THE
ELECTRICIAN

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Application of Science

THE publicity given by the national Press to the meeting of the British Association last week, may serve to bring home to the public the debt which they owe to science, both electrical and otherwise. The refrigeration and dehydration of food are only two forms of electrical service born of science which have gone a long way towards saving the nation from any acute food shortage, and while Lord WOOLTON may recognise this fact, the general public are not in all cases as aware of its importance as they should be. The British Association meeting may have done something to remedy the omission, it may have been instrumental in telling the public of the measures taken by the Government to protect their interests, but even so, few seem to realise that many of these measures were advocated by the scientific world, a decade or more before the war.

As a nation we have during the last five years achieved many things which but for the exigencies of war would have taken much longer to develop, and though such advancement is peculiar to all wars, it shows by comparison a general failure in times of peace to make the best possible use of our research developments.

Whereas the last century was one of discoveries and applications, of commercial support and development, the current century, no less prolific of discoveries, has produced little support of their academic pursuit and small encouragement in the wider application of the knowledge they have made available. The universities were before the war by no means as allied to practical affairs as they should have been and deliberate anticipation to meet the needs or the dangers of the future met with very little enthusiasm.

The electrical industry may be quoted as the chief exception to such a policy and one has only to regard its development, its progress through the century to realise that had the other industries of the country taken similar measures of research and co-operation with the scientific world, the country would not only have been more prepared to switch from peace-time production to war-time needs, but the future transition would be easier to bring about.

The achievements of the war have shown that British scientists are of the first rank but more are needed; they have shown too that much has been wrong in the past with the attitude of the Government, of industry in general and of public opinion in their treatment of research; they have amply demonstrated that unless public authorities, industrialists and others are prepared to remove obstacles to research and apply the findings of science to everyday problems, much of the scientific effort is wasted or its benefits delayed. The research which the electrical

industry before the war applied to the electrification of mines and electro-agriculture is a case in point, for the work offered opportunities which, had they been accepted would have found those two industries better prepared for the demands which the war has made upon them, while their future economic stability would have been less speculative.

British Example

THE electrical industry has long been advocating the substitution of mechanisation for man-power, and where its plans have been listened to the results have proved its value. With so many works and other industrial establishments to be rebuilt; with so much out-of-date and worn plant to be replaced, the opportunity for the nation to put its production house in order is there for the taking. And, if we are to compete with those other countries more mindful of the value of the application of science to industry, it must not be allowed to pass. We have the engineers to develop the machinery; we have the initiative and the energy; we need only the support of industry and public to show that British science and engineering can still lead the world.

Plymouth Under Fire

AMONG the cities and towns subjected to early attack in the Battle of Britain was Plymouth—a name already made famous by its association with another projected invasion—but it was not until January, 1941, that the arrangements made by the electricity undertaking to deal with "incidents" was put to any serious test. Some brief details of the more selective experiences of Mr. H. Midgley, city electrical engineer, and his staff are given elsewhere in this issue, and it is pleasing to record with what success they overcame their difficulties. Though there must of necessity be a certain amount of similarity in air-raid experiences, the visits we have made to the more damaged areas show that the means adopted to deal with the problems are distinctly dissimilar. This may be because the damage made by air-raids assumes different characteristics with type of bomb, weather conditions, height of release, accuracy of aim, and so on, with the result that treatment of an "incident" calls for its own particular form of repair. In the case of Plymouth the means adopted were peculiarly effective for though on one occasion the whole of the network was made dead by a direct hit on the station and damage to sub-stations, a substantial supply in the city was made available in under two hours.

Tasmanian Tribute to Britain

A GENEROUS tribute to Great Britain is paid by the Hydro-Electric Commission of Tasmania in its annual report. After stating that the placing into commission of new power units at Tarraleah and Waddamana stations had relieved the anxiety that had been felt at many peak periods during the last few years the Commission adds:

"That Great Britain was able to build for us and deliver these large turbo-generators during the war whilst fighting for her existence through air and sea warfare is an achievement which we propose to record by a suitable plate on each machine, such as:—'Built by the workers of Great Britain and carried by British seamen to Tasmania during the war years 1939 to 1944.' Thus these historic units will remain as lasting symbols of the indomitable courage and solidarity of the empire at a time of great national stress."

A Rural Problem

WHILE Tasmanians are well-served electrically, 85 per cent. of the homes having a supply, the Commissioners are faced with the problem of connecting the remaining 15 per cent. in the most sparsely populated areas, numerous requests having been made for extensions. To comply with these on a self-supporting basis is an impossibility. Many people, state the Commissioners, hold the view that the initial cost of an extension is the main difficulty to be overcome in connection with rural service, whereas it is the annual cost of keeping the service in operation without undue loss that presents the greatest difficulty. The Commission has in the course of preparation a report on the matter which will shortly be submitted to Parliament for consideration. By way of contribution towards the capital cost of extensions into scattered rural areas, the Commission has already expended from its reserves a sum of £71 836, whilst a further amount of £10 000 allocated this year is available for future extensions. There is ample evidence that Tas-

manians are fully electrically-minded and that there will be a big demand for electric cookers and water heaters, mainly, from Great Britain as soon as they are available. Notwithstanding many restrictions the retail supply of electricity for the year increased by 12 479 000 units, or 10.17 per cent. higher than the sales for the previous year.

Little Barford Power Station

THE Little Barford station of the Beds. Cambs. and Hunts. E.S.Co., which was put into commission in the autumn of 1941, may be said to be of both worlds, in that it was conceived before the war and because of the need for generating capacity was raised to its full status of 120 000 kW in a shorter time than might otherwise have been the case. The station embodies the feature adopted by Edmundsons, of housing generating and boiler plant as one unit without dividing walls, and without entering into the pros and cons of such an arrangement, it must be said that the openness thereby given to the station is particularly attractive. From the point of view of appearance, mention may also be made of the control room where the lighting, projected on to a dome ceiling, produces a shadowless and clear illumination of all the controls and their ancillary equipment. Photographs rarely do justice to power station interiors but those reproduced elsewhere in this issue will serve to show in some degree the clean layout which has been adopted, while a war-time overall thermal efficiency of 25.09 per cent. and a coal consumption of 1 lb. per 1.288 kWh generated tell their own story of the merits of the station.

Durham Just Another Town?

WHEREAS Durham C.C. have welcomed the plan of the North-Eastern E. S. Co., to build a new power station in the area, Mr. T. SHARP who has prepared a development plan for the Council says that "The county's cultural centre will lose half its attraction and Durham will become just another common little industrial town with the sole distinction of having a cathedral and a fine stretch of river. To build this power station at Durham would be an act of blind and brutal philistinism." Nor does Mr. SHARP see any financial advantage for the city. The Council, the County Council and other local organisations have welcomed the scheme on the grounds that it will bring prosperity, but Mr. SHARP says the 300 employees at the station would mostly be technicians brought into the district, and the power would not be a fraction cheaper than if it came from 20 miles away. Mr. SHARP also says a number of other things in his report which indicate his dislike for the proposal, all of which raises the old arguments concerning the preservation of the countryside and the livelihood of those who are to live in the neighbourhood. Durham, with its ancient castle and cathedral, has long been famed as a show place and no-one would knowingly spoil its fame. The opposition to the North-Eastern E. S. Co.'s proposal should bear this in mind. No one has yet suggested that the power station will give local employment equal in volume to that of an industrial works, but the station, if erected, will undoubtedly have a material effect upon the national opportunities for providing work. In all the opposition so far made to projected power stations, criticism appears to be based on local needs, whereas it should by now be generally realised that where electricity is concerned its service is anything but local.

Artistic Lighting to Aid Sales

AT meetings of the I.E.S. and the A.S.E.E. last week the subject of the speakers was artistic lighting, ranging from the characterisation of objects and people, to stagecraft as applied to the theatre and cinema. In some ways both speakers had much in common and both emphasised the need to treat lighting with a deeper seriousness than is generally given to it. With the return of peace-time freedom in the matter of installations and consumption there will be in the opinion of many lighting engineers, a desire to utilise light for decorative purposes to a much greater degree than before the war. Conversation with many who use light in our departmental stores as an aid to sales, indicates that opportunities for development in this field alone offer wide scope to those who possess sufficient knowledge of their subject and so throw into relief some article of appeal that its display so increases the desire to possess that any sales resistance is jolted, and we gather that our big stores intend using all the tricks of good artistic lighting, as part of their sales drives.

Little Barford Power Station

Brief Description of Plant and Installation

ERECTION of the Little Barford power station of the Beds. Cambs. and Hunts. Electricity Supply Co., designed and constructed by Edmundsons Electricity Corporation, was commenced before the war, completed in 1941 and put into commission in the autumn of that year. The initial capacity of the station was a boiler plant made up of two units with two 30 000 kW turbo-alternators, but due to the exigencies of the war the capacity of the station was raised to its present level of four boilers and ancillary equipment, with four turbo-alternators of 30 000 kW each, making in all a total of 120 000 kW with an evaporative boiler capacity of 300 000 lbs./hrs. per set, at a pressure of 675 lbs. per sq. in. at 910° F. The overall thermal efficiency of the station is 25.09 per cent., and the energy generated per lb. of coal consumed is 1.288 kWh. The station is operated in two shifts.

A point of special interest in the construction of the station is that the building is a complete unit, housing the boiler plant, the turbo-alternators and their ancillary equipment without any dividing walls, thus on entry one sees the four turbo-alternators and their boiler units as a whole, giving to the interior of the station not only an appearance all its own, but one which is particularly attractive. This feature has been embodied in other stations designed and constructed by Edmundsons.

Coal is supplied to the station by way of six railway track sidings, with provision for extensions, two branches going to a rotary motor-operated tippler. The hopper feeds a system of belt conveyors capable of handling 120 tons per hour, which in their turn feed a 60-ton crusher. Discharge can be made to any of twelve bunkers by means of any one of a series of conveyors, the control being housed adjacent to the crusher house, and its operation facilitated by push-button.

The boilers comprise two Stirling units fired by B. and W. burners and equipped with B. and W. E-type mills and two Lopulco fired units by International Combustion, Ltd. Each boiler is rated at 300 000 lb./hrs. All boilers are fitted with B. and W. oil burners for starting up, initial ignition being obtained by h.t. spark, and two d.c. oil pumps supply all boilers. Sturtevant electrostatic precipitation is provided for each boiler, the gases being discharged to the air by way of two chimneys at a height of 275 ft. Ash is treated by B. and W. hydro-jets and conveyed through a sluice way to an ash dump, where it is collected by lorry for disposal.

The Stirling boilers are fitted with Bailey furnaces, and the economisers are of the continuous loop type; the fan plant in each case comprises two induced and two forced draught units, driven by two-speed squirrel cage Laurence Scott motors. The superheaters are in two sections controlled by an attemperator between the primary and secondary elements. The feed temperature is 370° F.

The International boilers, are of the tri-drum bent tube type and the feed temperature is again 370° F. The fan plant is as in the case of the Stirling boilers.

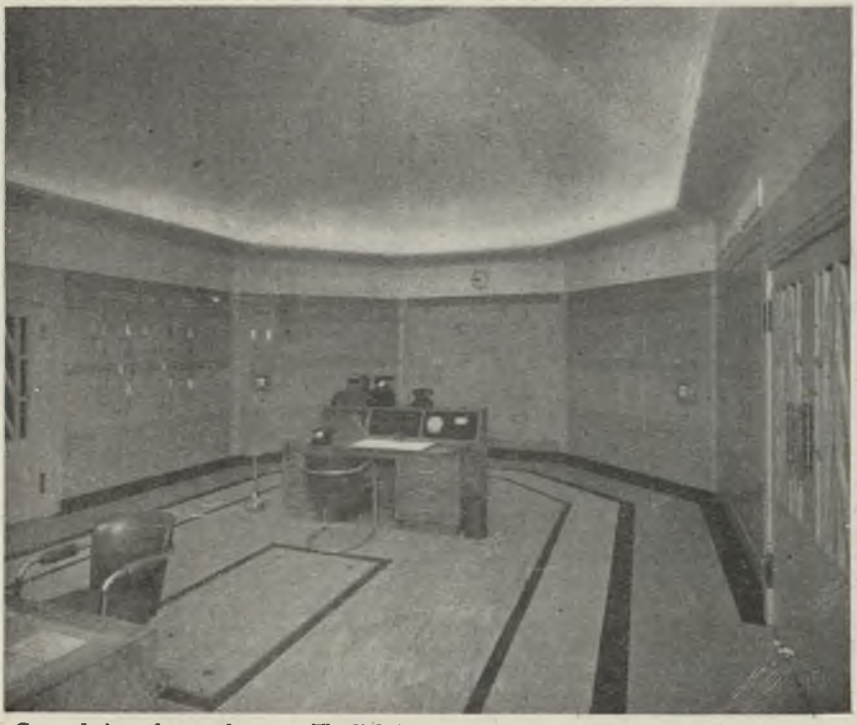
Water of 22/25 per cent. hardness is taken from the nearby River Ouse, and is treated by a Permutit water softening system with a capacity of 2 500 gal./hrs.

The four turbines are each of the three cylinder type, one high pressure, and two low, and were made by the English Electric Co., Ltd., for operation with 30 000 kW machines. Each is rated at 24 000 kVA when operated at a steam pressure of 650

The four 30 000 kW English Electric turbo-alternators

3.3 kV English Electric air-break switchgear

lbs. per sq. in., at 900° F., and run at a speed of 3 000 r.p.m. The glands are sealed by saturated steam. Each turbine has barring gear interlocked with oil pumps for jacking oil. Blade washing is by saturated steam or water. Two auxiliary



General view of control room. The lighting arrangement is a feature of the installation

oil pumps, one steam, and the other electrically-operated, are provided. Two surge tanks are included, one in the condenser piping after ejection, and the other connected before the feed pump. Three air ejectors of the quick start type are fitted; the condenser body is in each case of mild steel, with cast-iron water boxes and expanded tubes at each end. Each condenser is made in two halves to allow for cleaning, thus permitting one to remain in commission.

The four alternators are 33 kV machines, with a power factor of .8, and generate at 11 kV; exciter and two rotor fans per alternator. Each machine is solidly coupled to a 132 kV/37 500 kVA transformer, and an 11/3.3 kV, 3 000 kVA transformer is solidly connected to each generator for station auxiliaries. Closed circuit water cooling is used, and voltage control can be either remote or in the engine room.

The main switchgear of the cubicle panel type is by A. Reyrolle and Co., Ltd., situated on the sub-station site. The 3.3 kV gear is of English Electric draw-out, air-break, remote-operated type. The 400 V switchgear is set out on contactor panels, and an English Electric 8 kW steel bulb rectifier supplies the d.c. needs for battery charging, cranes and lifts.

The cooling tower which is used only in the summer time, has a capacity of 2 500 000 gal. and is designed for meeting a load of 60 000 kW; it is 200 ft. high with a diameter of 180 ft.

The main electrical contractors in addition to those already mentioned included George Kent and Co., Ltd.; Foster Instruments, Ltd.; Cambridge Instrument Co., Ltd.; Ferranti, Ltd.; Bailey Meters and Controls, Ltd., British Thomson-Houston Co., Ltd., who supplied various instruments and recorders; Contactor Switchgear, Ltd.; Ivor Power Speciality Co., Ltd.; J. Howden and Co., Ltd.; and Keith Blackman, Ltd.

Thanks are due to Mr. H. Ewbank, chief engineer of Edmundsons to enable us to obtain the necessary information for this article.

Fused and Unfused Plugs

IN order to meet the demands of factory-made houses and other post-war building schemes, Victor, H. Iddon, Ltd., are producing a special series of accessories, including a new fused and unfused domestic plug, known as the Nettle, which is designed to help to fill the gap until an agreement can be reached on either uprating or a new standard.

The Nettle plug and socket

The body of the plug is of the usual 5 A size made to B.S.S., but in spite of it being so small, it incorporates a B.S. fuse type A. One cap of the fuse is gripped by the head of the live-pin, whilst the other cap is held tight by the terminal for the live-conductor. Furthermore, a spare fuse is housed in the recessed space of the plug lid and is protected by an insulating cover marked " spare fuse."

The fused and unfused plugs are alike except for the fuse-arrangement being replaced by a current-carrying pin in the case of an unfused plug. The relevant markings on the plug body indicate the type in question. A feature of convenience is that the earth-pin and the c.c.-pins are solid with their terminals, and can be pushed out of the plug body for easy and quick wiring. The automatic cord-grip for which a patent has been applied, consists of two serrated levers, pivoted in the body. Both levers press the conductor firmly against serrations in the base. Any size of flex' or cable normally used, is gripped over a sufficient area, ensuring that the unavoidable movement of the conductor does not result in cutting the insulation. Further, the levers are tapered from side to side, so that the grip is of wedging character when pulling on the cable.

The lid of the plug is fastened to the base by the two screws which operate simultaneously the two cord-grip levers. The reduced number of screws employed on the plug should speed up wiring considerably when used to its full advantage on mass-assembly.

Ratings at present being manufactured are 5 A and 15 A. Prototypes of other sizes, and of various pin centres have been made to cater for whatever compromise may be found on the question of plugs and sockets, so widely discussed.

Selected "Incidents" at Plymouth

Result of Interview with Mr. Midgley on Air-raid Damage

BY reason of its tactical importance Plymouth was subjected to frequent, and occasionally concentrated, air raids until the enemy were driven from France, and the devastated shopping centre and other areas bear witness to the severity of the attacks.

An expedient for supporting temporary cables alongside a damaged bridge

Recently a representative of THE ELECTRICIAN was afforded an opportunity of seeing the bomb damage at Plymouth and hearing from Mr. H. Midgley, the city electrical engineer, something of the story of his department's achievement, and the arrangements made to meet any eventuality.

On the sounding of an "alert" the complete A.R.P. organisation, comprising repair parties, transport and drivers, firemen and first-aid squads, "stood to" at appointed stations, and the number on duty was reported by telephone from each station to the chief senior officer directing operations from the underground central control room. This was provided with its own telephone system connecting the generating station, the principal sub-stations, the C.D. centre and the Post Office telephone exchange, while rediffusion gave "take cover" warnings. As each incident was reported by direct communication from the C.D. centre it was plotted on a map of the district, and by reference to a plan of the distribution system it could be seen at once whether any h.t. main or substation was affected. From any of the various depots would also come a record of any switch that had been opened, indicating cable damage. Instructions were then given for appropriate action.

Raids took place in the latter part of 1940, but the organisation was not seriously tested until the night of January 13, 1941. The "take cover" warning was sounded at 6.39 p.m. and soon reports started to come in of fire caused by incendiaries. These involved the generating station, offices and the larger sub-stations and were promptly tackled by the works' fire parties. The Post Office lines went dead, but the undertaking's own telephones were not affected. After fire at the Armada Street depot had been got under control, a water pipe burst and owing to water appearing behind the switchboard, instructions were given to shut down the d.c. supply. At 8.25 p.m. the electricity supply at the control centre failed, and immediately afterwards the other depots reported failure of supply. A minute later a message was received from the generating station that it had been struck by a H.E. bomb, which totally wrecked most of the main 6 600 V e.h.t. switchgear and started a serious fire. A party, with foam equipment, and two first-aid men were despatched there to augment the generating station's own fire crew and a call was sent to the fire brigade headquarters for additional assistance. The effects of the blast from the explosion limited the efficacy of the CO_2 fire fighting equipment in the switch house, and the fire spread to the offices and the roof of the generating station, but, working under most difficult

The only building left standing in this area was the substation shown in the circle

conditions, the department's fire brigade and the A.F.S. succeeded in extinguishing the flames.

The bomb damage had rendered the whole network of the undertaking " dead," and

"Pool" gear erected on road, which was closed, near the generating station

steps were taken to put into operation a scheme already prepared to meet such a contingency. In order to resume some of the most important supplies a link was made with a large private generating plant; and by 10.07 p.m. the most vital Service supply in the city had been restored. This was followed by the restoration of supply to a large hospital at 10.44 p.m., to another hospital at 5.09 a.m. the next day, to the P.O. Telephone Exchange at 5.43 a.m. and to the remaining large hospital at 6 a.m. This took up the whole of the supply available from the private plant. All these establishments were fed from the general distribution network, and considerable isolation of other consumers had to be carried out in order to avoid overloading the available supply.

With all the high voltage switchgear in a state of chaos, it was obvious that the generating station could not be run for some time because of the lack of auxiliary supplies, and the grid sub-station could not be utilised through the normal channels. A request was made to the Central Electricity Board's area control room for the necessary " pool " gear to be sent to Plymouth, and simultaneously arrangements were put in train to carry out the pre-arranged plan to restore supplies pending the commissioning of the " pool " gear. This plan was based on the fact that whilst the e.h.t. network of the city operated at 6 600 V, there was superimposed a 33 000 V system. This consisted of two step-up transformers situated near the generating station fed from the 6 600 V switchgear, and feeding through step-down transformers into the 6 600 V network at two sub-stations in the centre of the area of supply. The procedure consisted of the direct connection of the 6 600 V cables from the l.t. side of the grid transformers to the 6 600 V cables feeding the 33 000 V transformers at the point indicated on the drawing reproduced on this page. The amount of work involved will be realised when it is explained that each phase connection consisted of two cables, consequently necessitating twelve joints. A large pit was dug in record time so that eight jointers could work simultaneously. All the work, including phasing, for the energising of the first of the two circuits was completed by 8.25 p.m. the next day, 24 hours after the damage had occurred. As this circuit had a capacity of only 40 per cent. of the undertaking's load, it was necessary to build up the load gradually, connecting at the various sub-stations only such low voltage feeders as were carrying essential supplies. This work was facilitated by the fact that all such feeders had been marked previously. Frost and rain impeded the work of the

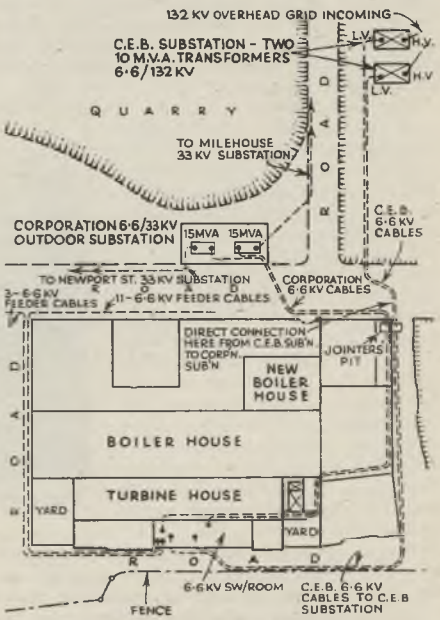


Diagram showing direct connection from C.E.B. sub-station to Corporation sub-station

engineers engaged on the outside work, but in approximately seven hours full use was being made of the transformer capacity available. In the meantime, the jointing of the second connection was in hand, and within approximately 48 hours of the damage at the generating station the maximum load which could be carried was being supplied.

Switchgear Erected on Roadway

This was, of course, only a temporary measure pending the commissioning of the " pool " gear, for the erection of which a road adjacent to the generation station, was, with the permission of the police, temporarily closed. The building repairs to the switch house occupied several months, and the repaired and new switchgear was recommissioned in three sections, the corresponding sections of the " pool " gear being taken out of commission.

The fire at the generating station was put out with salt water from the estuary, and two motor converters used for station auxiliary supplies were soaked with water falling from the roof. One was dried out and in commission fairly quickly, but the water got into the windings of the other, and as fast as it was dried out the salt reabsorbed moisture. It was obvious that rewinding would be necessary. The makers wanted nine months to do this, so Mr. Midgley decided to bring in a redundant motor converter from one of the depots. Later that depot was burnt out, so it was fortunate that the machine was removed. As a result of that experience Mr. Midgley decided that in event of a similar occurrence he would adopt the rather drastic procedure of washing out the windings with fresh water to remove the salt before drying the machine.

When it was reported that the fire at the Newport Street depot, mentioned above, was becoming serious, Mr. Midgley went there. He found the staff had done extremely good work, but the fire was beyond their control. The Post Office telephone was not working, and in view of the importance of this depot the chief engineer decided to drive personally to the Fire Brigade headquarters, some two miles away, to ask for reinforcements. After a journey through streets partially blocked by debris, etc., he arrived there only to find that operations were now being directed from a point nearer to the centre of the fire area and within half a mile of Newport Street. However, despite this delay, the reinforcements sent to Newport Street were able to extinguish the fire before the most vital e.h.t. gear was damaged, thanks to the good work done by the department's own staff in preventing spreading of the fire.

Further heavy raids occurred in March and April, 1941. According to official estimates upwards of 1 000 H.E. bombs and 27 000 incendiary bombs, including 500 explosive incendiary bombs, were dropped, causing extensive and widespread damage. Fortunately the generating station was not hit again, but the distribution system of the undertaking suffered considerable damage. Reports of failure of supply were dealt with according to priority of importance of restoration, but in every case the first step taken after a heavy raid was an inspection of all sub-stations to ascertain whether any interference with high voltage supplies had occurred. It was found that in every case of damage to e.h.t. cables the protective gear acted satisfactorily. The majority of the sub-stations were on e.h.t. ring mains and this proved invaluable in restoring supplies. In some cases important supplies were restored without delay during the raids by switching operations carried out under instructions from the central control of the department.

Some idea of the extent of the work involved by raid damage can be obtained from the fact that on one occasion 12 e.h.t. cables were severed, and altogether approximately 900 cables had to be cut, 600 straight joints made and 5 000 services removed.

Bombs in Coal Dump

One on two H.E. bombs fell in the coal dump at the generating station without doing any material damage, and an incendiary went down the chimney, but did not ignite.

As the result of a H.E. bomb explosion a piece of a stone wall about 3 ft. long was hurled 100 yards through the air to crash through the roof of a sub-station. It landed on the end of the busbar chamber of a 6 600 V switchboard, breaking away the metal cover and the hard-setting compound and leaving the three-phase busbars exposed, but the supply was not affected. In due course the supply was switched off and repairs effected.

Another incident occurred at a static sub-station which had been constructed of breeze blocks to match surrounding house property. Blast from a parachute mine caused the complete collapse of the building, but the plant was undamaged, though a voltmeter was put out of action by a fuse holder being shaken out of its socket.

The undertaking lost through air raid damage 10 000 consumers, including all the large stores and buildings in the centre of the city.

Paying a tribute to his staff and workmen, Mr. Midgley said he could not speak too highly of the way they carried on during and after big attacks. He had at times literally to send them off their jobs to get sleep, otherwise they would have kept on with the work.

New Equipment and Appliances

Arc Suppression Coil Design—Street Lighting Control

A PATENTED design of arc suppression coil is manufactured by the **Hackbridge Electric Construction Co., Ltd.**, having, it is claimed, important advantages over other types such as the earlier Petersen coil, and providing superior protection against earth faults on overhead transmission lines. The new coil has on the same core and in addition to the main untapped winding, which in service is connected between the transmission line neutral and earth, a secondary tapped winding loaded by a reactor. Tuning of the suppression coil is done by means of an externally-operated rotary switch which varies the amount of the secondary winding connected to the loading reactor. A separate potential winding and current transformer can be provided, if required, for operating relays and indicating devices, it being common practice to include, for example, a recording ammeter as associated equipment. The working value of induction density in the core of an arc suppression coil must be near the saturation value to avoid excessive voltages under certain operating conditions, but with the ordinary arc suppression coil, where tappings are provided for tuning it to the transmission line characteristics, it is impossible to achieve this condition evenly over all tapping positions. This disadvantage is overcome in the Hackbridge arc suppression coil in which, while the main winding is rated to carry the full current, the core is so designed that saturation occurs at the minimum current, and this desired condition of saturation can be maintained for all current values by the operation of the tapping switch in loading the reactor across the correct proportion of the tapped secondary winding. A number of these coils are now in service in Great Britain, and engineers connected with their operation have expressed satisfaction with their improved characteristics.

Hackbridge arc suppression equipment

For remote control of street lighting **Londex Ltd.** have evolved a simple scheme using their relay type LQA over one or two pilot wires, or over G.P.O. rented wires. Where the supply authorities have laid a cable with a fifth core or pilot wires they are able to apply remote-controlled street lighting by simply controlling the coils of mercury relays. Either a.c. or d.c. can be used for the control of relays, and a switching capacity of up to 50 A can be provided. If, instead of a simple on and off action, two different types are required, one for the whole night and the other for half-night lamps, the Londex relay, type L F/FS, with suitably arranged cams can be supplied, working as follows: First impulse, all lights on; second impulse, half night lamps off, whole night lamps remaining on; third impulse whole night lamps off. If there is no master switch the relays can be operated by any time switch, thus giving entirely automatic operation.

A new extensible arm local lighting bracket, which may be incorporated with a low voltage lighting transformer, has been designed by **Meritus (Barnet), Ltd.** The lamp can be adjusted immediately to any position within the radius length of the arm. The electric cable is carried inside the arms and passes through a large hole in the knuckle joint. It is therefore impossible for the cable to be damaged. The knuckle joints have triple friction surfaces of special design which are unaffected by oil or moisture. An independent local switch is provided as optional and may be fitted in the head or in the base.

Export Licensing Relaxations.—The Export of Goods (Control) (No. 1) Order, 1945, made by the Board of Trade, on January 9, and operative as from January 15, frees most Middle East countries, including Cyprus, Egypt, Iran, Iraq, Palestine and Syria from restriction requiring the licensing of all goods for export, but goods included in the schedule to the previous Orders will continue to be subject to the licensing requirement on export to any destination.

What Manufacturers are Doing—IV

Advance in Turbine Design—Progress in Research

THE features of the last year's working of the Metropolitan-Vickers Electrical Co., Ltd., were again governed by the war and normal developments and manufactures had necessarily to be deferred until happier times. Even so, to deal with all the activities of the company is not possible in these days of paper shortage, but the following are typical examples of the work carried out.

Turbine Units

Of plant in hand, interest attaches to a number of turbine units to run at 3 000 r.p.m. which, in respect of output, reflect the advances made in recent years. The largest consist of two units each of 60 000 kW, which are under construction for a British station. They are of the three cylinder type, operating at 1 235 lb./sq. in.g. and employ steam re-heating; the hydrogen method of cooling is to be used for the alternators. Another large 3 000 r.p.m. unit is one of 50 000 kW, for overseas installation. This is also of the three cylinder type, operating at 1 250 lb.g., but without reheat. The alternator is being wound for 33 kV.

Of 1 500 r.p.m. turbo-alternators, two, each of 60 000 kW, are being manufactured, with the alternator of one wound for 33 kV. Work is also proceeding on three units for South Africa, two being of 10 000 kW rating and one of 7 500 kW. Apart from these large units, progress was made in the completion and shipment of a large number of rail-borne mobile power stations for the U.S.S.R., ranging in output from 1 000 kW to 5 000 kW. In addition, several 500 kW transportable geared generator units are nearing completion. These latter incorporate the company's self-contained turbine units and are mounted with the generators on a massive combined bedplate, permitting their shipment and installation as completely assembled units.

Progress has also been made in the completion of geared turbine marine propulsion units for cargo vessels. These units incorporate Metrovick double reduction gears and condensing plant. Each is of 7 500 S.H.P. capacity.

A.I. type motors, both induction and synchronous induction, were built in increasing numbers during the year. A notable development was a new type of TEFC motor of the high torque squirrel cage type, applied to pulveriser mills and to fans. Also of interest was the production of a 2 000 H.P. squirrel cage motor for starting a synchronous condenser on the "Rosenberg" principle.

A large number of the flameproof variety of mining type transformers were supplied to the U.S.S.R., ranging from 75-320 kVA, 6 000-3 000/400 V, believed to be the largest of this type manufactured in this country.

A larger amount of priority work for the Services was carried out by the switchgear department, but equipment for the reconstruction of the Russian electrical system took a greater share of the output than previously. Equipments have been or are being completed for a number of steam and hydro-electric stations.

A result of the speed-up in the installation of additional generating plant in this country is reflected in orders received for extensions. Among these may be mentioned equipments for Fulham and the London Power Co. The former consists of 66 kV metal-clad units, and the latter of 66 kV single-break units.

One new design is that of a range of fuse-switch units to replace the company's type MB switch and fuse equipment. This apparatus is designated MC and comprises a compact arrangement of double break switch combined with high rupturing capacity fuses and is available in ranges of from 60 to 300 A.

During 1944, the sales and manufacture of medium and small motors continued on a high level, and the demand for standard machines formed a high proportion of the total. Amongst a.c. motors, flameproof types occupied a prominent place, requirements being divided between the needs of the coal mines and the increasing call from the oil industry, the latter including slip-ring motors up to 450 H.P. at 1 500 r.p.m.

Carrier Current Protection

Recent tests have shown that the company's system of carrier current protection can be applied successfully to transmission lines containing considerable lengths of underground cable, and equipments intended for application to such lines are in process of manufacture.

Perhaps the largest direct-coupled Ward-Leonard winder equipment in this country was commissioned in the Sheffield area to meet a required output of over 2 000 tons of coal per day from a depth of 1 245 ft. This equipment has a rating of 2 650/5 300 H.P., the winder motor armature being 126 in. diameter, weighing 32 tons and running at 73.5 r.p.m. Servo-operated Ward-Leonard control of the winder motor is utilised in conjunction with an equalised Ward-Leonard motor-generator set which embodies a 13 ton flywheel, load equalisa-

tion being obtained by an oil servo type electric slip-regulator. Orders for similar large Ward-Leonard winders for essential mineral output in South Africa are also under construction.

During the year eight of the ten electric locomotives for the South African Railways were completed and the remaining two are expected to be shipped by the end of the year. A further order was received from the same railways for 28 locomotives of a larger capacity. These will be of 2 500 H.P. and will weigh about 105 tons, the wheel arrangement being $0-6+6-0$.

The year was one of considerable activity in the company's research department, and certain highly specialised apparatus was constructed to meet important needs. One example is the production of lyophilic dryers for penicillin, in which the solution is frozen and dried by evaporation in vacuo. The department also has under construction several electron microscopes for the magnification of sub-microscopic structures up to 10 000 dia., thereafter being amplified by photographic enlargement. The company, it is interesting to state, constructed the first microscope of this type in the country.

The company's 80 W, 5 ft. fluorescent tube continued to be in great demand and 1944 saw the introduction of a solid-filled choke for operating this lamp. The new choke is smaller than that originally used and is practically noiseless in operation. A further development of interest was the "warm white" lamp, distinctly pink as compared with the existing "daylight" tube.

Extensible Service Termination

Unit Design for Requirements of Houses or Block Dwellings

ATTENTION is drawn by J. G. Statter and Co., Ltd., to the report of the Electrical Installation Committee with respect to l.t. service terminations and as an answer to the recommendations made, have designed what they call a Mettric extensible l.t. unit. This is constructed in a plastic material and consists of a base to which four rabitted pillars are attached, one at each corner. These pillars receive the top, bottom and side panels and have a metal centre stem which is used both for attaching the pillars to the base and also for securing the cover. Extra pillars can be provided in the centre of one or more of the sides in order to provide for the fitting of cable boxes where necessary.

The essential feature of the design is that by means of extension pieces inserted into the rabitted corner pieces, further boxes can be attached both vertically and horizontally, depending upon the shape of the space available. These extension inserts are so designed that they allow easy wiring from box to box and, as with the side panels, are easily withdrawn, thus allowing accessibility to the fullest extent.

While the unit was primarily designed for use as a combined service termination, it can, due to the physical dimensions being uniform, be put to further uses, taking advantage of its extensibility, examples of which are given below.

As a combined service termination it is designed to meet the requirements of a normal domestic house having either a .0225 sq. in. or .60 sq. in. incoming cable. It can comprise one or more units, but, for the purpose of description it is assumed that three units would be the normal requirement. The arrangement of these units would then be (1) Supply authority's unit containing a single pole h.r.c. fuse, metered live and neutral splitter blocks, cable sealing box and space for a second single pole h.r.c. fuse and cable sealing box if required for looping out to another consumer. (2) High loading apparatus unit containing two single-pole h.r.c. fuses and switches of a push-pull design controlling cooker and immersion heater circuits or similar apparatus. (3) Consumers distribution unit containing two single-pole h.r.c. fuses for heating and power circuits, two single-pole h.r.c. fuses for lighting circuits, a neutral splitter and a control switch of push-pull design.

The unit is arranged to meet the requirements of premises wired on the ring main principle but can be extended if more fuses are required (i.e., if the premises are wired on the radial system). An earth connector splitter is provided on one of the unit extension inserts, all auxiliary earth wires being brought to this splitter, and the main earth wire taken via a hole provided in the back of the cable box to the plumb of the service cable.

All fuses are mounted on bases designed to allow vertical wiring at the back, and live terminals are protected by means of an insulated cover. There is space in the unit for the accommodation of a bell transformer.

The company mentions that the variations in physical dimensions of meters render their inclusion in a unit of uniform dimensions impracticable, and therefore the meter is not included as an integral part of their termination. It is suggested, however, that the meter be installed either on the top of the termination or at the side

(depending upon the position of the meter terminals) butting against the termination, thus eliminating the appearance of external wiring.

The patented push-pull switch referred to above is of 60 A capacity and possesses q.m.b. features. These features are produced by the action of a coiled spring, inserted in a contact plate, moving over a central rod of a double-cone formation, the plate making contact with terminals situated in the body of the switch.

The switch, approximately 2½ in. dia. by 4 in. high, is fitted in such a way that the cover cannot be removed from either the high loading apparatus unit or the consumers' distribution unit without first opening the switch or switches, thus making an effective interlock.

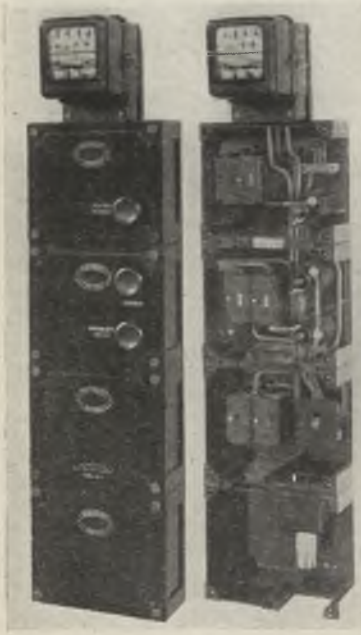
As to wiring arrangements, from the incoming cable sealing box, the live cable core is connected to a main high rupturing capacity fuse. Connection is made from the main fuse via the meter to the live pole splitter block in the supply authorities' unit. The neutral cable core is directly connected to the neutral splitter block, a shunt lead being connected to the meter. It will be noted that all connections taken from these splitter blocks are thus metered. From these metered live and neutral splitters, connections are made to the switches provided on the high loading apparatus unit and the consumers' distribution unit.

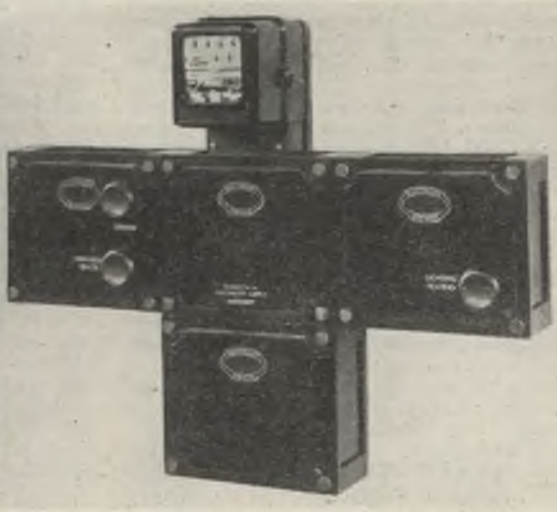
For use as a rising main box in a block of flats where services are required to a number of flats on each of several floors, provision is made for incoming and outgoing .1 sq. in. 2-core cambric cables or the like, terminating at two multi-way blocks, one for the live pole and one for the neutral.

In the case of a two-flat layout per floor, two h.r.c. fused-ways would be provided together with a neutral splitter, these being connected to the appropriate main terminals. Should more than a two-flat layout per floor be required the unit can be easily extended, with units each containing four h.r.c. fused-ways and a neutral splitter—these again being connected to the appropriate main terminal blocks. As in the case of the combined service termination an earthing connector block is provided.

For use as a rising main box in a block of flats where services are required to approximately two flats on each of four floors, a cable sealing box is provided suitable for a .1 sq. in. 2-core cable, the live core of which is taken to a h.r.c. fuse terminal, and the neutral to a neutral terminal. As an extension to this basic unit a further unit is provided containing up to four h.r.c. fused-ways and neutral splitter block, the earthing connector block being fixed to the extension insert as in previous instances. Provision would be made for a cable box for the continuation of the rising main.

From these examples it will be seen that the main feature of the design lies in the extensibility of its construction and its adaptability for use in any domestic premises, whether they be normal dwellings or blocks of flats. The units may be assembled either horizontally or vertically.





Left: The Mettric arrangement for a vertical assembly; one illustration shows the interior. Below: an alternative arrangement of the units

Theatre Lighting

Some Problems of Installation and Operation

AT a meeting of the A.S.E.E. on January 13, a paper entitled "Some Installation, Maintenance and Operating Problems of Theatre Lighting," was read by Mr. L. G. Applebee, in the course of which he said that in the carbon filament lamp days the load on the stage plugs was considerably larger than was the case today, and although the load had dropped from say 20 A to about 10 A, the size of the plugs and sockets remained the same for two reasons, namely: (a) It had become a standard, and apparatus travelling from theatre to theatre was thus, from a connection point of view, interchangeable; (2) although the connected load was small the plug portion must be mechanically strong.

The general practice in the professional theatre or playhouse was to instal the plugs below the stage floor with a metal trap let into and flush with the floor immediately over the sockets, the trap being fitted with a slot for the trailing cables which feed the stage portable apparatus.

Two Necessities

It was frequently found that the sockets were fitted in a most inefficient manner, the live sockets themselves pointing straight upwards. Two necessities stood out, namely: (1) The lid of the trap should be self-closing; (2) the sockets should not be installed directly under the lid or opening of the trap, but under the stage within reach of the operator's sight and hand with the socket pointing horizontally or at an angle of 45° to allow easy access. Stage plugs were usually wired in a three and four colour system and frequently as many as four sockets were fitted to each trap position. In a good class installation, therefore a small 15 W pigmy sign type lamp was fitted with a shade to direct the light into the sockets, so that in a "dark" change the operator could see which plug he was connecting.

In the case where a d.c. supply for the use of arc lanterns was provided, the plugs and sockets were fitted with differential pins so that the polarity could be ensured, and also so that an arc lamp could not be connected to the ordinary a.c. lighting. Arc lamp sockets should never be fitted in the same trap as the a.c. lighting plugs, but should have their own trap with the word "arc" cast on the lid.

The tendency was to instal too few orchestra plugs. The minimum should be 20 so that with two musicians to each stand an orchestra of 40 could be accommodated. There should not be more than 10 plugs to a fuse, and they should be fitted well up the wall to prevent the bandsmen kicking them with their feet. Half the sockets should be on the stage wall side and half on the audience side of the pit. All should be three-pin and the orchestra stands should be earthed. The lamps used in the orchestra stands should not exceed 25 W and should be pearl. The reason for the small wattage lamp was to restrict as far as possible the amount of reflected light from the music to the audience.

Connecting the Footlights

The question of the correct position of the footlights often arose with the architect who pleaded or demanded that the top of the footlights must not arise above the stage floor. This he asked without any consideration of the effect on the stage lighting. For if the point source of light was allowed to be below the level of the floor a rising shadow towards the back of the stage would result. The method of connecting the footlights was often carried out with little thought. In the majority of cases the holders were in a trough at the back hidden from the audience by a screen or board. Some electrical experts placed the footlights in position and then proceed to bond the conduit to the end of them. The obvious thing to do was to have long tails in "Greenfield" which connected to a connector box under the stage. The footlights could then, if desired, be lifted out on to the stage for maintenance purposes.

Spot lanterns were usually placed in the No. 1 batten position on each perch, possibly on the front of the circles or in the roof void. In each case connections should be by means of a plug and socket adjacent to the lantern. In all cases the spot lanterns should, if they could, be fixed in the roof or on a convenient cross-beam struck at 45° down towards the stage. When spot lanterns were built into the circle fronts, forced ventilation in the form of an exhaust should be provided.

It was forbidden under the Cinematograph Act, to instal any resistance above 2 kW in the projector rooms. If, therefore, dimmers were required to be operated by the bio room staff, such as the auditorium lighting or to control the colours in the footlights and battens, they must be accommodated outside the bio enclosure.

Other lighting arrangements were also discussed.

Electrical Personalities

We are always glad to receive from readers news of their social and business activities for publication in this page. Paragraphs should be as brief as possible.

Blackpool Electricity Committee reports that **Mr. H. F. Shannahan,** the borough electrical engineer, will be retiring in March.

Mr. Edmund M. Kindersley has resigned his position as establishment officer of Edmundsons Electricity Corporation, Ltd., to take up a position in Manchester. He was with Edmundsons for eleven years and, as parting gifts from the staff, Mr. Kindersley received a George III silver tankard, a silver cigarette box, and a set of books on Persian subjects, the presentation being made by General Wade Hayes, managing director.

We gave in our last issue a brief report on the lecture entitled " The Poetry of Light " which **Mr. R. Gillespie Williams** delivered at a meeting of the Illuminating Engineering Society last week and we reproduce above a photograph of the speaker and the living models who " illustrated " his remarks.

Mr. R. Gillespie Williams and the living models who illustrated his I.E.F. address " The Poetry of Light "

Capt. (temporary Major) G. J. S. Drury, R.E., who has been awarded the M.B.E. for service in Italy, has been a member of the Newcastle office staff of the B.T-H. Company since 1930.

On retiring after 35 years' service, **Mr. A. Howcroft,** chief inspector, G.P.O., engineering dept., Blackpool, has been presented with a cheque by his colleagues.

Miss Caroline Haslett is visiting Sweden to lecture for the British Council. She has already visited Sweden several times as vice-president of the International Federation of Business and Professional Women and, as director of the Electrical Association for Women, she attended the World Power Conference there.

Mr. Thomas Robertson has retired from the employ of Marine Instruments, Ltd., at the age of 71 years, after completing 57 years' unbroken service. **Mr. Henry James Murrell,** aged 83 years, who is still working on marine sextants, has been connected with the firm for 41 years.

Mr. W. J. Terry, chairman and managing director of the London Electric Wire Co. and Smiths, Ltd., and managing director of the Liverpool Electric Cable Co., Ltd., has been re-elected chairman of the Cable Makers' Association for the third year in succession.

Mr. F. C. Fuke has been elected to the board of the General Accessories Co., Ltd., and, therefore, relinquishes the position of general manager of British Mechanical Productions, Ltd., but will continue as this company's chief electrical engineer. Both companies are members of the Philco group.

Mr. W. M. Little, manager and engineer of the St. Helen's transport department, is to succeed **Mr. J. M. Calder** as manager and engineer of the Reading Corporation transport department. Mr. Calder is retiring at the end of March.

Sequel to the refusal, explained in our last issue, by **Mr. H. E. Annett,** electrical engineer, Bolton, of £3 000 remuneration in connection with work on station extensions in 1940-41, was a meeting of the Electricity Committee on January 11, to discuss terms, and as a result Mr. Annett has agreed to reconsider his decision not to accept responsibility for further extensions to be completed by September, 1946, on the direction of the Central Electricity Board, and is to receive a grant of £5 050 " for additional professional services in connection with this work." The Committee has decided that he should carry out the work and that, subject to the approval of the Central Board, the sum of £7 800 be paid in respect of additional services, to a number of Corporation officials, including £1 000 to **Mr. T. Jack,** deputy electrical engineer, £500 to **Mr. J. Cook,** station engineer, £250 to **Mr. J. Bentham,** commercial assistant, and £100 to **Mr. J. Heath,** chief engineer draughtsman. Mr. Annett has been at Bolton for 40 years, 17 as electrical engineer.

At the invitation of the British Government, after consultation with the Governments concerned, **Lord Reith** is to visit the Dominions and India to discuss the future organisation of the telecommunications

services of the Commonwealth. He will be accompanied by **Sir Edwin Herbert,** Director-General of the Postal and Telegraph Censorship Department, **Sir Stanley Angwin,** Assistant Director-General, Post Office, **Mr. John Buckley,** War Cabinet Office, and **Mr. L. V. Lewis,** Post Office. Cable and Wireless Ltd. announce that consequent on his acceptance of the invitation Lord Reith has resigned from the boards of Cable and Wireless (Holding) Ltd. and associated companies.

Members of the Midland Electric Manufacturing Co.'s Social and Athletic Club held their annual Christmas dinner and concert in the company's canteen on December 20. **Mr. T. Birkett,** director and former general manager, presided and distributed awards for long service. This year 22 members were admitted to the M.E.M. "Gold Watch Brigade" on completing ten years' service with the company. They included **Mr. G. Smith,** an employee in the foundry, recently repatriated from a P.o.W. camp in Germany. Seven employees were also presented with illuminated addresses to mark the completion of 21 years' service.

The following elections have been made by the Board of the Institute of Physics:—Fellows: G. D. Coumoulos, F. A. M. Heppner, D. Jack, S. D. Threadgold, D. G. Underwood, R. Witty and H. G. Yates; associates: B. C. Abbott, S. H. Ayliffe, J. G. Ballantyne, R. H. Booth, D. F. Bracher, W. Cochran, H. O. Foulkes, V. E. Gough, T. S. Hutchinson, N. R. Labrum, A. S. P. Ledger, G. W. Mack, J. H. Mason, J. W. McHugo, M. J. Moroney, N. Pearce, S. E. Presgrave, O. J. Russell, G. H. Stafford, E. E. Welch, and R. L. Whitmore. Seven subscribers and thirty-eight students were also admitted.

The following have been elected to the board of management of the newly-formed North-East Engineering Bureau, which is intended to help in the expansion of the engineering industry and give advice to engineering firms:—Col. E. G. Angus (George Angus and Co., Ltd.), Mr. D. G. Brown (Redheugh Iron and Steel Co., Ltd.), Col. B. H. Leeson (A. Reyrolle and Co., Ltd.), Mr. R. W. Mann (Victor Products (Wallsend), Ltd.), Mr. J. E. Steel (Steel and Co., Ltd.), Mr. H. Wright (R. Powley and Sons), Mr. J. H. Arthur (Ashmore Benson Pease and Co., Ltd.), and Mr. R. L. Clark (John Tinsley, Ltd.). The secretary is Mr. J. E. Spoors. The bureau has now 94 member-firms subscribing about £6 000 annually. A general manager is to be appointed, and more than 100 applications have been received for the post.

Appended are further names from the New Year Honours List:

M.B.E., Mr. John Bunyan, staff engineer, Allen West and Co., Ltd.; Mr. J. M. Lawrence, production manager, Philips Lamps, Ltd.

M.B.E. (Military Division), Major F. Allan Eyre, principal of F. Allan Eyre & Co., wholesale electrical factors and merchants, Chesterfield.

B.E.M., Mr. W. Andermahr, toolmaker, A. C. Cossor, Ltd.; Mr. L. Anderson, inspector (engineering), telephone manager's office, Swansea; Miss E. E. Barratt, supervisor, telephone exchange, L.N.E.R. Co., York; Mrs. D. L. Bennett, telephone supervisor, War Office; Mr. W. A. Dawson, foreman chargehand toolmaker, Whiteley Electrical Radio Co., Ltd.; Miss O. H. Day, supervisor, P. O. Telephone Exchange, Cheltenham; Mr. W. Douglas, superintending foreman, Yorkshire Copper Works, Ltd.; Mr. T. Edwards, foreman, Bubery Owen and Co., Ltd.; Miss A. S. Forster, forewoman, Standard Telephones and Cables, Ltd.; Mr. R. C. Hill, wireman, Metropolitan Vickers Electrical Co., Ltd.; Mr. D. Hodgson, head foreman electrician, Cammell Laird and Co., Ltd.; Mr. J. W. Jones, station electrician, R.A.F. station; Miss Mildred King, senior chargehand, Telegraph Condenser Co., Ltd.; Mr. J. F. King, the London Electrical Firm, Ltd.; Mr. C. H. Knight, overseer (telegraphs), Head Post Office, Leeds; Mr. E. Manns, turbine house pump attendant, North Eastern Electric Supply Co., Ltd., Mr. W. Morrison, foreman electrician, A. T. R. Brown, Ltd.; Mr. H. J. Martlock, chargehand, Admiralty Civilian Shore Wireless Service; Mr. S. Naisbitt, electrical chargehand, T. R. Dowsons, Ltd.; Mr. J. H. Nixon, chargeman electrician, Robson and Coleman; Mr. H. Poulton, drilling machinist, Marconi's Wireless Telegraph Co., Ltd.; Mr. C. Price, fitter, Brush Electrical Engineering Co., Ltd.; Mrs. D. E. Sincock, welfare supervisor, Marconi's Wireless Telegraph Co., Ltd.; Mr. E. I. Townsend, electrical fitter, H.M. Dockyard, Gibraltar; Mr. K. Warwick, assistant chief inspector, Philco Radio and Television Corporation of Great Britain, Ltd.; Mr. E. Whitmore, foreman, Skefko Ball Bearing Co., Ltd.; Mr. A. S. Wilson, chargeman of electrical fitters, H.M. Dockyard, Rosyth; Mr. J. Wolfenden, foreman, Ferranti, Ltd.; Mr. G. T. Egan, tool room superintendent, Philips Lamps, Ltd.

Obituary

Mr. J. A. Hirst, founder of Brookhirst Switchgear, Ltd., aged 73 years. He was chairman of Electrical Switchgear and Associated Manufacturers, Ltd., and a former chairman of the B.E.A.M.A.

Oldham.—The T.C. has agreed to a proposal for the extension of the electricity supply to cottage properties in the Failsworth district.

News in Brief

I.E.E. Liverpool Group.—The newly-formed Liverpool group of the Illuminating Engineering Society, held its first sessional meeting at the electricity showrooms, Liverpool, on January 9, when an address on "Bright Light Sources," was given by Mr. J. N. Aldington.

Hospital X-ray Apparatus.—The Bradford Health Committee is to provide additional X-ray apparatus at St. Luke's Hospital at a cost of £1 028.

A.S.E.E. Luncheon.—The Association of Supervising Electrical Engineers' annual luncheon and reunion will be held at the Connaught Rooms, Kingsway, London, W.C.2, on March 10, at 12.30 for 1 p.m., when the President of the association will be in the chair.

Street Lighting Scheme.—The Prudhoe-on-Tyne U.C. is to meet the North-Eastern Electric Supply Co., Ltd., to discuss street lighting.

Power in Brazil.—It is reported that electric power installations of various types supplying light and power to 2 179 communities, now number 1 343. Nearly all the hydro-electric power at present produced in Brazil is concentrated in the industrial State of Sao Paulo and in Rio de Janeiro.

Electricity in Mines.—The Minister of Fuel and Power has issued a list of electrical apparatus for which certificates of flameproof enclosures have been granted during the three months ended December 31, 1944. At the request of the B.E.A.M.A., copies of these quarterly lists are on sale, price of 1s. 2½d. (post free), and may be obtained from The Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, S.W.1.

N. Wales Hydro-electric Plans.—When addressing Merioneth farmers at Dolgelly, recently, Col. J. Rankin, general manager and director of the North Wales Power Co. Ltd., stated that the company had spent £3 000 000 on the development of electricity in North Wales, and already plans were being completed on schemes covering a total of £500 000 to be carried out during the first five years after the war. It was decided to submit to the company a report on the general position of Merioneth farms, and to draft a resolution for submission to the Government urging financial assistance to ensure that electricity supply schemes to farms and rural areas would be an economic proposition.

Rural Electrification. — The Durham County Farmers' Union has asked union headquarters to support a plan for rural electrification similar to that in the U.S.A.

Dundee Traffic Lights.—At a recent meeting of the Works Committee, it was unanimously agreed that the traffic control light signals should be improved.

Electrical Colliery Equipment.—Charlaw and Sacriston Collieries, Ltd., have electrified the winding engine at Sacriston Pit, Durham. The work was done without interfering with output.

Television Committee's Report.—The report of the Television Committee is expected to be published in March, when it is probable that a recommendation will be made that the B.B.C. television station at Alexandra Palace should start transmissions at the earliest possible moment.

Conference on Atmospheric Pollution.—The Institute of Fuel is to hold a joint conference with the National Smoke Abatement Society on "Atmospheric Pollution," at the Institution of Electrical Engineers, Victoria Enbankment, London, W.C.1, on February 23, commencing at 10 p.m. During the afternoon session a paper will be read by Mr. John Bruce on "Grit and Smoke from Power Stations."

Cumberland Post-War Plans.—At a recent Press conference at Whitehaven, Ald. J. J. Adams said that the West Cumberland Industrial Development Co., and the Cumberland Development Council had been in consultation with the Central Electricity Board and the United Steel Companies with the object of planning a new super power station in West Cumberland. This would be fed with waste gases from the steel works at Workington and save a large amount of raw fuel now being conveyed many miles for conversion into electricity supply.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of January 16, 1920: Owing to the recent storm, telegraphic communication with the Continent and with certain parts of the North and with Ireland have been interrupted. This illustrates the need for more underground cables, and we hope that the Post Office authorities will proceed with the work of extending their underground network as rapidly as possible.*

Answers to Technical Questions

We produce below the answers to a selection of questions which have been sent to us by readers. The co-operation of students, and others in making this feature one of general interest is invited.

What are the best methods to adopt to reduce to a minimum the burning of relay and contactor contacts on d.c. circuits and, if condensers and resistances are used for the purpose, how are the values of these calculated?

When an inductive circuit carrying d.c. is broken the current cannot immediately drop to zero since the e.m.f. set up by the falling current ($e = L.di/dt$ volts) tends to maintain it. The current there-

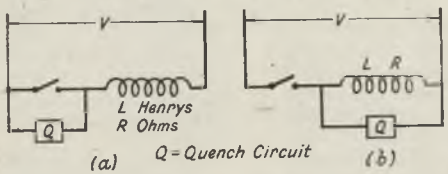


Fig. 1 (above)

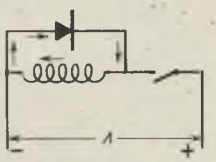


Fig. 2 (left)

fore drops gradually until all the stored energy of the inductance of the circuit ($W = LI^2/2$ joules) has been dissipated. If a suitable circuit in which this energy can be dissipated is not provided, it will dissipate itself in an arc at the contacts at which the circuit is being broken. The circuit introduced for dissipating the energy is known as a quench circuit and may be connected in either of the ways shown in Fig. 1. The quench circuit may consist of a plain resister, a non-linear resister, a condenser (with or without a resister in series), or a rectifier. In all cases, if the contacts are separated without a spark, the current in the quench circuit at the first moment after the separation will be equal to the current through the contacts before separation.

Plain Resister—A convenient value for the quench circuit resistance is to make it equal to R; if connected as in Fig. 1a. this will limit the initial voltage across the contacts to V but the current in the circuit will only be reduced to half instead of being completely broken by the contacts. If connected as in Fig. 1b. the initial voltage across the contacts will be $2V$ and that across the coil will be V. There will, however, be a continuous energy loss in the resister so long as the contacts are closed. In either case the value of the quench resistance can be increased to 2 or 3 times R in order to improve the normal circuit conditions without seriously affecting the sparking.

Non-linear Resister—A resister of a material such as Metrosil which has a high resistance at low values of voltage across it, and a low resistance at higher voltages, is an improvement on the above, although more expensive in first cost. If connected as in Fig. 1b., for instance, the resistance at normal voltage can be several times that which would be employed for a plain resister, thus reducing the energy loss; on breaking the circuit the rise in voltage causes a reduction of the resistance and this limits the rise in voltage to a safe value.

Condenser.—The use of a condenser, generally in series with a resister (plain or non-linear), gives rise to conditions which are considerably more complicated than with the resister alone. The condenser prevents the flow of current through the quench circuit under normal steady conditions but, provided it is large enough, acts as a short circuit at the first instant after the opening of the contacts and subsequently becomes charged to normal circuit voltage. When the contacts are closed again the condenser will discharge itself through the contacts and unless a resister is in series with it, the discharge current may be sufficient to cause the contacts to weld themselves together. At the first instant after opening the contacts the conditions are thus similar to those obtaining with a resister but it is no longer necessary to use a fairly high value of resistance in order to limit the current under steady conditions. Too low a value will, however, lead to too high a discharge current on closing, and the series resistance should not be less than R. It has been shown that there may be a transient increase of arc voltage if the capacitance is less than L/R^2 although in practice values somewhat less than this can safely be used.

Rectifier.—The rectifier can be used in the circuit of Fig. 1b. and connected in such a direction that it will carry no current under normal conditions, i.e., as in Fig. 2. The rectifier must be of such a size as to carry momentarily and without damage the full value of the circuit current and it must normally be able to withstand full circuit voltage in the opposite direction. The metal rectifier is the simplest and most robust type and is eminently

suited for this purpose; it has the advantage of negligible energy loss under normal conditions and does not cause a discharge current on closing the circuit as is the case with the condenser. A point which must sometimes be considered when a quench circuit is used across the coil of a relay or contactor is that the quench circuit allows the current to die down slowly and so delays the operation of the relay or contactor. Calculations of the rate of delay of current are, however, very complicated when using quench circuits containing rectifiers or non-linear resisters and generally can only be done by the use of a differential analyser. E.O.T.

Electricity Supply

Bedford.—The Electricity Committee has obtained sanction to borrow £7 500 for mains and services.

Lichfield.—The Electricity Committee recommends that the 10 per cent. increase be not charged for the December quarter.

York.—A supplementary estimate of £2 470 for street lighting has been approved by the Highways Committee.

Sheffield.—The Electricity Committee has obtained sanction to borrow £15 000 for distribution mains.

York.—The Electricity Committee has obtained sanction to borrow £1 000 for sub-stations and is seeking sanction to borrow £860 for providing supply to a farm.

Manchester.—The Rivers Committee has arranged for the appropriation by the electricity department of land at Carrington for the proposed new power station.

Glasgow.—The Education Committee has arranged for the electricity department to undertake electrical work at Househillwood temporary school at a cost of £340.

West Bromwich.—Sanction is to be sought for a loan of £1 000 for meters and £1 745 for the provision of a new substation at Hall Green.

Ilford.—For the year ending March 31, 4 414 627 more units were sold than in the previous year. Income at £483 238 showed an increase of £28 479.

Accrington.—Electricity is to be installed in the 100 pre-fabricated houses being erected on the Richmond Hill and Fern Gore sites.

Cardiff.—The Emergency Committee reports that the Welsh Board of Health has declined to approve the installation of electric cookers in requisitioned houses.

Thatcham (Berks.).—A scheme of electric street lighting which will mean a rate of 6d. in the £, is to be recommended at the next parish meeting.

Hapton.—The Lancashire Electric Power Co. has notified the P.C. that the charge for maintenance of street lighting has been increased from 15s. per lamp per annum to 22s. 6d.

Oxford.—The Highways and Lighting Committee proposes to include the sum of £16 000 in the annual estimates for 1945/46 in anticipation of a return to full pre-war street lighting.

Keswick.—The Lighting Committee has reported to the U.C. on a meeting held recently with the Electricity Commissioners on the question of the Council taking over the electricity supply in the urban area.

Salford.—The City Council last week approved of extension for Agecroft power station for an increase in generating capacity from 57 000 to 100 000 kW by 1947-8, at an estimated cost of £3 000 000.

Chesterfield.—The Electricity Committee is to provide supply, at a cost of £1 200 to Boythorpe Colliery, the company having agreed to pay £260 per annum for five years as a minimum charge for electricity consumed.

Consett (Co. Durham).—The question of installing gas or electricity in council houses is being considered by the U.C. It is stated that electricity charges in the council area vary, and it is intended to approach the supply companies with a suggestion for bringing about a standard rate.

DEVELOPMENTS IN CORNWALL

IN pursuit of its policy of continuous development, the Cornwall E.P. Co., in conjunction with Edmundsons Electricity Corporation, has prepared an extensive programme for immediate and future extensions, part of which, already in hand, will involve the company in an expenditure of over £500 000. The work will include new h.t. lines to the Camborne, Redruth, Newquay and Penzance area, together with the necessary transformer substations and additional h.t. switching facilities at Fraddon, the point where connection is made to the grid line of the Central Board.

In order to meet anticipated demand, the Central Board have already given a direction for the installation of an additional 15 000 kW at Hayle, and plans for future extension of the distribution system are under consideration, designed to link up remote rural areas. The cost of distribution line construction has always been a serious item in rural development, but Edmundsons and its associated group, claim to have succeeded in designing new types of lines in which the cost of construction has been materially reduced.

Industrial Information

Employment Acts.—A summary of the Reinstatement in Civil Employment Act,

The Bilton-Scratchley window putty router being operated

1944, and the Disabled Persons (Employment) Act, 1944, has been issued by the National Joint Industrial Council for the Electricity Supply Industry.

Machine Shop Lighting.—The photograph reproduced herewith shows part of the ground floor machine shop at the Redditch works of the Heywood Compressor Co., Ltd., where a new B.T-H. lighting scheme has just been completed. The mounting height was restricted to 11 ft. and overlamp dispersive reflectors with 200 W gas-filled lamps were used midway between trusses in symmetrical layout to give an average intensity of 12.5 f.c. This general average intensity was supplemented by low voltage units and Mazdalux low voltage lighting brackets on most of the machines. This supplementary lighting was necessary as much horizontal and vertical internal turning is carried out. At the far end of the room is seen B.T-H. high rupturing capacity fuse switch and distribution gear. It is interesting to note that the photograph was taken under black-out conditions and the installation, carried out by the Shropshire, Worcestershire and Staffs E.P. Co.

Putty Routing.—The building trade will be the permanent gainer by at least one of the inventions which have been born of our war-time needs. The idea behind the Bilton-Scratchley router for the quick removal of old putty from the window frames of bomb-damaged houses, was conceived by a Croydon builder and put into practical form by Mr. W. J. Bilton, a mechanical engineer, of the same borough. The router, produced by the latter's firm, is a simple accessory to a portable electric drill. Mr. Bilton chose the Wolf ¼ in. light production drill, type EG 2C, by Wolf (S.) and Co., Ltd., as the handiest power unit to which his cutter is fitted in the ordinary way, and over this is slipped the special attachment which enables the tool to maintain its correct position when in operation.

Reducing Smoke From New Houses.—The National Smoke Abatement Society has sent to municipal authorities a memorandum setting out the importance attached by the Government in the new Housing Manual to the reduction of the amount of smoke emitted, and offering its help and advice.

Heaton Works Journal.—The Christmas number of the journal incorporating the activities of C. A. Parsons and Co., Ltd., and Sir Howard Grubb Parsons and Co., contains articles on "The work of the late Hon. Sir Charles A. Parsons," "Work in Hand," "Photography Applied to Engineering," and "The Condensation of Atmosphere Moisture on Insulation Surfaces."

A new B.T-H. lighting scheme for a machine shop

Company News

T. M. Birkett and Sons Ltd.—Intm. div. 5% (same).

Dublin United Transport Co. Ltd.—Fin. div. 3% on both ord. and pref., mkg. 6% for 1944 (same).

Berry Wiggins and Co. Ltd.—Div., 3d. per sh. on "A" 5s. ord., half-yr. to Dec. 31, 1944 (same).

J. S. White and Co. Ltd.—Net pft. to Sept. 30, £55 943 (£56 240). Fin. div 4% (same), again mkg. 6½%, tax free.

Sudan Light and Power Co. Ltd.—Net pft. for 1943 £31 543. Pref. div. £3 380. ord. div. 6% £24 360, fwd. £39 970 (£36 167).

Park Gate Iron and Steel Co. Ltd.—Drs. propose to reduce the cap. from £2 000 000 to £1 000 000 by cutting 10s. off each £1 unit of ord. stk.

Brooke Tool Manufacturing Co. Ltd.—Fin. div. 12½% (same), mkg. 20%, less tax (same), payable Feb. 7. Tradg. pft. is stated to be £33 626 (£32 932).

Watford Electric and Manufacturing Co. Ltd.—Ord. sh.holders subscribed for 94 100 of issue of 100 000 2s. ord., and pref. sh.holders took up 18 135 of issue of 20 000 10s. 6% cum. pref. Blce. will be taken up by guarantors.

British Tyre and Rubber Co.—Intm. div. 4½%, and bonus 3%, both less tax, mkg. 11% (same), payable Feb. 6. Net pft., subject to completion of audit, is stated as £201 557 after E.P.T., but before providg. for inc.-tax (£200 963).

British Industrial Plastics, Ltd.—Prelim. statemt., shows that gross pfts. were £240 107. After deductg. gen. and spec. exs. and providg. £15 417 for deprecn., £17 578 for research and developmt. and £106 000 for taxatn., the net pfts. £21 705 (£21 659). The div. on £429 392 ord. is maintained at 8%, less tax, and is payable Mar. 28.

Dussek Bros. and Co. Ltd.—Gross tradg. pft. to Oct. 31, £75 332 (£77 041), plus div., rents, etc., £802 (£227). To exes., incldg. dirs.' remun., salaries, repairs, bad debts, etc., £51 554 (£52 671), dirs.' fees £610 (nil), deprecn. £3 335 (£3 424), net pft. £20 635 (£21 174). Pref. div. £1 826 (same), ord. div. 12½% £6 256 (same), tax £11 250 (£8 750), fwd. £22 238

Company Meeting

Power-Gas Corporation Ltd.—At the annual meeting held at York, on January 18, Mr. Wilfred Beswick, the chairman, said the group of companies had made important contributions to the war effort in the production of plant and equipment. In particular, they had played a substantial part as main contractors in the provision of equipment for the artificial harbours for the invasion of Europe. He anticipated that the change-over from war-time to peace-time production could be effected smoothly and without any loss of time, and was confident that when the time came they would be able to hold their own in the export markets. Mr. N. E. Rambush, managing director, stated that this year's order book was in a very satisfactory state and that he looked forward to the future with great confidence.

Contracts Open

We give below the latest information regarding contracts for which tenders are invited. In the case of overseas contracts, particulars are to be had from the Department of Overseas Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated.

Leeds Housing Committee, January 22.—Electrical maintenance repairs over a period of six months ending September 30, 1945, in connection with seven groups of dwellings. Specifications from the Housing Director, Priestley House, Quarry Hill, Leeds.

Stone U.D.C., January 23.—Supply, delivery and erection of approximately 1 mile overhead line and 1 000 yds. underground cable in two sections. Specifications from the Electricity Department, 56, High Street, Stone, Staffs.

Bootle B.C., January 27.—Supply of electric lamps (Form No. 14), for six or twelve months from April 1, 1945. Particulars from Mr. W. A. Harrison, borough engineer, Town Hall, Bootle.

Salford Public Health Department, January 27.—Supply and delivery to Hope Hospital, Eccles Old Road, Salford, 6, of the undermentioned equipment: (a) 30 food conveyors, trolley type, suitable for conveying sufficient food for 30-35 patients; (b) 1 dish-washing machine, suitable for handling the normal requirements for 500 persons. Particulars from the Steward of the Hospital.

Gellygaer U.D.C., February 3.—Supply and delivery of (a) indoor and outdoor transformers; (b) kiosk complete with switchgear and accessories; (c) e.h.t. and l.t. cable; (d) overhead line equipment and (e) wood poles. Specification from the Electrical Engineer, Electricity Offices, Hanbury Road, Bargoed, Glam.

Commercial Notes

County Court Judgments

NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*

TRAPP, H. G. (male), Mill Road, Okehampton, radio dealer. £15 16s. 3d. Nov. 18.

FOWLER, Ernest A., 4, Benham Grove, Portchester, electrician. £11 7s. 10d. Nov. 9.

COATES, Geo. c/o Sargents, Fish Docks, Grimsby, electrical engineer. £52 14s. 4d. Nov. 1.

Satisfaction

BAXTERS (BOLTS, SCREWS AND RIVETS) LTD., Birmingham.—Sat'n. Dec. 27, £4 000, reg. June 28, 1940.

Notices of Intended Dividends

EVERINGHAM, William, now residing at 38, Estcourt Avenue, Headingley, Leeds, and carrying on business at 35, Quay Road, Bridlington, of plumber and electrician. Claims to be sent by Jan. 27, 1945, to the Trustee, John Stanley Snowball, Bank Chambers, Scarborough, Official Receiver.

MOULD, Eric Cecil, trading as Empire Electrical Co., residing and carrying on business at 24, Westrow Gardens, Seven Kings, Essex, lately carrying on business at 28, Clements Road, Ilford, Essex, and The Facade, High Road, Goodmayes, Essex, electrical retailer. Claims to be sent by Jan. 23, to the trustee, Arthur Harold Ward, 42, Tavistock Square, W.C.1.

Coming Events

Friday, January 19. (To-day.)

I.E.E., MEASUREMENTS SECTION.—London, W.C.2. "The Fixing of Confidence Limits to Measurements," H. J. Josephs. *5.30 p.m.*—I.E.E., N.E. STUDENTS' SECTION.—Newcastle-on-Tyne. "The Electrical Properties of the Human Body," J.M.A. Lenihan. *6.30 p.m.*

Saturday, January 20.

I.E.E., LONDON STUDENTS' SECTION.—Visit to the Museum Automatic Telephone Exchange, Howland Street. *2.30 p.m.*

I.E.E., WEST WALES SUB-CENTRE.—Swansea. "Maintenance of Distribution Plant and Mains on A.C. Networks," F. N. Beaumont, and F. A. Geary. *3 p.m.*

Monday, January 22.

I.E.E.—London, W.C.2. Informal meeting. Discussion, "Applications of Electricity to Water Supply." (Opened by J. F. Shipley.) *5.30 p.m.*—I.E.E., N.E. CENTRE, Newcastle-on-Tyne. "The Electrical Aspect of Farm Mechanisation," C. A. Cameron Brown. *6.15 p.m.*—I.E.E., N.W. STUDENTS' SECTION, Manchester. "The Development of the Stroboscope," D. T. Broadbent. *6.30 p.m.*

BIRMINGHAM ELECTRIC CLUB.—Grand Hotel. "Industrial Electronics," Dr. W. Wilson. *5.30 p.m.*

I.E.E., MERSEY AND N. WALES CENTRE.—Liverpool. "Thermoplastic Cables," H. Barron, J. N. Dean and T. R. Scott. *5.30 p.m.*

Tuesday, January 23.

LUTON ELECTRICAL SOCIETY.—Town Hall. "Fluorescent Lighting." *7.30 p.m.*

Wednesday, January 24.

I.E.E., RADIO SECTION.—London, W.C.2. "Television Broadcasting Practice in America, 1927/1934," D. G. Fink. *5.30 p.m.*—I.E.E., SCOTTISH CENTRE, Edinburgh. "Planning the Future Electricity Meter," G. E. Moore. *6 p.m.*—I.E.E., E. MID. SUB-CENTRE, Loughborough College. "An Analysis of the Load on a Modern Electricity Supply System," P. Schiller. *2.30 p.m.*

I.E.E., S. MID. STUDENTS' SECTION.—Birmingham. "Apprenticeship," J. P. Quayle. *7 p.m.*

Friday, January 26.

I.E.E., N.W. CENTRE, RADIO GROUP.—Manchester. Informal discussion, "High Frequency Heating." *6 p.m.*

ILLUMINATING ENGINEERING SOCIETY (Birmingham Centre).—Imperial Hotel. "Lamps Trust." *6 p.m.*

Saturday, January 27.

ASSOCIATION OF SCIENTIFIC PHOTOGRAPHY.—Caxton Hall, Westminster, S.W. "Electric Discharge Lamps for Photography," H. K. Bourne. *2.30 p.m.*

Metal Prices

Monday, January 15.

		Price.	Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	,,	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9 5/16d.	—	—
Sheet	,,	10 7/8d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	per lb.	1s. 0 5/16d.	—	—
Brass (60/40)—				
Rod, basis	per lb.	—	—	—
Sheet ,, ...	,,	—	—	—
Wire ,, ...	,,	10 7/8d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£6 18 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	,,	£27 10 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ...	,,	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G. ...	,,	£26 0 0	—	—
Lead Pig—				
English	per ton	£26 10 0	—	—
Foreign or Colonial	,,	£25 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	per ton	£303 10 0	—	—
Wire, basis... ...	per lb.	3s. 10d.	—	—
Aluminium Ingots ...	per ton	£110 0 0	—	—
Spelter...	,,	£25 15 0	—	—
Mercury (spot) Warehouse ...	...per bottle	£69 15 0	—	—

NOTE.—Above prices are nominal only, no allowance being made for tariff charges, charges for insurance, etc. Prices of galvanised steel wire and steel tape supplied by Cable Makers Association. Other metal prices by British Insulated Cables Ltd.

IF anyone could make a Blower, it must be Hoover Ltd. who had made the world's best vacuum cleaner in peace-time.

Apparently the Government thought so too, for from the early days of the war they gave Hoover Ltd. contracts for Blowers — tens of thousands of Blowers. Hot Air Blowers for drying, Blowers for cooling; Blowers for a multiplicity of jobs, from cooling Radar Valves to testing airmen's dinghies so that they could be carried in safety on R.A.F. planes.

Blowers are just one of the technical products that Hoover Ltd. will place at the disposal of industry when peace comes; Blowers of all sizes and with a capacity of five to over a hundred cubic feet of free air per minute.

Other products include Rotary Transformers for Radio Equipment, Fractional Horse-Power Motors and Generators.

If these enter into your post-war plans consult us now!

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PERIVALE · GREENFORD · MIDDLESEX

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