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Presidential Addresses.

There being no fewer than seventeen branches and sub-branches of the Association of Mining Electrical Engineers it is inevitable that, at the beginning of a new session, we should be loaded all at once with an abundance of "copy" in the form of presidential addresses. Seeing that the monthly capacity of this journal is limited (in accordance with the extent to which its great business pulling value is tangibly acknowledged in the form of advertisement contracts) we are obliged to hold over for the time being a number of these addresses. As it is, this issue is mainly devoted to the publication of several of those reviews of the past, criticisms of the present and visions of the future, which are the favourite ingredients resorted to in the compounding of inaugural lectures. It is, however, just as well to have a representative assortment of these assembled inside one cover, for the reader will find added interest in being readily able to make comparisons: he will, moreover, gain a better idea of the trend of Association affairs by learning the opinions of members who are so actively imbued with its interests as to have merited election to the highest offices in their respective branches of the Association.

Compulsory Certification.

In view of the recent official enquiry into the qualifications of colliery engineers it is not surprising to find that several of the newly installed Branch Presidents availed themselves of the opportunity to ventilate their views concerning the official certification of mining electrical engineers; and its inseparable twin, the subject of education.

In regard to the desirability or otherwise of compulsory certification it will be noticed that whilst some of the speakers are definitely in favour of the proposal, there are others who speak of it in non-committal terms and are careful to keep an open mind, whilst again there are others who are definitely unbelievers.

Perhaps, for the present, it would be best if all the members most directly concerned—they being the mining electrical engineers engaged in actual practice—were to adopt the position defined by Mr. Muirhead, Chairman of the Advisory Committee of the Association, in his address at Kirkcaldy, as reported on page 176. Mr. Muirhead plainly stated that the Association, as an Association, is neither for nor against Compulsory Certification: its only concern in this matter is to ensure, as far as it possibly can, that the colliery electrician shall have that adequate proficiency which would assuredly be demanded were compulsory certification to come about.

It should be observed that in recommending mining electrical members to accept this point of view we introduced the elastic phrase "for the present". For, just as the Association was invited to submit evidence to the recent Committee of Enquiry so doubtless it will be granted a similar privilege should the wider issue of compulsory certification for the colliery electrical staff be brought forward for official consideration by the Government.

If that enquiry should eventuate there would be time enough then for the Association to enunciate its considered policy. In the meantime by concentrating its energies towards the provision of more adequate means for the education and training of competent men it will not only render the very greatest service to its members and national progress but it will, automatically and as a result of that work, be the better able to weigh with true judgment the worth of compulsory certification; and be prepared to advance evidence of fact and well-informed opinions of greater cogency, authority and value.

It is highly probable that the qualifications and duties, (and, by inference, the legal responsibilities) of men engaged in electrical work in collieries will soon be defined by statute. What precisely will be the effect of this initial grip of the weighty hand of the law when applied to colliery electricians cannot be surmised in general terms. Each of the men employed in colliery electrical work will already have been trying to size up the prospect of how he, as an individual, will be affected. There are all sorts of men so engaged: the highly qualified will probably look forward to enjoying the grip of control as of a friendly and helpful nature, others of lesser degree are not likely to be so comfortable in their outlook.

Evidence of Competency.

There is only one piece of sterling advice available for all. They must be able to produce visible evidence of competency—and those who are wise will forthwith set about gathering unto themselves as much strong evidence as possible. This, in effect, is the counsel of several of the Branch Presidents and it is so indisputably sound and of such vital importance that we have lifted it clear from the other themes of the addresses and set it here in the prominence of isolation.

There is evidence of competency in the passing of the Examination of the Association; there is evidence in the preparation by study for that examination, even though the pass may not have been gained; there is evidence in the election to membership of the Association.

Obituary.

Mr. C. F. JACKSON.

Members of the Association of Mining Electrical Engineers and a wide circle of men interested in colliery affairs would learn with deep regret of the death of Mr. C. F. Jackson which occurred at his residence, Newland House, Keresley, near Coventry, on Oct. 14th last, after an illness of considerable duration. He was Treasurer of the Association from 1911 to 1918, and was subsequently elected Vice-President of the Association, an office which he held from 1918 to 1920.

Born in the suburbs of Manchester 54 years ago, Mr. Jackson received his earlier education at Manchester Grammar School, and later was articled to Sir William Garforth, of Poulton Pearson's Colliery, Normanton (Yorkshire). His marriage took place at Normanton, his bride being Miss Mary Fisher, daughter of a Yorkshire colliery manager and engineer. He went to Kentucky (America) for five years to gain knowledge in coal-mining matters, and on his return to England, was appointed surveyor to the Criggleston Colliery, four miles south-west of Wakefield. Next he visited Scotland for still further experience, and was afterwards connected officially with the Staveley Coal and Iron Co., near Chesterfield, Derbyshire.

In 1898, Mr. Jackson was appointed manager of the Measham Colliery, Leicestershire. Mr. Jackson was at the Measham Colliery for nine years, and in 1907 accepted the management of Exhall Colliery, which was in anything but a flourishing condition. There was greatly increased output during the 17 years he was there, and for a portion of that time he also held the agency of the Newdigate Colliery. When he left Exhall Colliery about six and a half years ago, he was the recipient of a piece of plate subscribed for by the officials and workmen of Exhall Colliery.

Mr. Jackson then assumed the managership of the Coventry Colliery, Keresley, and took with him various officials and workmen from the Exhall Colliery. Under his careful guidance, the colliery—the biggest individual pit in the Warwickshire coalfield—has been developed and made excellent progress. When Mr. Jackson and his followers reached Coventry Colliery they found it in a somewhat parlous condition, with plenty of scope for their energy. They were at the time raising somewhat less than 2000 tons of coal per week. In a short time they doubled, and even trebled, that quantity, and in less than four years they raised 15,000 tons per week, which is the largest quantity that any pit in Warwickshire has ever produced.

Although a very busy man, Mr. Jackson devoted much time to parochial life at Keresley and adjacent parishes. He was one of the principal promoters of the Club and Institute, at Keresley, on which some thousands of pounds were spent. It was mainly through his influence with the directors of Coventry Colliery that so much work was contributed in connection with the erection of Exhall Church Hall, he also giving a substantial donation from his private purse.

In 1928 he was the president of the South Staffordshire and Warwickshire Branch of the Institute of Mining Engineers.

Mr. Jackson leaves a widow, four sons and two daughters.

Rules for Preparation of "Copy" for Publication.

Written Matter.

Best done on Typewriter: if hand-written use ink.
Leave ample space between the lines.
Leave wide left-hand margin.
Do not underline words or phrases.
Do not waste capital initials.
Use sheets of paper of uniform size.
Use paper upon which a pen will write.
Number the pages.
Never write on both sides of the paper.
Read and revise the manuscript before you post it.
Refer to each illustration by a specific Figure Number.

Illustrations.

Photographs must be smooth or glossy "Solio" or "Velox" type of print.
Photo prints must be not less than Quarter-plate.
Do not send negatives.
Blue prints are useless.
Photographic views from catalogues are useless.
Line drawings, curves and diagrams must be in bold black lines on white paper or card: or ink tracings.
Line drawings, curves and diagrams must be at least twice the size they will be when published.
Thin lines, small spaces and small lettering on drawings will not do: they disappear when the drawing is reduced.
Lettering and Figures must be "printed" uniformly and of such size as will be legible when the drawing has been reproduced on the smaller scale.
Mark every photograph and drawing with the Figure Number in agreement with the reference to it in the manuscript, also mark all with the Author's Name and the Title of the Paper or Article.
Drawings must be arranged in compact form as if in an imaginary square: do not have individual lines, lettering or reference numbers straggling outside the imaginary enclosing square.
Check the accuracy of all curves and drawings particularly regarding references to letters and figures in the manuscript.
Never fold photos, tracings or drawings for Post: photos send flat, large tracings and drawings may be rolled.

CALLENDER CABLES.

Callender's Cable & Construction Co. Ltd., have enlarged their telephone arrangements at Hamilton House, including additional lines, and as a consequence, the telephone service have changed their number, which on and after November 24th, 1930, will be Central 5241.

"KLOSD" A.C. MOTORS.

The Ford Motor Co. have placed an order with Messrs. Crompton Parkinson Ltd. for 1460 "Klosd" a.c. motors This important order is believed to be the largest ever placed for standard motors of one type, and has been obtained in competition with all electric motor makers in this country. These motors will be delivered from the regular production schedule of the Crompton Parkinson factory at Guiseley.

Proceedings of the Association of Mining Electrical Engineers.

YORKSHIRE BRANCH.

The Yorkshire Branch held its first meeting of the Session in Barnsley on Saturday 11th October, 1930. There was a very good attendance of members and a long discussion took place on the question of Certification of the Mining Electrical Engineer.

Mr. C. C. Higgens having delivered his Presidential Address, Mr. Roslyn Holiday, Treasurer of the Association, proposed a very hearty vote of thanks to Mr. Higgens for his most able and interesting address. Mr. J. Stafford, President of the Doncaster Sub-Branch, seconded the proposal, which was carried unanimously.

Presidential Address.

C. C. HIGGENS.

It is an old custom to call upon the incoming chairman to deliver himself of an address. While this event was still far off I thought the idea rather a good one. It seemed so simple. There was once a meeting on the sea shore, and the Walrus, being in the chair, the author tells us:—

> The time has come the Walrus said,
> To talk of many things,
> Of Shoes and Ships and Sealing Wax,
> And Cabbages and Kings.

What could be simpler? But as the month of October approached and I started to get down to the "Shoes" and the "Ships"—I gradually came to the conclusion that this old custom was not exactly a good old custom: it appeared to have the savour of the human sacrifice to appease the gods.

One of the subjects which we ought to consider at any suitable opportunity is our Association. Sundry references in the technical press and more particularly in our own excellent journal, *The Mining Electrical Engineer*, have called attention to the importance of this year in the history of the A.M.E.E.

In 1908 there was a distinct rumbling—an uneasy movement—the electrical-cum-mining world was disturbed. Correspondence on the subject of the proposed association appeared in the press. In April 1909 a meeting was held at which it was decided to form an Association and this was followed on the 17th December 1909 by the birth of our Association at the inaugural meeting in Manchester. Its progress during the comparatively short period of twenty-one years has been highly creditable to the little band of enthusiasts who founded the Association and nursed it through the early, difficult years. Today we take the Association for granted. Our membership is close on two thousand. Our Branches and Sub-Branches cover England, Scotland and Wales, and no one would think of suggesting that we were not doing highly useful work, benefiting alike the mining electrical engineer and the industry which employs him. But, 21 years ago, with a membership of about 50, looked upon in many quarters as an utterly superfluous society, things were very different. The struggle for existence was a hard one and it is difficult properly to appreciate the faith, the doggedness, and the foresight which enabled the founders to pilot our Association through infancy and adolescence to this splendid maturity. Combined with their faith in the necessity for our Association must have been a remarkable foresight as to the progress which would be made in the electrification of our mines.

The remainder of this session will be devoted by the Branch to the consideration of present and possible future developments, so it will be worth while for a moment, to take a backward glance in order better to appreciate the progress made towards our goal—the complete electrification of the British Mining Industry.

Arc Lightning dynamos made by Gramme were exhibited at the Paris Exhibition in 1878: when that exhibition was opened the electric motor was unknown. It is said that at the exhibition one of the engines driving a Gramme machine in some way failed or that an attempt was made to shut it down without first disconnecting the dynamo from the live busbars, and to everybody's surprise the set continued to rotate. If the story is correct, then the year 1878 saw the birth of the electric motor, in the accidental motoring of a Gramme dynamo.

In this country Col. R. E. B. Crompton was one of the earliest electrical pioneers. He brought a pair of Gramme dynamos from Paris to England, formed the Crompton Company, and was soon manufacturing arc lamps and generators and carrying out electric light installations in this Country and on the Continent.

In 1881 experiments were being carried out with colliery lighting and shortly afterwards a 100 h.p. haulage motor was put down in South Wales. That may not have been the first motor installed in a colliery, but it must have been one of the first, and it does indicate that, in the very earliest days, the mining industry was ready to experiment with the newly discovered science which, well within the lifetime of a man, was destined completely to revolutionise, among others, the coal mining industry.

It is interesting to note in connection with the 100 h.p. haulage motor, that it is recorded its adoption displaced 27 horses and enabled the output to be increased by 100 tons a day. Whether it be in the 1880's or the 1930's, the intelligent application of electricity to industry has and will reduce costs and raise outputs.

The speaker has not come across any statistics which give definite information as to the extent to which electricity had been adopted in the collieries in 1909 when our Association was formed. In Mr. Horsley's reports will be found the horse-power of motors installed below ground back to 1912 only: but from those figures it is possible to estimate that in 1909 the total h.p. installed below ground in Great Britain could not have been more than about 180,000 and, incidentally, in 1910 there were 15 deaths directly due to electric shock below ground.

Coming to the present day, the latest figures for motors installed are for 1929, and the aggregate h.p. is:—

Below Ground	918,116
Above Ground	835,588
Total	1,753,704

Similarly, in 1929 nine deaths occurred directly attributable to electric shock below ground. It is not necessary to quote any more statistics, but it will be agreed that the figures mentioned are interesting in that they give some some idea, firstly, as to the development which has taken place in electrical engineering over a period of 50 years, and, secondly, how the application of electricity in mines has advanced during the life of our Association; in which progressive work the members of our Association have had no small share.

One of the avowed objects of our Association is the promotion of safety in the application of electricity in mines, and the figures just mentioned, of fatal shocks in 1910 and 1929, 15 and 9 respectively, are of interest. Despite the rapid growth of electrical apparatus installed, the total number of fatal accidents from shock underground has been constantly reduced year-by-year—the average over the last six years is 7, whereas from 1907 to 1912, the average, with merely a fraction of the present amount of plant installed, amounted to 11. Again it is only fair to claim that this creditable improvement has largely been due to the educational activities of our Association.

One is tempted, knowing the licence granted in presidential addresses—on the principle, presumably, that if you give the speaker enough rope he is sure to hang himself—to attempt to refer to the remarkable developments which have taken place in all branches of electrical science. It is a temptation which must be kept firmly in check. If we spend too long with the "Shoes and Ships," we shall never get to the "Cabbages and Kings."

Nevertheless, we do live in an extraordinary age. Within only a few short years wireless has become an everyday matter; international telephony is an accomplished fact, and potted sight and sound have become available, thanks to the electrical engineer, at nearly every cinema house in the country.

As regards our own industry, there are several noticeable tendencies. First of all there is the steady growing in favour of a.c. as compared with d.c. The easy transformation of pressure on a.c. circuits is, of course, a tremendous advantage—especially as loads grow and the only way to keep currents down to a reasonable figure is by raising pressure. In this connection it is noticeable that pressures taken underground have risen considerably in the last few years. In *The Mining Electrical Engineer* a few months ago was an interesting description of a South African mine in which energy is taken down the shaft cables at a pressure of 20,000 volts. This move towards higher pressure is perfectly sound, and provided the cable, switchgear and transformer manufacturers are able to supply apparatus which will stand up to underground conditions it is wise to utilise higher pressures in order to keep down the copper mains to a reasonable section and at the same time to improve the regulation of the underground system.

The tendency to raise stator voltages in a.c. motors is also a marked one. 3300 volts is now quite a common pressure to apply to haulage and pump motors and this certainly does make it possible to keep down distribution losses without loading the system up with too many transformers. Squirrel cage motors are also noticeably more popular, which is a good thing from the maintenance point of view. Manufacturers have helped in that direction by making the high torque type of machine, thus making it possible to adopt the squirrel cage machine for many duties which previously called for a slipring motor owing to the starting torque required.

Power factors are receiving far more attention today than they were a few years ago. The taking of outside supplies paid for on the k.v.a. demand basis, combined with financial stringency within the mining industry, no doubt account for much of the attention given to this important question. It is the exception today to find a colliery of any size in which synchronous motors, static condensers, or both are not employed to cut down that unwanted, expensive, wattless component inevitable with inductive loads. In this respect, it would appear that the mining industry is in advance of other industries and here again our Association undoubtedly deserves much of the credit for this satisfactory state of affairs.

Notwithstanding adverse criticisms, made usually by people who know nothing about our industry, and in spite of very real financial difficulties, the coal industry is today on a pretty high technical level. As a people we are inclined to self depreciation and after hearing so much from outsiders at times as to how badly our mines are worked it is interesting and reassuring to note figures comparing the output per manshift in the Ruhr mines and in the mines of Scotland. The former figure was 22.6 cwt. whereas the highest district average for the U.K. (Scotland) was 23.6 cwt. But notwithstanding the high technical efficiency and excellent organisation in evidence at many of our collieries, unfortunately it is an indisputable fact that our colliery industry is passing through an exceedingly difficult time. No end of remedies have been offered. Rationalisation—whatever that may mean—compulsory amalgamation, compulsory limitation of outputs, export subsidies, protection, safeguarding, shorter hours, longer hours—and as many more. Further, Parliament has come to the aid of the industry with a new Coal Mines Act, heartily approved by some, but not quite so enthusiastically acclaimed by others.

Whether any of these domestic remedies are likely to be beneficial it is hardly possible to say; but one thing is certain, and that is, if a solution to the problem has not yet been found it is not because of any lack of anxious thought on the part of those technical and financial experts who have the unenviable responsibility of the colliery industry upon their shoulders.

Unhappily, our coal industry is not the only one in difficulties. The heavier industries generally are up against that awkward problem—finding sufficient customers who will pay a sufficiently good price for their products. Subject as humanity is to letting fear dominate its thought, such conditions inevitably result in price cutting; and price cutting, if not checked, leads to industrial collapse.

It would be easy, though perhaps not very profitable, to point to various national and international causes of today's difficulties and to suggest remedies. However, that would be outside the province of this address to mining electrical engineers.

It is the job of the engineers to see that they are suitably equipped with knowledge and to apply this knowledge to such good effect that the best possible use is made in our pits of that tireless servant of man—electrical energy.

One dependable means towards securing the very necessary and somewhat specialised mental equipment—a very obvious aid—is our Association. Our Journal is a veritable text book, unique in its up-to-dateness and comprehensiveness, of mining electrical engineering. Every meeting and visit of the members is an invaluable opportunity for the interchange of ideas. It has been said of old time "It is more blessed to give

than to receive." That is the spirit in which we should regard our Association. It is of little use being just a "receiving" member. It is not what we can get out of the Association but what we can put into it that matters. Everyone of us has some kind of knowledge and experience not possessed by his fellows. We should make a point of contributing to discussions, whether our contribution be an observation, a criticism, or a question, all will help to unfold the subject under consideration—and we are giving something.

The writing of papers, even quite short and simple ones is another way in which we can give rather than receive and again, in this part of our duty to the Association, we find that in the giving we receive far more than we have given. Manufacturers' representatives have read before our Branch many splendid papers but our colliery members would get greater benefit if they volunteered more papers themselves and left the manufacturing people to join in the discussions.

Remembering the quotation which served as an excuse for these meandering remarks—the speaker would, in conclusion, urge the members of the Association to make this twenty-first birthday year a record one. From small beginnings the A.M.E.E. has grown steadily in numbers and importance. All ought to be proud of the privilege of membership and make a point of attending every possible meeting. If any member has a friend who ought to be a member and isn't, bring him along, make him join. Would one and all make a great effort to shew the rest of the Association what the Yorkshire Branches can do when they really set themselves whole heartedly into a job.

WESTERN DISTRICT SUB-BRANCH.

At the General Meeting of this Branch held in Swansea, on 11th October, 1930, nine new members were elected.

Mr. S. T. RICHARDS, the retiring Chairman, introduced Mr. W. M. Thomas as Chairman for the present session, and said Mr. Thomas was a pillar of strength and a very keen worker in the interests of the Association. Primarily concerned with the mining side, they all knew that Mr. Thomas kept a close personal interest in the affairs of electrical engineers and of the staff, especially at his own collieries, and it was a great credit to him that he has created such an interest amongst his staff regarding the welfare of this Association. He had persuaded members of his staff to study for the examinations, and some of them had been very successful. He thought the Branch might congratulate itself on its choice of Chairman, as undoubtedly the election of Mr. W. M. Thomas would do honour to the Branch, and in his year of office this Sub-Branch would endeavour to do honour to Mr. Thomas. He wished him every success during his Chairmanship.

Mr. W. M. THOMAS then took the chair, and said it was an honour to do so. In taking up his duties he wished to acknowledge the work of his predecessors who had made his task comparatively easy by their organised efforts. Not the least among them was their last year's Chairman, Mr. Richards, who, as they all knew, was one of the leading mining electrical engineers in West Wales. Mr. Richards has done a great deal of valuable work for the mining electrician, and had contributed some valuable papers to the Association. He was held in high esteem and his services as Chairman of the Western Sub-Branch had enhanced its reputation. He proposed a hearty vote of thanks to Mr. Richards for his work during the last year.

Mr. COPE seconded the vote of thanks. He did so with great and real pleasure and, as a mining member of the Sub-Branch, appreciated the fact that they had been very fortunate in their last year's Chairman, and the able manner in which he had carried out his duties.

Mr. W. M. Thomas than delivered his inaugural address as follows

Chairman's Address.

Scientific Control and Efficiency in Mining Operations.

W. M. THOMAS, A.R.S.M.

Modern mining practice demands scientific control and a high degree of efficiency in all departments to obtain the best returns for employer and employee. A mining undertaking is viewed generally from one aspect only—either the workman's or the employer's—with the net result that the two forces which go to make the whole are frequently in opposition. In these remarks it is proposed to review, very briefly, some of the problems which must be faced in the scientific control and efficient working of a mining property.

Before setting out to develop a mining concession, it is fundamentally necessary to have a complete report, by an engineer or engineers of repute, of the mineral area: its extent, the seams or deposits that are workable, depth from the surface, nature of adjacent strata, dip of seam or mineral deposits, faults, and other geological features, the location of the property to railways, proximity of water supply, and many of the other surface details embodied in a report. When all these factors are set out, the value of the mineral taken, its cost of working computed, and a contemplated output fixed, then and then only can a prospectus be drafted for capital to develop the taking.

It is very necessary to emphasise these points because occasionally one finds the assets of a company wholly above ground, the seams or other mineral deposit unworkable, and the public who have subscribed to finance the undertaking hoodwinked.

In every mining undertaking that is operating, there are at least four important sections to which scientific control is applied :—

1. Head office organisation, including sales department and clerical staff.
2. Engineering section, mechanical and electrical.
3. Mining section.
4. Labour problem.

HEAD OFFICE ORGANISATION.

This incorporates the clerical staff and is for the most part outside the purview of the engineer whose interest is mainly in the last named sections, viz. :—

ENGINEERING, MINING, AND LABOUR.

ENGINEERING SECTION.

One of the basic problems of the engineer is the provision of cheap power and plenty of it, and cheap steam or other motive force is a fundamental. From a

mechanical standpoint the operating of a modern boiler plant is dependent on the scientific control of the many variables which affect the efficiency of the unit and the cheapness of the steam.

On the one hand the colliery manager looks upon the percentage of boiler coal consumed, its monetary value and the cost expressed per ton of colliery output. The engineer is more concerned about the evaporation in lbs. of water per lb. of fuel and the cost of evaporation per 1000 gallons of water.

This last named—the cost of evaporation—is the figure which jointly interests the colliery manager and the engineer and which is the critical figure of the boiler plant.

Steam and Fuel Records.

A careful tabulation of these items month by month will give absolute figures for purposes of comparison. In this way unseen troubles which influence evaporation can be diagnosed and considerable economy effected by systematised control.

One outstanding recommendation to colliery engineers from the study of these figures is, that all low grade fuel should be used on colliery boilers which are specially designed for burning such fuel. Occasionally one finds washed peas and other valuable coals used on colliery boiler plants where other lower grades should be used.

The boiler coal cost can reach a stupendous figure in the course of a year and unless cheap steam is generated all other units are adversely affected.

Transmission and radiation losses on steam plants are so self evident that they are often neglected. Frequent periodic examination and testing with a record of the results is the only way to point out losses in this direction.

In reference to peak loads on boiler plants the accumulator system is now an established fact.

All engines operating from the steam mains should have a complete record of performance and steam consumption, preferably in the graphical form, indicator diagrams from time to time, and an account of cost of upkeep and repairs in the Record Book of that engine. It is only by control of this kind that the various units can be worked at their most economical figures and so add, in the aggregate, to the efficiency of the mine in general.

Compressed Air.

Compressed air has a very wide application in the mines of this country; periodic testing of compressed air lines on a "time-pressure-fall" basis and the consumption of the various machines in use give the engineer a fair indication of the condition of the pipe lines and the performance of the units in relation to the power absorbed as obtained from the steam or electric energy used in driving the compressor. A careful tabulation of compressed air data helps to check wastage; compressed air leakages are not always inconvenient, but they are certainly extravagant, and it is surprising the amount of money that is dissipated into the atmosphere in this way.

Electricity.

Cheap electricity is of paramount importance in mining practice. To-day, colliery power stations generate at a cheaper rate than we are likely to get from public supply stations. Obviously there is one great advantage at the colliery—the cheapest and low grade fuels are available on the spot, no transport charges except by conveyor from the screening plant, and very often wagon hire is eliminated. Hence cheaper steam can be supplied and finally the cost per unit is less than at stations where the fuel has to be transported, sometimes to considerable distances from the collieries.

In tabulating generating costs, the fixed and variable charges should include at least the following—

Interest and Depreciation, Rates and Taxes:	Fixed charges.
Fuel, Labour, Stores, Home consumption (condenser, &c.)	Variable charges.

These, when recorded daily, weekly, and monthly, as the case may be, give the engineer a summarised form of the performance of the plant. In addition to this information, the computed steam and coal consumption per k.w.h. should be tabulated.

Regulation of Loads.

The Load Factor on a generating station is intimately connected with the cost of generating. In this respect haulage units are very unfavourable; a careful investigation should be carried out to see if gradients can be reduced, speeds adjusted, and the removal of any other causes which affect adversely peak loads. A graphical time-load diagram of each haulage and other units will reveal possible economies in levelling out peaks.

Systematic Testing.

Apart from the fact that periodical testing is compulsory under the provisions of the Coal Mines Act and Regulations, it is very necessary that tests of electrical apparatus be conducted for the prevention of breakdowns and the efficient working of the plant.

The tests should include :—

- Insulation to earth.
- Continuity of earth conductors.
- Measurement of air gaps between rotors and stators.
- Examination of motor bearings.
- Testing of signalling systems for circuit resistance and insulation to earth.
- Testing and examination of minor electrical apparatus—such as shot firing exploders, re-lighting apparatus, telephone systems, &c.

It is in the maintenance of electrical apparatus, particularly minor electrical apparatus that systematic control proves most valuable: as an example, the weekly systematic testing of shot firing exploders has resulted in a reduction of misfired shots and complaints from shotmen are now negligible.

All testing of apparatus must be accompanied by complete records which, when tabulated from time to time, give a history of the particular machine or apparatus and a very fair idea of its condition. Faults and impending troubles are accordingly diagnosed before hand, and all this information provides the electrical engineer with a key to control the reliability and efficient working of the plant.

MINING SECTION.

On the mining side, scientific control is to-day indispensable. To the survey department is allocated the work of planning the surface features and underground workings; careful recording of boundaries, properties, contours, layout of workings, the records and the correlation of seams, computation of reserves, and all geological features relating to the deposit are undertaken by this department. By systematically recording all this information it is possible to set out schemes to the best advantage for the development and economic working of the area.

The method of working the seam, whilst related to the scheme as set out by the survey department, is of vital importance in the winning of coal, the aim being to get the utmost amount of "large" or "round" coal at the minimum cost with the maximum safety.

Cost of Seam-Working.

The cost in working a seam is divided into collier cost, daywage cost, and cost of materials and power. The collier cost is further subdivided into coal getting, timbering and dead-work; the best results are obtained when the output per collier shift is the maximum and the items of timbering and dead-work are the minima. So also in regard to daywage this item must be as low as practicable per ton of output.

In the materials' cost, the general adoption of steel arches and other semi-permanent and permanent supports, steel sleepers, &c., will eventually result in considerable economy, giving as they do comparative freedom from falls, safe roadways, better ventilation and conditions suited for regular outputs.

Ventilation.

Closely allied to the method of working a colliery is the ventilation; the limitations set down by the C.M.A. and Regulations make it imperative to record periodically ascertainments of quantities and pressures, and many concerns also take frequent analyses of the atmosphere from different parts of the mine. It is only by careful enquiry into the itemised details that a regular quantity can be obtained and a correct distribution made.

Leakages, as every mining man knows, are responsible for enormous losses in pressure and quantity between the main intake and the workings, and it is amazing what small proportion of the whole gets to the coal face. Methods of investigation and control are detailed by Mr. D. Farr Davies, Major David and Mr. A. L. Davies, in their papers before the South Wales Institute of Engineers.

Graphical interpretation of these figures gives the engineer an indication of the tendency of the ventilation in any particular district or colliery. For example, the exact condition and tendency of an area liable to spontaneous combustion is revealed in the graphical record of periodic analyses and the ratios of CO and CO_2 produced; this is true even though the area be sealed off.

Haulage.

The haulage problem of modern collieries is a big one, first in the lay-out and secondly in the cost of installation and upkeep. The present is a time for the development of mechanical haulage.

A careful record should be made of the performance of each haulage, time involved in continuous operation, period and number of stops, and the load on the machine.

A graphical time-load record often suggests a number of operations that can be conveniently cut out to improve the efficiency and performance of the unit.

Scheduled rope costs in £ s. d., and per ton, should be graphed for every haulage.

Horse haulage is extremely expensive where gradients are heavy and the distance hauled exceeds 200 yards.

Treatment of Coals.

The method of working deals with the production of the maximum proportion of large coal, the screening and washing operations are concerned with the effective sizing and cleaning of that coal and delivering it with the minimum breakage into wagon.

The larger sizes, 3 ins. and over, are classified and hand picked on the screening belts; from 3 ins. to ½ in. is generally treated in washing plants and finally re-sized over shaker screens and in trommels.

The general tendency is for all coals to be sold by analyses and modern plants and concerns take periodic samples of the various sized coals; the sales department is consequently in possession of the exact percentage of impurities in the coals and can guarantee the customer within certain limits of the average ash content.

A chart of these periodic analyses is a true record for each grade produced and for this purpose a fair average sample must be taken of each grade.

It must not be forgotten that the proportion of coal in the hutch product, i.e., the refuse, is also a criterion of the loss and this refuse must be sampled from time to time.

Flow diagrams of treatment plants, apart from the permanence of record, when put side by side, often lead to suggested simplification of processes.

To-day, a very important problem is the settling of effluent from washeries and the treatment of the finer sizes. The Lessing process in which a solution of Calcium Chloride is used as a separating medium, is a modern example of progress in this direction.

Safety First, Accidents, and Ambulance Organisation.

Directly concerned with the efficiency of a mine is the care to avoid accidents and provision for first aid treatment when accidents happen. All accidents should be discussed monthly and suggestions put forward and agreed upon to prevent similar accidents in the future. An investigation of this kind has an improved effect on the incidence of accidents and certain safety devices and precautionary measures are often the outcome of such discussions.

The provision of ambulance requisites is compulsory under the Regulations of the Coal Mines Act. The proper treatment of injuries and the care of the patient together with the adoption of safety devices has a direct influence on the morale of the men and the cost of accidents.

THE LABOUR PROBLEM.

The Labour factor has always been much to the fore in mines and it is still a source of difficulty. The Principles of Scientific Management as enunciated by Taylor is the development of true science relating to this problem.

In dealing with it there should be a dual objective, viz.: prosperity both for the Employer and the Employee.

In management by initiative and incentive the success is dependent entirely on the workman, i.e., the initiative embraces all the good qualities in the men and the incentive is increase of pay. This is only one side of the problem.

When the labour operations are scientifically controlled the prosperity of the firm (which is made up of Employer and Employee) is a matter for the management, and it is up to the management to achieve fulfilment.

Mr. Taylor, in the work referred to, has given examples from steel works, machine shop practice, bricklaying and so on, to prove that by organised effort to deal with the problem in a scientific manner the output per man has doubled, trebled, and in some cases increased to an even greater degree, with less fatigue, more pay to the worker, and finally a better co-operative spirit between the management and the man.

The principles enunciated by Taylor are:—

a. Substitution of science for individual judgment of the workman.

The adaptation of a scientific method of performing a task involves much less fatigue to the worker than the older methods of rule and thumb or of tradition. The net result is an increase of output by the workman, better wages and a more satisfactory return for the employer.

b. Scientific selection and development of the workman.

The choice of the right man for a job and his proper training is obviously a correct thing to do. Physique, personality, mentality and all other qualities need to be reviewed in the selecting of a particular workman.

c. Intimate co-operation of management and workman.

This is one of the great difficulties in mining life. A prominent stumbling-block which interferes with that spirit of co-operation is a strike. If that spirit of co-operation is to be engendered then strikes must be abolished either by agreement or by Law.

One writer has put it that men strike because they instinctively dislike to be bossed and that strikes are caused because men are adversely affected by real or apparent mistakes.

Oftentimes, when a strike is settled, the grievance remains and the gap between employer and employee becomes still wider.

Our coalfields will prosper when strikes are abolished and a scientific control of labour established, for this will surely bring about a true spirit of co-operation between management and men.

THE CHAIRMAN, in regard to the presentation to Mr. E. D. C. Owens, referred to the splendid work done by Mr. Owens during the three years he was their Secretary. He had given very freely of his time and energy to the advancement of the Swansea Branch. The work of a secretary involved a great deal of hard labour, and the increase in membership spoke for itself as to the work Mr. Owens had done. It was with very great regret that they had to accept his resignation, and it was to be hoped that Mr. Owens would still be able to share in the activities of the Branch. He called upon Sir Arthur Whitten Brown, president elect of the South Wales Branch of the Association, to make a presentation to Mr. Owens as a token of their esteem.

Sir ARTHUR WHITTEN BROWN, thanked the Chairman for allowing him to make the presentation to Mr. Owens. He congratulated Mr. Thomas upon occupying the Chair, saying that in his inaugural address he had put before them ideals of management that were certainly to be aimed at. With regard to his references to Mr. Taylor, that great engineer, it was said of him that while being borne to his grave by six men, he suddenly sat up in his coffin and said if they would only get rollers to work, five of the men could chase after other jobs.

Referring to Mr. Owens, Sir Arthur said it was a great pleasure to make this presentation to him, especially as it was through his suggestion that Mr. Owens first took up the Secretaryship. When Mr. Owens became the Secretary, he and Sir Arthur were, as he expressed it, friendly rivals. Since then they had become members of the same camp, working together to assist in the attaining of the ideal looked forward to, viz., the total electrification of the South Wales mines.

He then presented to Mr. Owens a Cigarette case suitably inscribed. Cigarettes, and an old English pewter tray.

Mr. OWENS thanked the members very much for the valuable presents which he would always treasure. He said that during his term of office as Secretary he had always received every assistance from all the members, both of the Sub-Branch and from the South Wales Branch at Cardiff, and it had made his job all the easier. He was pleased to see Mr. Stretton there; he had always given Mr. Owens a helping hand. He referred to his successor, and said that in Mr. Stanaway they had a keen and energetic Secretary who would do all in his power to further the interests of the Sub-Branch. As the chief reason for his resignation had now been removed, Mr. Owens said he hoped to be able to give more time for the benefit of the Sub-Branch.

Mr. C. E. YATES proposed a vote of thanks to Sir Arthur Whitten Brown for making the presentation to Mr. Owens, and said they were all grateful to Sir Arthur for the great assistance he had rendered to the Sub-Branch.

Mr. TANNER seconded the vote of thanks.

Mr. ISAACS then proposed a vote of thanks to Mr. W. M. Thomas for his admirable address. He told them at the beginning that it was controversial, and he had set before them a high ideal which would be very difficult to attain.

Mr. STRETTON said he wished to associate himself with the vote of thanks to Mr. Thomas for his excellent address. As a Past President of the Association he said this address was worthy of being a Presidential Address. He had never heard the salient facts of colliery management better expressed, and he thanked the speaker for the address.

Mr. W. M. THOMAS, responding to the vote of thanks, said his great difficulty had been to leave out detail. The subject was one to which they must all set their minds, in the reorganisation of the industry. When he heard many labour leaders and others talking about reorganisation of the coal trade, he often felt that they did not know what they were talking about. It was only when they got up against the hard facts and put them together, that they realised what scientific control meant to the industry. He saw great success yet for the British Coal Fields when they came to adopt proper methods of control in production and distribution.

DONCASTER SUB-BRANCH.

Visit to the Metropolitan-Vickers Works, Manchester.

Thirty-three members of the Doncaster Sub-Branch were entertained at the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd., on September 29th last. On arrival at the works the visitors were cordially welcomed by Mr. A. E. du Pasquier, the Publicity Manager of Messrs. Metropolitan-Vickers, and Mr. R. G. MacLaverty, the Company's Sheffield manager.

The first works' section explored was that devoted to the lighter types of switchgear, both open type and enclosed truck type. One heavy duty open type, oil-break switch without the tank was of particular interest; the accessibility for changing both primary and sparking contacts being a feature which was noted with satisfaction in view of past experiences of such operations under very trying conditions.

Next the construction of pedestal type mining switchgear was inspected. The visitors were given to understand that this gear has been built up on a foundation of actual experiences of colliery electrical engineers; it certainly appealed as both practical and sound; it was interesting to note how Messrs. Metropolitan-Vickers have met the suggestion of H. M. Electrical Inspector of Mines regarding Earthing via the Oil-Breaker Switch. Some of the devices on the market for this purpose are cumbersome and complicated for the conditions under which they have to be applied; the Metropolitan-Vickers' arrangement provides a simple and efficient means by which to carry out the suggestion for safer working in connection with high pressure apparatus.

In connection with the manufacture of controller gear, considerable interest was evinced in a very ingenious type of haulage controller for fool-proof working. The guide was very thorough in his description of this apparatus and many members will look forward to seeing it under actual working conditions in the mine.

Motor starters, built on mass production lines, claimed attention; here were seen starters continually on the move being gradually built up *en route* and finally examined in detail and tested. Many mining electrical men are still rather sceptical regarding mass produced articles; an examination of the starters in question would remove any remaining doubts as to the high degree of product gained in this instance.

Inspection of one of the motor test bays shewed how everything seemed to travel onwards in the wonderful sequence of operations characteristic of expert organisation. The overspeed test house specially built for testing out high speed machinery next claimed attention: here a fracture at excessive speed can do little harm other than to the machine itself; it is interesting, however, to note that only once during the testing of hundreds of high speed machines has this house been called upon to retain the shattered fragments due to fracture.

At this stage a halt was called for lunch, kindly provided by the Company. This pleasant and important function was not permitted to occupy too much time, Mr. du Pasquier being anxious to give the visitors as complete a works' tour as possible.

In the huge machine erection shop were seen turbo alternator sets, from 500 k.w. up to 70,000 k.w. capacity, in their various stages of assembly; and one immediate impression here was the use made of fabricated housings instead of cast iron. This innovation is giving every satisfaction in the construction even of the largest machine; the method equals, or even surpasses, cast iron as regards neatness, and it scores heavily in the question of weight. One self-contained turbo alternator set of 750 k.w. capacity was extremely interesting from the colliery engineer's point of view, being a complete unit on a common shaft it called for little in the way of special foundations; this, coupled with its compact construction and neat appearance, made quite an impression on more than one who had been previosly troubled with the accommodation and foundation bogey of the turbo sets.

Passing onward through this shop were noted machines bearing the names of towns in the British Isles, the Colonies, and many foreign countries; some of the large machines in parts being ready loaded on trucks and ready for shipment.

In the heavy switchgear erecting shop many and varied types of compound filled gear were available for inspection; noticeable particularly were some of the 132,000 volt switches under construction for use in connection with the "Grid". In the transformer assembling shop various works were in progress in the building of transformers, from those of the tiny instrument type to giants of 75,000 k.v.a. capacity. Particular notice was given to tapping change switches for operation on no load and a more elaborate type, which is yet ingenious and simple in operation, with the transformer on load. Another feature of interest was the form of cooling tubes; these tubes are built up from light gauge material of oval formation with protruding welded seams thus forming extra external cooling surfaces.

The tour was rounded off by a demonstration in the high pressure test laboratory. Various striking experiments at pressures nearing the seven figure scale being effectively displayed.

The members wish to record their thanks to the Directors and Management of Messrs. The Metropolitan-Vickers Electrical Co., Ltd., and especially to Mr. du Pasquier, Mr. MacLaverty, and their colleagues for spending time and trouble so freely and kindly on their behalf.

The Doncaster Sub-Branch at the Metropolitan-Vickers Works.

WEST OF SCOTLAND BRANCH.

The West of Scotland Branch held the opening meeting of the new session in the Royal Technical College, Glasgow, on 15th October last. There was a large attendance of members and, after the minutes of the previous meeting had been read and adopted, the following applications for membership, which had been approved by Council, were unanimously passed: Hamilton McAndrew, 43 Queen Street, Glasgow, S.W. 1; Alex. Lightbody, 6 Letham Terrace, Letham, Falkirk; Archd. Connell, "Underhill," Cochrane Street, Strathaven, Lanarkshire; Robert Lamb Cribbes, 229 St. Vincent Street, Glasgow; George T. R. Coughtrie, 67 Mavisbank Gardens, Bellshill; John Coughtrie, 624 Tollcross Road, Glasgow; Thomas Coughtrie, 67 Mavisbank Gardens, Bellshill; Andrew Haig Harle, A.E.I. House, 74 Waterloo Street, Glasgow; John McDonald, 45 Afton Place, Broad Street, Denny, Stirlingshire; and James Stevenson Scott, 26 Hill Road, Dykehead, Shotts, Lanarkshire.

Thereafter Mr. R. D. Rogerson, M.E., A.M.I.E.E., M.Inst.C.E., Branch President, delivered his Presidential Address.

At the conclusion of the Address, Mr. H. A. McGuffie, a Past President of the Branch, moved a vote of thanks to Mr. Rogerson, which was heartily endorsed by those present.

Presidential Address.

R. D. ROGERSON.

Having thanked the members for the honour of electing him to the office of President, Mr. Rogerson said he had found some difficulty in the selection of a subject for his Address. The various subjects of interest to mining electrical engineers had been so well discussed by many able men who had preceded him in that office, that repetition to some extent appeared unavoidable.

At the risk of departing somewhat from the usual lines of an address of this character, he proposed to review briefly some of the problems confronting engineers in the coal trade today:

Intensive Machine Mining Practice.

Where intensive machine mining practice is being successfully applied, the largest possible output is obtained from the shortest possible length of working face by means of coalcutters, conveying machinery, and efficiently organised transport. This phase in modern mining practice is now beyond the experimental stage. Its adoption has become a positive economic necessity. The universal desire for this phase in mining practice has not been brought about simply by the ordinary laws of progress. The economic pressure of present day mining, together with the knowledge of lost export markets, to which we largely depend, has forced our mining engineers to seek new avenues wherein the rehabilitation of the industry may be found.

Mining Engineers have of late been the butt of many accusations as to the inefficient organisation of the industry. It is only natural, therefore, that they should endeavour to repel those attacks and ask themselves whether or not there are some grounds for the misrepresentations to which they have been subjected. The comparatively slow progress of mechanical mining in many pits today is not always due to a lack of initiative or to the want of economic circumstance. Full allowance must be made for geological and other conditions prevailing. In many seams machine mining practice is made difficult owing to their high inclinations and to dislocations in the strata. In addition, a restraining influence in the adoption of those labour-saving appliances is occasioned in many instances by the life of the seams or the colliery. When conditions permit, and the outlay in plant necessary is consistent with the life of a colliery, it is seldom that the application of intensive machine mining practice is long delayed.

In the successful application of intensive machine mining practice, the duties of the electrical engineer have become more onerous. In no small degree does the economic success of the organisation depend on the efficient application of his industry. Portable electrical plant which, incidentally, is the most difficult to maintain in safe working order, has to be moved daily. Flexible trailing cables, subjected to all sorts of mining abuse, have to be preserved in safe condition. Earthing continuity, from all points of application to the surface earth plates, have to be sustained; and in the maintenance of many units of electrical gear, access to them for repairs is difficult except at the week-ends or during idle periods.

One of the most important functions in the application of mining machinery is maintenance. A short delay in any cycle of operations has a very adverse effect on the organisation as a whole. With the maximum number of workmen concentrated on the minimum length of face, any delays on the cutting or conveying units have a disastrous effect on the manshift output of the section.. When the most efficient method of mining and conveying the coal has been evolved, intensive machine mining practice resolves itself chiefly into a question of machinery maintenance. To the electrical engineer, the problem of preserving his equipment in reliable and safe working order is no sinecure.

In the application of intensive machine mining practice, organisation must begin on the surface. Adequate and efficient screening plant must be provided for the proper sizing and cleaning of the coal. Shaft winding capacities must be sufficient to handle the outputs easily. The size of tubs introduced may, to some extent, prejudice the extent of machinery application at the coal face. The installation of efficient transport units subsidised with large haulage roadways systematically supported with circle girders are matters which are part and parcel of efficient organisation throughout. The penalty for lack of synchronism in the complete cycle of coal produce means a sacrifice of the benefits connected with the acceleration of any individual process.

Electricity Supply.

In the application of machinery underground, a supply of cheap power is of paramount importance. It does not always fall to the lot of the colliery electrician to have the selection of his system or source of supply. He is, nevertheless, always in a position to suggest improvements and alterations whereby the cost of energy per ton of coal raised can be diminished. When a colliery is developed to its desired tonnage, a standstill attitude towards electrical equipment inevitably leads to an increased cost for electricity per ton of coal raised. The workings are always extending with longer lines of energy transmission. Longer and more numerous transport systems arise, increased quantities of water may require to be handled, auxiliary ventilation machinery

is evolved, and the problem of increased electrical unit consumption per ton of coal raised subsequently follows. If the electrician is in the happy position of installing his own plant, say at a new colliery, he invariably selects and instals the best equipment. In collaboration with the manager and mining engineer, he ascertains the probable outputs, the extent and proposed method of working, together with the water growths likely to be met with. From these approximate data he is enabled to build up his plant on sound economic lines, and under such conditions the ultimate supervisory duties are usually of a more agreeable nature.

When the reorganisation or scrapping of existing electrical plant becomes inevitable, a great deal of foresight is necessary, and considerable industry requires to be expended before the change-over can be made.

In considering the question of the source of supply, many points requires consideration. In the case of a new colliery, and one which is in convenient proximity to others belonging to the same company, the question of private supply from a central generating station arises. Under these conditions minimum costs per unit can often be obtained at the pitbank. The source of supply at the collieries may, however, have some bearing on a decision. Again, it is often propounded that the finances required for this scheme would be better employed underground in the development of the mineral resources. When the question of public power supply receives favourable consideration for new collieries, it usually does so on the understanding that the colliery, above and below ground, will be worked exclusively by electrical power, as a better load factor can then be usually obtained. The chief consideration in utilising public power supply efficiently is in obtaining a high load factor and high power factor. The installation of power factor correcting apparatus can deal efficiently with the power factor problem. In dealing with load factor, the proposition is more difficult. As this is one of the most fruitful sources in diminishing overall unit charges in public supply, it requires some foresight and consideration in mining layout. In the securing of a high load factor it is necessary to lay out the workings so that there is some flexibility in choice as to when some of the various loads can be applied. Instance the case of electrically operated pumps where the lodgment capacity for holding the water is limited to short periods of standage. Under these conditions pumps may require to work intermittently on all shifts during the 24 hours, and no selectivity as to periods of load is possible. Where standage is provided, it may be possible to eliminate this load from the peak load shift. The reduction in maximum demand would then shew a corresponding increase in load factor, with a subsequent reduction in overall cost per unit of energy used.

In considering collieries using public supply and producing load factors over 60%, it is doubtful if much saving can be shewn by private plant outlay, unless over very long periods. Initial outlay, capital depreciation, maintenance charges, and the probability of a very low load factor on generating plant installed, does not, under every circumstance, constitute an irreproachable field for private plant installation.

One of the chief claims to private supply is the amount of low-grade fuel usually available at the colliery, which could be utilised in the production of cheap power at the colliery. This aspect of the case, the speaker would submit, is one which should be thoroughly investigated. It it self-evident to the mining engineer that the quantities of gum produced in proportion to other marketable fuels are likely to increase owing to the ever extending use of conveyors and coal handling plant at the coal face. Take for example the Scottish coalfield. It is estimated that there is a stock of approximately half-a-million tons of washed gum lying in the colliery sidings at the present time. The average value is about 4s. per ton.

It appears that about 26 million tons of low-grade fuels are produced every year, of which the collieries already use (for steam-raising purposes) about 15 to 16 million tons. The remaining 10 million tons are sold often at extremely low prices. This is probably due to railway freights being as high for low-grade as for ordinary marketable fuels. If it were possible to find some more remunerative use for this 10 million tons, the coal industry as a whole would benefit. If these low-grade fuels could be utilised in the production of cheap power at or near the pithead for delivery into the consumer mains, the earning capacity of the collieries might be considerably increased. Unless, however, this fuel is consumed on the pitbank vicinity, transport rates make its value of less importance. Many pits, however, are so small that they obviously could not generate electricity for sale on economic lines. The capacity of the plant installed at most collieries is little in excess of their dayshift requirements during the periods of full load. The disposal of any surplus power during light load periods is subject to synchronism of the available load with that of surplus supply. This, however, is not usually the case. If collieries are to supply current to power company's mains at such periods as to relieve large power stations of some portion of their peak load, considerable additional plant would require to be installed. The solution of the problem is difficult and is one in which a great deal of controversy exists

In considering the reorganisation of supply for old collieries, the changes most numerous are usually underground. In changes from d.c. to a.c., the surface alterations may only constitute the installation of a motor generator or rotary converter. The changing of motors, switchgear, and cables underground is usually of more serious dimensions, necessitating, as it does, the effective working of the colliery during the process of alternation.

In whatever system is evolved, changed, or reconditioned, it requires close co-operation between the officials in matters of detail to achieve the benefits of meditation and foresight.

In considering the question of an economic supply of electricity, it must be remembered that power and maintenance charges may constitute 15% to 20% of the total costs of production. Many collieries to-day consume 20 to 30 units per ton of coal raised. Naturally, one must conceive the value of a cheap unit supply delivered on the switchboard, economically transmitted underground and effectively utilised at the point of application in the winning of the coal.

The cost of electricity per ton of coal raised is no direct guide as to its economic use. One of the most valuable and contributory sources in efficient electrical operation is the load factor obtained, whether it be derived from public or private supply. A high load factor indicates that the selectivity of load application is efficiently organised.

The selection of cables and their installation in the shaft and underground roadways is also one of the problems involved in economic operation. Cables unsuitable or insufficient in capacity may involve losses far in excess of the first cost of suitable and adequately sized plant.

When the question of voltage-drop arises, it may become a very serious defect if not attended to. Delays occur in operating plant with consequent loss in output. Heating of the cables may take place with centralisation of the conductors and their ultimate unreliability. Burn-outs in stators operating on currents far in excess of their normal ratings, are some of the factors which contribute to high electricity charges, and subsequent increases in costs of production.

It is not always advisable to instal the ultimate requirements in cable capacity when workings are being developed. Maximum cable capacities, as frequently required on main roads, do not permit of their being installed as one cable. As the load increases, cables of equal capacity may be run in parallel along the main road. High voltage transmission with step-down transformers in-bye can be installed, but this procedure is usually only adopted after the workings have traversed a reasonable distance from the shaft bottom.

In putting in cables on main roads, if at first the maximum capacity is not installed, the process of replacement, or of raising the cable capacity should commence before the effects of voltage-drop becomes too apparent. The damage caused to cables and also to motors owing to their current-carrying capacity being overtaxed may result in future trouble, even after the cause of voltage-drop has been removed. The process of replacement should be carried out in phase with the total coal face extensions and load and should not be delayed after the workings or load have reached a predetermined point.

The question of purchasing long lengths of large capacity cable for main road replacements, from a financial viewpoint, is usually a serious one. In view of this, it is often advisable to instal in stages as the workings advance, as the cost of purchasing is then a more gradual process.

In putting in shaft cables, two cables connected in parallel on the ring main principle are often installed. Should one cable fail, the other will be available for supplying pumps or auxiliary ventilating machinery underground until repairs are carried out on the faulty cable. The advantage of this arrangehas only to be experienced to be appreciated. If gas is freely given off in the workings, or if standage for water is limited, the loss of current for a few hours may create a great deal of inconvenience.

The installation of switchgear underground is a very important phase in the duties of an electrician. Gear installed of a suitable type and of adequate capacity, when properly housed, will seldom require more attention than a periodical renewal of fuses or contacts and a coating of preservative to preevnt corrosion setting in. The proper housing of gear is of pre-eminent importance. A runaway tub or fall of ground may involve the scrapping of gear which was formerly reliable and of a suitable type. When installing gear, consideration should be given to the arranging of facilities for cutting off individual units without in any way affecting the operating of others. In long uninterrupted transmission lines, isolating switches should be installed at predetermined points on the roadway, as it facilitates examination and testing of the cable when faults arise.

The selection of motors for underground work depends to some extent on the nature and periods of load. Reliability in operation is perhaps of greater importance than efficiency in design. The loss in output arising from an operating delay may be far in excess of the cost of the motor itself. Standardisation of capacities is of some importance within reasonable limits.

The Status of Colliery Electricians and Compulsory Certification.

The duties of colliery electricians within the past few years have become more exacting. For the colliery manager and mining engineer, the need for certification was introduced chiefly as a guarantee to the recipient's qualifications for the safe execution of his duties. From the viewpoint of safety alone, similar recognition on the part of the colliery electrician is now due. No standard of electrical qualification has yet been laid down, and under existing regulations an Electrician is more of a Specialist than a general Official. So far as the law is concerned, his duty would seem to be limited to finding out troubles that exist and reporting them to the Manager. Needless to say, this is not what happens in practice, but, even so, it is not well that law and practice should be based on principles which are at variance.

The colliery electrical engineer, in his own sphere, is in much the same position in relation to his assisatnts as the Agent of a group of collieries is in relation to his Managers. Like the Agent, he has no defined statutory duties, but unlike the Agent, he has no statutory responsibility for the safety matters with which he concerns himself, and for which in practice he is ultimately responsible. The present position of the average colliery electrical engineer is inconsistent with the principles of general control of the mine. Modern conditions and requirements demand that the manager shall have an intelligent and even fairly intimate knowledge of the general principles of electrical engineering, but only in exceptional cases does he possess that familiarity with detail which is requisite to maintain the installation to the best advantage. Even if he has the knowledge, he certainly cannot have the time, and in practice, the colliery manager is very much in the hands of the electrician in technical matters which affect the correct installation, subsequent use and maintenance of plant.

A Committee of Inquiry, which was appointed some time ago by the Mines Department to inquire into the Qualifications and Recruitment of Officials of Mines under the Coal Mines Act, have submitted their report recommending that the duties of Colliery Electrical and Mechanical Engineers, immediately responsible for the safe installation and maintenance of electrical and mechanical plant, should be fully and clearly defined and made statutory. Should the Mines Department accept, as is likely, the recommendations of this Committee, alterations in existing regulations as to organisation and practice would require to be made. Until a definition of statutory duties has been made, the question of qualifications cannot be raised. Even then it may be desirable that a period should elapse in which the working of the defining regulations can be studied and examined, and any changes which may be brought about in organisation and practice can be observed.

It will be clear from the foregoing notes that in law the responsibility for the discharge of the safety duties falling to the mechanical and electrical staff rests on the shoulders of the manager. Not only is he responsible in law for the general control and supervision of these staffs, but also, for the most part, for the detailed performance of their day-by-day duties. If a mechanic neglects the fencing of some part of dangerous machinery, or if the electrician neglects some

detail in the safe maintenance of, say, a gate-end switch, it is the manager whom the law holds responsible. If prosecution be necessary it is also he who is prosecuted and not the mechanic or the electrician who may be to blame. It is not the desire of the electrician to saddle his inefficiency upon the manager's shoulders, but rather to shew that he is capable of maintaining his plant in safe condition and be prepared to accept responsibility for its proper and efficient performance.

When the new responsibilities of mining electrical engineers have been defined, it is almost certain that the Mines Department will insist on definite qualifications before a person is permitted to hold the position of a colliery electrical engineer. Should, and when, this change comes into operation, the possessor of a certificate from this Association will almost certainly be considered as having shewn that he possesses the necessary qualifications. It is a matter of conjecture as to what time limit may be set for candidates who desire to sit for the Examination. It may be a twelve months' period or it may be one of three years. Service certificates may be granted to those over a certain age and with a certain number of years of continuous experience as a colliery electrician.

No matter what position may eventuate, colliery electricians under thirty years of age should give serious consideration to the Association's Examinations, so that when compulsory certification does come they will be in a position of security. Those members of thirty years and over should also take advantage of the Service Examination, which only calls for an oral examination to ascertain if they have obtained a satisfactory standard of competence. The speaker considers that it is a tribute to the perseverance of those members of the Association who have been responsible for the progress which has been made in this direction. It is also a signal honour to the Association as a whole because of the significant position in which it will inevitably be placed in the future of coal mining.

Underground Lighting in Safety Lamp Mines.

One of the problems of mining which appears to have intensified itself with present day mining practice is the lack of suitable lighting in mines where the use of closed lights is imperative. The evolution of a system to meet the requirements of health and adequacy in illuminating capacity can scarcely be said to have yet arrived. The disability attributed to insufficient lighting underground is reflected in the large number of cases of nystagmus reported within recent years.

A number of theories are put forward as to the cause of nystagmus, some of the reasons advanced are serious, others are more entertaining than instructive. Defective lighting is one of the causes most commonly accepted. One of the hard nuts to crack, however, in the admission of this theory is that in America the disease is practically unknown, where almost all the pits have to be worked with closed lights. Notwithstanding this difference, it is an undoubted fact that in this country not more than 2% or 3% of the cases reported occur in naked light pits.

Within recent years considerable development has taken place in the manufacture of electric hand and cap safety lamps. It is many years now since the oil safety lamp was condemned as an inadequate illuminating agent in underground work. A modern oil safety lamp, when well cleaned and trimmed, may emit a candle power illumination as high as the average 2 volt electric safety lamp. The damaging feature, however, of the oil safety lamp is that its power of illumination is considerably impaired if the user is careless in its handling. If the lamp is tilted in any way, the glass becomes smoked and its illuminating power is, therefore, considerably reduced. There is no method whereby the soot can be effaced from the inside of the glass until it is again opened up at the end of the shift. The trimming of the wick, to a large extent, determines the amount of light given off and, consequently, its candle power capacity. In addition, the same negative feature is involved in the oil safety lamp as prevails with the electric hand lamp, namely, the rays of light emitted from the lamp are not parallel to the line of vision of the user, and, therefore, the total candle power capacity of the lamp is not effectively used.

In the case of electric hand lamps, the cross rays, which intersect the direct line of vision, are stronger usually than with oil safety lamps and may be responsible for intensifying the strain of the eyes. The large number of electric hand lamps in use may, therefore, be a contributory factor in the prevalence of nystagmus to-day.

As advocated by the speaker in a paper read before this Branch of the Association some five years ago, some form of electric safety lamp, embodying the features of the small open light carried on the head, would appear to be the type which would meet the requirements for underground use, and thereby diminish the number of cases of nystagmus. The electric cap lamp was designed presumably to secure those features, but the perfect electric cap lamp has not yet been evolved. The clumsiness of the head piece, the liability to fracture of the cable leading from the battery to the head piece are features which require improvement. Perhaps the most serious defect in the construction of the cap lamp is the excessive weight of the battery. The weight is about 5 lbs. and this load slung on the back during the shift reduces the vitality of the wearer.

Notwithstanding the present defects of the electric cap lamp, there is no other lamp of the closed type more suitable for use in mines where closed lights are imperative. The rays of light thrown off are more or less parallel to the line of immediate vision of the wearer in each and in every direction. In consequence of the arc of illumination being diminished, the effective candle power to the wearer is greatly increased.

Maintenance of Underground Roadways.

The use of timber in mines as a means of supporting the overlying strata is a heritage handed down from our forebears, to whom it was the best means available to their circumstances. Its era of extensive and general use as underground supports is nearing its close, and in a few years steel will have supplanted its use to all but a limited field. Under a variety of conditions timber can still be used economically, provided certain scientific principles prevail as to size and quality, and also the preparation and probable period of useful service of same.

One of the imperfections in the use of timber is that it is not foolproof, and ignorance of the simple laws underlying the strength of beams under various conditions of load leads to many of the avoidable accidents arising from falls of ground. A great deal of the timber which is erected underground does not give 50% of the life which could be normally expected owing to bad workmanship. The preservation and setting of timber is highly skilled work, and those entrusted with its erection should be highly efficient.

The estimation of roof pressures in collieries is a real problem and has proved most baffling to the investigator. This pressure is so changeable and the factors involved so complicated that the laws applicable to static earth pressures cannot be reliably applied.

The earth pressures to be counteracted in underground work may be divided into the following classes:

(1) Pressures at the coal face.
(2) Pressures due to dead load gravity.
(3) Pressures abnormal in strength and direction, produced by abnormal strata structure, such as faults, cleavage planes and folds.
(4) Pressures due to the "swelling" of the strata caused by the pressure of water.

From an economical viewpoint, the mathematical values of these forces are not necessary. It is, however, essential to know generally their direction and strength. In the application of steel for underground supports true significance can then be given to scientific thought and attainment in the safer control and support of the overlying strata.

The value of steel supports is of two-fold importance. The indubitable increased security in roof support will eventually shew a positive diminution in accidents from falls of ground. Universal application will tend towards their standarised manufacture, and efficient installation will subsequently shew reductions in costs of production.

Standardised Specification in the Sale of Coals.

The amalgamations of colliery companies and the formation of large combines in the future will result in greater technical supervision of the blending and commercial grading of coal at the colliery than has hitherto prevailed. In recent years, corporations and large combines, by means of their magnitude, have found it desirable in the interests of economy to establish buying departments. Technical experts attached to these departments have evolved a system of sampling, testing and evaluating all coals purchased, and have, in many cases, formed for themselves standards by which all supplies must be graded, depending on the specific use for which the coal is required.

All large consumers nowadays test the coal received at their works, in order to ascertain if the standards for which the coal is required is being maintained. Generally speaking, from the producer's point of view, he continues to sell his coal from day to day at a fixed price with little knowledge as to the variation in quality. The consumer is immediately aware of any depreciation in quality and generally loses little time in advising the colliery company. The seller seldom receives credit for supplying a superior quality of coal and has no means of checking the figures of the buyer, when a claim for allowance for inferior quality is made. This leads to a great deal of irritation and annoyance to both the buyer and the seller, and frequently raises the argument, that coal, being so variable in quality, cannot be maintained at any predetermined standard, and therefore should be sold at a uniform price. This, however, is actually an argument in favour of a specification with a sliding scale of bonus and penalty, since only by such means does the price paid bear a true relationship to the value of the material received.

It is admittedly difficult to maintain a regular standard of coal, owing to the variations in the seams from place to place, but it is obviously unfair to expect the buyer to pay the same price for a depreciated article, even though the deterioration has occurred owing to natural causes.

Sliding scale contracts, so that improvement in quality may be rewarded and depravation in quality penalised, form one of the important phases in the future aspect of the marketing of coal. It does not appear impossible that at some future date all coal will be sold to standard specification, and that coal inspectors will be appointed to test all deliveries on behalf of the buyers and sellers jointly. It cannot be expected that the quality of a coal can be maintained rigidly to a standard similar to manufactured products, and therefore a sliding scale of prices synchronising with qualities would tend to diminish the free ash contents of the material despatched from the colliery and the injudicious mixing of the seams in order to avoid duplication of screening and cleaning plants. This would ultimately lead to the stabilisation of better averages in selling prices and would tend towards improvement of the coal trade generally.

Coal Mines Bill.

The Coal Mines Bill, after a long and somewhat tempestuous passage, has at last become an Act of Parliament. It comes into force immediately and its effect on the coal industry will be followed with interest and perhaps not a little trepidation.

The Bill is divided into four Main Parts, as follows:

(1) Hours of Work.
(2) Organised Marketing.
(3) National Industrial Board.
(4) Reorganisation, with Compulsory Amalgamation.

(1) *Hours of Work.*—The effect of the Act is to reduce the permitted number of working hours for miners from 8 to 7½ hours. The time is measured from the descent of the last man in the shift to the ascent of the first. This Section comes into operation on December 1st next. A "spread-over" clause has been inserted in the Act, which gives power to the Owners and Miners in any district to redistribute the hours if desired. The hours per day must not exceed 8, or the working week or fortnight more than 45 or 90 hours respectively. By this arrangement, a short working shift on Saturdays, or alternate Saturday holidays, may be obtained. Whatever arrangements are made in the various districts there is one indubitable fact that remains. If wages are to be maintained at their present level, pieceworkers must receive an increase in existing rates equal to the diminution in working hours. This will, consequently, have a very adverse effect on costs of labour.

(2) *Organised Marketing.*—The purpose of the marketing provisions contained in the Act is to increase the proceeds of the Industry, so as to nullify the increase in costs of production resulting from the diminution in hours. The Owners have now their marketing schemes completed, which have, however, to be approved by the Board of Trade before they become operative. In the absence of a scheme, the Board may then themselves formulate a scheme and impose it upon the coalowners affected.

(3) *National Industrial Board.*—Under this heading, power is given to the Board of Trade to constitute a Coal Mines National Industrial Board. Disputes as to wages or other conditions of labour in any district, which cannot be settled between the two parties, may be referred to the National Board. This Board will enquire into the dispute and report to the Owners and Miners concerned.

(4) *Reorganisation, with Compulsory Amalgamation.*—Where it appears expedient for the more economical and efficient working of the Coal Industry, an amalgamation or absorption scheme must be prepared by the Owners. Failure to submit a scheme within a specified period may justify the Board in preparing a scheme, if such amalgamation appears to be in the national interest. The Act requires the constitution of a Reorganisation Commission consisting of five members.

Any benefits likely to be derived from the application of the Coal Mines Bill are not expected to mature in the form of cheaper costs or increased revenue. To increase the selling price of coal to meet the increased costs of production due to the diminished hours appears to be a point in which theory and practical application do not agree.

In General.

Future prosperity in the coal trade would appear to point to the direction of maximum production from the minimum number of producing units; centralised selling agencies and amalgamations and grouping, with the elimination of the smaller or non-supporting units. A diminution in average labour charges can be anticipated with a subsequent increase in outlay for mining plant. Steel supports will have almost universal application, and in the general reorganisation of the industry the application of electricity will continue to uphold its position of predominance.

In conclusion, let it be understood that whatever is the fault with the coal mining industry it cannot be attributed to those in technical charge. In Scotland it is gratifying to know that machines are now responsible for 63% of the total output, due to the "mechanising" of coal face operations underground: in the Fife district the proportion is even as high as 71%.

Considerable credit is due to the Scottish Miner for his ready response and adaption to machinery introduction. Notwithstanding this individual progress, we have, as an Industrial Nation, still some considerable leeway to make up in relation to the world's production of electricity. The relative position of the three leading countries in world's output is as follows:—

		Production per head of population per annum.
The United States	... 41.0% of the Total	... 816 Units
Germany ...	... 11.3% of the Total	... 453 Units
Great Britain	... 5.5% of the Total	... 330 Units

Obviously an enormously increased production and utilisation of electricity is vital to our industrial national existence. The Electricity Board are proceeding on the lines of erecting gigantic super-power stations using, of course, condensing steam turbines and more or less high class coal. Latest methods of very high steam pressures and temperatures of superheat, pulverised-fuel firing or mechanical stoking, air heating and scientific principles of control and operation are part and parcel of their efforts to secure overall thermal efficiencies of 25% to 27%. Whatever methods of generation are adopted, it is obvious that to encourage the more universal use of electricity, cheaper tariffs must be provided for industrial undertakings, and also for the domestic consumer, especially in rural districts. The reason for high domestic tariffs is due more to the effect of low load-factor than to the actual cost of generation per unit, and in this direction much headway could be made if an inducement were given to non-participants rather than to the participating individual, who will use only what he requires. Power supply undertakings can only hope to encourage the use of electricity by providing conditions of sale whereby economy in domestic costs can be secured.

In coal mining, the demand for electricity will continue to grow, and we hope that its economic use will continue to be a credit to the industry in general and particularly to the enterprising mining electrical engineer.

NORTH WESTERN BRANCH.

Visit to Gladstone Docks, Liverpool.

On Saturday, July 12th last, members of this Branch visited the Gladstone Docks of the Mersey Dock and Harbour Board, Liverpool. These docks are very extensive and time did not permit a thorough inspection. Amongst the various items of interest seen was the pumping station for the graving dock, which is the largest dry dock in the Kingdom. This station is equipped with five sets of centrifugal pumps, having discharge pipes 54 inches diameter, each pump being driven direct by a vertical four-cylinder, two-cycle, Diesel oil engine running at 180 r.p.m., and capable of developing 1000 h.p. These pumps can empty the dock of approximately 44 million gallons, say 200,000 tons of water, with the level of 28 feet in the body of the dock, in 2¼ hours, or at the rate of 1300 tons per minute.

At the conclusion of this visit, the members went on board the White Star liner "Baltic", which was berthed in Gladstone Dock, and were given every opportunity of inspecting various parts of the vessel. They remained on board whilst she sailed to the Landing Stage, during which time lunch was served.

Mr. W. T. Anderson proposed a vote of thanks to the Mersey Docks and Harbour Board, and to the White Star Steamship Co., Ltd., for providing such excellent facilities for the visit; and also to Messrs. J. Davenport & Sons, of Wigan, who made all the arrangements for the visit and sail on the S.S. "Baltic". Mr. J. W. Cartwright seconded the vote of thanks which was carried with acclamation.

In particular the members were indebted to Mr. Taplin, of the Mersey Docks and Harbour Board, who conducted the party around the Docks; and to Mr. Robertson, of the White Star Steamship Co., Ltd., for the arrangements on board the S.S. "Baltic".

Members of the North Western Branch
(a) at Gladstone Docks (b) aboard S.S. Baltic.

SOUTH WALES BRANCH.

This Branch held its inaugural meeting of the Session in Cardiff on the 4th October last. The following applications for membership were accepted:— Messrs. E. W. Elliot of Wyllie, and J. R. Jones of Varteg (members); Messrs. E. Griffiths of Oakdale, and A. Hughes of Oakdale (associate members); Mr. E. C. Ings of Swansea (member of the Western Sub-Branch).

Mr. W. W. HANNAH extended a cordial welcome to Mr. Wight: they were grateful to him because he was not only a Past President of the South Wales Institute of Engineers, but because he was the Vice-Chairman of the Monmouthshire and South Wales Coal Owners' Association. Moreover, Mr. Wight had always shewn himself very keenly interested in the mechanical and electrical side of mining.

Mr. Hannah then said he would like to point out that South Wales had again achieved more than its share of distinction in securing the second and third Association Prizes this year and with regard to the Examinations, one of the two honours certificates had been won by a member of their branch; they had also carried off more than their share of first and second class certificates. He congratulated the members who had brought those honours to South Wales.

Mr. W. D. WIGHT presented the following Certificates and Awards:—

A.M.E.E. Examination Certificates:—

Honours, Mr. B. J. Burkle; First Class, Mr. Idris Arthur, Mr. W. T. Gay; Second Class, Mr. John James, Mr. Evan Jones, Mr. Idris Walker.

Association's Second Prize to Mr. F. E. Pring for his Paper "Electric Coalcutters in Low Seams."

Association's Third Prize, shared with a West of Scotland member to Mr. C. L. James for his Paper "Power Factor—its cause and Effect."

Branch Prize of £2 2s. 0d. to Mr. C. L. James for his aforesaid paper.

Sir Arthur Whitten Brown the President-elect, then took over the chair from Mr. W. W. Hannah. Unfortunately, owing to his suffering from a severe attack of laryngitis, the new Branch President was unable to read his address. Prior to making the presentations, Mr. W. D. Wight addressed the meeting.

An Address.

W. D. WIGHT.

I am told that this year is the occasion of the coming-of-age of your Association; you have now attained manhood. That is something of which you might well be proud but in addition to that the success, as shewn by your attendance tonight, and the prizes which have been awarded to members of this branch are the greatest credit to you. I am told that this is the most numerous branch in the kingdom. That you may prosper and increase year by year is my ernest hope.

There are many qualities essential for success in life. In commerce attributes are required differing much from those necessary in a technical pursuit such as that of electrical engineering. In fact as an example this is so evident that characteristics which are admittedly predominant in certain races such as the Hebrew, and shall I venture to suggest the Scots, have made those peoples especially conspicuous in business affairs.

To attain distinction in engineering of any kind requires such concentrated effort upon the acquisition of knowledge of the forces of nature and the application of them to the use of mankind. that the engineer has little time to devote to the mercenary side of life. Still some attention must be given to other than the purely technical matters, and I would place first in order the building up of character, for without a character which inspires confidence it is futile to expect success in life.

Secondly, I would advise that the ability to exercise control should be cultivated. Perhaps the first essential for this may be expressed shortly in a few words, "behave as a gentleman." Good manners are always appreciated. Dignity is lost by bluster and bad language. Above all be honest and just in your dealings. The attainment of respect from subordinates is the signpost towards promotion.

Thirdly, while the study of electricity in all its varied phases must be the leading idea of all of you who have decided to devote your lives to that pursuit, it is said that a change of work is relaxation and prevents the mind from becoming fogged, and I would suggest that the study of a foreign language is an excellent way of clearing the head and relieving the strain which ensues from the too close application to a particular line, and here I would recommend the acquisition of the Spanish language. According to the report of the University Grants Committee only thirteen honours degrees were given either wholly or partly in Spanish in 1927-28 as against 61 in German and 423 in French, which points to Spanish having the greater prospective value.

Having so far spoken in general terms, I now propose to say a few words with more direct application to your own pursuit. The development of the mining industry and the application of machinery to the winning and working of coal has during the past twenty years produced a different state of affairs from that to which the old mining engineer was accustomed. It is no longer within the capacity of one man to know all and do everything which is today necessary in the conduct of a colliery. The mining electrical engineer is a child of modern progress, and the colliery manager has to leave to him many technical jobs of which the manager has no intimate knowledge, and the manager must depute to trusted officials several departments of colliery work. The mining electrical engineer is a specialist and he has to know two distinct factors governing the electrical machinery. Firstly, he must understand by personal practical experience the conditions under which machinery has to work; and secondly, he must have the ability to diagnose quickly any difficulty which may arise and provide for carrying on the working of the plant until it is possible to make good any cause of trouble.

In all professions the tendency is to place far too much reliance on purely academical honours. This is a mistake which even our University professors are beginning to protest against, and some of our most eminent men are now saying that the possession of a certificate is no criterion to the ability of the person holding it. I do not mean that certificates are of no value, they are required in order that they may provide some basis on which a judgment may be made; but the mining electrical engineer, in common with other colliery officials has to have not only a theoretical knowledge of his subject and the ability to appreciate the technical side of his craft, but he must also be able to understand and handle men. I am afraid that no examination system which has ever been invented will provide that acid

test which will separate the fit from the unfit, but I agree that the first test for a man is his ability to sit down and pass a written or oral examination on the subjects which engage his mind.

Many years ago, an old professor of engineering made the remark that when he wanted to know whether a student really understood the working of a piece of machinery he asked him to make a drawing of it and when the student tried to make his drawing the student realised the limits of his knowledge. There is a great deal to be said for the giving of certificates such as I have the pleasure of presenting tonight, and I would like to congratulate all those who have been successful, and wish luck to those who are going to try again.

To those who have been unsuccessful, I would like to remind them that even the greatest men have failed to realise their ambitions. To take the name of one man whose name holds a foremost position in the electrical world, the late Lord Kelvin, I would like to remind you that in his student days, his ambition was to be senior wrangler of his year, he failed to achieve that honour and was beaten into second position by a man who had more cleverly grasped the idea of what you have to do in order to pass examinations. It is said that Lord Kelvin in trying to answer the questions seriatim became involved in a very difficult one which occupied so much of his attention that insufficient time was left to answer all of the remaining questions. He should have answered all the easy questions first and then tackled the difficult ones. The man who beat him had already learned that little trick, and so he won.

I would like to tell you one little story concerning Lord Kelvin, relating to the days when he was a professor of physics. During a lecture he noticed that one of his students was rather drowsing over his note-book and suddenly he addressed this student and asked him a question which no doubt each and all of you have asked yourselves. What is electricity? The drowsy student suddenly brought to attention, stammered, and said, "I did know, Sir, but I have forgotten." Lord Kelvin then addressed the class, saying, "well, gentlemen, we have life's greatest tragedy before us, I don't know and do not think anyone knows what electricity is, but there is one among us who did know and he has forgotten." I tell you this little story in order that we may all approach with due humility the study and practice of those unknown forces which it is the electrical engineer's business to harness and handle; but I would suggest to you that in all your technical work you never lose sight of the fact that you have not only got to handle something of whose nature you know nothing at all about, but in addition you have also got to handle men, and while you will know something about men you should treat them with the same care as you would treat a machine when you want to get the best out of it.

After presenting the several awards and certificates to the successful members, Mr. Wight said he thought he would not transgress by telling them that a certain committee of the Coal Owners' Association had recently recommended the Board of Trade, in the event of qualifications for posts under the Mines' Act being made compulsory, that the Association's Certificates should be acknowledged as sufficient qualification.

Maj. E. IVOR DAVID expressed the thanks of the members for Mr. Wight's attendance and for the valuable advice he had given to them all. His remarks on the value of character needed no better illustration than himself who was one of the characters of the South Wales Coalfield; if he had not been a first-class mining engineer, he would have been a first-class- mechanical engineer, and although the greater part of his time had been taken up in mining engineering he left some samples of his mechanical ingenuity for the following generation.

Dealing with Mr. Wight's reference to the Association's Certificates, it was true that technical engineers were sometimes accused of over-valuing certificates obtained by examinations. The desire of the Association was that their certificates should be taken as an indication that the colliery electrical engineer had a knowledge of his technical subject up to a certain standard and his possession of the Association Certificate was a guarantee of this.

The agent or manager who had to engage a colliery electrical engineer had to form his own opinion of the many other qualifications required in a man to fill the position such as, personal character, ability to handle men, time keeping, experience, etc., but it was the Association's opinion that he would be assisted and his mind relieved in one direction, at least, by the knowledge that the applicant possessed an Association Certificate.

The Association's examination papers were set by practical men and there was no attempt to introduce trick questions, an honest endeavour was made to guarantee that the holder had a knowledge of the Coal Mines Act and the technical problems that he was likely to meet in the course of his duties.

Mr. Wight spoke as an authority and his remarks that the certificate was being accepted in this respect were very cheering to all those present.

Mr. Wm. THOMAS, Chairman of the Western Sub-Branch, seconded the vote of thanks and said he well remembered back in 1907 when Mr. Wight was President of the South Wales Institute of Engineers, the very fine address he delivered. At that time he was one of the stalwarts of the South Wales Coalfield. On several arbitration cases he had always given sound judgment and a fair deal in disputed cases. He was one of nature's gentlemen and the branch was honoured by his presence.

The vote of thanks was warmly carried,

Mr. WIGHT, in reply, said he hoped the Association would not make the mistake of setting too difficult an Examination. There was a great tendency at the present time with all the opportunities given for technical education to raise the standard too high. It had been done with the colliery managers' certificate much to the detriment of the class and of the industry. They were making it too difficult for really good men to succeed. One branch of mining had been made almost impossible namely, underground surveying. The authorities had managed to put an extremely high classification for that and he believed only one man in South Wales passed last year. That was not what they wanted. An examination was not intended to be something put before students in order to exhibit the ability of the examiners. It was meant to shew that the candidates had been trying to learn their business and had attained a measure of proficiency. If the questions were kept within reasonable range they would be successful but if they went to extremes, as had been done, they would dishearten students and the certificates would become so rare that the supply of qualified men would be insufficient.

Mr. IDRIS JONES, proposing a vote of thanks to Mr. Hannah, referred to the steady progress made

by the Branch during Mr. Hannah's presidency. It had been a most successful year and the results of the examinations shewed the interest taken by the student members, this was largely due to Mr. Hannah; he endeavoured at all times to extend the knowledge especially of student members, and his efforts towards advancing the aims of the Association and improving the status of its members deserved their highest praise. He also recognised the present difficulties of the other side when advancing the ideals at which he aimed. The South Wales Branch looked forward to having the continued support of Mr. Hannah for a very long time. Major W. ROBERTS seconded. Mr. DAVID EVANS supported the motion and paid a personal tribute to Mr. Hannah with whom he had been associated for a considerable time. He was an excellent official, could always be relied upon was an expert electrical engineer, and had contributed his full share to the success and advancement of his Company.

The vote was carried with acclamation, which Mr. Hannah suitably acknowledged.

NORTH WESTERN BRANCH.

The first meeting of the new Session was held in Warrington, on Friday evening, October 3rd.

Capt. MACKINTOSH, President, in opening the proceedings, remarked that on the completion of his year of office he desired to take the opportunity to express his thanks to the Committee and the members for the very loyal support they had given him. Mr. Bull, the new President, needed no introduction; he was a colliery man known to all of them and he would, without doubt, prove to be one of the best of Presidents and would add prestige to the Branch

Mr. R. F. Bull, President Elect, then took the chair.

The Minutes of the previous meeting were approved.

The following new members were elected: Messrs. R. Bryce and E. J. Christian (members); Messrs. C. L. Moore and J. Maddock (associate members); and Mr. W. J. Davies (student member).

In the absence of Mr. W. Bolton Shaw, the Hon. Treasurer, the President submitted the annual statement of accounts which had been circulated amongst the members. Mr. J. Whittaker moved, Capt. Mackintosh seconded and the accounts were passed.

Examinations.

The President read the draft regulations for the Association's Certificate Examination. In reply to a question the Secretary said the only difference between the draft and the existing regulations was that two new certificates had been provided for, a Second Class Ordinary Certificate and a Service Certificate. One suggestion which had been conveyed to him was that the Honours Paper, instead of being taken on two consecutive Saturdays should be completed on one day, the morning and afternoon.

Mr. J. Whittaker pointed out that in Section 8 it was stated that a student should have had three years general electrical experience above and below ground in a mine. Did that mean six years in all?

The President replied that he should read it to mean three years experience in and about a colliery in all.

On the motion of Mr. Roseblade seconded by Mr. Whittaker the draft regulations were approved.

The President congratulated Mr. R. A. Gerrard, who unfortunately was unable to be present, on having secured a First Class Certificate. He also remarked that this meeting was a fitting opportunity for the Branch to send a note of congratulation to Mr. G. M. Harvey who had been appointed Deputy Electrical Inspector of Mines under Mr. Horsley. Mr. Harvey was closely associated with himself (the President) for some time, and for a longer period with Mr. Bolton Shaw, at a Lancashire Colliery, and later as assistant in Mr. Shaw's Manchester office. It could be said, therefore, that Lancashire had given the newly appointed official his early training in colliery work. Mr. Harvey joined the Lancashire Branch many years ago and for some time acted as Secretary. He had done a great deal of work for the Association and had occupied the Presidential chair. All who knew him would agree that the Mines Department had made a very fitting appointment and secured a man who understood his duties and appreciated the difficulties to be faced in colliery electrical engineering work.

Capt. Mackintosh moved that a letter of congratulation be sent to Mr. Harvey. Mr. Roseblade seconded and the resolution was carried.

The PRESIDENT said he desired to express his appreciation of the honour bestowed upon him by electing him to the position of President of the Branch. He would like to thank the Past President for what he had said tonight and also for his remarks at the Annual Meeting. He could assure the members that he would do his utmost to carry on the business in the best interests of the Association, aided by the wholehearted support of the Committee, the Hon. Treasurer, and Hon. Secretary. It would perhaps interest members to know, a fact that leaked out in a casual way the other day, that the great grandfather of their Hon. Sec. Mr. Vincent Heyes was Manager at Seghill Colliery, and his great great grandfather's brother (whatever relation that might bear to him) was the famous Mr. Hedley who made many experiments in 1813-14 at Wylam Colliery, Newcastle in order to obtain an engine heavy enough to pull, and a rail strong enough to bear the engine. Mr. Hedley managed to get two engines actually to work at his colliery, and George Stephenson seemed to have done the same thing at Killingworth Colliery a year or two after. It was pleasing to know that the Branch had some inventive engineering talent inborne amongst its members: Mr. Bull then addressed the meeting as follows.

Presidential Address.

R. F. BULL.

Let me thank you again for electing me to the Presidency of the North Western Branch of this Association. Its importance is growing year by year and its usefulness must be felt in all the coalfields of Great Britain. As the Association has now reached its 21st birthday, it would be a suitable time to celebrate its coming of age by a record number of new Members, better attendances at Meetings, and by more candidates sitting for the Examinations, which are held about the month of May. In this connection I cannot do better than quote a passage from Mr. Frank Anslow's article in the January 1929 number of *The Mining Electrical Engineer* where he says :—

"It is to the advantage of all concerned that our Colliery Engineers and Electricians should take the fullest opportunity of the facilities offered by membership of the Association to obtain an ever increasing knowledge of their craft."

Our past President's Address dealt, amongst other matters, with the Duties of the Colliery Electrician, and one of the objects of this Association is to improve his status. We hear very little about the conditions under which the colliery electrician has to work, but a great deal about the machines and apparatus he has to instal and maintain, and also of the duties which he often has to carry out under extremely difficult conditions. With a fairly large plant he cannot personally supervise the maintenance and testing of all the apparatus, and he has therefore to rely largely on his authorised Assistants conscientiously to carry out his instructions. It is seldom that properly trained shop electricians can be obtained for colliery work, and the electrician in charge has generally to train his own men, or to get them from a neighbouring colliery where they have already gained some experience, though this is not often possible for obvious reasons. This condition of affairs is not as it should be. Young colliery electricians, when they are out of their time, often leave to obtain better situations, and their usefulness is thus lost to the coal industry.

The maintenance of plant below ground is frequently made much harder for the electrician by the misuse of apparatus by authorised drivers; this work, except coal-cutting, is generally looked upon as a convalescent home for compensation men. The speaker is of the opinion that managers should obtain the advice of the electrician-in-charge in regard to authorising drivers. All men in charge of machines should report daily to the electrician on the running of their machines, and acquaint him with any detail which appears to be at all out of order during their shift. It is not easy to obtain from these men a daily report which is of any value and some education is necessary. It is not necessarily suggested that drivers should be educated to do more than their appointed duties, but as any lengthy stoppage, of say a haulage, is such a serious matter, it is vitally important that they should be carefully chosen, and thoroughly trained spare men should be available to take up the duties on emergency not only during ordinary working shifts, but at any time when the haulage has to be used.

Referring to the technical or office-work side, there are two kinds of buying at a colliery, viz. the standard stores which can be purchased by non-technical men, and special plant and material which should only be dealt with by technical men. The days are gone when an order can be made out in this way: "One engine, Price £5000, d/d in 12 wks."

The use of electricity at collieries has opened out vast scope for electrical engineers, and today the general view is that nothing but the best apparatus should be installed: yet there is still need for improvement.

We must have more reliable trailing cables. It is difficult to understand how the ordinary cab tyre cable came so much into use for coalcutters; if ever there was a place where the metallic envelope for earthing is required, surely it is at the coal face. One difficulty appears to be to get the right relative mechanical strength between the earth shield and the three core cable.

Mining switchgear is not yet by any means ideal. Frequently operated switches require a lot of maintenance. An overload trip coil will generally operate satisfactorily with a sudden increased rise of current above its setting, but if the increased current is put on gradually the result will most probably be very different. An overload coil may function at the works' test, but it does not follow that it will trip the switch after six or twelve months use. The best form of tripping device, in the author's experience, is shorting the low volt coil. In general a more delicate setting and the surer action of tripping switches is called for.

We have a difficult task to comply with M.D. 23 circular. With new switchgear designed for the purpose it appears to be an easy matter, but even then great care must be taken with interconnecting cables which feed both ways. Take the case of a feeder supplying one distributing board and another supplying a second board some distance away with an interconnecting cable between them, the boards operating in parallel. If it is necessary to work on one of the distributing boards four switches should be earthed, and it must not be forgotten that one of them is the outgoing switch on the live distributing board, and another the switch supplying the feeder to the board on which work has to be done. Assuming the switches are all connected up alike internally, on an incoming switch the incoming feeder would be earthed, and on an outgoing switch the outgoing feeder, so it would appear to be necessary to label the cables incoming or outgoing. The interconnecting cable might, however, be either. Different switch makers have different methods. The surest way for a harassed electrician, say at midnight, would be to earth both feeders at the main switchboard in the power house, if this can be done.

Improvements have been made in the design of motors; these have usually resulted in reducing the size and amount of metal to such an extent that in order to get sufficient cooling effect fan blades are employed: these fans tend to draw more dust and dirt into the open type of machine, and so block up the ventilating passages which have to be blown out frequently. This dirt is very difficult to dislodge, and it is doubtful if any open type machine would pass its original full load heating tests after a year's work below ground.

More light below ground, inbye, is wanted, and as flameproof fittings are appearing on the horizon, we shall have to look to our lighting cables and switchgear to see that these are really safe and efficient for this purpose.

One of the minor triumphs of electrical engineers is electrical signalling to the winding engineman. When one remembers the awful din that had to be made before the engine could be started, all those with sensitive ears must welcome this great improvement if for that reason only, to say nothing of the greater safety, the time saved and the ease of operation.

As one who has had to lay down plant for a new colliery it may be of interest to mention briefly a few points that have to be kept in mind and which require more judgment than is often thought. We will not consider here the temporary plant put in for sinking purposes, as time is too short to go into those details. We must have electrical power and the first question is: can we buy current cheaper than we can generate it? Assuming there is no waste heat available, we come straight to the boiler house coal, and it is on the quality and price of this coal and the way it is burnt, and on the water available for condensing purposes, that the question largely turns. The cost of getting the coal is assumed to be the same whether it be good or inferior, and if all the power can be obtained from the inferior coal cheaper than power can be bought, less the price at which the inferior coal can be sold, then there is a case for the colliery power station.

The colliery consumption expressed as a percentage of the get gives no right impression as to the value of the coal burnt in the boilers. The coal tipped into

the bunkers may quite possibly be one quarter dirt, more or less, and the price charged should be its marketable value. In other words the colliery consumption per annum should be a percentage of the total price obtained for the coal sold.

If it is decided to generate power at the colliery it is not wise to have the first generating sets too small, and they should preferably be of the same size. The load will be a gradually increasing one, and it may be some years before the maximum is reached. The engine room and boiler house must be designed with due regard to extensions, and the run of cables, should be laid down on a plan. If a cooling tower has to be employed it is as well to remember that repairs can be done on a large tower by turning the water for the time being all to one end, but provision should be made for extensions.

The author does not propose to enter into the merits of electric against steam winding, except to say that he considers the electric winder is bound to be more extensively used in the future ; and to mention the fact that where a colliery or collieries require a large amount of power, a better case is made for electric winding as larger generating units can be installed and the nett cost per unit thereby reduced. Air compressors up to about 5000 cu. ft. are more conveniently driven by electricity than by steam, the larger sizes can be steam engine or turbine driven. A large amount of power can unwittingly be easily wasted with compressed air, and meters should be put in to check the air from time to time. As regards the fan drive this offers a splendid load for a synchronous induction motor to raise the power factor on the system, and this type of motor can also be used for driving air compressors, which are generally running through the week.

It is usual to instal a small temporary fan for the first few years, and sometimes an intermediate fan before the final large one is ordered. Great care must be exercised in fixing the size to fit the E.O. of the mine. This is very difficult to estimate, and has often turned out to be very different from the expected. It depends on the size and nature of the roadways and the amount of air required. The large fan has to be capable of supplying the final requirements of the mine with an E.O. very different from that which exists when the fan is first set to work.

Referring now to the boiler house, the object must be to get the maximum efficiency out of the coal used, and a variety of plant is before us. The success or failure of the colliery power station to supply current cheaper that it can be bought depends to a great extent on the choice of this plant with its coal and ash handling machinery, and method of firing.

When laying out cable sizes it is usually uneconomical to put in a cross section which would be only just large enough to carry the required load without overheating ; as although the capital cost of such a minimum cross-section cable would be low, the energy losses in the cable, which go on all the year round while the cable is under load, would, owing to the high current density, be considerable. The economical size (which is that at which annual capital charges plus annual I^2R losses are a minimum) varies of course in different cases, depending on the cost of the wasted energy in the cable and the load factor of the cable ; generally speaking the economical current density is found to be about 1000 amps. per square inch based on the maximum load. Further, if the minimum allowable size from the point of view of current-carrying capacity is put in there is no possibility of increasing the load on the cable though we know from experience that loads usually increase ; some spare copper in a cable is, therefore, like spare plant, an exceedingly useful thing.

Apart from the question of maximum permissible loading, in many cases the voltage drop has to be considered and is often the fundamental in fixing the cable size. In other words the voltage drop requirements may have to be satisfied first and the current-carrying capacity considered afterwards. This is particularly the case where squirrel cage coal face motors are concerned, and it is necessary when fixing cable sizes to assume such motors are working at the furthest point to which they are likely ultimately to be carried forward. If this is not done, then when a motor is shifted further inbye the voltage the motor receives will be much lower than it should be, and if that is the case the starting torque (which is proportional to the square of the voltage) will be very much reduced, the motor will take a greater current than it should, and get overheated. In other words the motor will be working inefficiently and the I^2R losses in the cable and motor will be increased.

The space occupied and arrangement of machinery has to be carefully considered ; also the cost in wages to run it, as well as the maintenance costs and interest and depreciation charges. Considerable savings can be made by a well thought out plan. In the author's opinion a reliable simple plant, which may cost a little more to run, is to be preferred to an elaborate one which operates more efficiently for a time but the parts of which require frequently renewing at considerable expense.

Washery dant and dust might be more generally used. There is machinery on the market for handling dant, but more experimental work needs to be done, to devise better methods of conveyance drying and burning such refuse efficiently under the boilers. As regards the dust brought up with the coal, this may easily reach 5% of the output, and a great deal is wasted. If the dust cannot be separated below ground, it might be collected in a more or less air tight tipping chamber at the pit top, and conveyed in pipes to the boiler house.

The author in conclusion has to say that in his experience of the running of two separate generating stations at collieries, the results in both cases have more than justified their erection.

Capt. MACKINTOSH thanked Mr. Bull for his excellent address. Mr. Bull had had a great deal to do with the model layout of collieries and the experience gained in the course of that work had been put very clearly before them. Papers and addresses of this kind were always effective and welcome because they recounted the results of practical experience. They all realised the pitfalls Mr. Bull must have been up against, and the reading of such papers gave them valuable information as to how they had been avoided. He moved that the thanks of the Branch be accorded Mr. Bull.

Mr. J. WHITTAKER seconded and it was carried.

The PRESIDENT in reply said it was always difficult to find a suitable subject for an address, but it occurred to him that a short account of his practical experience in the lay out and working of a new colliery would be acceptable. He thanked the members for the hearty vote of thanks. He remarked that if the members desired to discuss any of the points raised he was quite willing to throw open the Address for discussion.

Mr. WHITTAKER said he would like to emphasise the remarks of Mr. Bull when he referred to the equipment of a new colliery. Without going into the merits or demerits of compressed air versus electricity he would say that the feeling of suspicion which existed among some electricians that they were going to be done out of their jobs by the more extensive use of compressed air had been dissipated. As a matter of fact their work had thereby been increased.

The President had remarked that further experiments were in hand with regard to the drying of dant but it would be of interest to the members to know that those experiments had advanced to such a stage that some data was now obtainable with regard to the use of wet dant.

On the question of the colliery manager's view of a fan drive though he could not discuss the subject he would suggest there was a lot to be said for the steam drive of a fan, even to-day.

Capt. MACKINTOSH remarked that the President had raised the question of the electrical engineer having something to do with the fitness of a man to drive the electric haulage. It was the fact that in some collieries the haulage drivers came directly under the control of the electrical engineer, but he was also under the supervision of the manager and one had to be very careful in passing any opinion on that point.

Regarding the President's remarks on fans for cooling the windings of motors: fortunately, Capt. Mackintosh was not a designer of electric motors, but during the past twenty years much progress had been made and designers appeared to think the right thing to do was to cut down the amount of copper used. If the same amount of copper were to be put into motors today as was usual twenty years ago he was afraid colliery people would not buy them.

The subject of whether it was better for a colliery to purchase current from a public power station or generate its own was always a vexed question and one which had always to be considered with reference to the conditions prevailing at a particular pit or group of pits. One advantage in the purchase of a supply from an outside authority was the convenience factor and that could not be put down in plain £ s. d. For instance suppose a colliery manager wanted a blacksmith to do a job on the Sunday morning and a motor was required to drive the blower, if the electricity was generated at the colliery it meant someone had to be there to start up the plant, whereas if the power came from an outside source of supply it was only necessary to touch a switch or, as it were, turn on a tap.

With regard to Mr. Whittaker's observations he would ask him whether he realised what the efficiency of compressed air was at the coal face. He would not say that electricity could be used everywhere underground but it certainly was adaptable to most places, and after all it was up to the manager of the pit to see that it was properly ventilated. He quite agreed with Mr. Whittaker that compressed air would still be used in pits, and it must be the engineer's job to use the most suitable power in the most efficient way. In some situations it would be impossible to use electricity, then the management had to fall back on compressed air.

Mr. WHITTAKER said Capt. Mackintosh had fallen into the trap he had warned them against, namely the suspicion that the use of compressed air would, of necessity, cut down the use of electricity. If Capt Mackintosh's friends, who were colliery engineers had the least idea that the use of compressed air, other than a motive power was beneficial for ventilation he could not congratulate him upon his colliery friends. He was aware of the low efficiency of compressed air and he was also aware of the advantages of electricity, but he was rather referring to the future of the Lancashire coalfield in particular which definitely lay in the working of deep, dusty and gassy mines. The standard of ventilation was not going to be judged by those who, in consultation with electrical and mechanical engineers, were going to decide whether electrical or compressed air coal cutters should be used purely on an efficiency basis. The standard of ventilation was laid down by law and had to be complied with. However well ventilated a mine may be the manager has to realise the potential danger of the presence of gas even in small quantities. A pit normally deemed safe, might, without any notice become dangerous locally, and that had to be borne in mind by the colliery manager, irrespective of mechanical efficiencies.

Mr. YEAMAN remarked that he had been connected with a colliery which did quite a good deal in the way of burning dant and they had no special preparation for drying it. The whole question was to put in sufficient boilers to do the work. A boiler burning dant could not be expected to give 10,000 lbs. per hour if that was its capacity with good fuel. It would, perhaps, be necessary to put in twice as many boilers, but what was saved in the cost of fuel would more than cover the extra expense in boiler plant.

Compressed air would no doubt be more commonly adopted in mining than it was at the present time but the trouble was the amount of leakage that occurred. He had known of cases where the leakage reached as much as 45 per cent. of the output of the compressors. Another point for consideration was the burying of the air mains. Though they were not probably buried when first installed they gradually got covered and when it became necessary to alter the inclination of the road no one knew where they were.

Mr. ROSEBLADE said he would like to see the electric light fittings taken more inbye and that was becoming possible with the introduction of the flameproof fitting. On the question of buying, as a representative of a manufacturing firm, he would say that they often wished the buyer could place himself more in the manufacturers' hands. For instance if a man were buying gas tight fittings he ought to have regard to the makers' point of view.

Mr. THIRLBY, speaking as a visitor, congratulated Mr. Bull on his election as President. Switchgear, in his opinion, was the bugbear in the electrical equipment of a colliery, and certainly one of the worst features underground. Motors giving the same output were smaller than they used to be but the difficulty was that they got choked up with dirt.

Mr. MORTON said he was glad the President had referred to the question of cables because that was a matter which was often lost sight of by colliery managers who gave more attention to the mechanical side. After all, in the layout of a system the question of cables was very important because a great deal of money might be lost if as much foresight was not exercised in that section of the plant as in any other.

One of the difficulties in connection with switchgear was that a switch might be put in to break a load of twice the normal but it had to be remembered that there might be a lot of power behind it. Quite a serious state of affairs could arise if the erection of the switchgear was not done with some relation to the capacity of the power generators, and it was still more

important in the case of a colliery which did not generate its own current but got it from a big station supply such as the Lancashire Power Company. In such circumstances switchgear must be used which would break a very big k.v.a. behind it.

The PRESIDENT said he was very pleased to hear from Mr. Whittaker that dant was being burnt at his colliery. It would be interesting to know how it was collected, dried, conveyed and burnt. In Lancashire boilers it burnt better when it was slightly wet, and it was more easily handled in this state when hand fired.

The type of fan drive was a very debateable point and depended somewhat on the position of the fan in relation to the boilers. If the fan was a long distance away from the boilers there was a loss of steam in the pipe line and with a steam engine drive a man had generally to be in charge all the time. A fan running continuously year in and year out offered a splendid opportunity for the use of a synchronous motor to raise the power factor of the whole system.

There was no comparison between the efficiency of compressed air and electricity. The efficiency of a small compressed air turbine driven generator lighting one lamp is about 4 per cent., but these little lamps are very useful in certain places, and no doubt pay for themselves many times over.

Mr. Yeaman's figure of 45 per cent. for leakage of compressed air was a very large one. He was glad to hear that speaker's statement about the burning of dant.

WARWICKSHIRE & SOUTH STAFFS. BRANCH.

This Branch opened the Session on September 25th, and met in Cannock.

Following tea the customary business was conducted. Mr. A. M. Anderson was elected to Membership and the Branch President, Mr. A. Hulme, drew attention to Professor Statham's report on the Association Examinations held this year.

Mr. A. HULME expressed to the Meeting his regrets in having to retire from the Chair, but felt contented that in Mr. Dixon the Branch had a stalwart supporter.

Messrs. Gunnell and H. W. Morris spoke on the Branch's behalf and thanked Mr. Hulme for his services to the Association during his term of Office.

Mr. I. T. DIXON taking the Chair mentioned his pleasure in being honoured with the Office as Chairman, and in his address drew particular attention to the Association's Certificate as a means by which the candidate could best shew his ability.

(P) Presidential Address.

I. T. DIXON.

My first duty is to thank you for so kindly electing me to be your Branch President for this session. Our Branch is in a very satisfactory condition. We have 116 members and a reasonably good bank balance. In passing, this should not prevent and does not excuse members who have not paid their subscriptions from doing so at once.

On reading the Report of the Chief Examiner of our Association Examination for 1930, many members would no doubt have been disagreeably surprised at the small number of candidates for certificates: it gives food for thought to learn that only 30 out of a total membership of close upon 2000, presented themselves and only 20 were able to satisfy the examiners and gain a pass.

There would seem to be a serious indifference to technical education on the part of the thousand or more working electricians who are members of the Association. Since the examination was inaugurated away back in 1910, twenty years ago, only 592 members have tried for certificates and 393 have been successful.

As you are possibly aware there has been a Departmental Committee of Enquiry into the Qualifications of Colliery Officials and a future development is the probability of B.O.T. Certification of Colliery Electricians.

It has thus become even more essential for all colliery electricians to acquire at the least the necessary amount of technical knowledge to satisfy the B.O.T. requirements before compulsory certification is established by law.

Failing a certificate of technical competence (either compulsory or voluntary) how is a manager engaging a new electrician to judge the candidates qualifications? He can enquire into the applicant's length of training and experience, but he himself has probably not the necessary detail knowledge of electrical matters to ascertain with certainty the technical ability of the candidate.

The maintenance of colliery electrical plant today is not the simple matter it was, even ten years ago. It might, in comparison, be said that in those days any Tom, Dick or Harry could attend to a d.c. motor or a plain 3-phase motor, but complicated starting gear and protective devices and special types of machines require a knowledge of principals only to be obtained by study. Above all the electrical equipment of the modern colliery is a vital factor in the economy of the concern.

I do not mean to suggest that it is possible to make a colliery electrician out of paper diplomas and certificates—far from it. But the Certificate of the Association is a valuable guide to the prospective employer, and it is now recognised as such.

Apart from this, any electrician who has his heart in his job wants to learn all he can about it. An ordinary colliery electrician may know just how to do a job when it is all straightforward work, but the one with technical knowledge is he who makes progress. Opportunity comes to all at some time and the man with the clearest evidence of his qualifications is the one to gain by opportunities.

Now, it is unfortunate, that before a student can enter electrical engineering classes at the Technical Colleges, he must have a standard of general education higher than that of a primary school. This means that young electricians have to attend night classes for two or three years to qualify for acceptance at a Technical College.

Many find this extension of ordinary school work at night classes irksome and are inclined to let themselves be put off from attending evening classes at all. Let me impress upon you that without a good grounding in Mathematics and Physics it is impossible to understand properly the theory of electricity.

This condition of public educational routine calls for junior technical instruction at every colliery centre. It is hoped that the Educational Authorities will provide this at Technical Schools and deal with the practical and theoretical questions which arise in the daily work of colliery electricians, not forgetting the mechanical

side when this is related to the application of electrical power to the operation of mechanical apparatus at collieries.

Modern mining electrical plant is getting more complicated and its use universal. The call now is for really competent men; the day of hapazard methods is over and those men who do not realise that they must supplement their practical work with technical knowledge will be left sadly behind.

The Council of the Association of Mining Electrical Engineers has given much time and thought to the needs of the colliery electrician. They have made suggestions to Local Education Authorities relative to a course of instruction for students to cover the critical period between the elementary and the technical school. After due deliberation they have taken as their model the course for Junior Electricians as drawn up by the Joint Advisory Committee of the Electrical Contractors' Association and the City & Guilds of London Institute with the addition of particular details suited to mining practice, to ensure safety from shock, fire and explosion.

The primary object of the Junior Course is to enable the student to appreciate the underlying principles of his daily work, to co-ordinate cause and effect in the phenomena he sees and to grasp the meaning of and the necessity of the work he daily carries out to instructions.

The advantage of this arrangement is obvious. Any fool can close a switch and turn a handle to start a motor—when he has been told to. But supposing the motor doesn't start one morning. It is the man who knows what is happening inside the switch and the the starter who scores then. There have, moreover, been far too many accidents caused through ignorant but keen youngsters trying to find out what goes on inside the starter. The man who knows doesn't need to poke his fingers about inside the case while the juice is on.

The Council emphasise the value of simplicity and direct application in the instruction to be given to the student. They suggest two courses in stages to follow the Junior Course for Colliery Electricians. It is generally felt that the classes provided by Technical Schools and Colleges are too advanced for working electricians and that the classes do not cover the Coal Mines Regulations or the Application of Electricity to Mines.

The subject matter suggested by the Council is of a general nature and is appropriate for those who desire to sit for the Association's Certificate Examination.

The Staffordshire Education Committee have an excellent school at Cannock which caters for youths from 16 years old. Any electrician living near would be well advised to consult the Principal of the Mining College as to the courses he should take. The school is particularly well equipped, has excellent workshops, and earnest students receive every encouragement and assistance. The syllabus covers the ground necessary for the Association Certificate and the Staffordshire Education Committee are prepared to give tuition in special subjects if there is a reasonable number of students requiring such tuition.

Mining electricians who are members of our Association have definite advantage as it provides technical lectures, papers and discussions by men of ability and, further, its journal, *The Mining Electrical Engineer*, is unquestionably a very valuable text book.

In conclusion I would like to say how much I appreciate Mr. Harvey's kindness in providing me with information on which I have based my address to you.

DONCASTER SUB-BRANCH.

Chairman's Address.

JOSEPH STAFFORD.

(*Meeting held in Doncaster, Oct. 25th,* 1930.)

It is always a matter of great difficulty, even to the erudite, to produce an inaugural address every ancestor of which has stored up impedimanta to the task of choice of subject. To the ordinary everyday practising engineer, the difficulties are numerous, and it is only in the knowledge, that on such occasions as this one has the whole world over which to roam free from the slings and arrows of an outraged audience, that one is encouraged to proceed.

During the last few years notable anniversaries in the field of engineering have been numerous; we now celebrate the coming of age of our own Association together with the tenth birthday of our monthly journal "The Mining Electrical Engineer". Crowning all electrically, next year is to see the celebration of the centenary of Michael Faraday's great demonstration of the phenomenon of electro-magnetic induction.

At such a time as this, whilst the anniversary fever is prevalent I might find an excuse to indulge in a short retrospective review of engineering, and particularly mining electrical engineering, during the last few decades; incidentally trying to appreciate the debt that the community in general, and coal mining in particular owe to electricity.

It is difficult to-day to imagine how we existed before the advent of electricity—streets and houses lit with oil or gas; telephones a curiosity; horse traction in streets, steam traction underground; no cinemas; and lastly, no wireless, the last perhaps, as some of our wives may assert, not an unmixed blessing when in the hands of a long distance fiend. I just remember the interest and excitement evoked in the nineties, when electricity was first introduced for street lighting in the town in which I was living, how the crowds congregated to see the striking of the arcs, and to avoid disappointment, being warned by the authorities in charge of the mysteries that the trick was a difficult one to perform, and was not always successful at the first attempt. About this same time generating plants consisted of large multipolar machines driven by triple expansion vertical engines, a great advance on the slow horizontal engines and bi-polar machines of the eighties; and boiler units, just emerging from the cylindrical type to water tube, were of ten to twenty thousand pounds per hour evaporation only.

The character of electricity demanded a more constant and higher speed prime mover than the reciprocating engine. Though the year 1894 saw the first practical turbine, the De Laval, it was not until 1900 that the first important Parson's type installation was started up, with units of 500 k.w. to 2000 k.w. The vertical spindle Curtis turbine of 5000 k.w. was first installed about 1903. Since that period of revolutionary change in prime movers, power plant design has steadily improved until to-day there exists a turbo unit of over 200,000 k.w., and a boiler unit (now invariably water-tube) of one and a quarter million lbs. per hour evaporation.

In this march of power-engineering our own country has not been lagging, as we were privileged to see for ourselves last session upon the occasion of our visit

to the Valley Road Station of the Bradford Corporation, and as evidenced by the results published from time to time of the operations of some of our private and municipal power undertakings. Such progress in design as has been made, has resulted in a great reduction in fuel consumption per unit generated, the best figure to-day being about 1 lb. of coal per unit, which is about one-third of the best performance of fifty years ago.

Until central electricity stations came into being there was no demand for boiler units of much larger evaporative capacity than 10,000 lbs. per hour, but as soon as the demand arose boiler makers had to bestir themselves. Immediately prior to the War, units of 60,000 lbs per hour were being built, but since then progress was so rapid that by 1920, units of 300,000 lbs. were being put down, and to-day the stupendous production I mentioned before, a unit evaporating one and a quarter million lbs. per hour has been installed in the East River Station of the New York Edison Co., working at a pressure of 375 lbs. per square inch, and a temperature of 725 degs. F. To we lesser mortals of the engineering world, these gigantic units—the last one I have named being large enough to run ten South Yorkshire Collieries—whilst wooing us with their magnitude, do not, I think, fill us with unalloyed envy. For the normal demand of a large isolated colliery, say up to 150,000 lbs. per hour, units of larger than 30,000 lbs. per hour, are to my mind wasteful, and I may confess I would not part with 10,000 to 15,000 lbs. units without a pang of regret. Reliability is more cheaply bought with the smaller units than with the larger ones, and heavy capital charges may easily outway any small gain in thermal efficiency which the larger units may, but do not always, effect.

In its anxiety to make ends meet the colliery world is to-day exploring every avenue in an attempt to utilize its waste fuels and bye-products to the best advantage, including in its purview, low temperature carbonisation, waste gas burning, washery slurry elimination, and the burning of low grade fuels, slurry and dust.

Many of us in Doncaster, recently witnessed the Market Place preludes to the St. Leger and heard loquacious vendors proclaiming the worth of their medicines, cures for all ills under the sun, each salesman possessing the one and only panacea for your ills or mine.

During this last few years we have witnessed and read many such preludes dedicated by commercial, technical, political and other interests to the cause of waste elimination and utilisation in the field of fuels ; all enthusiastic, many laudable, but none of which has yet resulted in revolutionising the colliery world, or performed one tithe of the miracles proclaimed in such preludes. Amongst the miracle workers, pulverised fuel has not been allowed to take a back seat ; it has promised nearly as much as some of its contemporaries, but I believe that, notwithstanding this handicap of overzealous partisans, it is making considerable progress. Short flame burners are now a reality ; grinding can be performed satisfactorily with correct mills ; transmission, storage and mixture troubles are being overcome ; and the flue dust problem is being gradually solved ; so that I think we can confidently look forward to some real success with pulverised fuel on Lancashire boilers in the near future. But, even when all the technical difficulties of design and operation have been overcome there will be no huge fortunes to be made in this direction.

The amount of unpreventible waste fuel suitable for utilization as pulverised fuel, (such as washery slurry or dust), available at a modern colliery, should not be large after all steps have been taken towards its elimination, and in good practice it may be not more than half the boiler consumption. The value of the good fuel conserved by this waste when burned as pulverised fuel is not of great magnitude when compared with other items of colliery costs. Capital costs in connection with pulverised fuel are still, of necessity, very high indeed, and the charges on this account swallow a large percentage of the apparent available savings. However, when all is truly balanced there is no doubt some economy to be effected in this way and the next few years will probably see many collieries utilizing their waste fuels by this expedient of pulverising.

This question of waste fuel needs to be borne in mind when consideration is being given to the connection of collieries to the National Grid; to my mind the most economical scheme will be the one that allows the colliery to run the minimum amount of its own plant at a good load factor for the consumption of its unavoidable waste and bye-products, the balance of power being drawn from the Grid; provided capital charges, transmission and allied costs do not render the Grid cost higher than colliery generating costs.

After this fragmentary digression may I now return to our history lesson. Transmission problems of fifty years ago have been solved by electricity. At that remote time we could transmit power by line shafting about 1000 feet; by wire rope about 3 miles; by compressed air 10 miles, and by water pressure 25 miles, all at relatively low efficiencies and certainly at heavy cost. Whilst such limitation of transmission radius existed you will appreciate that it was impossible for much progress to be made in the mechanising of industry, and it is for the solution of this leading problem that the world, and particularly the mining world, owes its unpayable debt to electricity.

British progress is proverbially slow, but generally sure, and this may account for the fact that it was not until 1900, or over 20 years after Edison ran his first commercial electric generating station in America that electricity began to be used to any extent at or in British Mines. Even to-day, of the half million horse-power of colliery plant, according to statistics only 20% is electrically driven, so that there is certainly no need for us yet to rest upon our oars, nor to fear any early limitation of our labours. The progress that has been made so far has however, been revolutionary.

Those amongst us who are of maturer years will be able to draw for the benefit of our younger members, pictures of colliery conditions at the commencement of this century. For example, I remember vividly my first view of a group of collieries lying, panoramic, in a picturesque valley of Nottinghamshire, each pit indubitably betraying its presence and its bustle by innumerable puffs and billows of steam from winding and fan engines, from compressing, hauling and screens' engines. Looking upon that same valley to-day one sees a very different picture; the languid vapour rising from the cooling tower at the central power station being the only visible distant manifestation that work is proceeding.

The modernisation of such groups of collieries was one of the first duties that electricity was called upon to perform, and there is not the slightest doubt that the majority of these groups would not be in existence to-day had not electricity come along with its timely aid.

Let us consider the various conditions and operations that have been so revolutionised by electricity. Winding with low pressure steam engines demanded up to as much as 80 lbs. of steam per shaft horse power hour, whereas the same engine to-day electrically converted needs an equivalent of under 30 lbs. The modern large high pressure compound steam winder requiring (say) 35 lbs. of steam per shaft h.p. hour has found a formidable rival in the steam-electric unit with its 25 lbs. demand for similar conditions. Whilst it would not be altogether correct to say that electric winding is commercially more economical than steam winding there is so much in its favour that it is gaining ground every year: to my mind this tendency is right when considered broadly and in conjunction with the potentialities of the future as foreshadowed by the National Electricity Schemes.

Colliery pumping—gargantuan outpouring of profits—has exercised engineering minds since the days of Newcomen and Watt, but it was not until the advent of electricity that any radical change from the beam and the slow-moving steam or air pump could be made. A very old friend never tired of telling me a story in connection with an early installation of electric pumping plant in a Derbyshire colliery. He was very proud of his pioneering achievement, and had numerous visitors to inspect the new method of pumping water by electricity. Among his visitors was an old colliery manager who, although convinced that water was being pumped was thoroughly mystified, and as evidence of his complete disapproval of the new-fangled idea gave his final and parting shot "Well I think now't of it, thou's still got pipes!"

Rotary pumps especially for land drainage work, and necessarily of slow speed, had been in operation since the days of Victoria's Exhibition at the Crystal Palace in 1851, and series stage pumps were being developed in the seventies, but they were doomed to sleep until their fairy prince came along, and it was not until the beginning of this century, with the development of a.c. practice, that any real progress was made with centrifugal pumps in the pit. Since then, as you know, enormous strides have been made in centrifugal pump design; all made possible by electricity.

I might perhaps digress here for a few moments to talk of pumping in connection with land drainage, in which question I am particularly interested. As you know, practically the whole of that part of the South Yorkshire Coal Field directly north, south and east of Doncaster consists of low lying lands, the area around Doncaster being less than 25 feet above sea level, and farther east only a few feet above sea level. Subsidence of the surface results in the formation of basins from which the collecting water cannot escape by gravity, and which has therefore to be pumped. A large colliery, working from 6000 to 10,000 acres under land of this character will probably need four to six pumping stations properly to drain its area, and you will realise readily, especially if you are conversant with the Fen districts, the difficulties encumbering the provision of pumping stations where electricity is not available. Without electricity a steam or oil engine station is the only alternative, the steam station requiring in addition to the engine house, a boiler house, and very often an attendant's cottage. As a matter of fact, the old steam pumping stations are mostly very permanent comprehensive structures erected at great cost. You may see examples of such stations very near Doncaster on the Hatfield Chase and other drainage areas, now being converted to electricity. In addition to the heavy capital and attendance costs of these stations, all the fuel, whether oil or coal, has to be carted to them. You will also realise that these stations, being designed to deal with a heavy rainfall, will necessarily be idle for a large proportion of the time, and in order to spread the work and provide time to start up the machinery, large impounding reservoirs are generally provided on the low level drain, again at great cost.

With electricity available the whole conditions are changed: a very small compact comparatively cheap station is possible—very often no more than a well with motor house erected over it—no impounding reservoir is necessary as the pumps can be entirely automatic, keeping the water levels low at all times, and no individual attention is necessary. The constant and regular pumping also results in better drainage conditions. The colliery drainage area with which I am connected has four pumping stations upon it, with an aggregate of 120 h.p. of electrically driven centrifugal pumps, all automatically controlled, in continuous commission, with one man only to attend to them all, and draining nearly 6000 acres of land at a very low cost. Again, thanks to electricity.

Screening, washing, and other surface adjuncts have all benefited by electricity to some degree, especially screening; the isolated noisy and messy steam engine, with miles of steam piping, has been displaced by the electric motor, the cleanly character of which enables it to be housed under nearly ideal conditions even on colliery screens.

Towards the solving of these problems of the application of electricity to coal mining our own Association has played no small part, its meetings and publications have stimulated ideas and efforts, and these, with its collateral endeavours have resulted in great benefit to the industry as a whole. May success continue to attend endeavours so unselfishly made.

By this time I am afraid you will begin to suspect me, a mechanical, "ladling out the jam in such large doses" and you will no doubt be anticipating a "pill" It is here "In-bye."

Notwithstanding the fact that electricity has made such unrestricted strides on the surface and around the pit bottom, hesitancy is still manifested with regard to In-bye; and, knowing the arduous and potentially dangerous natural conditions to be contended with, there would appear little prospect of complete electrification In-bye for many years. The average colliery manager to-day would sooner see the—well, he certainly hesitates before he agrees to the introduction of electricity in-bye in his pit. And can we really blame him? He will tell you that he has quite enough to do to tolerate such a necessary evil as the mechanical department, but when you come on the scene with your mysterious fluid that no mortal has yet defined, and ask to repeat in his dark domain the wonders you have wrought on the bright surface, as I said before, he hesitates, and why?

You ask him to obtain the permission of a Government Department to allow you to festoon his roads with sinuous cables which are always in the way of his tubs and his rippings; to fasten on the end of these, boxes of tricks which are a sealed book to ordinary mortals (sealed with the assent of a great University); and, finally to liberate your nectar into plant which is not amenable to a hammer and chisel, but requires treatment which only you, yourselves, can apply. And you, yourselves a body of men with specialist training

and an Association of your very own to help and encourage you in your mysterious pursuits. Again, I say the colliery manager hesitates, your very calling saviours of necromancy.

However, speaking seriously (although the quality of a jest is often judged by its modicum of truth), I really wish to be allowed to call attention to the question of the relatively complicated and intricate nature of electrical apparatus for use in conditions such as exist in-bye. The evolution of an engineering unit generally occupies at least two stages before the original idea or invention is perfected—the first stage being the building up of the idea to a workable unit, the resulting unit frequently being complicated; the second stage being the simplification of that unit for purposes of commerce, reliability and safety. To my mind present day underground electrical apparatus, considering the multitudinous and exacting demands that underground conditions have imposed upon its design and construction for purposes of safety, is a proud monument to the skill and application of everyone connected with its production and use. These demands have, however resulted in relatively complicated apparatus, and I think you will agree with me when I say that, having reached such a stage in its evolution, the next step should be toward simplicity, coupled if possible with an even greater degree of reliability than exists to-day.

Manufacturers of modern electrical apparatus, at least those specialising in mining gear, are I know fully alive to these conditions and are laudably making every effort to improve upon their already excellent productions, but they require more help from the man who uses and maintains their product. We must not be content to leave the matter solely in the hands of specialist designers, physicists and such others as are engaged in the development of our plant, but take our part with them ; to my mind, a very important part. The user knows or should know his own requirements, the conditions existing, and the behaviour of the plant or apparatus handed to him to fulfil those conditions, and unless he co-operates unreservedly with the manufacturer, clearly defining what he wants and, equally as clearly, what he does not want, keeping the manufacturer conversant with the behaviour of his plant, its shortcomings and sometimes its excellings, suggesting where improvements and modifications can be effected, putting forward new problems for solutions ; unless he co-operates to this extent, progress will not be as rapid as it should be.

This is your duty and your privilege, and I know has always been your effort and aim, but even greater efforts are needed if the progress of electricity in-bye is to reach a standard commensurate with its progress on the surface.

Whether, in face of all the natural hazards associated with mining in-bye, we shall ever be successful in attaining these ideals, time can only tell, but to hold the ideals in front of us and work for them is worth even more than achievement.

Aesop's Fables, which I imagine, are to the Philosopher what Euclid's first book is to the engineer, contain the fable of the countryman and the snake, wherein it is recorded that the snake rewarded the countryman for his kindness in saving its life by biting his offspring. You of the electrical fraternity would do well to study that fable when confronted with the problem of displacing compressed air from the pit. I think you will follow my meaning without much further comment. By all means do all in your power to save its life, give it the best of motive power in high efficiency synchronous motors, carry your precious power to it miles in-bye so that it can perform those duties which only compressed air can do properly, but do not let it bite you by ousting you from your legitimate holdings in-bye. You have a tremendous advantage in efficiency over your rival (which requires five units to do the work you can perform direct by one), and your problem appears to be, to my mind, to render the use of electricity as innocuous and docile as compressed air ; nothing but experience and continued application will enable you to do this. We can take encouragement from the fact that we are not ploughing a lonely furrow in our endeavours, for, as we know, an enormous amount of research work is being done to help us by Government Departments and by private enterprise. All of us I am sure were greatly heartened after our summer visit to the Government Research Station at Buxton.

I fear that I have already trespassed too much upon the privilege of this chair, and I can assure you that I would not have dared to do so had I not known you to be very long suffering. The fact that you have honoured me by asking me to occupy this chair for a session is proof of the latter virtue, and I hope that I shall not impose upon your good nature.

When you thrust this honour upon me at the last meeting I had no opportunity given to me adequately to express my thanks to you, and I take this present opportunity, assuring you that my best endeavours will always be directed to the wellbeing of our Association.

The success of a Chairman's term of office depends very greatly upon the support he receives from his fellow members and officers, and it is in the knowledge that I shall receive this in full measure from all of you that I look forward to a successful year : one which I trust we shall remember as fitting to mark a milestone in the history of our Association—its coming of age.

Mr. BLEACH (past Chairman of the Doncaster Sub-branch) in proposing a vote of thanks to Mr. Stafford for his interesting and instructive address said that Mr. Stafford had stressed the point of being a mechanical man and he (the speaker) had been reminded of a quotation by Carlyle which states that good orators rarely made good speeches, as a good speech should consist entirely of truths. Mr. Stafford however not only gave a good speech but proved himself a master of oratory. It was John Ruskin who said "We are not sent into this world to do anything into which we cannot put our hearts. We have certain work to do for our bread, this is to be done strenuously, other work to do for our pleasure, this is to be done heartily, and what is not worth this effort is not to be done at all." He certainly thought that Mr. Stafford had proved the truth of this statement and he looked forward to many such enjoyable evenings under his, Mr. Stafford's Chairmanship.

Mr. HIGGENS (President of the Yorkshire Branch) seconding the vote of thanks said that he would like to compliment the members of the Doncaster Sub-Branch on being able to obtain such a Chairman as Mr. Stafford; at the same time he (the speaker) would like to compliment Mr. Stafford in the progress made by the sub-branch since its inception four years ago: he had been one of the first to see the desirability of such a branch and he must feel justly proud of its position to-day. The members could look forward with sure confidence to its further progress under such a Chairman as Mr. Stafford.

WEST OF SCOTLAND BRANCH.

Joint Propaganda Meeting

held in Kirkcaldy, on Friday, 24th October, 1930.

A joint meeting of the Scottish Branches for general propaganda purposes was held in Kirkcaldy, Fife, on Friday, 24th October, 1930, at 6-30 p.m. The principal object was to assist in the work of furthering and resuscitating the interests of the East of Scotland Branch.

Mr. F. Beckett, Vice President of the Association, and Past President of the West of Scotland Branch, occupied the Chair, others present being, Messrs. A. B. Muirhead, F. Anslow, R. Rogerson, C. E. Hart, A. Dixon, J. Dinnen, J. R. Laird, R. Wilson, and W. G. Gibb, of the West of Scotland Branch, and Mr. James Walker of the Lothians Branch.

An account of the speeches by Mr. Beckett and Mr. Muirhead is given here. In addition, Messrs. F. Anslow, D. C. Gemmell, A. V. Reis, and Paterson took part in the address.

Mr. James R. Laird of the West of Scotland Branch gave a lecture, the incidents dealt with being: wireless in 1854 to the present day, cable troubles, machinery troubles and the human element. These various incidents were illustrated by lantern slides, and Mr. Laird's endeavours were much appreciated by those present.

At the close of the Meeting a vote of thanks was proposed to Mr. Beckett for presiding, to Mr. James R. Laird for his lecture, and also to Mr. Walker of the Lothians Branch for arranging the lantern. Mr. Robert S. Laird was also thanked for his services in operating the lantern.

The intention to hold a further Joint Meeting of all the Scottish Branches on 15th November, 1930, was intimated, this to take the form of a visit to Kelty Power Station and Cowdenbeath Workshops, belonging to Messrs. The Fife Coal Co., Ltd. At that meeting Mr. J. W. Gibson, President of the Association would be present and address the company, and Mr. Charles C. Reid of The Fife Coal Co., Ltd., would preside. The visit to Kelty had been made possible through the kind invitation of Messrs. The Fife Coal Co., Ltd., who were also providing tea and light refreshments for the gathering.

Mr. F. BECKETT.—The meeting which we are holding tonight is a Joint Meeting of the Scottish Branches of the Association of Mining Electrical Engineers. These joint meetings are held occasionally to enable the members of the different branches to meet one another, exchange experiences and generally assist each other.

The old practice of jealously keeping to oneself the knowledge one had gained has happily almost disappeared and most men now realise that the more we impart our own personal experiences and knowledge to others and compare it with theirs so much the more knowledge do we gain.

In the application of electricity to mining the problems encountered are often very different to those prevailing in other industries, and are so varied that it is a great help to be able to discuss them with other men and to exchange views with them. A new light is often thrown on a subject which enables us to overcome a difficulty which has so far evaded a solution.

Tonight the other Scottish Branches have come to lend a helping hand to their brothers in the Kingdom of Fife, and Mr. James Laird who has grown grey in colliery work is going to give us "Some Interesting Electrical Incidents", and will illustrate these with lantern slides. Afterwards, Mr. Laird will be only too pleased to answer any questions which may be put to him.

(Mr. James R. Laird then delivered his Lecture, after which Mr. Beckett again addressed the meeting.)

Mr. F. BECKETT.—The conditions under which electrical apparatus has to be installed and maintained in mines are entirely different to those which prevail in any other industry. What is good enough for almost any other industry is often not satisfactory in a mine; although only 25 years ago the opinion was commonly expressed that anything was good enough to go down a pit. There were, however, even at that time, a number of men who felt that in order that electricity might be effectively applied with safety to mining services it was essential that there should be close co-operation and interchange of ideas between the designer, the mining engineer, and all who are concerned with the installation and maintenance of electrical plant in mines.

The Founding of the Association.

There was at that time no association or society which provided facilities for these men to meet together and discuss the various problems which arose. The natural result was the formation, 21 years ago, of the Association of Mining Electrical Engineers.

The founders had in view certain definite objects, viz. :—

(1) To consider means of minimising the Risks attending the Application of Electricity to Mining.

(2) To procure the adoption of Improved Methods or devices tending to Increase Safety.

(3) To promote the General Advancement of Electrical Mines.

(4) To facilitate the Exchange of Information and Ideas among members, and generally to
Extend the Experience, Increase the Efficiency, and Elevate the Status of the Members.

The means which the Association adopted for the furtherance of these objects are many.

Organisation of the Association.

Branches were formed in all the mining districts. The Branches are self-governing, subject to the General Regulations of the Association.

Each Branch elects a President and Committee for this purpose, and sends representatives to the General Council of the Association.

Each Branch Committee arranges meetings of its members, at which papers of general interest to the members are read and discussed. It also arranges for visits of inspection to mines, works and other places of interest.

Joint Meetings are often arranged with neighbouring Branches or kindred Associations.

The Association publishes and sends to each member the illustrated monthly magazine called "The Mining Electrical Engineer". In this will be found a copy of the papers read at each of the Branches, together with the discussions which took place.

Prizes are awarded each year for the best papers published during the year.

The Association also annually holds an Examination and issues Certificates to successful candidates.

Membership of the Association.

The Association recruits its members from all classes of men who are interested in its objects, so that we have in our ranks, Consulting Engineers, Manufacturers of Mining Machinery, Electricity Supply Engineers, Mining Engineers and Electricians, Mine Managers, Professors of the Universities, Home Office Inspectors, etc., each one contributing something from his knowledge and experience for the benefit of his fellow members.

The importance of the work which the association is doing is being more and more recognised by other Associations connected with the Mining Industry, and by the Mines Department of the Home Office.

The Association has, on several occasions been asked to give its views on matters of vital interest to our industry. As an instance, our representatives gave evidence before the Committee formed by the Mines Department to enquire into the Qualifications of Colliery Officials, including electricians and engineers. This question is one which has received considerable attention from the Association for many years, and the recommendations which have been made by the Committee can be regarded as an important step towards the achievement of one of the aims of the Association.

These recommendations are likely to have a far-reaching effect, and it can be safely stated that we are within measureable distance of the time when the colliery electrician will enjoy a much higher status than he has today.

Need for Evidence of Competency.

We must, however, remember that increased recognition brings with it greater responsibilities, and electricians will have to see that they qualify for this improved status.

It is, therefore, incumbent on all, and on the younger men in particular, to see that they acquire the knowledge and experience necessary to pass the tests which are sure to be imposed at a later date. As an aid to these the Examinations which are held by the Association annually will be found of great benefit.

It is quite possible, that when the time is ripe for official certification, the certificate issued by this Association will be accepted as an indication that the holders of this certificate are fully qualified to receive the official certificate of the Home Office.

The younger men cannot be too forcibly impressed with the unique advantages to be gained by membership of the Association, and particularly with the value gained by securing the Certificate of the Association.

Both the Chief Electrical Inspector of Mines, Mr. Horsley, and the new Deputy Electrical Inspector of Mines, Mr. Harvey, have for years taken a keen interest in the work of the Association. Mr. Harvey is a Past President of the Association, and for several years has been the Convener of the Examinations Committee.

There are many other directions in which the Association has shewn great activity, but there is not time on this occasion to enlarge on them.

Mr. A. B. MUIRHEAD mentioned that following the able statement made by Mr. Beckett he desired to thank Mr. Laird personally for undertaking to give the Lecture that evening on such short notice. He mentioned the difficulties which had arisen in arranging a date for the Meeting and expressed sympathy with Mr. James Walker of the Lothians Branch and Mr. Gibb, Secretary of the West of Scotland Branch, for the additional burden which had been thrown upon them because of the postponement of the Meeting from the 10th October.

Mr. Muirhead proceeded to express regret that the activities of the East of Scotland Branch of the Association had so seriously depreciated. He paid a compliment to Mr. Dawkins, who unfortunately was absent, and to Mr. Paterson for the consistent effort they had maintained to keep the Branch alive in Fife. Mr. Muirhead outlined the advantages which accrued to the Mining Industry because of the activities of the Association and emphasised the advantage to the Colliery Electrician which resulted from the connection with it. He pointed out that it was surprising for two reasons that the Association did not appeal to the Scotsmen in this area :—

(1) The greater Education Facilities of the Association.

(2) The Low Cost of Membership.

and expressed the hope that a definite effort would be made to revive the past glories of the East of Scotland Branch.

In this connection Mr. Muirhead pointed out that the necessity for technical education on the part of the colliery electrician was daily becoming more important. There was a question very prominent in high places at the present time regarding the Qualifications of the Colliery Electrician. It was possible that an attempt would be made to define the statutory duties of the electrician and to make these more onerous. These steps would possibly be preliminary to a demand for certification.

The Association of Mining Electrical Engineers, he said, had as an Association, no interest in the question of making certification compulsory; their only interest lay in assisting to provide that standard of electrical knowledge which the colliery electrician should have, and that higher standard which it was likely would be demanded if those who favoured certification gained their ends.

Mr. Muirhead then mentioned the details of the Propaganda Meeting arranged for 15th November. He intimated that Messrs. The Fife Coal Co., Ltd., had kindly offered hospitality and facilities for a visit to Kelty Power Station and to Cowdenbeath Workshops, and that the President of the Association, Mr. J. W. Gibson, would be present to address the Meeting at Cowdenbeath Workshops, when it was hoped sufficient numbers would come forward to enable the work of the East of Scotland Branch to be carried forward with enthusiasm and vigorous progression.

HIGH TENSION REVERSING CONTACTOR FOR RAND MINES.

An interesting item in a large electric winder equipment which has just been shipped to South Africa by The General Electric Co., Ltd., is the high tension reversing contactor. The rating of the contactor is 2,200 volts 400 amps., but as the supply system is liable to voltage surges of considerable magnitude, the insulation is designed to withstand a high potential test of 30,000 volts.

A metal and micanite construction is used, both fixed and moving contacts being carried on substantial micanite covered shoe bars on which ample surface clearance has been allowed. Each set of three moving contacts is operated by a 3-phase magnet, and the "forward" and "reverse" sets are interlocked, both mechanically and electrically, so that the arc on the opening set is completely ruptured before the other set closes.

The arc chutes have large laminated iron cheeks and, to secure a long and effective blowout, tapering laminated ribs are fitted to distribute the flux over the whole area of the chute.

It is interesting to note that the length of the wind is 3150 ft. and the normal load 5 tons of rock, the accelerating h.p. peak being 2500 with a winding time of 86 seconds.

Manufacturers' Specialities.

Ellison Flame-proof Starters.

The several illustrations herewith shew a range of improved starter and switchgear mining services recently introduced by George Ellison Ltd. The Ellison oil-break flame-proof star-delta starter on shortened floor stand, shewn in Fig. 1, is of the circuit breaker type and contains all that is necessary to start, stop, and protect a squirrel cage inducton motor. It is fitted with full automatic releases and, consequently, a separate circuit breaker is not required.

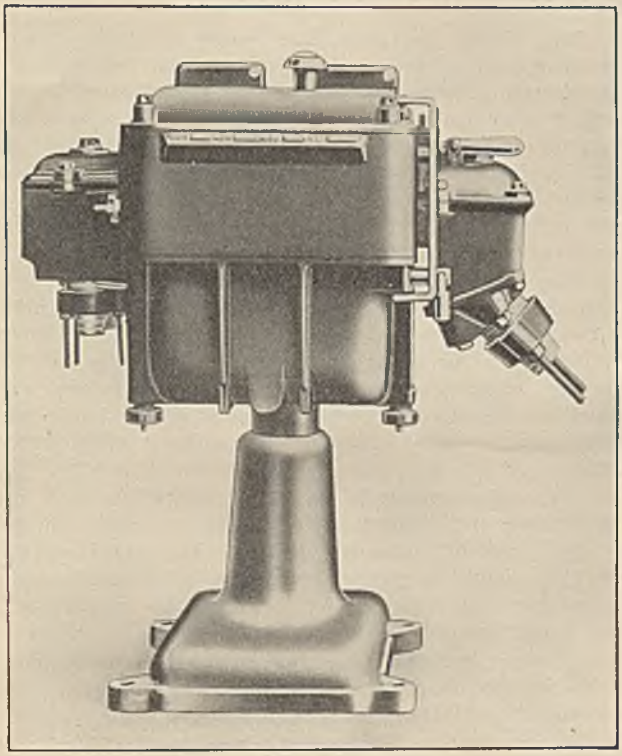

Fig. 1.—Flame-proof Star-Delta Starter.

A padlocked interlock bar of simple construction prevents removal of the cover and/or oil tank by unauthorised persons, and any attempt to remove the interlock bar while the starter is in the closed position trips the starter immediately. This motor starter has been certified by the Sheffield University as having passed their standard tests for flame-proof enclosure.

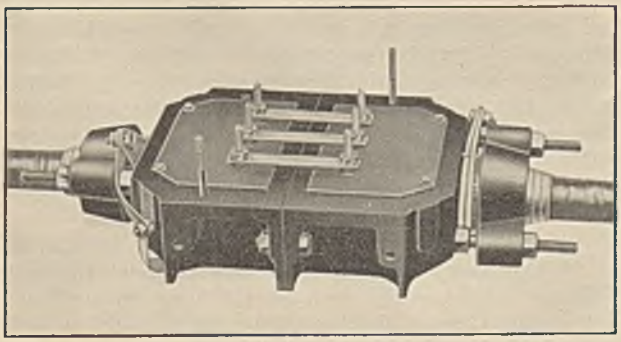

Fig. 2.—Cable End Coupling.

Specially designed cable dividing boxes, which are adjustable to the direction of the run of the cable are fitted to these starters: or the Ellison cable end coupling, illustrated in Fig. 2, may be bolted on.

With the cable end coupling, an extension cable can have the ends sealed above ground and it is then only necessary to bolt two half couplings together below ground when it is required to move the starter forward in the mine.

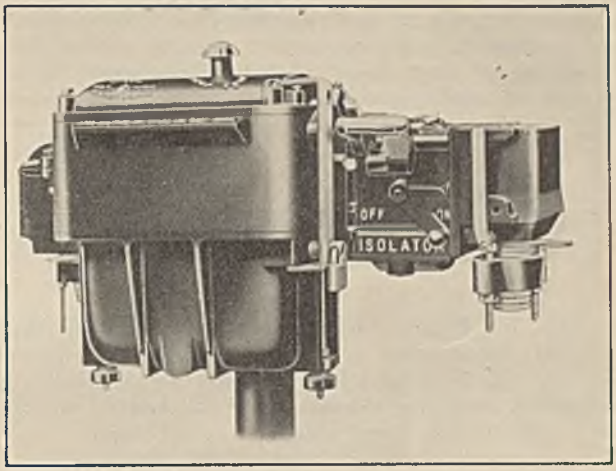

Fig. 3.—Starter with Interlocked Flame-proof Isolating Switch.

The star-delta starter may, moreover, be fitted with the interlocked isolating switch of flame-proof design, shewn in Fig. 3. This switch has also received the Certificate of Approval of the Sheffield University.

The fourth illustration is of an Ellison flame-proof auto-transformer starter for squirrel cage motors. This type of starter comprises an auto-transformer in conjunction with a change-over switch.

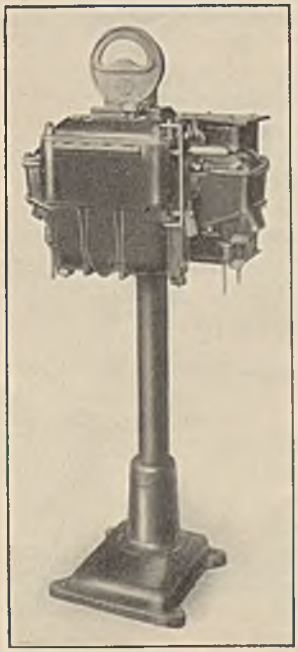

Fig. 4.—Flame-proof Auto-Transformer Starter.

The heavy current required for starting is supplied to the motor at low pressure from the tappings of the transformer, while a smaller current at higher pressure is drawn from the mains. The motor being started, the transformer is disconnected and the motor connected to the mains by means of the change-over switch, when the motor attained sufficient speed and the original starting current has decreased. The auto-transformer starter has an advantage over the star-delta starter in that any starting torque less than the maximum is possible by means of taps provided on the auto-transformer.

The change-over switch on this auto-transformer starter is similar to that of the star-delta starter and the oil-cooled auto-transformer is housed in a strong welded steel tank which has passed the Sheffield University Test for a flame-proof enclosure.

Jointing of Steel-cored Aluminium Conductors.

The wide and ever-increasing use of Steel re-inforced aluminium for overhead power lines has encouraged the design of simple and effective fittings for jointing the conductors in the middle of spans, and for terminating such conductors. In such situations it is imperative that the conductivity and mechanical strength of the joint should be at least equal to the corresponding characteristics of the strand itself. Tests have been made

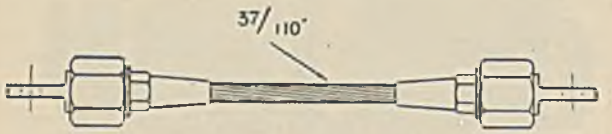

Fig. 1.

recently by British Insulated Cables, Ltd., on their patented aerial cable union, and the tests show that this type of joint complies fully with the requirements mentioned, and the following are the results of tests on a 37/.110 steel-cored aluminium cable union.

Mechanical Test.—A mechanical test was made on two ending fittings arranged as shewn in Fig. 1. Test No. 1 broke at 17,770 lb.; test No. 2 broke at 18,280 lb. The B.E.S.A. theoretical ultimate strength of the strand is 17,722 lb.

Electrical Test.—A joint was made up with a small length of cable each side. Contact clamps were fitted on each side of the joint at 11½ in. centres, and a third contact clamp was fitted on the strand at 11½ in. centres from one of the others, thus enabling the conductivity of the strand and the joint to be directly compared (Fig. 2). The joint was filled with an anti-corrosive compound. The following results were obtained with 410 amp. flowing :—

Drop across joint and strand: 22.2 mV.
Drop across 11½ in. length of strand: 25.0 mV.
Resistance of joint and strand:
0.0222/410 = .0000542 ohm.
Resistance of strand: 0.025/410 = 0.000061 ohm.
Relative conductivity of joint to strand:
0.000061/0.0000542 = 112.5%

Three hundred and fifty amperes were then passed through the joint and conductor for one hour, and a further test made with the following results:—

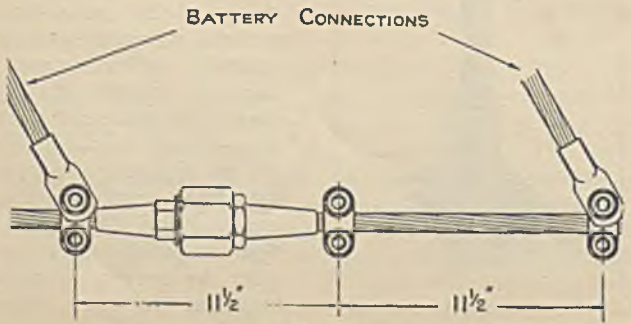

Fig. 2.

Drop across joint and strand at 295 A: 16.4 mV.
Drop across strand only at 295 A: 18.6 mV.
Resistance of joint: 0.0164/295 = .0000556 ohm.
Resistance of strand: 0.0186/295 = .000063 ohm.
Relative conductivity of joint to strand:
0.000063/0.0000556 = 113%

Cardiff Engineering Exhibition

Notable Exhibits.

GENERAL ELECTRIC Co., Ltd.

The display covers a wide range of electrical and mechanical plant and apparatus, indicative of the vast manufacturing resources of the G.E.C. Naturally particular prominence has been given to the specialities most in demand by South Wales industries. Thus the exhibits include several for colliery service, such as haulage motors, flame-proof and industrial switchgear, mining type bells and telephones, shaft signalling apparatus, conveying gear, vibrating screens and the like.

The industrial oil-immersed drawout switchgear unit is well designed and robust. A number of these units can readily be grouped together as a main switchboard for surface or below ground, while it is equally suitable for the control of motor or feeder circuits in any situation. Much of this gear has been installed in South Wales pits. It is standardised also in flame-proof patterns.

A popular exhibit is the liquid controller with the stator reversing contactor which offers a most efficient means of controlling haulage motors. The start is smooth and the simple operation by means of a single lever is another feature which has brought this control gear into favour in many South Wales collieries.

Of more general application are ranges of standard industrial motors and motor control gear, electric tools, and industrial lanterns and fittings.

A branch of engineering in which rapid strides have been made recently is industrial electric heating. The G.E.C. has devoted a large section of one of its most important factories to the development of electric furnaces and kindred forms of heating appliances. A typical example of this class of gear shewn on the stand is an 8 k.w. "Magnet" standard muffle type furnace, suitable for a maximum working temperature of 1000 degs. Cent. In this case the muffle is of refractory fireclay wound with highest grade nickel chromium wire and so arranged to give an even temperature throughout the length of the muffle. The terminal box is at the back of the furnace and the pyrometer flange and hole is also fitted there. There is an automatic temperature control panel mounted alongside the furnace. Other examples displayed include an oil heater fitted with special electric immersion heaters and a lead-melting pot which is capable of wide application. This pot has a capacity of 300 lbs. of lead or 250 lbs. of solder, carries heating elements on the bottom, and is mounted in a sheet steel casing, the space between the pot and the casing being packed with insulating material. The control panel consists of a three-heat switch, fuse and pilot lamp and is connected to the pot by means of flexible tubing.

A section of the stand is devoted to the manufactures of the Company's Fraser & Chalmers Engineering Works. This part of the exhibit includes (1) A working model of a "Bliss" Cluster Rolling Mill; (2) A Solid Injection Pulverised Fuel Burner and Redler Conveyors; and, (3) Various Conveyors, Pulleys, Idlers, etc.

The rolling mill exhibit is a complete working replica of one of the standard "Bliss" Cluster Mills for which Fraser & Chalmers are licensees and manufacturers in this country. The mill is only a model in regard to its size; in regard to material and workmanship, it is in accordance with best rolling mill practice. It has been designed and will be installed for actual commercial operation. This type of mill has proved very popular in the U.S.A. and Germany, principally due to the following advantages which it possesses: increase in speed of rolling; great reduction in the number of passes for rolling; saving in power; the use of small hard steel work rolls which permit of greater reductions as the material becomes wider and thinner, and enable a much greater pressure per inch of width.

The Fraser & Chalmers patent solid injection burner for a Lancashire boiler is shewn together with a sectional explanatory drawing shewing its application to a boiler. The coal is distributed to the boilers by means of a mechanical conveyor of the Redler type, this conveyor keeping a small hopper over each burner full. The advantage of this system is that the power consumption for distribution is extremely low, and the excessive wear on valves, pipe lines, and fans, associated with air conveying systems, is eliminated. For all Lancashire boiler work very uniform fine grinding is essential, and with this system a slow speed mill is used to maintain the fineness and uniformity of the product.

The component parts of belt conveyors such as pulleys, idlers and various samples of belts, together with numerous illustrations of conveying and screening plants convey a clear impression of the material, design, and application of Fraser & Chalmers plant for these duties.

Of exceptional interest, too, are the models representing gear which were too large to display on the stand. One of these is of a 500,000 k.v.a. 11,000 volt metal-clad switchgear unit for three-phase 50 cycle circuits. It is of the duplicate busbar type, change-over being effected by means of the G.E.C. patented turret method. Two models are shewn of "Grid" substations, which give a very clear idea of the methods to be employed by the Central Electricity Board for electricity distribution.

A. REYROLLE & Co., Ltd.,

Messrs. Reyrolle are shewing a new 30 ampere, flame-proof, air-break, circuit-breaker which has been specially designed for controlling the supply to motors fitted to mining and industrial machinery, and particularly suitable for switching squirrel-cage motors direct on to the line. It is of the triple-pole type, for use on 660 volt alternating-current systems; but a double-pole circuit-breaker of the same current-rating is also available for 550 volt direct-current systems.

The mechanism is built up on a frame, which can be completely removed from the flame-proof cast iron casing. Each phase is fitted with a bi-metal over-current trip, having an inverse time-lag characteristic, in addition to a separate instantaneous over-current release, working from a series trip-coil. The instantaneous trips have an adjustable setting ranging from 30 to 150 amperes, and the bi-metal elements come into operation at about 35 amperes. The series over-current coils also serve as electromagnetic blow-out coils for extinguishing the arc, and suitable asbestos-lined arc-chutes are provided. When required, an under-voltage release mechanism can be fitted, and auxiliary contacts can, if necessary, be incorporated in this to form an electrical interlock with a motor starter. There are also mechanical interlocks to make it impossible to open the lid while the circuit-breaker is in the ON position, and to prevent closing the circuit-breaker while the lid is open. The circuit-breaker may be used as a single unit, or it may be mounted on a bus-bar chamber to form part of a switchboard. When it is used as a single unit, the incoming and outgoing supply can be taken either through a cable-gland or through a plug and socket interlocked with the switch-operating handle. Provision is made in the design for the mounting of an isolating switch between the bus-bars and the circuit-breaker when a number of units are used to form a switchboard, or in other circumstances when an isolating switch is required.

A particularly notable exhibit is the new air-break reversing switch which has been specially developed for use in conjunction with electric drilling machines. The complete arrangement consists of a three-pole double-throw switch and three single-pole cartridge-type fuses in a robust cast-iron case; an incoming cable dividing box fitted with a detachable sealing gland is mounted on the top of the switch casing, and a three-pin-and-earth plug and socket is provided for the outgoing cable. The plug is mechanically interlocked with the switch handle so that it cannot be withdrawn when the switch is in the ON position. The whole arrangement is flame-proof, and the rating of the switch exhibited is 15 amperes at 250 volts 3-phase.

Another mining exhibit is the metal-clad portable, oil-immersed, circuit-breaker. This "Mothergate" switchgear has been specially developed to meet the many requirements of coalcutting schemes and the like, and a number of similar units may be mounted side by side on a skid, to provide a portable distribution centre. As shewn in the exhibit, each circuit-breaker is fitted with a plug of suitable rating for the trailing cable; the incoming dividing box is easily detachable and, by virtue of its plug-in feature, facilitates cable extension and obviates jointing when moving the switchgear to a new position. A complete system of interlocking is provided between the circuit-breaker and the plug of each unit, so that incorrect operation is impossible. The unit shewn is of 100 ampere rating and is fitted with time-limit overload protection, with an adjustable time lag. Other forms of protection may be provided, such as an under-voltage release, core-balance earth-leakage, or Reyrolle earthed-pilot protection, which provides an electrical interlock with the coalcutter or other machine.

Messrs. Reyrolle also exhibit examples of their detachable cable dividing boxes, known as "Flit-Plugs". These are metal-clad and of strong liberal design to withstand the roughest usage. Their principal service is in extending and linking up cable to gate-end switchgear or other such apparatus. They are of the plug-in type, and consist essentially of a compound-filled cable-sealing chamber having a flame-proof gland at one end, and, at the other a moulded insulator which houses either plug or socket contacts. When these flit-plugs are applied to gate-end switchgear they are uncoupled from the switchgear when the linking-up cable has to be extended, and a length of cable with a flit-plug at each end is interposed with no more trouble than the mere plugging in and bolting up involves.

The exhibit also includes a representative selection of the Reyrolle range of plugs and sockets. The examples shewn include 5 ampere and 15 ampere sizes for use with such apparatus as electric irons, vacuum cleaners, cooking utensils, and the like. In addition, there is a selection of the larger types, designed for mining and industrial service generally. New 5 ampere and 15 ampere

flame-proof plugs and sockets are also shewn. All Reyrolle plugs and sockets are entirely metal-clad, and provided with visible earth terminals.

The Company shew a set of their standard self-aligning fuses, designed to comply with Home Office Regulations, and to be used on circuits working at pressures up to 660 volts. These fuses have a separate hand grip, and it is impossible for live metal to be inadvertently touched while they are being held. The fuse wires are enclosed in asbestos tubes, fixed in separate chambers, and cannot be enclosed in the hand while a fuse is being inserted or removed. The fuses are built with self-aligning contacts, and are ventilated. The design is such that the fuses are suitable for front or back connections; the handles and clips are interchangeable; and the range comprises standard sizes rated for 30, 60, 100, 200, 350 and 500 amperes. A particularly interesting feature of this exhibit is a range of heavy-duty cartridge fuses of from 60 to 600 amperes capacity. These are suitable for fitting into the standard porcelain holders, and they are therefore particularly serviceable in cases where the extensions of generating plant have exceeded the safe limits of the open-type fuses.

J. H. HOLMES & Co., Ltd.

J. H. Holmes & Co., Ltd., are shewing, on the same stand as Messrs. Reyrolle, with whom they are associated, two examples of their wide range of electric motors. One is a flame-proof motor, and the other is totally-enclosed external-fan-ventilated; both are of the alternating-current, 3-phase, squirrel-cage type. Totally-enclosed external-fan-ventilated motors (Fig.1) have been specially designed to provide for service in situations requiring complete enclosure of the windings and working parts, to protect them against dust and dampness in the atmosphere. The motor proper is enclosed by an inner dustproof and weatherproof casing, and in addition an outer casing, which is part of the motor frame, provides an annular space through which cooling air is driven by means of a fan mounted externally on the motor shaft. The particular motor shewn is arranged for star-delta starting, and is rated at 28 B.H.P. at 770 r.p.m. and 440 volts.

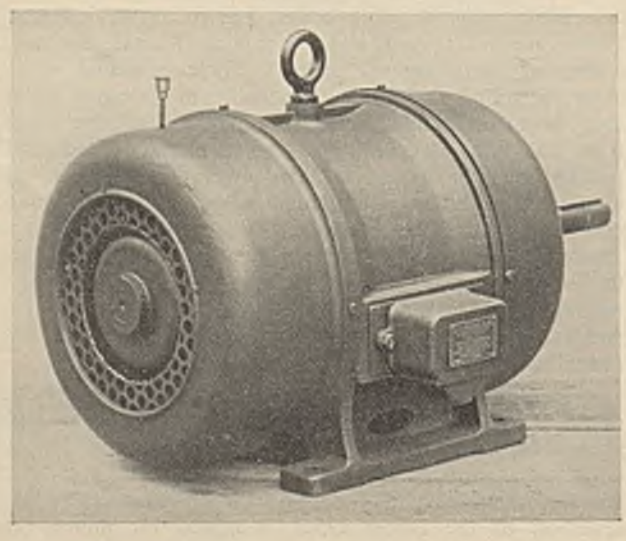

Fig. 1.

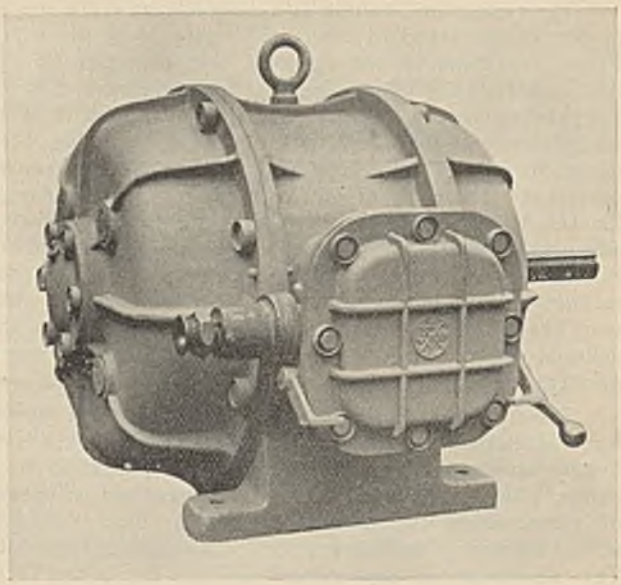

Fig. 2.

The flame-proof motor (Fig. 2) exhibited is rated at 5 B.H.P. at 760 r.p.m. and 440 volts. The design is such that, when required, a switch and a trifurcating box, or a switch and a plug, or a trifurcating box only (all necessarily of the flame-proof type), may be fitted without any alteration of the standard design. The example shewn is provided with a triple-pole non-automatic flame-proof switch, and a Reyrolle flame-proof plug for the incoming cable.

There were many other prominent exhibits, of which the following deserve particular mention. It is regretted that limitations of space prevent the publication of longer descriptions.

Ferranti Ltd.—This Company make an attractive display of their latest designs in the way of meters, transformers, instruments, electric heaters and wireless.

Gent & Co., Ltd.—As usual, the apparatus exhibited by this Company is of very great local interest owing to its being largely of a specialised mining character. The exhibits including mining bells and relays, suitable for parallel working on a bare wire signalling system; mining pushes; tapper keys; telephones, etc. This apparatus is of flame-proof construction and free from combustible parts. Other items include "Tangent" syrens and alarms, electric clocks, secret interphones, staff indicator systems, etc.

Brake Linings Ltd.—"Duron" bonded asbestos brake linings for heavy mining duty, as well as for motorcar and vehicle service, are the standard products exhibited by this Company.

Haslam & Stretton Ltd.—As district agents for Evershed & Vignoles Ltd., British Arca Regulators Ltd. and for "Thor" specialities, this Company provide an extremely interesting and useful display.

W. B. Dick & Co., Ltd.—These well-known specialists in lubrication stage an exhibit on the usual attractive lines. The Company specialise in oils for the lubrication of high speed machinery and generators, as well as for transformers and switchgear.