of Seamless Metallic Pyrometer Sheaths and Electric Resistance Alloys" by Heraeus Vacuumsmelze A.G., Hanau A.M., and at Sterbfritz (1s. 6d.). B.I.O.S.951. "The Magnetophon Sound Recording and Reproducing System" (10s.). F.I.A.T. 788. "Aluminium Hydroxy Chloride Production at Ludwigshafen by Electrochemical and Chemical Methods" (1s.). A few copies are available from the Stationery Office at the prices quoted, postage extra.

### Surplus Machine Tool Sales

A large selection of good quality Government-owned general purpose machine tools declared surplus will be available at two additional selling depots which the Ministry of Supply is opening next month. The depots are at Stormy Down Airport, Pyle, nr. Bridgton, Glamorgan (opening on January 8th), and at Madingley Road, Cambridge (opening on January 22nd). The tools may be inspected between 10 a.m. and 4 p.m. Mondays to Fridays inclusive, and offers to purchase may be made in the site.

### Scientifically Trained Personnel

The Manchester Joint Research Council, which has carried out a survey in the Greater Manchester Area in an effort to assess the increase to be expected in the number of scientifically trained men to be employed by industry in the coming years, as compared with the number before 1939, has now issued a report.

A questionnaire was issued to a representative cross-section of the industrial firms in the area asking for information on the degree to which employment of graduates would be increased over the numbers employed previous to 1939, and from the replies the Council has prepared a summary of the figures. These show that in the engineering industry the increase in the

number of firms employing graduates, as compared with 1939, is 35 per cent, and the increase in the number of graduates to be employed is 62 per cent. The number of firms in favour of a period of post-graduate research at the University before recruitment is 20 per cent, and the firms offering openings for graduates is as follows:—Scientific (research and development) capacity, 41 per cent; technical capacity, 87 per cent; managerial capacity, 59 per cent.

### Dutch Refrigerator Production

The Dutch Government has decided to end the importation of refrigerators from abroad, the Haarlem shipyard "Holland-Nautic" having started the production of refrigerators some weeks ago. The firm turns out models for operation on oil, gas or electricity—at present at the rate of ten a week. In the New Year, production will be increased to 100 a week, of which 20 per cent will be for the domestic market and the balance exported to Belgium, France, South America and South Africa.—*Reuter's Trade Service* (The Hague).

### New House Journal

The varied social activities of the staff of Johnson, Matthey, & Co., Ltd., will in future be recorded in a bi-monthly magazine with the title "The Bulletin." The December-January issue, a copy of which we have received, contains, in addition to reports on social activities, interesting articles on the company's educational facilities, the story of the company's smelting works, and explanatory notes on the National Insurance Bill, 1946.

### Shopping Centre Lighting

In the article under this title in our last issue it was stated that the fluorescent coating powders in the lighting tubes raise the overall efficiency to 25 lumens per watt. The figure should have been 45.

### Contractors Summoned

Three summonses alleging breaches of the factory regulations at the premises of F. W. Blanshard, Ltd., registered electrical contractors, of Oval Road, Croydon, came before Croydon Magistrates' Court recently. It was stated that an inspector who visited the premises noticed that the absence of a cover exposed the terminals and conductors of the switch controlling the main supply. The switch was energized. There was also a double-pole metalclad switch which was not properly earthed, and a small motor beneath a bench also lacked an earth.

For the company, it was explained that a new distribution board was being installed, and the double-pole switch was put in temporarily to facilitate the work. It was in accordance with electrical practice not to use temporary switches when work was in

in connection with them. The cover had been removed temporarily from the mains switch while work was being carried out on it. There was no danger to factory operators, who had no occasion to go near the switches, and the men working on them were experts. The bench motor had been removed for repair, and by an oversight the earth wire was not reconnected when the motor was replaced.

The summons relating to the motor was dismissed under the Probation of Offenders' Act, on payment of 4s. costs, and fines amounting to £15 were imposed on the other two summonses, with 5s. costs.

### Employers' Organizations Merger Proposal

Members of the Federation of British Industries and the British Employers' Confederation have agreed in principle that the two organizations shall be merged into one body with one council, president and staff. A scheme of amalgamation is to be prepared for submission to the members of the two bodies.

The function of the Confederation is to deal with labour questions while the Federation is concerned with commercial and economic matters. During the war there has been close co-operation and both organizations now have their offices in the same building, 21, Tothill Street, London, S.W.1.

### E.D.A. Sales Conference

The British Electrical Development Association notifies us that the date of the next E.D.A. Sales Management Conference in London has been fixed for May 7th, 8th and 9th, 1947.

### Bristol Electric Club

The annual dinner of the Bristol Electric Club will be held on January 10th at the Grand Hotel, Bristol.

### Manufacturers' War Service

The change-over to war production by Gent & Co., Ltd., during 1939-45 was almost 100 per cent and the company undertook the design, development and production of a wide range of components and instruments. Much of the work was secret, but the company has now issued a booklet which tells by illustration and brief notes the story of the effort made to supply the varied requirements of the Services, which included components for radio, radar, beam approach equipment, anti-U Boat devices and instruments, and air-raid sirens.

### Calendars and Diaries

A view by E. W. Haslehurst, R.I., R.B.A., of Chiddingstone, Kent, makes a charming old-world picture for the tasteful calendar of Milne & Longbottom, Ltd.

The British Vacuum Cleaner & Engineering Co., Ltd., has sent us a pocket diary for 1947.

This has a pleasing binding in maroon leather and contains a great deal of electrical data in addition to the usual commercial information.

Brook Motors, Ltd., has sent us a wall calendar with two months on a sheet each of which bears an excellent photographic illustration showing some of the applications of the company's a.c. motors.

A cut-out representation of a watt-hour meter, with monthly date slips, forms the 1947 calendar of Venner Time Switches, Ltd.

The calendar of the Northmet Power Co., for 1947 has some excellent coloured pictures of rural scenes within the company's area of supply. Each page covers three months.

The Leicester Hospital, Warwick, a reproduction from a picture by Noel H. Leaver, adorns the calendar which we have received from Linealux, Ltd.

### New Zealand Imports

Imports of electrical machinery and equipment into New Zealand during the first half of 1946 were valued at £1,714,000, against £1,356,000 during the corresponding period of 1945, and imports of radio apparatus £127,000, against £253,000.

### Christmas Holidays

The Saxonia Electrical Wire Co., Ltd., will close from December 25th and re-open on Monday, December 30th.

The head office of the Jackson Electric Stove Co., 143, Sloane Street, London, S.W.1, will be closed from mid-day, December 24th until Monday, December 30th.

### Trade Announcements

F. W. Cook & Co. (Southampton), Ltd., formerly of Hanover Buildings, and 57, Shaftesbury Avenue, have now opened temporary showrooms at The Strand, Southampton. The address of their electrical workshops is now 113, Highfield Lane, Southampton, and their engineering stores and workshops are at Vincents Walk, Southampton. Their branch in the Isle of Wight is, as before, 87, High Street, Shanklin.

James Scott & Co., of Chapel Street, Dunfermline, have removed their office to larger premises at 47, Campbell Street, Dunfermline. The telephone numbers remain unchanged.

### TRADE MARKS

**T**HE following application has been made for the registration of a trade mark. Objections may be entered within a month from December 4th :—

WORLD WIDE (design). B641,988, Class 11. Electric refrigerators, radiators, cookers, fans, immersion heaters and electrically-heated cooking utensils included in Class 11, and parts thereof not included in other classes.—World Wide Distributors, Ltd., 25-27, Oxford Street, London, W.1.

# An All-Electric House

## Twenty-two Years' Experience

**J**UST over twelve years ago an account was given in the *Electrical Review* (Vol. CXV, p. 505) of the electricity costs incurred over a period of ten years in the all-electric house of ten rooms described in the *I.E.E. Journal*, Vol. 64, p. 289. It is now possible to give the corresponding figures for twenty-two years. These are shown for each year (beginning in May) in Fig. 1, which also indicates the effect of tariff changes at the points on the abscissæ indicated by lettering as follows:—

**By S. Parker Smith,**  
C.B.E., D.Sc.

rate No. 1: nine times primary kWh at 0.6d. Secondary rate No. 2: all additional consumption at 0.3d. per kWh.

(g) As under (f), except that additional kWh are charged at 0.25d.

(h) As under (g), except that garage was included.

(j) As under (h), except that the 0.25d. tariff was raised to 0.3d. for last two quarters.

(k) As under (h) except that all additional kWh are charged at 0.3d.

(a) Fixed charge, £12 10s. 0d., at 12½ per

It is not easy to state the number of persons in the household. At the start there were

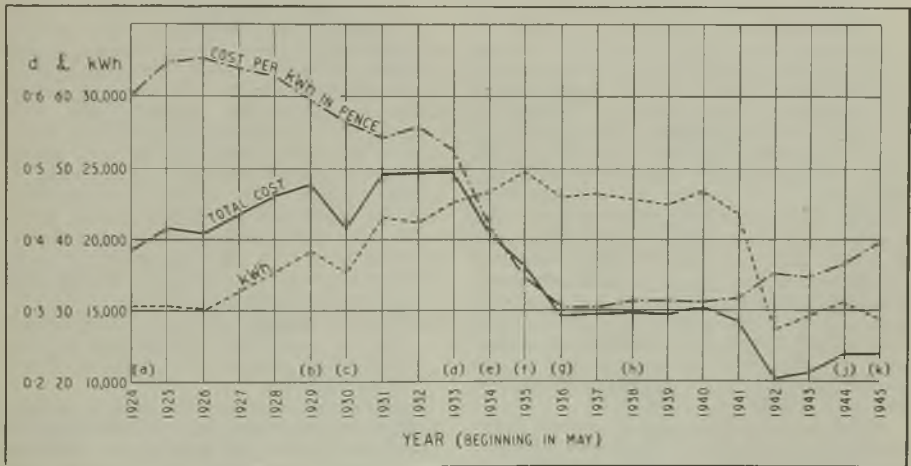


Fig. 1.—Consumption and costs for the twenty-two years

cent of assessed rental (£100), day kWh at ½d., night kWh at ⅓d.

(b) Fixed charge, £11 0s. 0d. at 10 per cent of assessed rental (£110); kWh as before.

(c) Fixed charge, £7 10s. 0d. (15s. per room); kWh as before.

(d) Fixed charge, £5 10s. 0d.—one room at 20s. plus nine rooms at 10s. each; day kWh at ½d., night kWh at 0.3d.

(e) Fixed charge as under (d); kWh, all at ⅓d.

(f) Primary rate, 40 kWh for one room and 20 kWh for each of nine rooms at 3d. Secondary

six persons (wife and self, two young children, two maids). There was a gradual decrease until, since 1942, there have been three persons (wife and self, daily help). The reduction in consumption called for during the war is shown in Fig. 1.

Thanks to the courtesy of Mr. George Morgan, general manager of the Glasgow

### EFFECT OF COAL PRICE ON COSTS

Year	Coal cost per ton s. d.	Cost per kWh sold		Percentage of coal cost to total cost
		Coal d.	Total cost d.	
1925-26	19 0	0.2	1.57	12.5
1938-39	19 0	0.15	0.68	22.1
1945-46	44 0	0.42	0.83	50.7

Corporation Electricity Department, the effect of coal costs (including handling charges) can be seen from the accompanying table.

These figures are illuminating. They show the big drop in production costs while coal charges remained steady and the big rise during the last war as coal became dear; the predominating effect of the cost of coal on present charges (twenty years ago it scarcely affected the price of electricity); the favourable tariffs in Glasgow for domestic users, which become less than half of the average production costs when used in the writer's house.

At no time during the war did the supply fail. From now onwards heavier charges must be expected because the 0.3d. tariff has become 0.4d. Incidentally, with the tariffs in force since 1934, the overall cost per kWh was not much different for a three-room house using 10,000 kWh per annum from that for the writer's ten-room house using 24,000 kWh per annum.

Comparison with the earlier article will show slight differences in consumption and costs. This arises from the fact that the periods now used are the Glasgow Corporation survey years to accord with tariff charges. The small differences do not affect the overall results.

## NEW BOOKS

**Piezoelectricity.** By W. G. Cady. Pp. 806; figs. 163; index. McGraw-Hill Book Co., Aldwych House, London, W.C.2. Price 45s.

Professor W. G. Cady's recently published book is a monumental work—a comprehensive treatise on the whole domain of crystal physics that centres round piezoelectricity. The subject is surveyed in that detail and documented with that thoroughness that we used to associate with German rather than with American professors. It is typical of the whole book that the mathematical development starts with a pair of general equations for thermodynamic potential, each containing 55 terms, and that the bibliographies total some 1,000 references. Inevitably the modest engineer in search of some definite item of information will frequently find himself bogged and will turn to smaller and less exhaustive treatments, but to the mature physicist and serious research student the work will be invaluable.

Cady was the first man to devise quartz resonators as standards of frequency. He first brought them to Europe over twenty years ago and had the immediate satisfaction of seeing his idea adopted and extended all over the world. He has in this book systematized the enormous mass of scientific information on the subject that has accumulated since that time. The technical applications are only treated insofar as they illustrate the scientific side of the subject.

It is refreshing to find Cady's sound common-sense frequently breaking through his wide learning and passion for generality. He dearly loves an all-embracing equation, but at the same time he is capable of the magnificent simplicity of this definition: "A piezoelectricity crystal is one that becomes electrified on squeezing." Again, in his enthusiasm for his subject, he has embellished the work with chapter headings selected from the world's literature. He can, however, include among these a quotation from a paper by the British

physicist S. Butterworth, a man never adequately honoured except by his fellow-workers, who will chuckle at the thought of Butterworth's dry grin when he sees himself elevated to this position of honour with Tennyson, Ovid, Machiavelli and Goethe. Finally one cannot forbear to quote this heartfelt truth from Chapter 28. "If Nature had paid more attention to the production of large and perfect tourmaline crystals instead of giving birth to so many quartz twins, all who are concerned with the applications of piezoelectricity would be deeply appreciative." These graces give character to a work that will stand for some time as a very solid contribution to the literature of contemporary physics.—L. H.

**The World of Industry.** By A. P. Young, O.B.E. Pp. 342; figs. 146. George Gill & Sons, Ltd., 67-68, Chandos Place, London, W.C.2. Price 12s. 6d.

Starting from the belief that industry occupies most people for about half of their working hours, and thus is the most potent influence upon their personalities and outlook, Mr. Young sets out to show how industry may be so organized and operated as to secure a real industrial democracy with the highest ideals.

To achieve his aim he has brought together a vast amount of material and has classified it and shaped it to give a quite remarkable picture of the growth of industry, its purposes and achievements, and its present state. Particular attention is paid to the "working team" in a chapter which deals with the relationships of workers between themselves and with their employers.

Mr. Young's last chapter deals with the future of industry. He thinks that Great Britain may set an example to the world by the economic and social order which is being built up here and he looks forward with optimism to eventual world co-operation which "will lead us to better pastures."—J.H.C.



# ELECTRICITY SUPPLY

## Cable Only for New Houses. Walsall Profits Problem.

**Aberdeen.**—GRIT NUISANCE COMPLAINT.—Residents of Ferryhill have decided to petition the Town Council asking for immediate action to be taken to alleviate the inconvenience caused by the emission of grit from the power station chimneys.

**Aldridge (Staffs).**—CONVERSION OF STREET LIGHTING.—The Urban District Council at its last meeting adopted the principle of lighting the public lamps by electricity and decided to purchase the necessary equipment. Councillor C. Rowley explained that through factors out of their control, many gas lamps were not completed, and it was almost impossible to replace broken mantles. The new scheme would be costly, but they were determined that their area should at the earliest possible date have as good street lighting as other places.

**Belfast.**—NO CABLE.—Replying to a complaint at a City Council meeting that people could not get electricity installed, Alderman M'Kee agreed that the Electricity Department had applications from several hundreds of people who had their houses wired in the expectation of getting supplies. The position, he said, was that the Department had not got one yard of underground cable in stock. It was dependent on a quota allocated from Great Britain for new houses completed by the Corporation and the Housing Trust. No cable would be released to enable a house to change from gas to electricity.

**Birkenhead.**—LOAN.—The Corporation Electricity Committee is seeking sanction to borrow £50,000 for mains and services.

**Blackpool.**—PURCHASE OF GOVERNMENT EQUIPMENT.—To carry out improvements at the Peel substation, cables and switchgear are to be bought from the Air Ministry by Blackpool Corporation at a cost of £17,944, and application is being made for permission to borrow the money. The equipment has been in use at the Squires Gate factory.

**Boston.**—STREET LIGHTING.—Six street lamps are to be provided for each of eleven villages in the area of the R.D.C. where at present there is a supply of electricity but no street lighting.

**Brighton.**—RECORD OUTPUT.—Since early in 1943 various units of generating plant at the Brighton Corporation's power station at Southwick have been out of commission owing to breakdowns, and it was only on October 23rd that the whole of the plant, of a nominal rating of 140,000 kW, was available for service. On October 24th the output and the maximum demand were higher than at any time since the station was commissioned in 1904, the figures being: kWh generated, 2,443,000, and maximum demand, 143,100 kW. These figures, states the

engineer and manager (Mr. H. Pryce-Jones) in a report to the Electricity Committee, are a clear indication of the serious shortage of generating plant throughout the country; the Committee has placed on record its appreciation of the results obtained by the engineer and his staff.

**POWER STATION EXTENSIONS.**—Having now had directions to proceed with the extensions at Southwick power station, the electrical engineer has submitted the following estimates totalling £7,555,000:—Building and civil works £1,790,000; generating plant £1,114,000; boiler plant £2,880,000; coal and ash handling plant £175,000; circulating water system £432,000; switchgear £210,000; general electrical works £200,000; other works £67,000; and contingencies, fees, etc., £687,000. It is proposed that in addition to the control and administration of the whole scheme as chief engineer, Mr. Pryce Jones shall be appointed mechanical and electrical engineering consultant, with Mouchel & Partners as consulting engineers for civil engineering and building work other than the circulating water system, wharves, dredging, etc., for which the consultants would be Sir William Halcrow & Partners.

**Burton-on-Trent.**—SUPPLY TO ESTATE.—The Electricity Committee has obtained sanction to borrow £3,740 for providing a supply to the Rolleston housing estate.

**Cwmbran (Mon.).**—TARIFF CHANGES.—New tariffs to come into operation on January 1st provide for a flat rate of 4d per kWh for lighting and 1d for heating, cooking and certain business purposes, with an alternative "all-in" rate.

**Darlington.**—OVERHEAD LINE.—The North-Eastern Electric Supply Co., Ltd., is to erect an overhead line from Bishopton to Great Stainton.

**Gateshead.**—CANTEEN EQUIPMENT.—Electric kitchen equipment costing £650 is to be provided in the Corporation Transport Department Canteen.

**Grimsby.**—SUPPLY TO WELTON-LE-WOLD.—The Electricity Committee is to supply electricity to Welton-le-Wold at a cost of £6,008.

**Halifax.**—NO CHOICE FOR MUNICIPAL TENANTS.—A recommendation of the Housing Committee that, as a matter of policy, municipal houses should have electric lighting, gas cooking and wash boilers and that where bedroom radiators were included in the specification they should be electric was approved by the Town Council last week. Moving the reference back of the proposal, Councillor Miss M. Pickles expressed the view that tenants should have the choice of cooking by electricity or gas. Councillor J. Burdock seconded the amendment and Alderman J. H. Stephenson, supporting it, said

that with the apparatus to be installed municipal tenants could not use enough electricity to take advantage of the cheap rate. Replying, Councillor A. Pickles, chairman of the Housing Committee, said that the Committee would like to give each tenant the service he chose, but it was not so easy in these early stages of housing. When supplies were normal the Committee would like people to exercise the option they had in the past. After the amendment had been defeated Alderman Stephenson asked whether a new tenant could have electrical equipment installed if he paid the hire charge. Councillor Pickles replied that the Committee had not decided the point.

**Hammersmith.**—CONCESSION TO MARK JUBILEE.—As 1947 will be the Jubilee year of the Hammersmith Borough Council's electricity undertaking the Council decided last week that the 25 per cent increase in charges which is already in operation shall be reduced to 15 per cent as from January 1st.

**Hove.**—DANGER OF BREAKDOWN.—The steadily rising demand for electricity caused by the connection of new consumers and the increased use of electrical appliances has caused the Electricity Committee serious concern. It is becoming increasingly difficult to obtain replacement plant and cables and new machinery required for extensions and in an endeavour to avoid the danger of a complete breakdown, it has recommended the re-imposition of the war-time rule that where alternative forms of heating are available no further connections for heating should be permitted.

**Martley (Worcs.).**—ELECTRICITY EXTENSION.—It was reported to a meeting of the Rural District Council that the manager of the Shropshire, Worcestershire & Staffordshire Electric Power Co. had promised to do his utmost to get a supply of electricity to Suckley as early as possible, but could not guarantee it in under a year as there was delay owing to the shortage of poles.

**Newcastle-under-Lyme.**—SUPPLY SCHEMES.—Old distributors in certain roads are to be replaced at a cost of £4,740 and the mains extended to Clayton Farm estate, £16,200 (including erection of substation), with other extensions costing £2,770.

**Perthshire.**—CABLES ACROSS RIVER TAY.—The first underwater electricity cables across the River Tay in Perthshire were laid last week. They will link the Carse o' Cowlie and Angus with Abernethy power station.

**St. Pancras.**—PRICE INCREASE NOT SANCTIONED.—At its meeting last July the Council approved, subject to the consent of the Electricity Commissioners, various tariff revisions estimated to yield an additional sum of £17,666 for the financial year. It is now reported, however, that the Commissioners are not prepared to consider the proposed increase until revenue is reduced by an amount equivalent to the income expected to be derived from the increase. In

the circumstances the Electricity and Public Lighting Committee has adjourned consideration of the matter until the spring when the financial position of the undertaking will be clarified.

**Southend-on-Sea.**—POWER CHARGES.—In the case of consumers with a demand up to 500 kW and an annual consumption of not less than 40,000 kWh, the Council has approved a tariff of £5 per kW, plus  $\frac{3}{4}$ d per kWh consumed with an increment of 0.0009d for each 1d by which the cost of coal exceeds 38s a ton. E. K. Cole, Ltd., with a demand of 2,000 kW, are to be charged £4 12s 6d per kW, plus  $\frac{3}{4}$ d per kWh (with coal clause as above).

**Scotland.**—SUPPLYING ISOLATED DISTRICTS.—The North of Scotland Hydro-Electric Board has brought electricity to the village of Finstown, near the Bay of Firth, Orkney. This is the first village to receive electricity under the Board's scheme to bring supplies to the isolated districts in the north of Scotland. Twenty-two consumers, including the local hotel, Post Office and four shops, have been connected to the main transmission line from the Board's generating station at Kirkwall. The shops and many of the houses have fluorescent lighting.

**Walsall.**—PROBLEM OF USING PROFITS.—Members of the Town Council at a special meeting held to consider the reports of the three trading undertakings were warned that if they adopted a recommendation of the Electric Supply Committee they would be breaking the law. The Committee's recommendation, moved by the chairman (Alderman J. Cuff Tibbitts), was "that in view of the abnormal conditions obtaining at the present time, the surplus amount of £19,157 remain in the electricity undertaking reserve fund, notwithstanding the fact that the Committee is aware that such reserve fund should be limited to 10 per cent of the capital expenditure of the undertaking."

The Finance Committee put forward an amendment that the money should be used for the reduction of the outstanding debt, but in the course of argument it was pointed out that there was a likelihood of the undertaking being taken over at the figure of its outstanding debt.

Alderman A. J. Stanley suggested that by charging consumers more than they ought to pay the Committee had accumulated more money than it was entitled to hold, despite the advice of the borough treasurer and the criticism of the Finance Committee.

Alderman E. H. Ingram, for many years chairman of the Finance Committee, said it had become almost a fetish for the trading undertakings to make as much profit as possible for the relief of the rates.

A long debate ended in the Council's accepting a suggestion by the Mayor (Councillor A. W. Percox), that the Electric Supply Committee and the Finance Committee should try to find another and less contentious method of using the money.

## N.W. England Scheme

### Four New Selected Stations

THE Central Electricity Board has received from the Electricity Commissioners a further Amending Electricity Scheme for North West England and North Wales providing for four new generating stations, with first sections each comprising an installation up to 130,000 kW of generating plant, to become selected stations.

Twenty-nine selected stations are at present operating in the area under the existing Schemes, which also make provision for the construction of three further new stations. In making representations to the Commissioners for the formulation of the present Scheme, the Central Electricity Board pointed out that all the new selected stations specified in the earlier Schemes for the Area have already been allocated and indicated that, as a result of a review of the prospective plant requirements, it had come to the conclusion that it would be necessary to take steps for the establishment of at least four other new stations. Of these, one is required in time to meet the estimated demand arising in East Lancashire in 1950 and the others to meet the anticipated growth in the demand in other parts of the Area in later years.

Copies of the Scheme entitled "The North West England and North Wales Electricity (Alteration and Extension) Scheme, 1946," together with an explanatory memorandum by the Commissioners are obtainable from the Stationery Office.

## Contracting Industry Agreements

THE National Joint Industrial Council for the Electrical Contracting Industry has agreed to continue in force (some with certain modifications) certain wartime agreements. Others which were only applicable in wartime conditions have been cancelled.

New agreements have been arrived at in connection with allowances, etc., on country jobs; payment of lodging allowance during the week of annual holiday with pay; and payment of "country money" during absence from the job.

Mr. L. C. Penwill, director of the Electrical Contractors' Association, has reminded E.C.A. members that all hours worked on Christmas Day must be paid at double rates; work on Boxing Day is to be paid for at time and a half; and in the Derby, Leicester, Nottingham and Scarborough areas time and a half is payable for work on Friday, December 27th.

Local working rules in certain towns in the North-Eastern area and in Scarborough, Sheffield, Manchester and Salford prescribe New Year's Day as a holiday, work on which is to be paid for at time and a half.

Unless agreement is reached by the N.J.I.C.

prior to the Christmas holiday in connection with the claim submitted by the E.T.U. for the payment of wages at normal rates upon bank, statutory and national holidays when no work is performed thereon, no wages will be payable upon any of the days referred to above which are observed as holidays. Further, no wages will be payable in respect of any additional days observed as holidays in individual establishments over the Christmas and New Year holiday periods. Should individual operatives be called upon to work on any day (other than a day which is a holiday in accordance with either the National or any applicable Local Working Rules) declared a holiday in the establishment concerned, wages at bare time rates will be payable, with overtime rates for all work performed outside the normal working hours.

## Electricity and the Community

ADDRESSING the newly formed Lancaster Engineering Society, Mr. E. R. Wilkinson (commercial manager, Central Electricity Board) suggested that the time at which an invention became of significance to a whole community, and not its inception, was the real beginning of a new era, as when, for example, the establishment of the grid and the accompanying standardization of frequency began to make electricity of general availability. Standardization of frequency was estimated in 1924 to entail an expenditure of £10.5 million, but by 1928-30 when the work was put in hand the figure had increased, due to the delay, by £6.5 million and later might have become prohibitive. Over 1,900,000 H.P. of consumers' motors and 900,000 kW of generating plant were changed over without dislocating industrial production, while the cost amounted to only 0.63 per cent of the present revenue of the supply industry. This experience showed that voltage standardization at 240 V (to cost now about £18.5 million) should be regarded as urgent.

The speaker then showed by statistical diagrams that the capital expenditure per kW by the supply industry was already substantially less than it would have been without the grid and that heat consumption per kW had been reduced by 9 per cent by 1938. A further advantage of the grid was the opportunity it provided to British manufacturers of demonstrating to the world their ability to construct large high-voltage power equipment. During the last war (in contrast with that of 1914-18) factories did not need to install private generating plant, as individual loads up to 50,000 kW were supplied as a result of the grid, while sites could be selected in less vulnerable areas. Without the speeding up of armaments production thus made possible, the end of the war might have been disastrously delayed.

With productivity per worker and hours of work of 1938 there would be a deficiency of output of well over 30 per cent compared with

national needs. To approach the pre-war standards of the United States in comparable industries, about 13 million H.P. of additional industrial machinery (compared with 1938) would be required. In addition to increasing mechanisation, engineers had the duty of improving efficiency of utilization of fuel resources; railway electrification, for example, would save 10 million tons of coal each year. Atomic energy might be applied within ten to twenty years, probably in central stations from which the power would be distributed as electricity.

## Electrodepositors' Technical Society

**T**O mark its coming of age, the Electrodepositors' Technical Society held a soirée at the Northampton Polytechnic Institute, London, E.C. The principal item on the agenda was the presentation in token form of the first medal to be struck for the Society to Mr. Samuel Field, its first president, who was largely responsible for the Society's formation. The actual medal will be handed to him during the international electro-deposition conference next May.

The ceremony was performed by Dr. S. Wernick, the president, who up to the time of his election to that office last year had been hon. secretary (a position now filled by Mr. S. W. Baier) almost from the outset. The medal is international in its scope and is to be awarded at intervals of not less than one year. Dr. Wernick, after reading congratulatory messages from kindred associations in many parts of the world, gave a brief account of the formation of the Society in 1925, mentioning the encouragement it received from the Faraday Society, and of its steady development since then and its regular meetings throughout the war.

Mr. Field related how, in 1897, when Head of the Department of Applied Chemistry at the Northampton Polytechnic (a position from which he retired in 1937), he gave what was probably the first course of lectures to students on electro-plating. Since the foundation of the Society in 1925, progress had been spectacular; this was largely due to collaboration between theoretical and practical workers, which it was the aim of the Society to foster. New metals had been introduced and researches into the deposition of alloys promised well for the future. The number of formulæ for solutions had been reduced to a few of constant composition and their effects could be closely controlled, while automatic plants had multiplied a thousand fold. He expressed his faith in the latent powers of the intellect (each worker making his contribution, however small) to make clear many scientific mysteries, among which were the fruits of Faraday's investigations into the migration of ions and the collection of some of them for service to man.

## Fuel Economy in Great Britain

**P**REPARATORY material for the British contribution to the Fuel Economy Conference to be held at the Hague next September has been published by the World Power Conference in a 52-page "Report on Fuel Economy since 1939" (1s. 6d.). The document covers all aspects of the fuel efficiency campaign and fuel restrictions during and after the war, the rise in prices and output of coal and the technological problems (with examples) that make for economy in use. A six-page bibliography lists the large number of publications on the subject during the period.

Regarding electricity supply, it is stated that the rise in coal consumption from 15.9 million tons in 1939 to 23.5 million tons in 1945 necessitated widening the range of fuels to include duffs, slurries and an increased proportion of dry slacks of high ash content. As gas coals have been in particularly short supply, house coals and suitably graded coals have had to be diverted to gas making from their normal uses. Railway consumption rose from 13 to 14 million tons per annum and no large-scale use of inferior coals has been practicable owing to steam-locomotive shortage. Technical problems arising out of the increased demand for electricity are concisely and accurately explained. In addition to the 37,285 million kWh generated in 1945 by authorized undertakings, 4,599 million kWh was generated at factories and 1,545 million at coal mines; "a considerable amount" of non-electric power was also in use.

Referring to the advantages of combined power and heating, it is stated that "considerable savings of fuel have been made by transfer to public electricity supply of consumers whose need for process steam was not equivalent to their power requirements." Mention is also made of the inefficiency of compressed-air power and the losses its use entails in collieries.

## Diesel-Engine Working Costs

**T**HE form of the report on heavy-oil engine working costs issued annually by the Diesel Engine Users' Association has not been changed, largely consisting of tabulated statistics. It shows that in 1944-45 the fuel consumption averaged 0.626 lb/kWh generated, being 6.5 per cent below the arbitrary standard, at an average running plant load factor of 63.8 per cent. Home stations containing 132 engines totalling 39,920 kW generated 26,702,892 kWh during the year at a total engine cost of 1.122d/kWh. Fuel oil cost 224s. per ton and lubricating oil 3s 8d per gallon, both including tax and delivery charge.

Overseas stations containing 63 engines totalling 29,891 kW generated 53,523,715 kWh at a total engine cost of 0.766d/kWh, using 0.6 lb/kWh of fuel oil, which cost 164s per ton while lubricating oil cost 5s 0½d per gallon.

# FINANCIAL SECTION

## Company News. Stock Exchange Activities.

### Reports and Dividends

**The Sun Electrical Co., Ltd.**, reports a trading profit for the year ended April 30th last of £22,527, as compared with £20,514 for the preceding year, and a net profit of £20,106 (against £18,915). As already announced the ordinary dividend for the year is 4½ per cent (against 2½ per cent), and after applying £1,500 to lease redemption reserve and £3,500 to income tax reserve, a balance of £2,144 is carried forward (against £2,112 brought in).

In his statement issued with the report and accounts, Mr. R. Tweedy Smith (chairman) says that the heavy demand for the great majority of the products handled by the company which arose at the conclusion of the war shows no sign of abatement, particularly in the case of installation equipment for the new housing schemes, of which a large proportion of the company's output now consists. Mr. A. G. Beaver, who has been general manager and managing director since 1902, has expressed a desire to relinquish some of his duties and his office as managing director. The board therefore proposes to appoint Major E. J. Beaver and Mr. R. J. Rawlings (who have been executive directors since 1935) as joint managing directors as from May 1st, 1947. Mr. Tweedy Smith feels that in recognition of the valuable services rendered by Mr. A. G. Beaver as managing director, the board should elect him chairman. Mr. Tweedy Smith has expressed his willingness to accept the board's invitation to act as deputy chairman.

**Electric & Musical Industries, Ltd.**—Presiding at the annual meeting held on December 12th, Sir Alexander Aikman (chairman) said that the year had been one of attempt to turn round to peacetime work but only a comparatively small proportion of their reconversion plan had been achieved. A considerable amount of reorganization at Hayes involving a scheme of decentralization had been set afoot and was nearly completed. They had been in contact with their companies and agencies in European countries, which had been closed to them during the war and steps had been taken where advisable to renew their activities.

Sir Ernest Fisk (managing director), in seconding the motion for adoption of the report and accounts, after reviewing the history of E.M.I., Ltd., said that they were now able to offer an entirely British television system which could be produced wholly by their own organization. Their fields of activity embraced acoustics, electronics, communications and allied developments. Decentralization had been brought about by forming each of their major activities into wholly owned

subsidiary companies each bearing the parent company's initials but with its own distinctive name. They had recently negotiated arrangements with Major E. Armstrong, inventor and pioneer of the new frequency modulation system for broadcasting and radio communications and had secured the latest designs and manufacturing technique from Radio Engineering Laboratories, an American company, which manufactured frequency modulation transmitting apparatus for the Armstrong system. The E.M.I. research laboratories had recently demonstrated to members of the Government Television Committee and to representatives of the B.B.C. their new system of televising motion picture films. Before the war their companies established a range of domestic electrical appliances, and during the past twelve months this branch of their activity had been revived, with new and more extensive designs. This apparatus was made and distributed with the H.M.V. trade mark. To meet the need for technical and engineering instruction, they had set up a college, under E.M.I. Institutes, Ltd., and had acquired the London Radio College at Chiswick for the operating centre.

**Decca Record Co., Ltd.**—Referring to the Decca Navigator in his address at the annual meeting last week, Sir Cyril F. Entwistle (chairman) said that during the past twelve months there had been intense activity, and striking progress had been achieved. At the request of responsible authorities in various countries fourteen detailed plans for the erection of Decca major transmitting chains had been submitted, and a contract had been placed by the Danish Hydrographic Department for three stations and a number of receivers for survey work in Greenland. The Admiralty was using the system for survey work in the Thames Estuary and the Dutch Navy had a number of receivers for minesweeping use off the coast of Holland. In August, by arrangement with the Ministry of Transport, they began equipping merchant vessels with their receivers and over thirty had already been fitted. A valuable accessory that had now passed through the development stage was a tracking device enabling an aeroplane of a ship to follow exactly any predetermined course. A wholly owned subsidiary, Decca Navigator System Incorporated, had been formed in the United States.

**Aerialite, Ltd.**, reports a trading profit for the year ended June 1st last of £29,195, and a net balance of £14,950, to which is added £9,710 brought in, making £24,660. After deducting the preference dividend to April 30th, 1946, and the ordinary dividend to June 2nd, 1945, there is a balance available for distribution of £14,522.

It is proposed to pay a final ordinary dividend for the period ended June 1st, 1946, of 45 per cent, making 55 per cent, less tax, for the year, and to carry forward £8,296.

Mr. L. S. Hargreaves (chairman and managing director) in his statement which accompanies the report and accounts mentions that the turnover during the year under review has increased by 40 per cent. Additions have been made to the plant, and the company has negotiated a satisfactory purchase of plant and equipment which it had operated on behalf of the Ministry of Supply.

The **General Cable Manufacturing Co., Ltd.**, reports profits for the year ended September 30th last of £108,955, as compared with £81,278 for the preceding year, and a net profit of £103,616 (against £76,383), to which is added £4,000, part of deferred repairs reserve no longer required. Taxation requires £74,186, and £10,000 is placed to reserve. The final ordinary dividend is 17 per cent, making 25 per cent for the year (against 15 per cent), and £4,312 is carried forward (against £4,132 brought in).

The **Barbados Electric Supply Corporation, Ltd.**, reports a net profit for the year ended June 30th last of £21,759, as compared with £19,572 for the preceding year. Tax provision requires £12,000 and the dividend for the year is maintained at 5 per cent tax free. The balance carried forward is £1,653 (against £1,894 brought in).

**Marco Refrigerators, Ltd.**, reports a net profit for the year ended September 30th last of £56,699, as compared with £31,526 for the previous year, to which is added reserve account transfer of £4,035. Taxation requires £42,200, and the dividend for the year is 10 per cent (against 5 per cent). The balance carried forward is £20,993 (against £8,234 brought in).

The **Morgan Crucible Co., Ltd.**, is paying an interim dividend of 3½ per cent. This is the same as for the previous year but is paid on increased capital.

The **London Electrical & General Trust, Ltd.**, has declared an unchanged interim dividend of 2 per cent.

## New Companies

**Lowdon Bros. & Co. (Engineers), Ltd.**—Registered in Edinburgh December 4th. Capital, £10,000. Consulting, electrical and mechanical engineers, etc. Directors: R. A. Smith and G. B. M. Greig. Regd. office: Temple Electric Works, 37, North Tay Street, Dundee.

**Ricketts & Hanson, Ltd.**—Registered December 6th. Capital, £1,000. To acquire the business of electrical installation contractors carried on by H. Ricketts and F. W. Hanson as R. and H. Electrical Contractors at Longbridge Lane, Birmingham, 31. Directors: E. H. Ricketts and F. W. Hanson. Regd. office: 181, Longbridge Lane, Birmingham, 31.

**W. H. Wright & Co., Ltd.**—Registered December 5th. Capital, £2,000. Manufacturers, importers and exporters of, and wholesale and retail dealers in, electrical appliances, wireless and television sets, etc. Directors: W. H. Wright and W. A. Wright. Regd. office: 19, Kensington Court Place, W.8.

**Ward's of Hull, Ltd.**—Registered December 5th. Capital, £1,000. Electrical engineers and contractors, designers and manufacturers of, and dealers in, heating, lighting, cooking, cleaning and other electrical apparatus, etc. Directors: F. Ward and H. B. Ward. Regd. office: 187, Newland Avenue, Hull.

**Whitfield & Robinson, Ltd.**—Registered November 15th. Capital, £500. Designers and manufacturers of, and dealers in, electrical equipment, apparatus and supplies, electrical, radio, television and other equipment, etc. Directors: I. M. Whitfield, D. Robinson and C. A. Robinson. Regd. office: 26, Belvoir Road, Coalville.

**Armature Service Co., Ltd.**—Registered November 15th. Capital, £1,000. To acquire the business carried on by D. A. W. Ward, A. C. Ward and E. C. Kensett (who are directors of the new company), as the Armature Service Co., at Hove. Regd. office: 66, Blatchington Road, Hove.

**Woodstock Radio & Electricals, Ltd.**—Registered November 14th. Capital, £100. Radio and television engineers, electricians, etc. L. Tree is the first and permanent director. Regd. office: 245, Oxford Street, W.1.

**Two-Way Talkie, Ltd.**—Registered November 13th. Capital, £10,000. Designers, manufacturers and distributors of intercommunication systems, telephones, electrical and electronic amplifying equipment, etc. Solicitors: Giles & Hunter, 112, Kennington Road, S.E.11.

**Koldec, Ltd.**—Registered November 20th. Capital, £1,000. Refrigeration and cold storage engineers, etc. Directors: T. C. E. Eaton and G. H. Craven. Secretary: A. F. Smith. Regd. office: 25, Bradstock Road, Stoneleigh, Ewell, Surrey.

**Powerparts, Ltd.**—Registered November 19th. Capital, £100. Manufacturers and repairers of, and dealers in, wireless and television sets, accessories and apparatus, electrical fittings, etc. Directors: K. C. Bennion (permanent managing director) and Belinda L. Montague. Regd. office: 11, Portland Street, Hereford.

**Thompson & Patterson, Ltd.**—Registered November 19th. Capital, £1,000. Manufacturers of, and dealers in, all types of refrigerators, fish frying ranges, passenger and goods lifts; mechanical and electrical engineers, etc. Directors: A. W. Thompson (director of A. W. Thompson (Electrical), Ltd.); and S. Patterson. Secretary: J. Green. Regd. office: 7, Church Street, Wath-upon-Deane.

**James Brandrick & Co., Ltd.**—Registered November 26th. Capital, £2,000. To acquire the business of general electrical and wireless merchandising and repair services now carried on by James Brandrick at 18, Middleton Road, Royton, as "James Brandrick." Directors: J. Brandrick, E. Butterworth and W. Turner. Regd. office: 18, Middleton Road, Royton.

**Conway & Burt, Ltd.**—Registered November 26th.—Capital, £1,500. To acquire the business of radio and electrical contractors and dealers carried on by G. L. Conway and E. Roberts at 86, Bromley Road, Horfield, Bristol, as Domestic Electric Services. Directors: S. G. L. Conway and Dora A. Burt. Solicitors: Parsons & Horden, Bristol.

**W. D. Martin, Ltd.**—Registered November 25th. Capital, £1,000. Electrical engineers and contractors, radio and wireless engineers, etc. Directors: W. D. Martin, W. Martin and J. Clayden. Regd. office: 3, Paradise Road, Richmond, Surrey.

**C.W.C. Equipment, Ltd.**—Registered November 25th. Capital, £100. Manufacturers of, and dealers in, fluorescent, electric, gas and other lamps, reflectors, switches, wireless valves, vacuum devices, etc. Subscribers: G. Conrad and W. C. Willis. Regd. office: 66, Victoria Street, S.W.1.

**Frank S. Adams, Ltd.**—Registered November 25th. Capital, £3,000. Manufacturers and repairers of, and dealers in, electrical and mechanical apparatus, wireless sets, etc. Directors: F. S. Adams and J. Clapton. Regd. office: Radio Works, North Street, Wilton, Salisbury.

**Radio & Electrical Services (East Cowes), Ltd.**—Registered November 21st. Capital, £500. To acquire the business of a radio and electrical engineer and retailer carried on by Harold A. Bowen at 34, York Avenue, East Cowes, I.W. Directors: H. A. Bowen and Mrs. A. V. Bowen. Regd. office: 34, York Avenue, East Cowes, I.W.

**Randall Brothers, Ltd.**—Registered November 23rd. Capital, £1,200. To acquire the business of electrical engineers formerly carried on by P. Randall as "P. Randall & Son." Directors: P. H. Randall and R. J. Randall. Regd. office: 21, Glasshouse Yard, E.C.1.

**Billingham Radio Relay, Ltd.**—Registered November 22nd. Capital, £2,000. To establish and maintain wireless signal and other stations for relaying wireless programmes, etc. Solicitors: Smith & Graham, W. Hartlepool. Regd. office: Regent House, South View, Billingham.

**Frank Griffin, Ltd.**—Registered November 29th. Capital, £5,000. To acquire the business carried on at 62, Hockliffe Road, Leighton Buzzard, as Frank Griffin, and to carry on the business of electricians, radio engineers, etc. Directors: F. E. Griffin and G. E. Griffin. Secretary: Miss A. E. Griffin. Regd. office: 60/62, Hockliffe Street, Leighton Buzzard, Beds.

**Silver Nite Products, Ltd.**—Registered November 29th. Capital, £100. Manufacturers of, and dealers in, electrical apparatus, radio and television equipment, etc. Directors: L. C. Campbell, D. Gross, H. Wiseman and Eileen M. Hirschfeld. Regd. office: 46, Curzon Street, Mayfair, W.1.

**Warren Electrical Co., Ltd.**—Registered November 28th. Capital, £500. Directors: C. E. J. Bayham, 1, Priory Avenue, E.4; and H. Bradford. Regd. office: 10, Church Hill, Loughton.

**Modern Electrical Engineering Co., Ltd.**—Registered November 28th. Capital, £2,000. Directors: E. S. Heffer and Mrs. Isabel M. Heffer. Secretary: Leslie J. Rice, 20, Charnwood Drive, South Woodford, E.18.

**Wrexham & East Denbighshire Relay Services, Ltd.**—Registered November 20th. Capital, £100. Directors: C. Gaffney and seven others. Regd. office: Midland Bank Chambers, High Street, Wrexham.

**Feltra, Ltd.**—Registered November 25th. Capital, £250. Electrical engineers and contractors, etc. Directors: F. Trapp and J. E. Felmingham. Regd. office: 21, Arkwright Street, Nottingham.

## Increases of Capital

**Volta Electric, Ltd.**—Capital increased by £45,000, in 35,000 preference shares of £1 and 40,000 ordinary shares of 5s., beyond the registered capital of £10,000. The capital has been reorganized and is now £55,000 in 35,000 5 per cent cumulative participating preference shares of £1 and 80,000 ordinary shares of 5s. 41,200 ordinary shares of 5s. were recently allotted as fully paid as consideration for 7,555 £1 shares in Stamford Electrical, Ltd., and 1,000 £1 shares in Sipson Engineering, Ltd.

**B. Winters & Son, Ltd.**—Increased by £2,000 beyond the registered capital of £1,000.

**Multi-Broadcast (Engineering), Ltd.**—Capital increased by £44,000, in £1 shares, beyond the registered capital of £5,000.

## Liquidations

**Midland Radio Relay Services, Ltd.**—Winding up voluntarily. Liquidator, Mr. A. E. Limehouse, 24, Market Place, Rugby. Particulars of claims to the liquidator by December 31st, 1946. This is a formal notice, as all creditors will be paid in full.

## Bankruptcies

**J. S. Griffin, electrical engineer, 108, High Town Road, Luton, Beds.**—Supplemental dividend of 5s. 8½d. in the £, payable December 24th at the Official Receiver's Office, 6, The Parade, Northampton.

## STOCKS AND SHARES

**S**TOCK EXCHANGE business is maintained at a tolerably high level of activity. The principal feature is the manner in which money, realized by the sale of British Government and other gilt-edged securities due for repayment next year, is being directed into industrial ordinary shares. In the case of many companies, the yield at current prices, calculated on the dividends which are being paid, is about  $3\frac{1}{2}$  per cent, a return which not so many years ago would have been regarded as modest even from Consols or War Loan.

### Firm Markets

Dividends are in the main satisfactory. Under conditions now prevailing in regard to financial operations, it is not surprising that anticipation looks for prices to go higher before there will occur that fall which most people regard as likely to take place in a few years' time. New issues are offered almost every business day. In the great majority of cases these are readily taken, a premium being established on the issue price as soon as the market opens, and, what is perhaps more surprising, improving upon that premium as the market settles down.

### Recent Issues

Aberdare Cables of South Africa shares were recently introduced to the market. They are now changing hands around 9s. 9d. for the 5s. ordinary, and 26s. 9d. for the  $5\frac{1}{2}$  per cent preference. This is a new enterprise, formed to manufacture in South Africa electric cable and electrical equipment as produced now by the Aberdare and South Wales Switchgear companies in this country. Later on, the intention is to extend production to cover some of the specialities manufactured by International Combustion. Laurence, Scott & Electromotors new  $4\frac{1}{2}$  per cent preference shares are quoted at 23s. 6d. and Dictograph Telephone 5 per cent preference at 5s. 6d. premium on the price of 20s. at which they were offered to shareholders. The respective yields are £3 12s. 3d. and £3 18s. 6d. per cent.

### Company Results

Expectations were confirmed by the declaration of a final dividend of 15 per cent by the Plessey Company, engineers and manufacturers of telephone and radio equipment. This payment is 5 per cent above last year's, and with the similarly increased interim, makes a total of 30 per cent for the year. Net profits, according to the preliminary profits statement, were £187,000 against £263,000 previously, but the figures are stated before the impact of taxes. At 38s. the 5s. shares pay 4 per cent on the money, allowing for the dividend in the price.

Profits of Joseph Lucas during the year of reconversion ended last August show an

insignificant decline to £364,000 and cover the 15 per cent dividend with a surplus equal practically to another 15 per cent on the ordinary capital. At 88s. the £1 shares give £3 8s. 3d. per cent on the dividend which has been maintained at the present rate for many years. A further strengthening of the already impressive balance sheet, added to the conservative character of the dividend and the company's established trading position, help to consolidate the high place held by the shares among industrial investments.

### "Tubes"

Tube Investments hardened to  $6\frac{1}{8}$  on declaration of a  $12\frac{1}{2}$  per cent dividend, making  $22\frac{1}{2}$  per cent for the year. Last year, a similar distribution was augmented by a special 10 per cent from contingency reserve, the repetition of which had not been expected.

### Electrical Components

Electrical Components 5s. shares were introduced to the market last May, when the published particulars of the business indicated an interim payment about January. A dividend of  $7\frac{1}{2}$  per cent has now been declared. A final at the same rate would make the yield on the shares, at 16s., over  $4\frac{1}{2}$  per cent. Until recently a subsidiary of B.I.C., the company is a wholesale distributor and shipper of electrical accessories of many descriptions.

### Preference Shares

Among the most expensive preference shares in the electricity supply market are those entitled to a share of assets in the event of winding-up. County of London "sixes" are a case in point. After repayment of all capital, they would participate on equal terms with the ordinary capital in the surplus assets. This consideration carries sufficient weight to place the shares on a yield basis below the average. At 35s. 6d. the return is £3 7s. 6d. per cent. By way of comparison, the 6 per cent preference shares of Scottish Power, Midland Counties and London Associated, are all quoted at about 28s. and yield  $4\frac{1}{2}$  per cent. Edmundsons 6 per cents stand at 27s. 6d., to pay £4 7s. 3d. per cent, whereas the 7 per cent issue at 36s. 6d. yields only £3 16s. 9d. ; the latter have capital participation rights denied to the "sixes."

### Stock Exchange Dealings

On Wednesday of last week the Stock Exchange reintroduced the system of fortnightly accounts in place of the wartime procedure under which all bargains were for cash. This measure goes only half way, however, to restoration of the full pre-war practice, since "carry-over" facilities from one account to another remain barred. Although, therefore, buyers at the start of an account will have a fortnight's grace before they are liable to pay transfer stamp charges, cash will still be required on Settlement Day.



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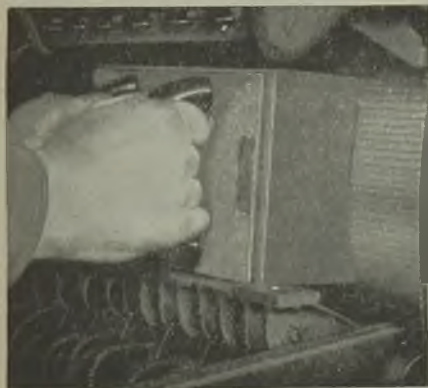


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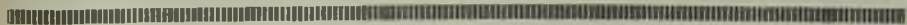
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# Current Transformer Testing

## A Simple Null Method

**METHODS** of testing current transformers for ratio and phase errors fall into three main classes: First, absolute methods in which voltage drops in standard resistances included in primary and secondary circuits are compared; second, comparison methods in which a standard transformer is used; and third, indirect methods which depend upon the measurement of exciting current under stipulated conditions.

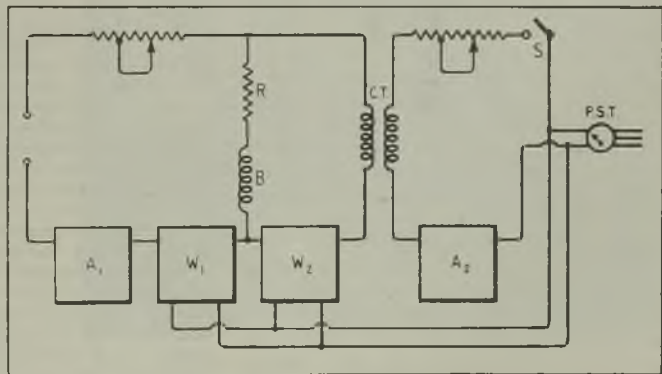
The fundamental drawback of the absolute methods is that the inclusion of a standard resistance in the secondary circuit alters the burden of the transformer so that the total effective burden is not under complete control. Comparison methods are convenient and accurate if a standard transformer of the same ratio as the test transformer is available. Indirect methods depending upon the measurement of exciting current are most flexible in their application. No heavy-current circuit is required, and these methods are, in a sense, absolute in that no comparison transformer is used. Further, by the measurement of exciting current, the performance of a transformer can often readily be investigated for currents considerably in excess of the full-load value.

The drawbacks of the indirect methods are twofold; first, the ratio error arrived at by tests of this class is the fractional difference of the actual and the turns ratio, so that, if the turns and nominal ratios are not identical the amount of turns compensation must be known; secondly, the methods are suitable only for transformers with no secondary leakage reactance. Notwithstanding these disadvantages, the indirect methods are often very useful, and the test described hereunder, which requires ordinary apparatus only, is a convenient one for investigating the performance of ring-type transformers of

medium- and low-grade accuracy, in normal and overload conditions, since for such transformers it is legitimate to assume that secondary leakage reactance is negligible.

The arrangement of the testing circuit is shown in the accompanying figure. B is the external burden of the transformer for which the errors are required and R is a resistance equal to the resistance of the secondary winding. B and R in series are joined to the source of supply in series with an ammeter  $A_1$ , a wattmeter  $W_1$ , and a regulating rheostat. The secondary winding of the test transformer CT in series with the current coil of a  $1\frac{1}{2}$ -A wattmeter  $W_2$  is connected in parallel with B and R as shown. The core of CT is overwound with a temporary winding of a known number of turns, and this winding is connected to the output terminals of a phase-shifting transformer PST in series with an ammeter  $A_2$ , a switch S, and a regulating rheostat. The voltage circuits of wattmeters  $W_1$  and  $W_2$  are

By **G. W. Stubbings**,  
B.Sc., A.M.I.E.E.



Details of testing circuit

connected to the output terminals of PST.

The test procedure is as follows. With the switch S open, the current for the testing supply through  $A_1$  is adjusted to the value corresponding to the load for which the errors are required. The voltage drop in B and R is then equal to the secondary e.m.f. of the transformer with a primary current corresponding to the current in  $A_1$  and with a total secondary impedance corresponding

to the combined impedance of B and R. The current passing into the secondary of the transformer through the current coil of  $W_2$  in this condition will therefore be approximately equal to the exciting current of the transformer for a primary current corresponding to the current in  $A_1$  and the total burden corresponding to B and R in series.

With the primary of PST energized, its rotor is set so that  $W_1$  reads zero. This voltage is then in phase quadrature with the current and the movable pointer is set to 90 on the degree scale. The rotor of PST is then set so that the wattmeter  $W_2$  reads zero, and, the reading of the pointer on the degree scale being noted, the rotor is turned through exactly 90 deg. The output voltage of PST is then in phase with the current passing through  $W_2$  into the secondary winding of CT.

The switch S is then closed, and the current from PST into the temporary winding is gradually increased. This current, as the output circuit of PST is practically non-inductive, will be either in phase or in phase opposition with respect to the current in  $W_2$ , so that, provided that the polarity of the voltage of PST is correct, an increase of current in  $A_2$  will decrease the reading of  $W_2$  and, when  $W_2$  reads zero, the m.m.f. of the current in  $A_2$  will be equal to that of the current originally passing through the current coil of  $W_2$  with S open. The observed current in  $A_2$  multiplied by the ratio of temporary primary to secondary turns is thus equal to the exciting current which corresponds to the current in  $A_1$  and to the total burden represented by B and R. Further, the angle of phase difference of this exciting current and the current in  $A_1$  will be indicated by the reading of the movable pointer of PST of the angle scale.

If  $I_0$  is the value of the exciting current calculated from the reading of  $A_2$ ,  $\theta$  the angle reading of PST and  $I$  the current in  $A_1$ , then the percentage difference of the actual and the turns ratio of CT will be  $100 \times \frac{I_0}{I} \cos \theta$  and the phase error in centiradians will be  $100 \times \frac{I_0}{I} \sin \theta$ . If in the above procedure the polarity of PST is incorrect after its final adjustment, so that the reading of  $W_2$  cannot be reduced to zero, it is necessary merely to turn the rotor through exactly 180 deg. When  $W_2$  reads zero and carries no current, the drop in its current coil is zero, so that the e.m.f. induced in the secondary of CT by the current from PST is exactly equal to the drop

in B and R. The impedance of the current coil of  $W_2$ , which tends to reduce the current passing into the secondary of CT with S open, is therefore immaterial.

The kind of sensitivity obtainable by this method can be illustrated by a numerical example. Suppose that the ratio of CT is 400/5 and that the errors of ratio and phase at one tenth of full-load current are of the order of 2 per cent, so that the exciting current is of the order of 3 per cent of the secondary current. If  $W_2$  has a current range of  $\frac{1}{2}$  A, the current passing into it with S open, will if the voltage of PST corresponds to the wattmeter range, be about 3 per cent of full-scale value. Although the reading of  $W_2$  will not correspond accurately to the exciting current and will be too small to be read with precision, it will be sufficiently large for the zero adjustment to be made with fair nicety. The sensitivity of  $W_2$  as a null indicator will, of course, increase proportionately to the increase of current from the testing supply. The number of turns in the temporary winding of CT can be made to suit the ratio and the range of  $A_2$ . Thus, if this winding comprises 20 turns, the current in  $A_2$  for the test at one-tenth of full load will be about 3 per cent of 20 or 0.6 A.

## Lighting in Industry

THIS month's meeting of the Birmingham Centre of the Illuminating Engineering Society considered whether the I.E.S. Code could profitably be applied in industry.

Mr. R. O. Ackerley, speaking in favour of the motion, said the code was arbitrary and there were many reasons for providing higher or lower values of illumination than those stated, though he could not see how any one of the clauses relating to quality could not profitably be applied. The code was intended primarily for those versed in lighting and its function as it stood was to guide the illuminating engineer; but it was also a guide to the purchaser, as it gave him a standard to apply. Controlled tests had shown that the code could be and had been profitably applied.

Mr. W. G. Markwick, taking the opposite view, agreed that there were benefits to be derived from the application of the code, but to what section of industry? The owner who had to foot the bill wanted to know what he would get out of it and production was not so great now as when lighting installations were poorer, though he agreed that there were other causes to account for the fall in production.

After considerable discussion, Mr. Mackenzie summed up and a vote showed an overwhelming majority in favour.

# Increasing Production

## Success of Bonus Scheme at a Twickenham Switch Factory

**A**MONG a number of devices introduced by Arcoelectric (Switches), Ltd., to step up production at its works at Twickenham is a scheme of bonuses for its employees which has met with exceptional success. Two types of bonus are given, a weekly one based on production and an annual profit-sharing bonus. Under the weekly scheme every process is timed and a standard basic output figure fixed. Points are then given for every minute worked over 30 in the hourly average at the rate of 6d. per point. An operator therefore can, and frequently does earn up to 15s. a week above the standard wage. Under the profit-sharing scheme, which is based on both efficiency and regular attendance, it is possible for an employee to receive the maximum equivalent of ten weeks' wages. The latter scheme particularly has a very good effect in reducing absenteeism after a "good week."

The average paid out under the weekly scheme amounts to about £40 per week, and under the profit-sharing scheme £2,000 per annum. Mr. N. H. Davidson, progress manager, tells us that before the weekly scheme was introduced the average number of minutes worked per hour was only about 40: now it is over 50. Absenteeism has fallen by 8½ per cent.

Motion study and the use of conveyors have also helped to improve output and, with the manufacture of peace-time articles now getting into full swing, it is expected that 10,000 switches a day will soon be coming off the production lines—a remarkable performance from about 80-100 employees in a small factory of only about 6,000 sq ft floor area.

At present, production is being concentrated almost entirely on push-button switches for incorporation in the bases of table lamps, but other products include vacuum switches for staircase lighting, etc., b.c. batten lampholders for illuminated signs (not much in demand here at the moment, owing to the lighting restrictions, but finding a ready market abroad), suspension and toggle switches, signal or pilot lampholders, test prods, pointer knobs, and turntables.

All the components are made on the premises, as well as all the tools. Ten presses cater for the large quantities of bakelite mouldings required, a rotary trimming machine being used to remove the flash and do the rough polishing. The pushes, etc., are trimmed on lathes. Power presses produce all the brass stampings required, such items as contact blocks being made by high-speed automatic machines. Assembly of the contacts for the table lamp switches is carried out by means of apparatus which swages and forms them on to blocks in one operation,



Final assembly conveyor. Note the arms on the edge diverting articles to operators along the line

each machine being capable of turning out 3,000 a day. Grooves for the screw fixing are drilled at the rate of ten a minute on other machines, while the holes for the screw assembly are tapped at the rate of 7,000-8,000 a day. Similar high-speed methods are used for the assembly of the blocks and the formation of the necks.

On the final assembly belt a novel device is used to pass partly-finished articles down the line. For instance, after the long and short contacts and ratchet have been inserted in the

moulding the assembly is placed on the edge of the conveyor to be caught by a metal arm which protrudes over the edge of the conveyor and diverts it to another operator farther down the line. Here it is placed, together with the top moulding, spring, pawl and push, in a neat jig arranged so that a light goes on when the assembly is correctly undertaken. Between

1,000 and 1,300 switches a day can be handled by each one of these jigs. After completion of the assembly the switches are placed on the centre of the conveyor and carried to the end of the belt for final test and inspection and boxing. They are then placed on an overhead conveyor which carries them to the Stores and Dispatch Department.

## Municipal Reports

**Bolton.**—The accounts of the Electricity Department (borough electrical engineer, Mr. H. E. Annett) show a total income of £573,672 (against £557,558 in 1944-45), with working expenses of £499,069 (£477,233). After meeting loan charges, etc., there was a net profit of £43,230 (£38,250), of which £7,898 (£1,519) has been utilized for capital expenditure items, £6,000 (same) is transferred to the reserve fund and £10,000 is again applied in aid of the rates. Sales, at 132.5 million kWh, were approximately the same as in the previous year, a rise of 6.4 million kWh under the combined light, heating and power tariff compensating for the reduced industrial power requirements. The cost per kWh sold was 0.973d. (0.931d.) and the price obtained averaged 1.03d. (1.01d.).

**Bromley.**—The wartime reduction of sales was fully recovered last year when an increase of nearly 18 per cent brought the total to 22.3 million kWh compared with 20.3 million in 1938-39. The report of the borough electrical engineer (Mr. W. G. Trend) indicates that sales under the domestic "all in" tariff, which rose by 2.9 million kWh, now account for some 60 per cent of the total. Total revenue last year amounted to £165,783 (against £146,281 in 1944-45), while working costs were £131,066 (£109,599), the financial result after the payment of all charges being a deficit of £7,206, compared with the previous year's loss of £6,982. Total costs per kWh were 1.80d. (1.86d.), revenue averaging 1.64d. (1.72d.).

**Bradford.**—Surveying the undertaking's progress during the past year in his annual report, the electrical engineer and manager (Mr. T. H. Carr) states that industrial inquiries for additional supplies are increasing in number and there is evidence of a general desire to adopt public supply. Development in this field was hampered by the difficulty of obtaining motors, the manufacturers requiring twelve to twenty-four months for delivery. Of the 1,295 additional consumers connected, 1,015 were domestic, and consumers in this class, excluding those occupying house and shop premises, now number 66,454 out of a total of 77,676. Their average consumption was 1,105 kWh compared with 988 kWh in the previous year. Commercially, there was a considerable demand for baking and cooking equipment and 22 baking ovens with an aggregate load of about 240 kW were connected, while a further 20 orders for

similar equipment were in hand. As far as large-scale electric cooking was concerned, development was seriously retarded by the restricted supply of equipment, but three large cookers were connected as well as four hot-cupboards and a considerable number of large kitchen-aid equipments. In order to establish the degree of saturation which has been reached in domestic electrical apparatus, the Department is co-operating with E.D.A. in carrying out a survey of the area.

Altogether 213.6 million kWh was sold during the year, a reduction of 2.9 million on the previous year; industrial supplies decreased by 12.1 million kWh, while consumption under domestic (special rates) rose by 9.7 million kWh. Revenue aggregated £1,158,047 (against £1,097,178), equivalent to 1.301d. (1.216d.) per kWh sold, and running costs, £938,543 (£862,003), averaged 1.054d. (0.955d.). After meeting debt charges and income tax, £179,117 (£243,906), there was a net profit of £40,387 against a deficit of £8,731 in 1944-45. During the year progress was made with the extension of the Valley power station.

**Mansfield.**—The Electricity Department (chief electrical engineer and manager, Mr. A. Latham) sold 18.6 million kWh in the year ended March 31st last, an increase of 6 per cent on the previous year. Income increased by £6,337 to £116,708 while working expenses rose by £11,346 to £96,085. Apart from the higher bulk supply charges, a revision of the proportion of costs borne by the undertaking for the services rendered by the Town Clerk's and Borough Treasurer's Departments resulted in an increase from £1,322 to £3,600. The net result of the year's working was a deficit of £2,898, the first for many years.

**Shoreditch.**—The accounts of the undertaking for 1945-46 record a revenue of £220,012 and a gross surplus of £25,265, there being a net profit of £1,910 after providing for loan charges and £3,500 for war damage insurance. A total of 29.2 million kWh was sold at an average price of 1.783d., compared with 27.1 million kWh at 1.742d. in 1944-45. The maximum supply demanded was 14,960 kW (12,650 kW) and the load factor fell from 27.41 to 25.72 per cent. Since the close of the financial year Mr. R. H. Rawll has succeeded to the position of borough electrical engineer and manager on the retirement of Mr. P. C. Ebner.

# Training Supervisors

## The "T.W.I." System

**F**OSTERED by the War Manpower Commission in the U.S.A. from 1940 onwards, the new method of training supervisors known as training within industry gave such good results that the Ministry of Labour sent an investigator to America to study the system and in September, 1944, the Ministry began to develop a similar service for firms in this country.

T.W.I. consists essentially of three main training functions for supervisors; job instruction, job methods and job relations. The first is the technique of passing on experience effectively; the supervisor has to learn how to instruct. The second is the analysis of how a job is done in order to find out how it may be improved. The third is the leadership and handling of people in their jobs and their relations with other people. These three skills are taught in a group-study course of five two-hour sessions each and are co-ordinated into a unified system of working efficiently.

### Job Instruction

In the U.S.A., the key to job instruction was found in the group discussions directed along definite lines. They were organized in the factory conference room or similar meeting place in an informal manner, the supervisors under instruction sitting around a table. The trainer demonstrated the inadequacy of simply telling someone how to do a job. A simple operation was taken and one of the supervisors present had to attempt it after a bare statement of how it should be done. He found that he could not grasp the whole sequence of movements and he failed. The trainer then showed the inadequacy of simply showing how to do a job. Another supervisor attempted the operation in an effort to imitate the trainer. This was a failure again. The trainer quoted the saying "If the worker has not learned, the instructor has not taught."

The next step was to take a simple operation and to conduct a member of the group right through it, explaining each move and making him use both his hands and his mind until he had mastered the whole process. When he could do this properly, he had to demonstrate back to the trainer

and explain each step clearly.

After this, the supervisors discussed the demonstration and how it could be applied to their individual factory instruction problems.

The second part of T.W.I., job methods, uses the discussion group system in a similar way. About a dozen foremen and a trainer or leader meet for five sessions of two hours each, the leader illustrating the technique by demonstrating a specific process. His object is to persuade them to find a fresh outlook on their work and the way it is done.

### Four-Step Analytical Method

The leader first of all demonstrates by showing how a process in the factory was formerly carried out. Each step is explained and demonstrated, showing how the work of materials handling, machine operations and hand labour is needed. He then takes the same process and goes through it in the same way, adopting the new method arrived at after making a "job methods" analysis. The resultant simplification, and savings in materials, in machine time and man-hours are shown. He next explains the analytical method which has produced the new way of doing the job. Four steps are outlined:—

(1) Break down the process into its parts, listing all the details exactly as done.

(2) Consider each part critically and study it in a detached way. This means in practice asking elementary questions about what is going on. "What is the purpose of this part—this action—this arrangement?" "Why is it necessary?" "Is this the best method of doing it?" "If not, can you think of a better method?" And, "When and where should this be done and who is best qualified to do it?"

(3) After this analysis there follows the building up of a new method. This means examination of the process as revealed in its parts and their sequence, elimination of unnecessary details, simplification of the job to reduce the number of things done, and the rearrangement of the process into a more easily operated grouping. For this part of the work to be thorough, all the key workers connected with the job should be called in and asked to make their own comments and suggestions about the way

they think the job should be carried out—about the use of jigs and fixtures, the sequence of operations, the supply of materials and parts, the machines best fitted to do the job, etc. The new process ought to be the creation of the men who have to do it, guided by the men who take the responsibility for its effective use.

(4) Having redesigned and replanned the job, the work is not really complete until the stage has been reached at which all the workers who are to carry out the job in the new way—and those who have the task of supervising the new method—have been "sold" the whole idea. This saves possible psychological difficulties later on. It is equally necessary to secure the approval of those in the factory who will have to deal with the new method's effects on materials, quality and costs, on safety and on quantity production. Again, the effects on piece rates and earnings are important matters to examine and make clear so that agreement is reached before applying the new method. When the method has been approved full credit should be given to those who have helped to design and construct it.

The series of four steps outlined is used by the leader of the supervisors' training group to show how to deal with their own problems, and the essential feature of this kind of instruction is this application. The leader asks each supervisor to bring to the discussion group a current process or methods problem which is giving him trouble in his own shop. The whole group then goes through the four-step method to find a solution to this problem. The supervisors deal with each other's troubles in a logical, co-ordinated process of thinking.

### Job Relations

The third section of T.W.I. is job relations, probably the most important and most difficult to teach. It is not easy to estimate losses in production arising from the failure of supervisors to deal wisely with human relations. A new approach was decided on by the U.S. War Manpower Commission—job relations training was to provide training for this skill, the skill of leading, of working with people, of getting results through people. Another set of five two-hour discussion groups was planned, to which supervisors brought their problems of human relations. The procedure for dealing with these problems was outlined simply and the leader provided a "textbook" consisting

of a card. On one side was the heading, "How to handle a problem." It gave four steps: "Get the facts; weigh and decide; take action; and check results." Under the first section were: "Review the record, find out what rules and plant customs apply, talk with individuals concerned, get opinions and feelings, and be sure you have the whole story." Under the next section came, "Fit the facts together, consider their bearing on each other, etc.," down to "Don't jump at conclusions." The remaining two sections were similarly analysed.

With the aid of this textbook, supervisors were taken through one current problem after another. They tried to solve each other's everyday difficulties of dealing with people and they learned a lot in this process because they had to follow a logical series of steps and stick to the points at issue.

### Results of Training

The instruction card had printed on its other side a few notes, "Foundations for good relations," outlined under four headings: "Let each worker know how he is getting on, give credit when due, tell people in advance about changes that will affect them, and make use of each person's ability." After a course of applying their experience and thought in this way, supervisors became more effective because they had been analysing their experience and using it according to common-sense, psychological principles. They had been taught to put themselves in the place of the man they were supervising; to look below the surface for the real cause of his discontent or inefficiency; to treat each man as an individual.

The discussion group has proved its value in training. It is clear, however, that management must give its full support to this system if the best results are to be obtained. At the present time, the Ministry of Labour is furthering T.W.I. through a special branch, the Training Department, T.W.I. for Supervisors, Ebury Bridge House, Ebury Bridge Road, London, S.W.1, and it has issued two pamphlets on the system. The work has been running for about two years and more than 30,000 people have already received T.W.I. group training. In the United States more than one and a half million people received the training. The verdicts of both countries are consistently favourable to this practical approach to the chief problems of industrial supervision.



# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

**Exeter.**—December 30th. Electricity Department. Two 12,000-kVA transformers. (December 6th.)

**Hastings.**—January 13th. Electricity Department. Two 2,000-kVA Scott-connected transformers and two switch kiosks. (December 6th.)

**Isle of Ely.**—January 4th. County Council. Installation of electric lighting at the Orchards Nursery, Wisbech. R. D. Robson, county architect, County Hall, March.

**London.**—Metropolitan Water Board. New or second-hand alternators, three-phase, 400/440V, for coupling to Diesel engines running at 600 r.p.m. (eighteen approximately 200 kW and six approximately 300 kW). (December 13th.)

**Manchester.**—January 13th. Electricity Committee. 6.6-kV substation switchgear. (December 6th.)

**Newark-on-Trent.**—January 16th. Borough Council. P.i. and armoured cable. (December 13th.)

**Newport (Mon.).**—December 31st. Corporation. Electrical installations in 134 houses, Alway Farm estate. (December 6th.)

**North Scotland.**—January 20th. Hydro-Electric Board. High- and low-voltage distribution lines (wood poles) on the island of Arran. (December 13th.)

**Rhondda.**—December 28th. Urban District Council. Six 300-kVA three-phase oil-immersed static transformers, 11,000/415/240 V. (December 13th.)

**St. Faith's and Aylsham.**—December 28th. Rural District Council. Electrically operated pumping and pressure distribution plant for seven sites. W. Herbert Bateman & Partners, Halifax House, Bank Plain, Norwich.

### Orders Placed

**Barrow-in-Furness.**—Electricity Committee. Accepted. Lighting columns (200) and lanterns.—G.E.C. Standard service units (500).—British Insulated Callender's Cables. Transformers.—British Electric Transformer Co.

**Birkenhead.**—Electricity Committee. Accepted. Switch unit (£309).—A. Reyrolle & Co.

**Liverpool.**—Electric Power & Lighting Committee. Recommended. 33-V cable, together with pilot and telephone cables, between Clarence Dock power station and substations (£260,878).—British Insulated Callender's Cables.

**Manchester.**—Electricity Committee. Accepted. Cables, Stuart Street power station and High Street substation.—Standard Telephones & Cables; Connollys (Blackley); Mersey Cable Works. Street lighting standards for twelve months.—Stewart & Lloyds.

**Mansfield.**—Electricity Committee. Accepted. Transformers.—Electric Construction Co.; Brush Electrical Engineering Co.; Ferranti.

**Wallasey.**—Works Committee. Accepted. Power installation at Mill Lane depot (£142).—R. J. Chatham.

Electricity Committee. Accepted. Underground disconnecting boxes (£804).—W. Lucy & Co.

**West Hartlepool.**—Town Council. Accepted. Steel street lighting columns.—Revo Electric Co.

### Contracts in Prospect

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Ashington (Northumberland).**—Factory for G. I. Colpitt & Sons; J. Huntley & Sons, Marion Street, Sunderland.

**Aspatia (Cumberland).**—Factory for Hackney and Co.; E. Taylor and Co., Ltd., builders, Littleborough, Lancashire.

**Aycliffe (Durham).**—Factory for Block & Anderson, Ltd.; Cordingley & McIntyre, The College, Durham City.

**Barrow-in-Furness.**—Factory for Lister & Co., Manningham Mills, Bradford.

**Birkenhead.**—Houses (257), Woodchurch estate (£358,294); Lloyd & Cross, Ltd.

**Blackpool.**—Houses (60), Collins Avenue; R. Fielding & Son, builders, Stanhope Road.

**Bradford.**—Extensions to works; J. Newbould & Son, Ltd., Dick Lane.

**Carlisle.**—Dining room and kitchen at Stanwix School; A. Blakely & Sons.

**Caterham.**—Houses, and flats, Crewes Lane (£20,930); P. E. Good, 34, Church Road, Warlingham.

**Chadwell Heath.**—Extensions to factory for Lewis Berger & Sons.

**Cheadle.**—Factory for British Hard Rubber Co.

**Cleator (Cumberland).**—Factory for the Cumberland Paper Co., Ltd.; John Laing and Sons, builders, Carlisle.

**Colwyn Bay.**—Houses (50), Mochdre; N. S. Jeffery, borough engineer, Town Hall.

**Connah's Quay.**—Permanent houses (94), for U.D.C. (£105,750); Shones (Buckley), Ltd., contractors, Church Road, Buckley, Chester.

**Dartford.**—Additions to County Hospital, for Kent C.C.; county architect, Springfield, Maidstone.

**Devonshire.**—Kitchens and dining rooms at schools at Broadclyst, Crediton, Newton Abbot and Plympton; H. V. de Courcy Hague, county architect, 97, Heavitree Road, Exeter.

**Doncaster.**—Works, Milethorn Lane, for Briggs Motor Bodies, Ltd.; Howard Crane, architect, 7, Buckingham Gate, London, W.1.

**Driffield.**—Houses (64), in several parishes; F. Vaux, architect to R.D.C., Danesmoor Chambers, 31, Quay Road, Bridlington.

**East Barnet.**—Houses (76), Linthorpe Road, Bevan estate, for U.D.C.; New Ideal Home-steads, Ltd., Station Approach, Sidcup.

**Eccles.**—Houses (20), Clandon Avenue, Peel Green; S. Crompton, builder, 744, Liverpool Road, Peel Green.

**Edinburgh.**—Reconstruction (after fire), of Theatre Royal; Edinburgh Varieties, Ltd., 50, Melville Street.

**Enfield.**—Houses (214), Bullsmoor estate (£243,829), for U.D.C.; T. H. Houslip and Co., Ltd., building contractors, 8a, Galliard Road, London, N.9.

**Feltham.**—Crematorium for S.W. Middlesex Crematorium Board; Denman & Sons, architects, Brighton.

**Garforth.**—Dwellings (52), Westfield estate, Allerton Bywater (£63,367), for U.D.C.; F. & C. Leach, Ltd., builders, Park Lane, Pontefract.

**Hamilton.**—Factory for making aluminium frames for McLean's Windows, Ltd., Glasgow; manager.

**Henley-on-Thames.**—Permanent houses (166), Greys Road North estate; T. L. G. Jefferies, borough surveyor, 33, Market Place.

**Huyton.**—New court room, magistrates room and police station, Stockbridge Lane; A. T. Nicholson, county architect, Fishergate Hill, Preston.

**Kilsyth.**—Completion of new secondary school (£100,000); county architect, Viewforth, Stirling.

**Leigh.**—Houses (186), and flats (48), Wigan Road; Nel Pan Lane site; borough surveyor.

**Louth.**—Houses (40), Eastfield Road; J. C. Barber, borough engineer, Town Hall.

**Macclesfield.**—Houses (30), Ivy Road; Forbes Building & Construction Co., Ltd., Stockport.

**Mountain Ash.**—Temporary houses (154), Buarth Capel site; U.D.C. surveyor, Town Hall.

**Newcastle-on-Tyne.**—Flats (24), Westbourne Avenue; city architect, 18, Cloth Market.

Factory on the Coast Road for Wills & Co., tobacco manufacturers, Bristol; Sir Robert McAlpine & Son, Ltd., Carlisle House.

**Newry (Co. Down).**—Textile factory for Horrockses Crewdson & Co., Ltd.

**Northumberland.**—Five schools (£250,000); county architect, County Hall, Newcastle-on-Tyne.

**North Shields.**—Houses (50) for Tynemouth Town Council; J. White (Contractors), Ltd., Dunston-on-Tyne.

**Oldham.**—Police houses (£24,000); A. L. Hobson, borough engineer, 75, Union Street.

**Ormskirk.**—Primary school; G. Noel Hill, county architect, Preston.

**Orrell.**—Houses (36), Moor Road site (£41,728) for U.D.C.; G. Halliwell, builder, Moor Road.

**Penryn.**—Houses (51), Tremough estate (£63,715); John Williams and Co. (Cornwall), Ltd., builders, South Street, St. Austell.

**St. Pancras.**—Flats (72), Torriano Avenue (£142,308); F. Troy & Co., Ltd.

Flats (126), St. Pancras Way (£189,763); Henry Neal, Ltd.

**Stockport.**—Houses (34), Dial Park Road and Mazda Road; T. Fryer & Co., builders, Garden Street.

Central bus station, Daw Bank and Chester-gate, and branch library, Stockport Road, Cheadle Heath; W. F. Gardner, borough surveyor.

**Stourport-on-Severn.**—New ante-natal ward at Lucy Baldwin Maternity Hospital, for Worcestershire C.C.; Martin, Martin and W. H. Ward, architects, 106, Colmore Row, Birmingham.

**Sunderland.**—Nursery schools at Springwell Farm, Thorney Close and Hill View, and kitchens and dining rooms at Havelock Junior, Barnes, and Hendon Schools; C. A. Murray, education architect, John Street.

**Swinton.**—Houses (110), Highfield Farm estate; H. Goodwin, U.D.C. surveyor.

**Thorne.**—Permanent houses (40), and bungalows (18), Brickyard Lane, for R.D.C.; W. Firth, Ltd., builders, Armthorpe Road, Armthorpe, Doncaster.

**Wakefield.**—Factory in Smyth Street for Close Asbestos & Rubber Co., Ltd., 5a, Cheapside.

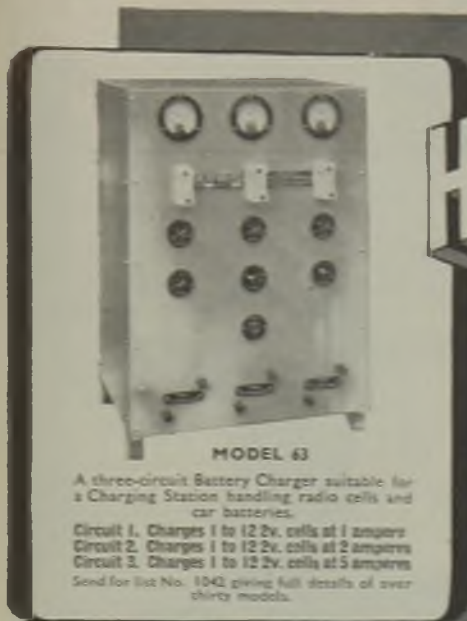
**Wallasey.**—Houses (159), Council estate (£182,155); Wm. Thornton & Sons, Ltd., Liverpool.

**Wallsend.**—Erection of factories on 20-acre site south of the Coast Road; Board of Trade, Clarendon House, Clayton Street, Newcastle-on-Tyne.

**Warlingham.**—Flats (24), Blanchmans estate (£21,700); Walter Smith & Partners, 552, Limpsfield Road.

**Whitehaven.**—Factory for Ennerdale and Co.; John Laing and Sons, Ltd., builders, Carlisle.

Factory for the Romney Perambulator Co., Ltd.; Border Engineering Co., builders.



**MODEL 63**

A three-circuit Battery Charger suitable for a Charging Station handling radio cells and car batteries.

Circuit 1. Charges 1 to 12 2v. cells at 1 ampere

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## TELCON METALS



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  - INDICATING INSTRUMENTS

Close technical control of production is an outstanding feature in the manufacture of MUMETAL. The illustration shows factory testing of a batch of MUMETAL cores. Our technical experts will be pleased to discuss the application of MUMETAL to your particular requirements.



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Enquiries to: TELCON WORKS, GREENWICH, S.E.10. Telephone: GREENWICH 1040



**LIGHTING FITTINGS BY**

**G.E.C.**

Advt. of The General Electric Co. Ltd., Magnet House, Kingway,

London, W.C.2

# CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First Post on Monday**, and should be addressed to Classified Advertisement Department, Dorset House, Stainford Street, London, S.E.1. (See Notice below for Christmas.) **THE CHARGE** for advertisements in this section is 2/6 per line (approx. 7 words) per insertion. **ONLY OFFICIAL AND GOVERNMENT ANNOUNCEMENTS CAN NOW BE DISPLAYED.**—35/- per inch. Where the advertisement includes a Box Number this counts as six words and there is an additional charge of 6d for postage of replies. **SITUATIONS WANTED.**—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

**REPLIES** to advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the **ELECTRICAL REVIEW**. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o **ELECTRICAL REVIEW**, Dorset House, Stainford Street, London, S.E.1. Cheques and Postal Orders should be made payable to **ELECTRICAL REVIEW LTD.** and crossed.

Original testimonials should not be sent with applications for employment.

## CHRISTMAS SCHEDULE

### CLASSIFIED ADVERTISEMENTS

Our issue of **December 27** has closed for press.

#### OFFICIAL NOTICES, TENDERS, ETC.

#### ELECTRICITY (SUPPLY) ACT, 1928

North-West England and North Wales Electricity (Alteration and Extension) Scheme, 1946

WHEREAS the Electricity Commissioners have prepared and transmitted to the Central Electricity Board a scheme bearing the above title, and hereinafter referred to as "the new scheme," for altering and extending the North-West England and North Wales Electricity Schemes, 1928 to 1944, by determining that four new generating stations, if and when duly authorised, will become selected stations for the purposes of the Central Electricity Board.

Notice is hereby given that the Central Electricity Board have caused the new scheme to be published and that any authorised undertakers or other persons interested in the new scheme and desiring to make representations thereon may do so by forwarding the same by registered letter to the undersigned, and posted not later than the 18th day of January, 1947. Copies of the new scheme with an explanatory memorandum, which the Electricity Commissioners have sent to the Board therewith, may be obtained at the price of one penny each from H.M. Stationery Office, York House, Kingsway, London, W.C.2. Dated this 17th day of December, 1946.

O. A. SHERRARD,

Trafalgar Buildings, Secretary, 4<sup>th</sup> 11  
1, Charing Cross, London, S.W.1.

#### SITUATIONS VACANT

#### CITY AND ROYAL BURGH OF DUNDEE ELECTRICITY DEPARTMENT

#### Appointment of Junior Charge Engineer

APPLICATIONS are invited for the position of Junior Charge Engineer in the Main Generating Station at Carolina Fort. Applicants must have had a proper theoretical and technical training, and practical experience either in a similar capacity or in a manufacturer's works.

The salary will be in accordance with Grade 9, Class H. of the N.J.B. Salary Schedule, at present £402 per annum. The successful candidate will be required to pass a medical examination and contribute to the Corporation's Superannuation Scheme.

Applications, giving full particulars of age, training and experience, accompanied by copies of recent testimonials, should be sent to me not later than Saturday, 4th January, 1947.

P. PHILIP, M.I.Mech.E., M.I.E.E.  
City Electrical Engineer.

Dudhore Crescent Road, Dundee. 4029

Please address your envelope..

## CLASSIFIED ADVERTISEMENT DEPT.

#### COUNTY BOROUGH OF WALSALL ELECTRICITY SUPPLY DEPARTMENT

APPLICATIONS are invited for the following appointments at salaries and conditions in accordance with the National Joint Board Schedule (the undertaking is at present in Class G, but it is likely that it will move to Class H in the near future).

(a) **METER ENGINEER**, Grade 7 (at present £494 per annum). Candidates must have had a sound technical training and have gained the National Higher Certificate or equivalent qualification, with experience in a type A polyphase meter testing station, including organisation and records and knowledge of the requirements of the Electricity Supply (Meters) Act, 1938, together with practical experience in the repairing, testing, certification and installation of all types of meters, and inspection, testing and connecting of consumers' installations.

(b) **ASSISTANT CONSUMERS' ENGINEER**, Grade 6 (at present £545 per annum). Candidates must have had a sound technical training and have gained the National Higher Certificate or equivalent qualification. They must have had practical experience of installation contract work and be competent to advise consumers on industrial power and other applications, and to prepare specifications and estimates for all classes of installations; with a good knowledge and experience of sales and development activities, including showrooms, and the installation and maintenance of hired apparatus.

(c) **JUNIOR MAINS DRAUGHTSMAN**, Grade 9a (at present £343 per annum). Candidates must have had a good general training in mains work, with experience in mains records and the preparation of drawings for mains extensions and substations.

Applications are also invited for the appointment of (d) **SHOWROOM ASSISTANT (MALE)**. Candidates must have had a good general education and experience in showroom work, with a sound knowledge of electrical domestic apparatus and the installation and use of same. Duties will include attending to consumers' enquiries re supply and tariffs, window displays, etc. The salary for the candidate of suitable age will be in accordance with the Local Authorities National Scale, Miscellaneous Division, Grade 1, commencing at £255 and rising to £300 per annum, plus bonus which is now £59 16s. per annum.

The appointments will be subject to the provisions of the Local Government Superannuation Acts and the successful candidates will be required to pass a medical examination. Applicants must disclose whether they are related to any member of the Walsall Town Council or its senior officers, and canvassing, directly or indirectly, will disqualify.

Applications should be in the prescribed form, which may be obtained from the undersigned, and should be submitted not later than January 3rd, 1947.

D. HOLT,

Upper Bridge St., Walsall. Engineer and Manager. 4049  
9th December, 1946.

**BOROUGH OF CHELTENHAM ELECTRICITY DEPT.**

**A**PPPLICATIONS are invited from Corporate Members of the Institution of Electrical Engineers for the following appointments:—

(1) **DEPUTY ELECTRICAL ENGINEER AND MANAGER.** A sound training, wide experience and progressive record in the technical development and administration of large or medium-sized undertakings in the electricity supply industry is essential. The salary will be in accordance with Grade 1, Class G, of the National Joint Board Schedule (at present £833).

(2) **SERVICE AND DEVELOPMENT ENGINEER.** The applicant must have had a sound training and experience in the sales and development section of a medium or large electricity undertaking, and must be capable of reorganising and expanding a domestic apparatus repair workshop, of preparing reports on schemes for development, and of dealing efficiently with all matters relating to a consumers' department. The salary will be in accordance with Grade 3, Class G, of the National Joint Board Schedule (at present £681).

(3) **TECHNICAL ASSISTANT.** Candidates must have had a thorough grounding in electrical technology, experience in the preparation of distribution schemes, and must be capable of dealing critically and statistically with all matters relating to an electricity undertaking. The salary will be in accordance with Grade 5, Class G, of the National Joint Board Schedule (at present £573).

In addition to the above three appointments there is also a fourth appointment set out below, for which the applicant is not required to be a Corporate or a Graduate Member of the Institution of Electrical Engineers.

(4) **EX-SERVICE TRAINEE.** Training, principally in the Distribution Section, for a period of two years is offered to a young ex-Service man, who has a sound basic knowledge of electrical engineering. The applicant will be required to show that he intends and is reasonably capable of passing, if he has not already done so, the Graduateship Examination of the Institution of Electrical Engineers during or at the end of the two-year period. The salary payable will be in accordance with Grade 10, Class G (at present £312) and, subject to satisfactory progress, will be increased during the second year to Grade 9a, Class G, of the National Joint Board Schedule (at present £343).

The successful candidates will be required to pass an examination by the Medical Officer of Health, and to contribute to the Council's Superannuation Scheme. Conditions of service, except those laid down in the National Joint Board Schedule, will be those included in the scheme of the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services. Candidates must disclose any relationship which may exist between them and members of the Borough Council or its chief officers.

Applications, stating age, whether married or single, and present appointment, together with full details of training and experience, and accompanied by not more than three recent testimonials, must be sent to the undersigned not later than 31st December, 1946, the envelope being clearly marked with the designation of the post for which application is being made.

R. W. STEEL, A.M.I.E.E., Engineer and Manager. 4021

**COUNTY BOROUGH OF HALIFAX  
ELECTRICITY DEPARTMENT****Appointment of Assistant Power Station Superintendent**

**A**PPPLICATIONS are invited for the position of Assistant Power Station Superintendent at the Foundry Street Power Station of the above Authority. The conditions of employment are in accordance with the National Joint Board Agreement, Class G, Grade 5, at present £573 rising to £604 per annum.

Candidates must be experienced in the operation and maintenance of a modern selected power station and have had a good engineering education. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful applicant will be required to pass a medical examination.

Applications, endorsed "Assistant Power Station Superintendent," stating age, training and experience, and accompanied by copies of not more than three recent testimonials, should reach the undersigned not later than 12 noon, Monday, the 30th December, 1946. Canvassing, either directly or indirectly, will disqualify.

A. G. CONNELL, M.I.E.E., M.I.Mech.E., F.Inst.F.,  
Borough Electrical Engineer and Manager. 3946

19/23, Northgate, Halifax. 3946

**SHEFFIELD CORPORATION ELECTRICITY DEPT.****Installation Engineer (Electrical Contracting)**

**A**PPPLICATIONS are invited for the above position from applicants who have had a sound training and considerable practical experience in the electrical contracting industry. Applicants should be able to prepare estimates and specifications for all classes of electrical installation work, to supervise the carrying out of the work, and to control staff. Experience of development work in the domestic, commercial and industrial applications of electricity would be an advantage.

The salary will be in accordance with Class M, Grade 9a, of the National Joint Board Schedule, commencing at £478 per annum.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937. Applicants must preferably be not more than 40 years of age, or have had previous Local Authority service carrying transfer value within the meaning of the Act. The selected applicant will be required to pass a medical examination.

Applications, on forms to be obtained from the undersigned, are to be returned to me not later than Monday, 6th January, 1947, accompanied by copies of not more than three recent testimonials. Canvassing or any communication to a member of the Council, either directly or indirectly, is prohibited and is a disqualification.

JOHN R. STRUTHERS,

Commercial Street, Sheffield, 1. General Manager. 4043

**HIS MAJESTY'S COLONIAL SERVICE****The Colonial Engineering Service**

**A** vacancy exists in the Nigerian Government Electricity Undertakings for a Deputy Electrical Engineer-in-Chief. Candidates must be Corporate Members of the Institution of Electrical Engineers and have had a sound mechanical and electrical training, together with experience in the operation and management of a large municipal or company-owned supply undertaking. Age preferably not less than 35 nor more than 40 years. The successful candidate will be required to assist the Electrical Engineer-in-Chief in the operation and administration of the electricity undertakings controlled by that officer, and in the preparation of plans, specifications and tenders for new electricity schemes. He will be required to assume the duties of Electrical Engineer-in-Chief as circumstances may require.

The appointment will be on probation for permanent and pensionable employment at a salary of £1,200 a year. Free furnished quarters are provided and free passages for the officer and, if married, for his wife on first appointment and on leave. Home leave is usually permitted after not more than 18 months' resident service and is granted at the rate of 7 days for each month of resident service. Income tax at Nigerian rates only.

Those interested should write to the Director of Recruitment (Colonial Service), 15, Victoria Street, London, S.W.1, stating age, professional qualifications and brief particulars of experience. 3996

**CITY OF PETERBOROUGH ELECTRICITY DEPT.**

**A**PPPLICATIONS are invited for the following appointments:—

(a) **ASSISTANT MAINS ENGINEER.** Candidates should have had a sound training and some experience in the construction and maintenance of distribution networks, and in the layout of modern street lighting. Salary and conditions of employment will be in accordance with the N.J.B. Schedule, Class G, Grade 9a, viz., £343 to £358 per annum.

(b) **JUNIOR MAINS DRAUGHTSMAN.** Candidates should have had experience in distribution drawing office, and be conversant with mains records and the design and layout of distribution networks. Salary and conditions of employment will be in accordance with the N.J.B. Schedule, Class G, Grade 10a, viz., £300 to £311 p.a. The selected candidates for each appointment will be required to pass a medical examination and to contribute to the Corporation's Superannuation Scheme under the Local Government Superannuation Act, 1937.

Applications, endorsed (a) "Assistant Mains Engineer," and (b) "Junior Mains Draughtsman," stating age, training, qualifications, giving details of experience, and accompanied by copies of two testimonials, should be forwarded to the City Electrical Engineer and Manager, Albert Meadow, Peterborough, not later than 30th December, 1946.

ARTHUR J. REEVES,  
Town Hall, Peterborough. Town Clerk. 3977  
7th December, 1946.

**CITY OF CHICHESTER ELECTRICITY DEPT.**

**A**PPPLICATIONS are invited for the following positions:  
 (a) **CONSUMERS' ASSISTANT.** Appointed person will be attached to showroom staff and will be required to advise consumers (both in showroom and on consumers' premises) on the selection and use of electric apparatus, tariffs, tariff assessments, queried accounts, etc. Salary in accordance with National Joint Council for Local Authorities Staffs, General Division (at present £160 at 21 years, rising to £300 at 30 years, plus cost-of-living bonus of £59 16s. per annum). Candidates should have had previous experience in a similar capacity. Education to School Certificate standard, and ability to drive car will be an advantage.

(b) **MAINS FOREMAN.** Applicants must be experienced in the erection, installation and maintenance of both E.H.T. and L.T. overhead lines and underground mains. Appointed person must be capable of supervising the work of the joiners and the mains gang; a good disciplinary and timekeeper, and able to drive car and light van. Wages and conditions in accordance with the District Joint Industrial Council Electricity Supply Industry (No. 11 Area, Zone 2), at present 59.88d. per hour.

Applications, stating age, qualifications and experience, accompanied by copies of recent testimonials, should be addressed to reach the undersigned not later than 31st December, 1946.

E. H. SKINNER, A.M.I.E.E.,

43, North St., City Electrical Engineer and Manager.  
 Chichester, Sussex. 3918

**SPALDING U.D.C. ELECTRICITY DEPARTMENT**

**Mains Recorder and Draughtsman**

**T**HE Spalding Urban District Council Electricity Dept. invites applications for the position of Mains Recorder and Draughtsman. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the selected candidate, before appointment, will be required to pass a medical examination. The conditions of employment will be in accordance with the N.J.B. Schedule, Grade 9a.

Applications, stating the applicant's age, whether married or single, and giving full details of experience, previous appointments and qualifications, together with copies of not more than three recent testimonials, should be addressed to the undersigned, endorsed "Mains Recorder and Draughtsman", and delivered not later than Tuesday, 31st December, 1946.

FRANK R. C. ROBERTS,

9, Winsover Road, Engineer and Manager.  
 Spalding, Lincs. 4048

**FIRST GARDEN CITY LIMITED**

**T**HE following vacancies are open:—  
 (a) **FITTER AND TURNER** for general maintenance work, experience with Brush-Ljungstrom turbines desirable.

(b) **FITTER** for water-tube boiler and pump maintenance, experience with Babcock & Wilcox stoker-fired units desirable.  
 Rates of pay 2s. 4d. per hour for day work, plus extra for superior ability and experience.

(c) **CONTROL ENGINEER**, experienced with E.H.T. feeders and turbo alternators, also D.C. rotary plant, rate 2s. 7 1/2d. per hour for shift work.

The above to be in accordance with J.I.C. (No. 9 Area) conditions; subsistence allowances will be considered pending permanent settlement in the district. Applications to the undersigned by 11th January, 1947.

W. A. BROWN,

Works Road, Electrical Engineer and Manager.  
 Letchworth, Herts. 4060

**LEEDS COLLEGE OF TECHNOLOGY**  
 (Principal: C. Chew, M.Sc.Tech., F.R.I.C.)

**Department of Electrical Engineering and Physics**

**A**PPPLICATIONS are invited for the post of full-time Lecturer in Electrical Engineering, duties to commence on 3rd February, 1947, or as soon as possible after this date. Applicants should be suitably qualified, and have had industrial and teaching experience. Salary according to Burnham Scale.

Particulars and form of application, to be returned not later than two weeks after the appearance of this advertisement, may be obtained by sending a stamped addressed foolscap envelope to the Director of Education, Education Offices, Leeds. 4016

**BOROUGH OF SCUNTHORPE ELECTRICITY DEPT.**

**Appointment of Chief Technical Assistant**

**A**PPPLICATIONS are invited for the above appointment from Engineers who are Corporate Members of the I.E.E. or who possess equivalent technical qualifications, and are not more than 45 years of age. Applicants should have had a thorough training and experience in electricity supply, preferably with a Local Authority. They must be conversant with the design, construction, operation and maintenance of 33-kV transmission, E.H.T., H.T. and L.T. distribution (overhead and underground systems) and substations.

The salary scale for the position will be that of Grade 3, Class F, as prescribed by the National Joint Board for the Electricity Supply Industry, commencing at £640 per annum. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, terminable by one month's notice on either side, and the successful candidate will be required to pass a medical examination.

Further particulars, conditions attached to the appointment and form of application may be obtained from me on receipt of a stamped addressed envelope. Applications, which must be made on the official form, should be delivered to me, in envelopes marked "Chief Technical Assistant," not later than 10th January, 1947. Canvassing, either directly or indirectly, will be a disqualification.

W. P. ERRINGTON,

34, High St., Scunthorpe, Lincs. Town Clerk.  
 9th December, 1946. 4044

**FARNHAM GAS AND ELECTRICITY COMPANY**  
**ELECTRICITY DEPARTMENT**

**Cable Joiner (Plumber)**

**A**PPPLICATIONS are invited for the position of Cable Joiner in the above Department. Applicants must have had a thorough training and experience in high and low tension joining.

Conditions of service and rates of pay will be in accordance with the Home Counties (No. 9 Area) Joint Industrial Council. Present rate 2s. 4d. per hour for a 47-hour week. Successful candidate will be required to pass a medical examination. Some priority in housing may be given in the allocation of accommodation when available.

Applications, stating age, experience and accompanied by copies of testimonials in support of candidature, to be submitted to the undersigned.

W. H. EMERY,

East Street, General Manager and Secretary.  
 Farnham, Surrey.  
 9th December, 1946. 4050

**SPALDING U.D.C. ELECTRICITY DEPARTMENT**

**Assistant Meter Tester**

**A**PPPLICATIONS are invited for the position in Meter Test Room for testing and repairing single-phase, 2-wire meters.

D.J.I.C. rates, No. 7 Area, 2s. 2d. per hour, 47-hour week. The appointment will be subject to the Local Government Superannuation Act, 1937, and the successful candidate will be required to undergo a medical examination.

Applications to reach the undersigned before 31st December, 1946.

FRANK R. C. ROBERTS,

9, Winsover Road, Engineer and Manager.  
 Spalding, Lincs. 4015

**ELECTRICITY SUPPLY BOARD**

**Appointment of Lady Tracers**

**T**HE Electricity Supply Board invites applications for the above positions. Applications will be considered only from candidates who have had considerable experience of tracing from draughtsmen's drawings relating to wiring diagrams, structural steel work, power station, substation layouts, etc.

Forms of application, and syllabus, may be obtained from the undersigned, with whom completed applications must be lodged not later than 31st December, 1946.

PATRICK J. DEMPSEY,

60/62, Upper Mount St., Dublin. Secretary.  
 9th December, 1946. 4041

### WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

#### Appointment of Relief Combustion Engineer, Ironbridge Generating Station

**T**HE above-named Authority have a vacancy for a Relief Combustion Engineer at their Ironbridge generating station, Shropshire, at a salary of £523 per annum, Class K, Grade 8a, of the National Joint Board Schedule.

Candidates must be well versed in fuel technology and have had a thorough practical training in mechanical engineering, together with a wide experience in the efficient operation of high-pressure boilers of large capacity, modern boiler house equipment, and instruments in major generating stations. Corporate membership of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers will be an advantage.

The appointment will be subject to the Authority's Superannuation Scheme under the Local Government Superannuation Act, 1937, and the selected candidate will be required to pass a medical examination.

Applications, stating age, full particulars of training and experience, accompanied by copies of three recent testimonials, should reach the undersigned not later than the 31st December, 1946. Canvassing, either directly or indirectly, will be disqualify.

H. F. CARPENTER,  
Clerk and Manager.

Phoenix Buildings,  
Dudley Road, Wolverhampton.  
2nd December, 1946.

3912

### BOROUGH OF BRENTFORD AND CHISWICK ELECTRICITY DEPARTMENT

#### Deputy Borough Electrical Engineer

**A**PPPLICATIONS are invited from suitably qualified and experienced persons for the post of Deputy Borough Electrical Engineer at a salary in accordance with Grade 1, Class E, of the N.J.B. Schedule of Salaries, at present £796 rising to £815 per annum.

Applicants must be Corporate Members of the Institution of Electrical Engineers, and have had a sound technical education and practical experience in the design and operation of 6.6/11-kV and L.T. underground distribution networks with A.C. and D.C. substations. Extensive sales development and commercial experience with a progressive electricity undertaking is also essential.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination and reside within the Borough.

Applications, stating age and experience, together with copies of not more than three recent testimonials, endorsed "Deputy Borough Electrical Engineer," must be delivered to the undersigned not later than Tuesday, 31st December, 1946. Canvassing, directly or indirectly, will be deemed a disqualification, and candidates must declare any relationship with members or officers of the Council of which they are aware.

A. E. JEANS, M.I.E.E.,  
Borough Electrical Engineer. 3931

197/199, Chiswick High Rd.,  
London, W.4.

### ENGINEERING APPRENTICESHIPS IN MINISTRY OF SUPPLY ESTABLISHMENTS

**A**N Open Competitive Examination for Engineering Apprentices in the Royal Ordnance Factories in various parts of the country and in the Royal Aircraft Establishment, Farnborough, will be held at local centres in March, 1947.

Engineering apprentices are expected to reach Higher National Certificate or equivalent standard by the end of their apprenticeship. Candidates must be not less than sixteen and not more than eighteen years of age on 1st March, 1947.

Copies of the regulations and forms of application may be obtained from the Secretary, Ministry of Supply, Room 268 (Exam.), Shell-Mex House, Strand, London, W.C.2. The latest date for the receipt of applications is 31st January, 1947. 4013

**A** Senior Electrical Sales Engineer is required for service in Malaya. Applicants should be fully qualified electrical engineers, preferably with steam turbine experience. Reply, giving full details of experience, age, and salary required, to—The Labour Dept., Brush Electrical Engineering Co. Ltd., Loughborough. 4039

### BURGH OF LERWICK ELECTRICITY DEPT.

#### Overhead Linesman

**E**XPERIENCED Overhead Linesman required, one with underground jointing experience preferred but not essential. Wages and conditions of employment will be in accordance with D.J.I.C. rates for No. 13 Area as a minimum, but a higher rate may be paid depending on qualifications.

Applications should be sent to the undersigned, giving full particulars of experience and enclosing copies of references.

Electricity Works, Lerwick. 4026  
JAMES STEPHEN,  
Engineer and Manager.

### COUNTY BOROUGH OF DARLINGTON ELECTRICITY DEPARTMENT

#### Assistant Mains Engineer

**A**PPPLICATIONS are invited for the above-mentioned position at the salary in accordance with the National Joint Board Scale, Class G, Grade 8, plus car allowance. The appointment is subject to the selected candidate passing a medical examination.

Applications on a form to be obtained from the Borough Electrical Engineer, Haughton Road, Darlington, should be returned to him not later than noon, 3rd January, 1947, endorsed "Assistant Mains Engineer." 4008

**A** British firm of telephone manufacturers in India has vacancies for Engineers capable of assisting in the planning of automatic telephone exchange networks. Applicants should have some knowledge of the assessment of traffic data, area layouts, and the general technical requirements of exchange networks. The position offers good prospects to young single men, good salary with kit and travelling allowances, and usual leave. Write, giving full details of experience and age, to—Box No. 206, Dorlands, 18/20, Regent Street, London, S.W.1. 3751

**A**PPPLICATIONS are invited for the position of Sales Clerk at a salary commencing at £315 per annum, rising to £360 by three annual increments, plus bonus, at present fixed at £59 16s. per annum. Preference will be given to applicants who have had experience in stock keeping and recording all types of electrical goods sold in electricity showrooms. Applications, stating age, education, details of experience, present position, etc., to be sent to the undersigned not later than Friday, 3rd January, 1947.—A. W. Barham, Chief Engineer and General Manager, Electricity House, The Parade, Watford, 4014

**A**RMATURE Winders and Improvers required, A.C. and D.C. top rates, good working conditions.—Electrical Power Repairs (Gillingham) Ltd., Strover Street, Gillingham, Kent. 5065

**A**RMATURE Winders and Improvers urgently required. Top rates and good conditions.—Box 113, c/o The Electrical Review.

**A**RMATURE Winders and Improvers urgently required. Top rates and good conditions.—Collins Electrical Ltd., 22, St. Alban's Place, London, N.1. 85

**A**RMATURE Winders and Improvers wanted for general repair works, A.C. and D.C. Top rates.—Phillips & Sons Electrical Ltd., 40, Waterford Road, S.W.6. 3757

**A**RMATURE Winders and Improvers wanted, must be used to A.C. and D.C. repair shop work. Write, stating experience and wages required, to—W. H. Sudden & Co. Ltd., Glenny Road, Barking. 3958

**A**RMATURE winding Working Foreman required for repair shop in South London. Good disciplinarian and repair shop experience essential.—Box 5057, c/o The Electrical Review.

**A**SSISTANT Electrical Development Engineer, of Degree or Higher National standard, with knowledge of electronics and experience of laboratory work on communications and measurements. Permanent position, good prospects. Apply, stating age, qualifications and salary desired.—Muirhead & Co. Ltd., Elmers End, Beckenham. 4066

**A**SSISTANT for sales department of company manufacturing heat-treatment furnaces and electrical equipment to prepare quotations and technical specifications and assist in publicity work, preparation of catalogues, etc. Young man preferred. Replies should give fullest details of education, previous and present positions and salary required.—G.W.B. Electric Furnaces Ltd., Dibdale Works, Dudley. 3847

**A**SSISTANT Works Engineer required for electric cable manufacturers, London area. Age 30-40. Experience in cable machinery desirable. State age, experience and salary required.—Box 4055, c/o The Electrical Review.



**ASSISTANT Bookkeeper (Lady)** required by City firm of exporters. No Saturdays. Write—Box P.Y.R., c/o 95, Bishopsgate, E.C.2. 3880

**BUYER/Progress Engineer** required for light engineering works, North Wales district. Preference given to applicant having held similar position and sound knowledge of modern methods of production. Write, giving full particulars, experience and salary required.—Box 4045, c/o The Electrical Review.

**CLERICAL Assistant** required for stores office. Must have good knowledge of electrical material.—London Electrical Co., 92, Blackfriars Road, S.E.1. 104

**COIL Winding Foreman** required by The Phenix Telephone & Electric Works Ltd. at their works at The Hyde, Hendon, London, N.W.9. Must be experienced in all types of coils used in the manufacture of telecommunication equipment. Apply in writing, giving full particulars and salary required. 3887

**CONSULTING engineer** requires man about 30 years of age competent to write specifications for factory plant installations and supervise work. Can offer post either in London or East Anglia to suit circumstances. State experience, qualifications, etc., and salary required.—Box 4040, c/o The Electrical Review.

**DESIGNER** required for manufacturers of electric motor starters. Only those with actual design and/or manufacturing experience in electric motor starters need apply, with full particulars as to experience, qualifications, salary required, etc., to—Box 3907, c/o The Electrical Review.

**DESIGNER-Draughtsman**, capable of taking charge of switchgear development up to 11 kv, required by firm in Midlands. Good salary and prospects. Housing accommodation for suitable man. Write—Box No. 324, 8, Serle Street, London, W.C.2. 3795

**DRAUGHTSMAN** with experience of H.T. and L.T. oil circuit breakers and metalclad switchgear required for South Midlands. Technical man preferred. Write, giving details of experience, technical education, age and salary required.—Box 3841, c/o The Electrical Review.

**DRAUGHTSMAN** with experience of small pressings, castings and/or electrical fittings required for work on automobile lamps by progressive firm in North London.—Box 4057, c/o The Electrical Review.

**DRAUGHTSMAN-Designer**, young, with technical ability and light engineering or instrument experience, required by small optical instrument firm in London. Good prospects for right man.—Box 4003, c/o The Electrical Review.

**DRAUGHTSMEN**, preferably with telecommunications experience, required by large firm in the Midlands. Maximum salary £350 plus cost of living bonus. Write, giving details of experience, age, and salary required.—Box 11, c/o The Electrical Review.

**DRAUGHTSMEN** required by switchgear engineers. Experienced in contract work, protective gear diagrams or design. Applications in writing, with full particulars, to—Ferguson, Pallind L., Manchester, 11. 86

**DRAUGHTSMEN** required, Seniors, for light frameworks and mechanisms. Workshop training knowledge of radio transmitters and receivers an advantage. Good salary paid to suitable applicants. S.W. London district.—Box 4019, c/o The Electrical Review.

**ELECTRIC Light Fittings Co.** have vacancy for person to take charge of ordering, despatch and invoicing. Experience in trade necessary. Write full details age and sal. reqd.—Box 4034, c/o The Electrical Review.

**ELECTRICAL Engineer**, experienced in design, take-off, pricing and submitting complete tenders for power and lighting installations for industrial buildings, cinemas, hotels, etc., required by large electrical contractors in West End of London. Only men with thorough experience of electrical sub-contracting work need apply. Salary up to £700 p.a. according to experience and ability. Please give full details of age, experience and salary required.—Box 4023, c/o The Electrical Review.

**ELECTRICAL Shop and Showroom Manager** or Manageress. Good class business. Must have had experience. Knowledge of radio an advantage, but not essential.—Warrington Electrical Co. Ltd., 129-131, Bridge Street, Warrington. 3909

**ELECTRICAL Showroom Salesman** required for old-established company in South Kensington, age under 45. Must have knowledge of electrical and radio trade. Permanent position. Write, stating age, salary and experience, to—Box 4018, c/o The Electrical Review.

**ESTIMATING and Costs Engineer** required. Previous experience essential, able to work on own initiative. Required by Midland firm manufacturing all types of regulators and resistances. Write, giving full particulars of experience and salary required.—Box 3997, c/o The Electrical Review.

**ELECTRICAL Engineer** required for investigations into factory processes and cable manufacturing problems. B.Sc. or equivalent in electrical engineering or physics. Some factory experience desirable. Age 21-26. Salary £6 to £8 per week according to age and experience. Opportunities for advancement. Apply—Staff Officer, British Insulated Callender's Cables Ltd., Erith Works, Belvedere, Kent. SR/14. 4010

**ELECTRICIANS**, first class, suitable for factory and private house work; also Maintenance Electricians for private plants. Open shop, Grade C wages. Write, giving full details of experience and copy of references, to—Box 4007, c/o The Electrical Review.

**ELECTRICIANS** wanted for large factory in Essex, under good conditions, including a 5-day week, good wages paid, in agreement with trade unions. Experienced in factory maintenance, wiring and plant installation. A.C. and D.C.—Box 4012, c/o The Electrical Review.

**ENGINEERS and Draughtsmen** are invited to apply to a large electrical engineering firm in the Midlands which has vacancies in the switchgear department for Technical Sales, Contract, Costing and Design Engineers; also experienced Technical Engineers capable of handling large projects for generation, transmission and distribution. Vacancies also exist for Draughtsmen for circuit diagram and general work.—Box 69, c/o The Electrical Review.

**ENGINEERS** required for research and development department of a firm in the London area. Previous experience on the development of electronic components necessary. Applicants should write, stating age and experience, to—Box 3929, c/o The Electrical Review.

**ESTIMATOR and Draughtsman**, with good knowledge of installation work. Write, giving full particulars, to—Troughton & Young Ltd., Imperial Court, Basil Street, Knightsbridge, S.W.3. 5071

**FURST-class Electrician** wanted, used to installation work. Permanent post for right man. Apply—R. J. Kemp & Co. Ltd., Coalville, nr. Leicester. 9926

**FLAME-proof, Air Break, Switchgear Designer-Draughtsman**, generous salary, good prospects, 5-day week. Assistance with housing. Write—Box No. 323, 8, Serle Street, London, W.C.2. 3796

**FURNACE Engineer** required by manufacturers, London district. Electrical and mechanical experience necessary in design and estimating, all types electric furnaces. Apply, stating age, experience and salary required, to—Box 4032, c/o The Electrical Review.

**JOURNEYMAN Electrician** for London and environs, used to factory power and lighting installation work. Write, stating experience, wages, etc., to—Box 4037, c/o The Electrical Review.

**JOURNEYMAN Maintenance Engineers**, familiar with all types of A.C. and D.C. lifts, motors, etc., for London and suburbs. Must have held similar job. Write, stating full particulars, to—Box 4035, c/o The Electrical Review.

**JUNIOR Sales Engineer** required with sound knowledge of industrial electrical equipment and capable of handling own correspondence. Apply in writing to—The Sun Electrical Co. Ltd., 118-120 Charing Cross Rd. W.C.2. 4017

**JUNIOR Test Room Assistant** required in West London district for A.C. and D.C. fractional h.p. motor testing. Reply, stating age, experience and salary required, to—Box 4038, c/o The Electrical Review.

**LADY** Shorthand Typist required in electrical contractors' office in the City. Please apply, giving details as to experience, salary required, to—Box 4061, c/o The Electrical Review.

**LARGE industrial undertaking** in North London requires Electro and Mechanical Draughtsmen for cubicle and switchboard work. Preference will be given to applicants with experience in rectifier equipment design. Write, stating age, experience and salary reqd., to—Box D6969, A.K. Adv., 212a, Shaftesbury Avenue, W.C.2. 4002

**LEADING firm cable manufacturers** and electric engineers requires immediately Senior Estimator. Good working conditions and prospects. Full particulars and salary required (in confidence) to—Box 4042, c/o The Electrical Review.

**MALAYA**. Applications are invited for the following positions: Assistant Engineer (Generation), age 25-35, good technical qualifications and experience of power station work essential. Mains Assistant, age 25-35; applicants should have experience on construction and maintenance of H.T. overhead lines and substations. Experience of installation and maintenance of motors and control gear also desirable. Remuneration for both positions according to qualifications and experience within the salary range £560 x £28 to £700, plus cost-of-living allowance, free passage, quarters, medical attendance and car allowance. There is also a contributory pension scheme. Apply in first instance to—Box 4001, c/o The Electrical Review.

**L**ONDON electrical wholesalers require Representative with car to cover London area and outskirts. Good commission paid with small car allowance. Write, stating experience, to—Box 1005, c/o The Electrical Review.

**M**ANAGER or Manager of good appearance and personality required for high-class electrical and radio retail and art goods business, 30 miles from London. Must be thoroughly capable and able to take full control. Write with particulars, stating age, experience and salary required.—Box 115, c/o The Electrical Review.

**M**ERSEYSIDE firm of electrical contractors require first-class Estimating/Supervising Engineer. Must be capable of preparing complete schemes, taking off quantities, costing and supervising all types of electrical installation work. Give full details of age, training, qualifications and experience. State salary required and send copies of references to—Box 4031, c/o The Electrical Review.

**N**ORTH-East Coast firm requires Engineer between 25 and 30 years of age for land boiler department to assist with tenders, testing, etc. Preferably with engineering degree. Please give full particulars with application and state salary required.—Box 4025, c/o The Electrical Review.

**P**OWER Station Electrical Maintenance Engineers required for modern power station in the Middle East. Candidates should have served a full apprenticeship with a reputed company of electrical engineers and had subsequent experience in the maintenance of power station electrical equipment, particularly metalclad switchgear for high voltages. Higher or ordinary National Certificate in Electrical Engineering. Age 30-35. Attractive salary in sterling plus allowance in local currency. Free furnished bachelor accommodation. Free medical attention and passages. Kit allowance and Provident Fund benefits. Apply, stating age, qualifications and experience, to—Dept. F. 34, Box 3952, c/o The Electrical Review.

**P**RODUCTION Engineer, young, with good education and experience of planning and jig and tool design, required by small optical instrument firm in London. Opening for man with initiative and drive.—Box 4004, c/o The Electrical Review.

**R**EQUIRED by oil company for Persian Gulf, experienced Electrical Engineer and Assistant Electrical Engineer, under 35, unmarried or prepared to proceed unaccompanied. Initial contract 3 years.—Box 4024, c/o The Electrical Review.

**R**OYAL Air Force. There are still several hundred vacancies for Short Service Officers in the recently formed Education Branch. Candidates should be between 23 and 31 and should have a university degree in Mathematics, physics or engineering. A man age 25 may draw pay at £310, £347 or £420 a year on entry, according to qualifications and experience. In addition to pay, single men receive free furnished accommodation and married men receive married allowance of £228; in both cases rations are provided in kind or a ration allowance of £57 a year paid in lieu. A gratuity is payable on completion of 5 years' service. This will ultimately be £500, but for officers appointed until further notice it will be £562 10s. Gratuity will be reduced for men in contributory service for civil teacher's superannuation by the amount of the superannuation contributions, which will be paid by the Air Ministry. Opportunities will arise for appointment to permanent commissions. Full details and application forms from Air Ministry (A.R.1), Kingsway, London, W.C.2. 3995

**S**TORES Clerk required by firm of elec. contractors, S.W.1 area. Knowledge of purchasing necessary. Write full details, age and salary reqd.—Box 4033, c/o The Electrical Review.

**S**TORES and Trade Counter Assistant, must have good knowledge of all accessories, switchgear and cable. Wage £5 10s. Wholesaler, West End, London.—Box 4006, c/o The Electrical Review.

**S**UDAN Government. Sudan Railways require an Electrical Foreman for service in the Sudan. Applicants should have served full apprenticeship and be conversant with A.C. and D.C. maintenance, distribution, motors, and equipment. Meter testing and Diesel power station experience would be an advantage. Minimum age 25 years. Provident fund contract with security for 7 years after completion of 2 years' probation. Starting rate £E.380 or more, according to age, qualifications and experience, with periodic increases on recommendation up to £E.920. Cost-of-living allowance now 35% of salary, subject to maximum of £E.180. Outfit allowance £E.40. Free passage on appointment and liberal leave with passage allowance (£E.1 = £1 0s. 6d.). Strict medical examination. Application form and further particulars from Sudan Agent in London, Wellington House, Buckingham Gate, S.W.1. Please mark envelope "Electrical Foreman." 4022

**S**ENIOR Designer-Draughtsman required for electrical control gear. Knowledge of contactor design essential. 5-day week and excellent prospects. Age over 35. Writing details of experience, salary required, to—Box No. 3277, 8, Serle Street, London, W.C.2.

**T**EL-COMMUNICATION Engineers required for exchange engineering. Sound grounding in "light current" electrical engineering; ability to read drawings and some experience in telephone exchange work required. Applicants should give full details of age, training and experience and state salary required.—Siemens Brothers & Co. Ltd., Reg. 231, Woolwich, S.E.18. 4051

**T**RADE Counter Assistant required. Good knowledge of electrical material essential.—London Electrical Co., 92, Blackfriars Road, S.E.1. 125

**W**ELL-known electrical engineering company have vacancies for suitable lads, over 15 years of age, with Matriculation or General School Certificate, for Apprenticeship in the above industry. Good rates of pay and living accommodation provided.—Box 3784, c/o The Electrical Review.

**W**ELL-known engineering trading and manufacturing concern have the following vacancies for well-educated gentlemen having good knowledge of electrical machinery and engineering plant. (a) Sales Engineer to take over correspondence in connection with sale and purchase, as well as to generally assist in the organisation; (b) Costing Clerk to deal with stores, wage sheets, etc.; (c) Young Electrical Engineer, with previous experience in overhaul of electrical machinery, as Assistant to Chief Engineer for supervision of works department. Applications in confidence, stating age, references, salary required, only from persons who held similar positions before.—Box 4066, c/o The Electrical Review.

**W**ORKING Foreman Armature Winder for repair shop in Central London district. Permanent situation for right man. Write, stating experience, wages, etc., to—Box 4036, c/o The Electrical Review.

**W**ORKS Manager, having held similar position for many years and experienced radio or light electrical engineering (mass production), is offered an excellent opportunity with view to ultimate directorship. Bucks area.—Box 4059, c/o The Electrical Review.

**X**Ray Apparatus. Watson & Sons (Electro-Medical) Ltd. have vacancies in London and Wembley for several technical men, preferably with some knowledge of X-ray apparatus, for Administrative, Development, Design, Drawing Office and Sales work. Excellent opportunities for permanent progressive positions in a growing industry. Write, in confidence, giving full particulars, to—Managing Director, Watson & Sons (Electro-Medical) Ltd., Parker Street, Kingsway, W.C.2. 4020

**Y**OUNG Meter Engineers wanted for manufacturers' office in Home Counties. State age, training, experience, and salary required.—Box 9993, c/o The Electrical Review.

#### APPOINTMENTS FILLED

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

**N**ORTHERN Aluminium Co. Ltd.—Electrical Engineer. All applicants are thanked.

#### SITUATIONS WANTED

**A** Works Manager desires change. Accustomed to complete charge of extensive factory producing telephone cables, cords and insulated wires. Position must command a salary in keeping with applicant's status.—Box 5002, c/o The Electrical Review.

**C**HIEF Engineer, M.N., First Class B.O.T. Certificate. M.I.Mar.E., requires position ashore, U.K. Considerable experience large and small Diesel and petrol engines, building and maintenance, boilers, refrigerators, mill engines and plant, electrical machinery, etc. Adaptable to new processes, wide range considered.—Box 3925, c/o The Electrical Review.

**E**LECTRICAL Engineer, Grad. I.E.E., age 26, works apprenticeship motor and dynamo manufacturer, subsequent experience on design, manufacture and repairs, excellent testimonials, etc., desires progressive technical situation in U.K. Starting salary £350 p.a.—Box 9997, c/o The Electrical Review.

**E**XECUTIVE (39) seeks progressive permanent position. B.Sc., A.M.I.E.E., extensive experience in design, development, industrial research. Modern mass production methods as applied to public address equipment, radio components and precision electrical measuring instruments. Experienced sales, purchasing and business management.—Box 5040, c/o The Electrical Review.

**ELECTRICAL Engineer, Grad. I.E.E., A.M.J.I.E.,** with practical and sales experience, desires post. Outside Sales or Representative's position preferred. Midlands area. Electrical, mechanical and heating engineering experience.—Box 9996, c/o The Electrical Review.

**ELECTRICAL Engineer, 21 years' experience** all types wiring, cooking, heating installations and maintenance, desires change to post where executive ability, experience and honest endeavour would be appreciated.—Box 5048, c/o The Electrical Review.

**ELECTRICAL Engineer, 36, 5 years' college training, 12 years' experience** technical sales, estimating tenders, orders, industrial motors and ancillary equipment, including fractional, seeks progressive permanency.—Box 5023, c/o The Electrical Review.

**FULL-time Agency wanted, London and the South,** by London engineer with own house, car and telephone. A.M.I.E.E., public school and university background; 20 years sales engineer for well-known motor and starter manufacturers. Excellent credentials.—Box 5035, c/o The Electrical Review.

**MECHANICAL Engineer, age 38, 10 yrs. Colonial Govt. service,** comprehensive practical experience maintenance and operation of Diesel-electric gen'tg. (and pumping plants), seeks position, preferably where housing available.—Box 9992, c/o The Electrical Review.

**POSITION on clerical, accounting or showroom staff** of electricity supply undertaking, contractors or manufacturers, by experienced Sales Representative. Health impaired for outdoor work only by 6 years' war service (army). Excellent references, holder of E.D.A. domestic certificate and diploma; varied previous experience in accounts and office work. Linguist, widely travelled.—Box 5000, c/o The Electrical Review.

**PUBLIC schoolman, good personality, aged 22, desires** position as Representative, and would make himself generally useful.—Box 5075, c/o The Electrical Review.

**REPRESENTATIVE, with large connection** wholesalers over whole southern half England, wishes contact reliable manufacturing firm, domestic lines and accessories. Own car. Immediate sales guaranteed. Available at once. References.—Manby, Norman House, Westbourne, near Emsworth, Hants. 5008

**REPRESENTATIVE (30), experienced supply company** routine (incl. showroom) as consumers' adviser, has practical experience of installations and apparatus. Seeks prospects S. London or near. Min. £350 p.a.—Box 5051, c/o The Electrical Review.

**SENIOR Design and Development Engineer, 44, wide,** varied experience light electro-mechanical design and production, electronics, plastics, D.O. organisation. At present with large world-famous concern, seeks executive post with smaller, progressive firm. London or near.—Box 5026, c/o The Electrical Review.

**SENIOR Draughtsman, age 26, desires change of occupation.** Experience in radio and heavy electrical engineering. Any progressive position considered.—Box 5046, c/o The Electrical Review.

**WORKS Manager, A.M.I.P.E., M.I.E.C.E.,** specialising in economical mass production electrical and light mechanical plants, seeks responsible position, London area preferred; sound experience modern production methods; excellent references.—Box 5032, c/o The Electrical Review.

#### FOR SALE

Traders buying and selling hereunder must observe the Restriction of Resale Order, S. R. & O. 1942 No. 958.

#### CITY OF MANCHESTER ELECTRICITY DEPT.

**TENDERS** are invited for the purchase, dismantling, loading and removal from site of the following plant:

- (1) One 1,500-kW Motor Converter (3-wire), 6,500/415/455 v., Bruce Peebles, 1920.
- (2) One 750-kW Motor Converter (3-wire), 6,500/403/455 v., Bruce Peebles, 1926.
- (3) One 1,000-kW Motor Converter (3-wire), 6,500/400/440 v., Bruce Peebles, 1925.
- (4) Two 220-kW Motor Generators (2-wire), 6,500/520 v., A.E.G., 1902.

Conditions and form of tender, also official permit to new the plant, may be obtained on application to Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Post Office Box 493, Town Hall, Manchester.

Tenders, addressed to the Chairman of the Electricity Committee, to be delivered not later than ten o'clock a.m. on Friday, 3rd January, 1947. The Committee does not bind itself to accept the highest or any tender.

PHILIP R. DINGLE,

Town Clerk.

Town Hall, Manchester, 2,  
9th December, 1946.

#### HECKMONDWIKE U.D.C. ELECTRICITY DEPT.

**THE Council invite tenders for the purchase and removal** of the following:—

One 100-amp. Ferranti single-phase Rotating meter Testing Set, unused and complete with meter tools as supplied by the manufacturer.

The equipment can be inspected at the Electricity Works, Bath Road, Heckmondwike, by appointment. Tenders should reach me not later than Monday, the 30th December, 1946.

The Council do not bind themselves to accept the highest or any offer.

L. A. DENNIS, A.M.I.E.E.,

Electricity Offices,  
High Street,  
Heckmondwike, Yorks. 4063  
Engineer and Manager.

#### HECKMONDWIKE U.D.C. ELECTRICITY DEPT.

**THE Council invite offers for the purchase and removal** of approximately 3 tons of Lead in ingots about weight of 30 lbs. each. Tenders should reach me not later than Monday, the 30th December, 1946.

L. A. DENNIS, A.M.I.E.E.,

Electricity Offices,  
High Street,  
Heckmondwike, Yorks. 4064  
Engineer and Manager.

**A. Cookley & Co. Ltd.** offer large selection of used Electric Motors, A.C. and D.C. Write—21/25, Tabernacle Street, London, E.C.2 (Monarch 3357/58).

**A** Number of All-Perspex Fluorescent Troughs, 4 ft. single Met-Vick type, new, complete with all gear, can be supplied by—John Phillips & Co. Electric, 31, Fortune Green Rd., N.W.6 (Tel. Hampstead 8132). 3999

**A** number of high-speed Diesel Generating Sets, unused. ex-Govt. disposal, for prompt delivery, latest designs, direct-coupled. 1 50 kW, 400/3/750; 3 50 kW, 110 and 230 v. D.C.; 2 30 kW, 400/3/50; 2 15 kW, 110 and 230 v. D.C.; 2 15 kW, 230/1/50. Many others available.

**A** Electropump Company, Wembley, Middlesex. 4065  
**A** Quantity of 3-ph., 400-v. suds Pumps, reconditioned, from stock. John Phillips & Co. Electric, 31, Fortune Green Rd., N.W.6 (Tel. Hampstead 8132). 4000

**A** Superior Streamlined Toaster in one-piece die-cast aluminium, with attractive mirror finish. Price 39s. 6d. subject. Immediate delivery. Sample, 31s. Cash with order.—Metropolitan Distribution Ltd., Truro. 94

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**L**. Goodman (Radio) Ltd., 9, Percy Street, Tottenham Court Road, W.1, are sole London agents for the "Midco" Elongated Fluorescent Choke and Fluorescent Starter Switches. Mueson 0216. 76

**L**ADDERS, single and extension, from—Ramsay & Sons (Forfar) Ltd., Forfar. 9004

**L**ARGE quantity of 3-amp. Toggle Switches for sale.—Box 5076, c/o The Electrical Review.

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**M**OTOR Generator Sets and Convertors, all sizes and voltages from 4 kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, City Road, London, N.1. Telephone, Clerkenwell 5512, 5513 & 5514. 28

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**R**OTARY Converters, 200-kW, 6,600/3/50 input, 230 volts, 2-wire D.C. output, complete with Transformer and switchgear, seen running in Liverpool. 2,000-kW, 6,600/3/50 input, 418/462 volts, three-wire D.C. output, complete with transformers, starting panels, D.C. machine panels. First-class condition. Two sets available.—Stewart Thomson & Sons (Liverpool) Ltd., Fort Road, Seaford, Liverpool, 21 (Bootele 2697); or Dacre House, Victoria Street, London, S.W.1 (Abbey 4017). 72

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6 230/1/50 Extractor Fans by Verity, 18" dia., 700 r.p.m.  
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1 Crompton Parkinson M.G. Set, input 400/3/50, output 60 volts, 400 amps. with direct coupled exciter.—Oldfield Engineering Company Limited, 96, East Ordsall Lane, Salford 5. 3988

**3**-h.p. Lister Vertical Single-cylinder Oil Engine, No. CS. 36281, radiator-cooled on combined baseplate, coupled to 2.2-kVA, 230-volts, single-phase, 50-cycles dynamo, 1,500 r.p.m., complete with switchboard, silencer and oil fuel tank; little used. Capel Type 2 LEV Vertical Water-cooled Twin-cylinder Petrol Engine, direct coupled to 15-kW generator by Crompton, 230 volts D.C., 65 amps., 750 r.p.m.  
50 kW Diesel Generating Set, comprising Fowler Sanders totally enclosed vertical Diesel engine, type 6 B.H., No. 2143, rated at 75 h.p. at 1,500 r.p.m., direct coupled by a flexible coupling to 50-kW, 480/240-volts generator by Crompton Parkinson, 104 amps., continuous rated, No. F.122574, with oil-cooled static balancer, back of board shunt field regulator; a three-wire system is obtained due to the static balancer; complete with air filters, Burgess exhaust silencer, cooling tanks, fuel tanks, switchboard; engine is push-button start from 2 1/2-volt, 100-amp. batteries; new 1941, and only run occasionally for periods of 2 hours for warming up. Two 36-kW Diesel Generating Sets, comprising Faxman-Ricardo type 4RG cold start vertical four-cylinder Diesel engine, No. 1573, water-cooled with wet sump lubrication, horse power 50/55 when running at 1,550 r.p.m., combined baseplate and direct coupled to 36-kW Harland open type compound wound generator for 300 volts D.C. supply. No. OX.1822/3, with shunt regulator; with switchboard dated 1940; overhaul completed 20/12/43, and unused since; engines sold separately. 22-kW Diesel Generating Set, comprising Lister four-cylinder vertical cold start Diesel engine, No. 60/9399, 1,100 r.p.m., direct coupled on fabricated bedplate to 22-kW Mawdsley screen protected compound wound generator, dated 1941, for 200/153/112 volts D.C., 0/152/203 amps., continuous rated, no switchboard; engine sold separately. 17-kW Diesel Generating Set, comprising Ruston & Hornsby totally enclosed vertical four-cylinder water and radiator-cooled Diesel engine, size 4, Class V50, No. 194748, 27 h.p., direct coupled on combined baseplate to Lancashire Dynamo & Crypto 17-kW, 480/240-volts, 35.5-amps. open protected continuous rated generator, running at 1,000 r.p.m., size D50A. No. 142516, dated 1938; complete with switchboard, fuel tank, etc.; very little used. Vickers Petters Four-cylinder Vertical Diesel Engine, type c.84, giving 350 h.p. at 260 r.p.m., starting by hot plug from battery of approximately 25 volts and air blast from bottle charged at approximately 600 lb. per sq. inch; overall size approximately 16' x 7' 6" x 9' high; can be seen running by appointment. Mobile Generating Set, comprising Mark 4 VPBE Ruston combined vertical Diesel engine, size 2, Class P.S., Serial No. 204990/P.12/14721, developing 80 h.p. at 1,000 r.p.m., with electric flywheel C/v1 180, self-starter single-stage vertical water-cooled air compressor combined with petrol-paraffin engine, C.I. silencer fixed close to engine and Burgess silencer. Tachometer, duplicate lubricating and fuel oil filters. Engine direct coupled by flexible coupling to 50-kW Mawdsley 230-volts, single-phase, 272-amps. alternator, No. J.A.61001, with exciter, back of board type exciter rheostat. Engine and Alternator mounted on a low loading trailer, fitted with road wheels with pneumatic tyres, fitted with hand lever brake, and complete with hinged covers. Quantity Spares, practically unused.—Thos. W. Ward Limited, Brettenham House, Lancaster Place, Strand, W.C.2 (Temple Bar 9631). 3894

**W**EE Meggers, 500 v., in case, £12 5s. 6d.; Record 500-v. Test Set, £11, C.O.D. (new).—Robins, 222, West End Lane, N.W.6 (HAM. 0879). 82

**1** 240-h.p. L.D.M. Slip-ring Motor, 400/3/50, 725 r.p.m., complete with oil switch and liquid type rotor starter.—Oldfield Engineering Company Ltd., 96, East Ordsall Lane, Salford, 5. 3787

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**10**-kW Unit Heaters, 3-phase, 400 volts. Immediate delivery.—Carter & Co. (Nelson) Ltd., Engineers, Nelson, Lancs. 4046

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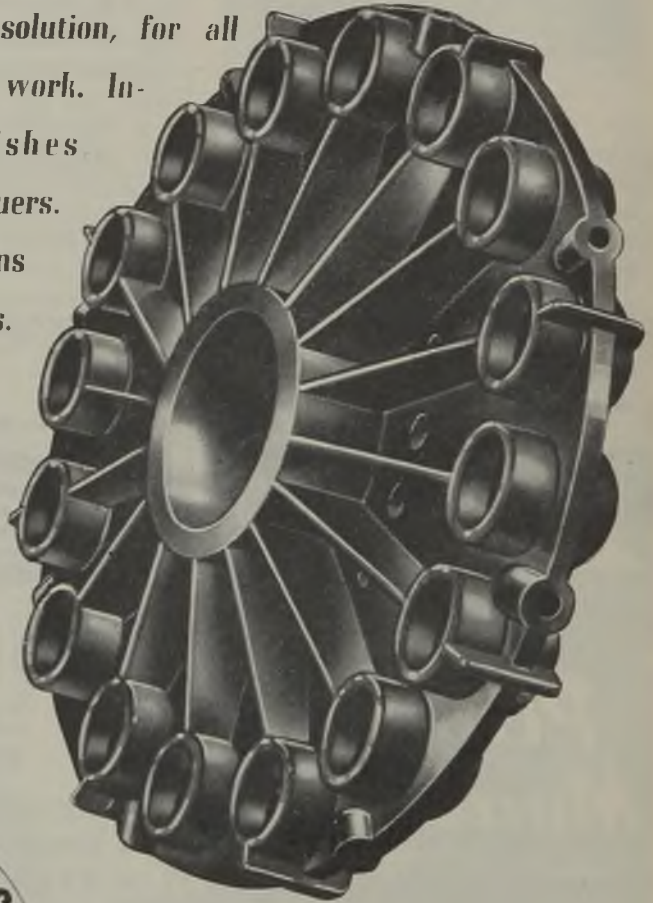
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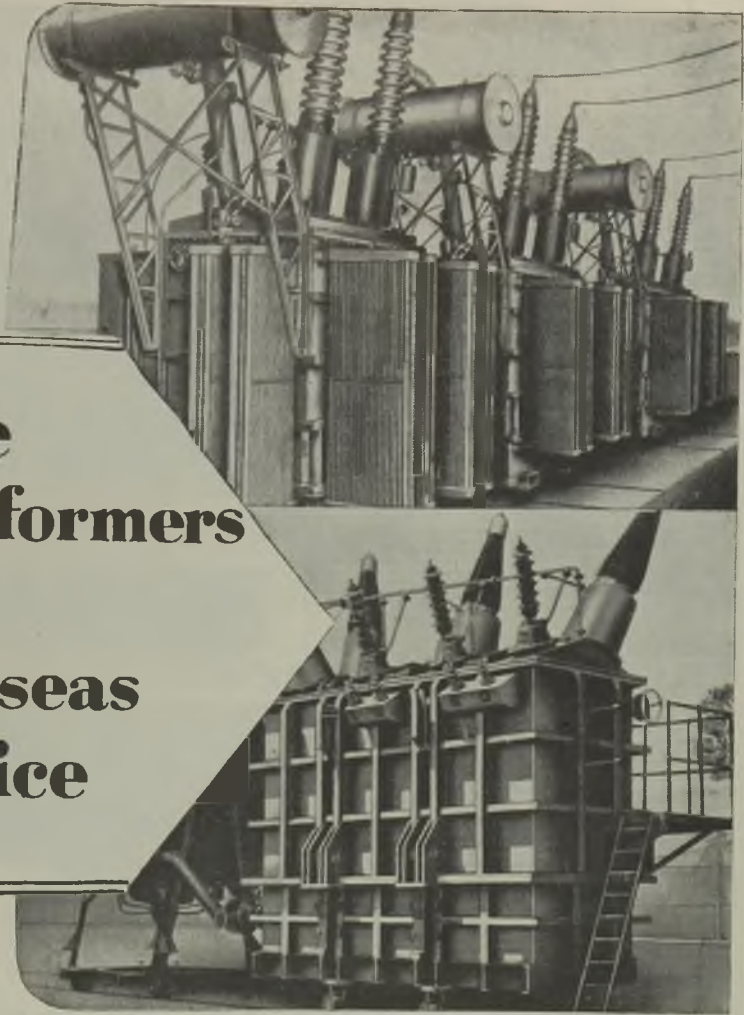
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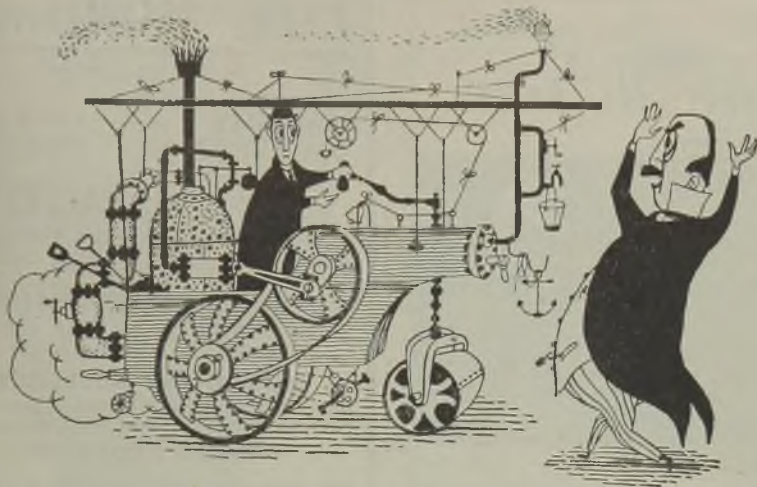


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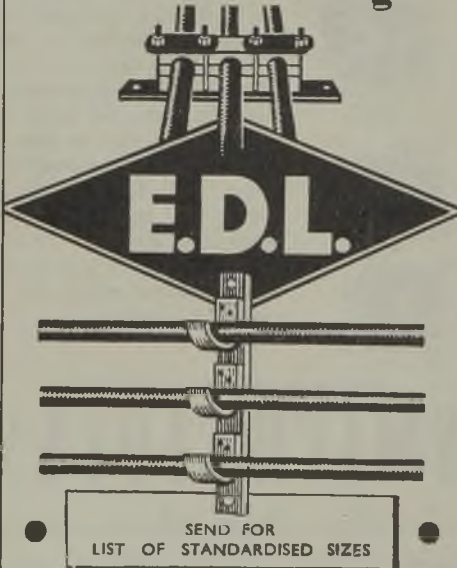


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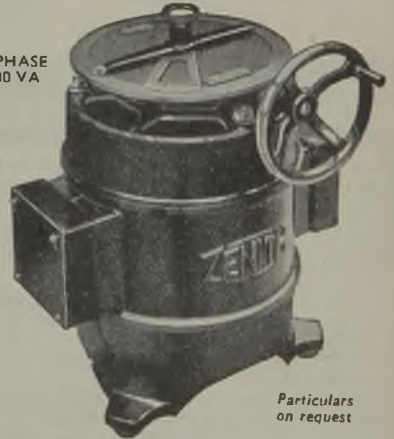


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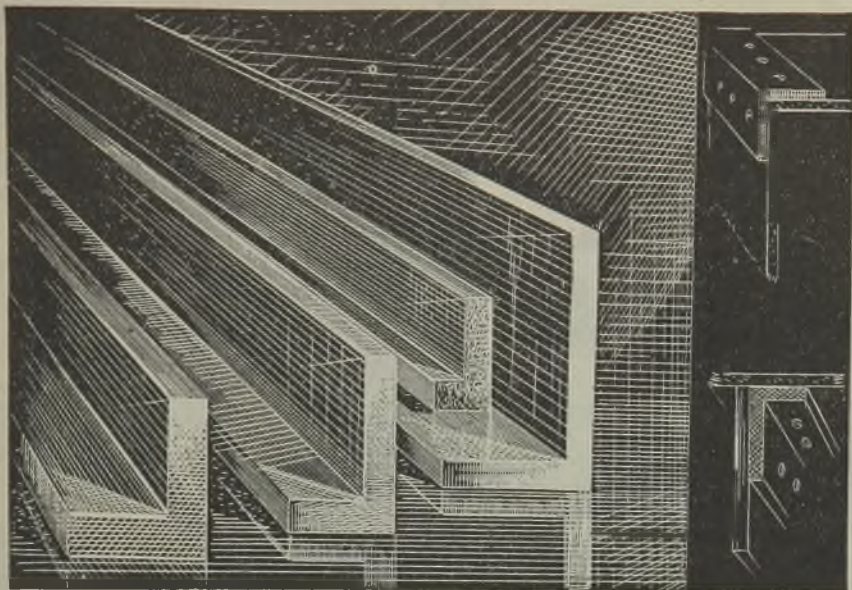


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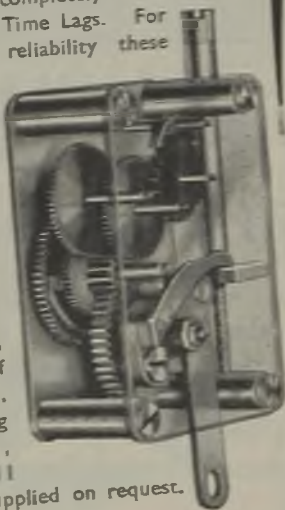
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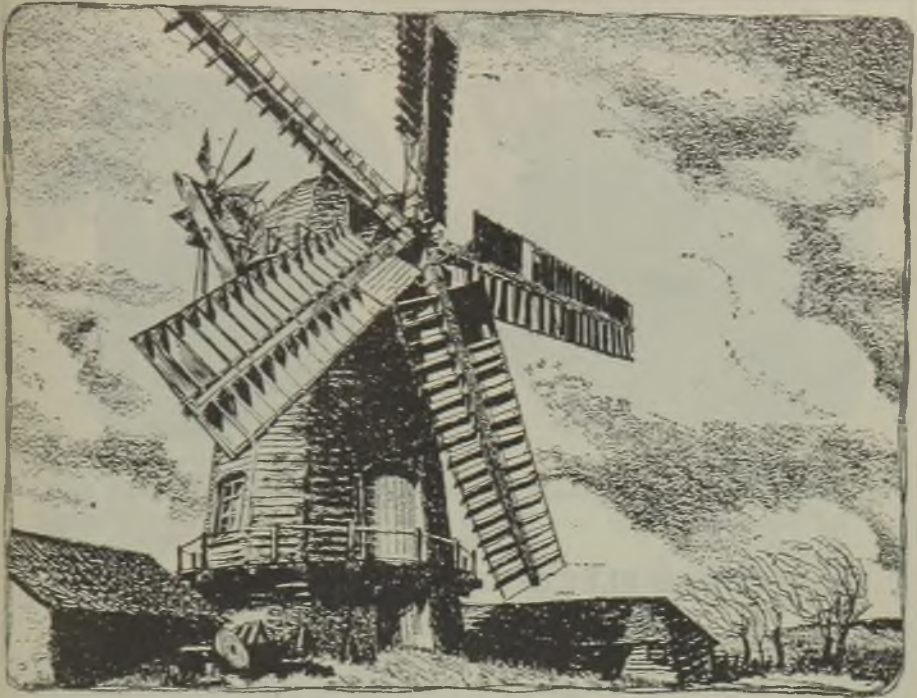
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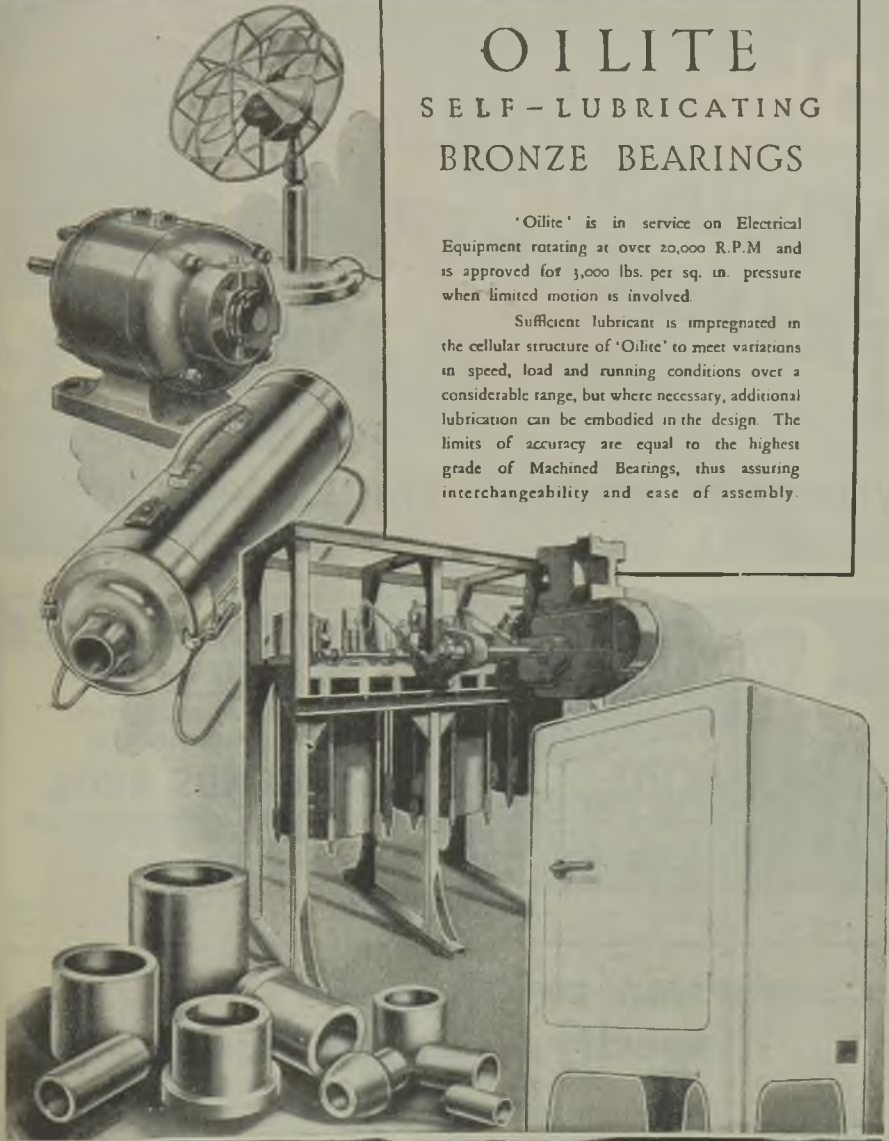
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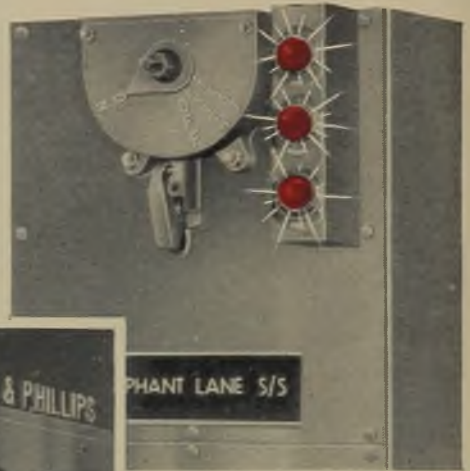
with strength equal to the time.

R. W. Emerson.

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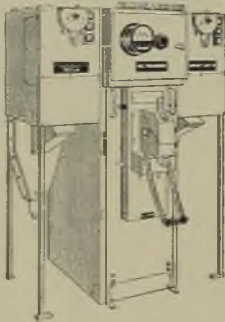
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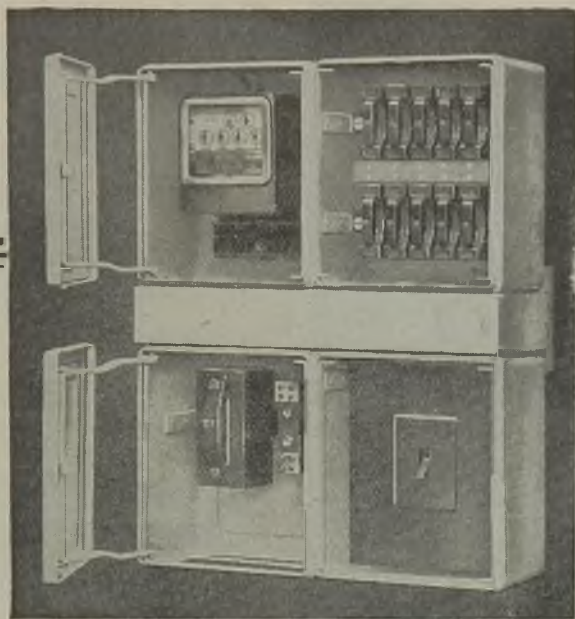


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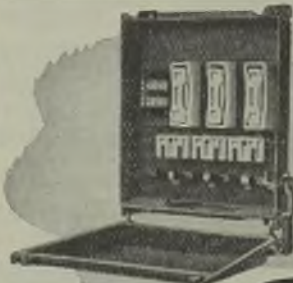
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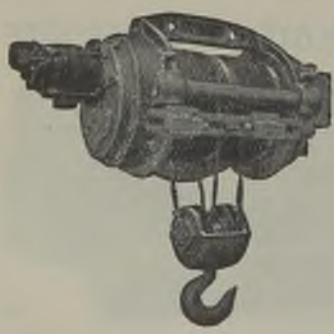
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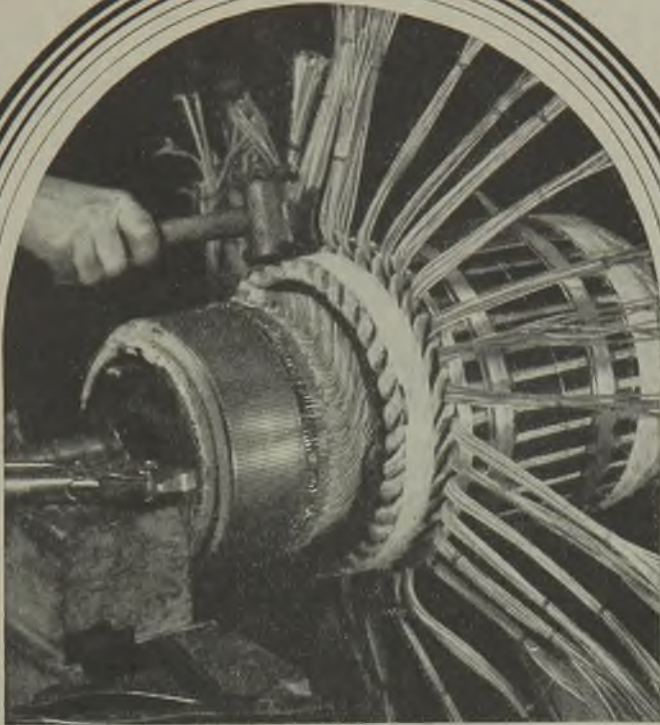
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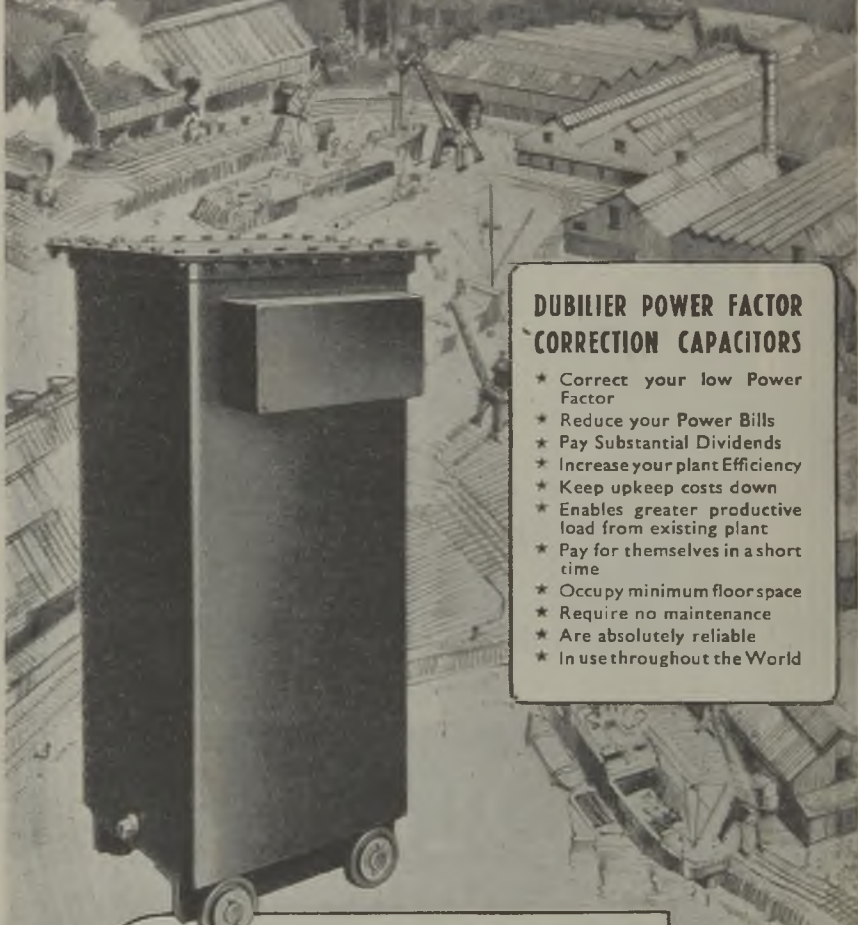
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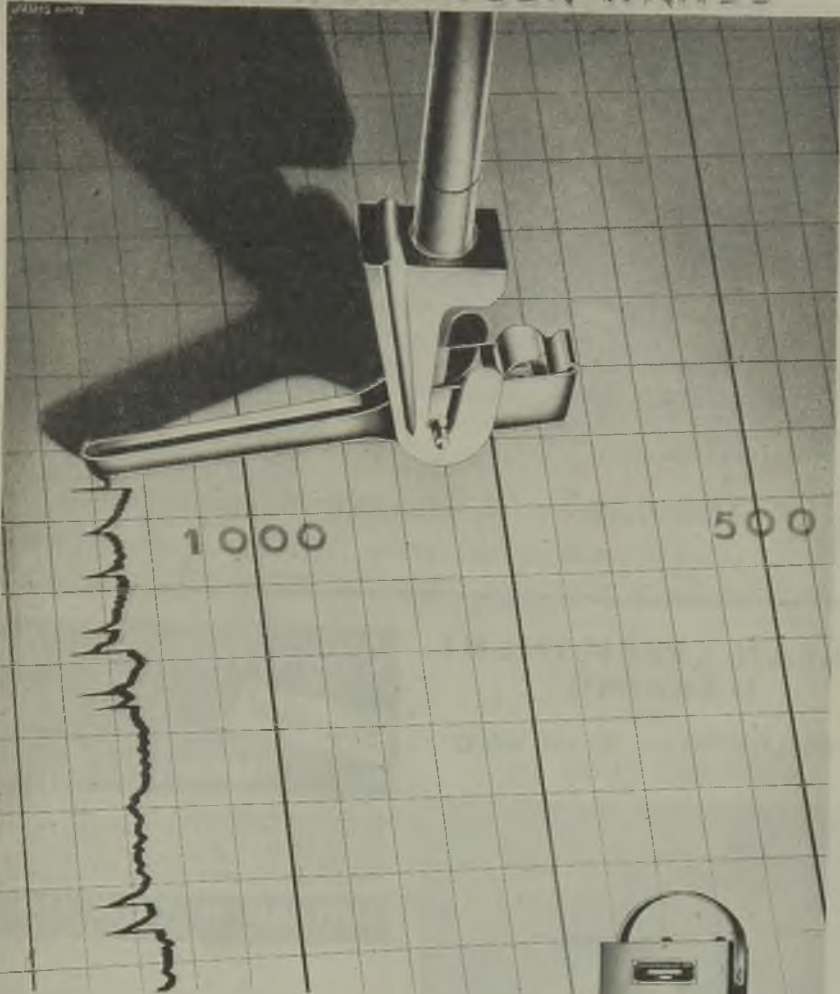
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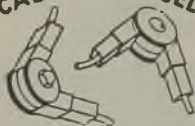
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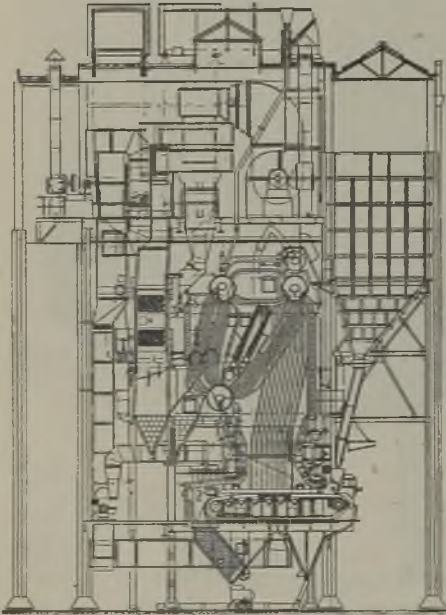


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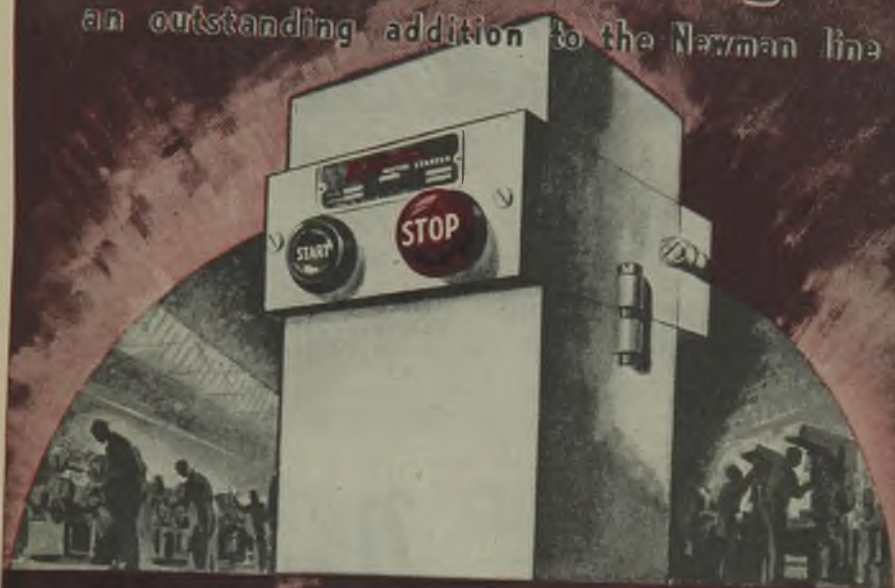
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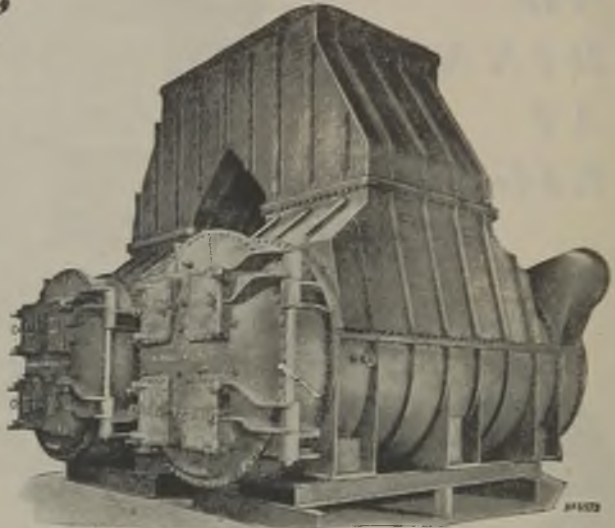
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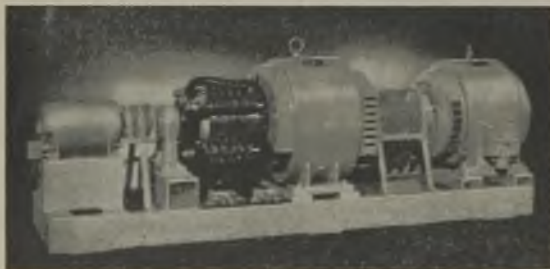
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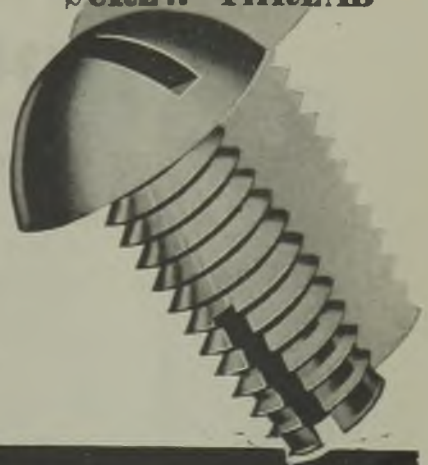
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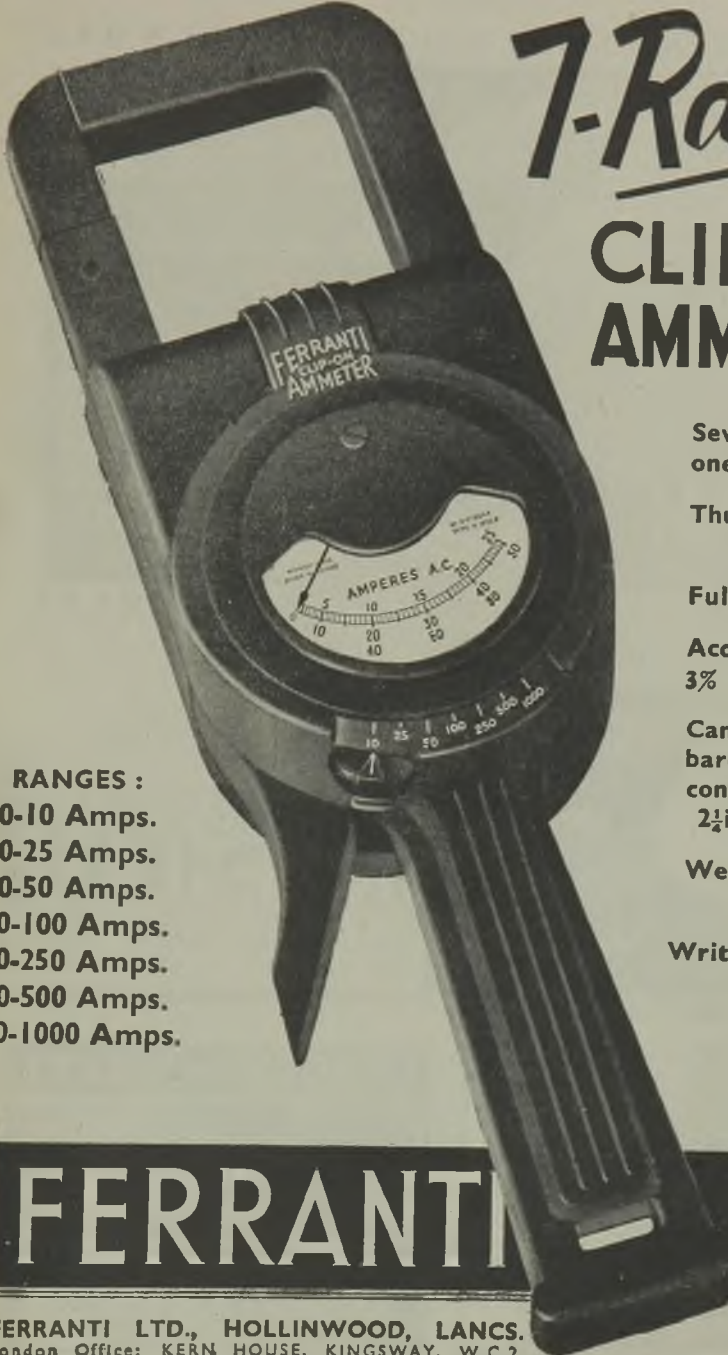
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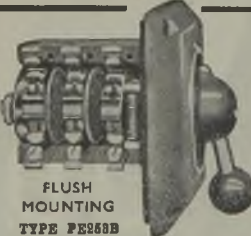
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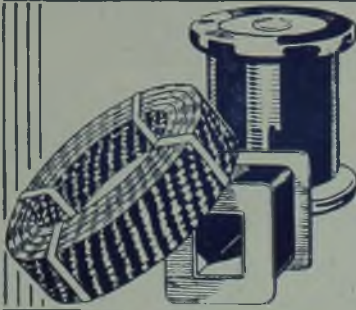


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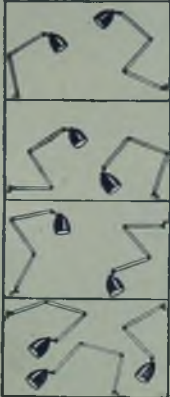
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