The Transactions of the South African Institute of Electrical Engineers.

Founded June, 1909; Incorporated December, 1909.

VOL. XIX., FEB., 1928. RESPONSIBLE EDITOR: MAJOR E. F. RENDELL. PART 2.

Proceedings at One Hundred and Eighty-Fourth Ordinary General Meeting.

23rd February, 1928.

Mr. P. E. Gregson (President) in the Chair.

There were present forty-one members and visitors, and the Secretary.

MINUTES.

The minutes of the Annual General Meeting, held on 26th January, 1928, were taken as read and confirmed.

NEW MEMBERS.

The President announced that the following gentlemen would stand for election at the next meeting:—

To stand for election by ballot:—Henry Bough (Member), Ernest Gustav Weyhausen (Member), Abe Colley (Associate Member), and J. O. Arnold (Member).

PRESIDENTIAL ADDRESS.

The President: The next item on the agenda, gentlemen, is the Presidential Address, and I will ask Col. Stewart Ross, Vice-President, to occupy the chair.

Col. Stewart Ross then occupied the chair

Gentlemen,—To have been elected President of this Institute is an honour which I deeply appreciate. Not only because of the high position this Institute holds in the technical life of South Africa, but also because of the many prominent and distinguished engineers who have been my predecessors in office. I can only thank your late Council for the confidence they have placed in me, and assure them it will be my utmost endeavour to uphold the dignity of the Institute and to further its interests to the best of my ability.

Previous presidential addresses have covered such a wide field of electrical engineering applicable to this country that it is becoming increasingly difficult to find fresh subject matter. I propose, however, to touch briefly on the early history of this Institute, the development of electrical engineering in the Union, and the progress of the industry generally.

The South African Institute of Electrical Engineers was founded in June, 1909, and incorporated in December of the same year; but it will be of interest to members if I relate the actual circumstances which resulted in the foundation of this society.

Some months prior to June, 1909, a paper on an important electrical subject was read before a meeting of a sister institution, at which the late Mr. Bradley, Mr. Murgatroyd and myself were present.

At the conclusion of the meeting regret was expressed at the absence of electrical engineers, in view of the importance of the paper read to our profession, and the suggestion was made that it would be in the interest of electrical engineering if a distinct association was formed. This met with immediate approval, and a provisional committee of three was constituted, with Mr. Bradley as chairman and Mr. Murgatroyd as secretary. The efforts of this committee eventually led to a meeting in June and the formation of this Institute. From that date the progress of the society is contained in the official records, but I should like to repeat that the early success obtained was in no small measure due

to those pioneer Presidents, Messrs. Campbell, Rider, Elsdon Dew and Bernard Price, who threw their full weight into the initial work.

Having briefly mentioned a few facts in connection with the early days of our own Institute, I will now touch on the progress of the electrical industry in the Union. As is generally known, the application of electricity in the first instance was for lighting only. This was made possible by the invention of the carbon filament lamp in 1879, by Sir Joseph Swan and Thomas Edison, and within three years the first lighting scheme in the Union was installed at Capetown Railway Station. This indicates that South Africa, even in those days, was in the van of progress. While the possibilities of electricity for the distribution of power had been demonstrated by Gramme in 1873, this was not recognised until many years after electric lighting had been placed on a commercial basis.

The earliest electrical engineer associated with the gold mining industry was the late Mr. Hubert Davies, who came to this country in 1889, to supervise the erection of electric light plants for three mines, the Jumpers, the Henry Nourse and Simmer and Jack. From these small beginnings, when a 20 k.w. bi-polar generator was considered a large installation, we can measure our progress by making a comparison with the recently completed Witbank Station with its three turbo alternators, giving a total output of 60,000 kilowatts, and with a line voltage up to 132,000. It would take up too much time to cover the various phases of the Industry's progress in this country—a progress which, while constantly maintained, has not been made without encountering difficulties.

While we in South Africa have no need to fear comparison with other countries, particularly in the application of electricity to the gold mining industry, nevertheless we must not lose sight of the fact that our facilities are limited, and to keep in touch with the most up-to-date methods, it is necessary for us to be conversant with what is happening in other parts of the world.

Since the scientific discoveries of Faraday, upon which electrical engineering is based, great achievements have been made, and it is my intention to touch on a few of outstanding interest. Steam still remains the chief source of power. It can be utilized anywhere, its capital cost is reasonable, and the size of plant or unit is in no way restricted. It is, under certain conditions, cheaper than water power, owing to the efficiency of coal-fired stations being constantly on the increase. Steam turbines continue to grow larger. The last record is created by the installation of a 168,000 k.w. set in two cylinders at the Hell Gate Power Station, controlled by the United Electric Light and Power of America. This turbine, which attains a speed of 1,800 r.p.m., will be served by condensors of record size (137,500 sq. feet). The largest hydro-electric generator develops 65,000 k.v.a. at a speed of 82 r.p.m. The capital cost of water power plants is increasing, compared with steam power, as difficulties often arise in harnessing the water.

These high speeds necessitate greater consideration of the ventilation problem. In the past little was known as to how much air flowed, and of its distribution, number of poles, fans, coil ends, slots and teeth in the core, etc.; but the engineer who designs an alternator in the near future will have to predict the ventilation along with the electrical characteristics.

Transformers, the corner stone of the alternating current system, are increasing in capacity with the growth of the industry. In the large sizes they have lost their traditional appearance in the use of self-cooling radiators, with air-blast adjuncts, in addition to various forms of applications for tap changing under load, which a few years ago were practically unknown. The necessity of tap changing arose through the interconnection of large systems and from the feeding of wide areas at high voltages from a central station where alterations at the consuming end could not be made conveniently by adjusting the voltage at the generator.

The world's largest single-phase transformer has a capacity of 33,333 k.v.a., which can be increased to 50,000 k.v.a. by air blast against the radiator. The voltages are 220,000 Star to 69,000 Star to 13,200 Delta. The high voltage bushing is 31 feet.

This plant is for the Philadelphia Electric Company, and will handle power generated by Conowingo water-wheel generators. At the new station at Witbank step-up transformers of 23,500 k.v.a are now in operation, transforming 6,600 to 132,000 volts.

Circuit breakers are a class of electrical equipment which are expected to handle emergencies without the ordinary scope of service. These vary in severity according to the local conditions, and it is practically impossible to estimate in the course of construction how severe the duty may be. As an example, imagine attempting to test a circuit breaker up to $2\frac{1}{2}$ million k.v.a.

The main protection for opening high voltage heavy power circuits is the oil breaker. The growth of superpower and interconnection necessitates circuit breakers capable of withstanding the most severe service. This is not merely a question of size as in opening, the action of the arc, the oil and the gas takes place unseen in the fraction of a second, but it must be approximately calculated to ensure a breaker being capable of operating under fault conditions. A $2\frac{1}{2}$ million k.v.a. rupturing capacity 1,500 volt oil circuit breaker is the largest at present in operation. It contains no porcelain, as this class of insulator is not considered suitable for the high thermal and mechanical stress.

The electrification of railways is a definite milestone in the progress of the industry, and, while it is not applicable to all sections, there can be no doubt there will be a gradual increase in the zones of operation as time goes on. The sections of railway which handle the heaviest freight and passenger train service are most likely to benefit by electric traction. Provided the capacity of the central station is sufficient, goods traffic can be handled more expeditiously by electric locomotives than by steam. Moreover, the electric locomotive is much simpler and safer in operation and lends itself to the application of safety devices. The question of the extension will be largely governed by financial considerations, and it is to be hoped that the increased traffic shown in other parts of the world will be reflected in South Africa.

A further indication of the continued advance in the use of electric power is the increase in capacity of electric hoists, and it is gratifying to be able to say that the largest hoist so far manufactured has been installed at the City Deep Gold Mine. The R.M.S. rating is 5,000 h.p. with a peak h.p. of 9,000. The diameter of the driving shaft is 36 inches, while the drum diameter is 35 feet. The total load, including normal load, is 40 tons, while the depth of the shaft is 4,500 feet.

In dealing with the progress of the industry, mention must be made of the improvement in the production of cables for power transmission, and also their application. These are now being made to carry 132,000 volts, which a few years ago would have been considered incredible. The use of power transmission cable is constantly on the increase, but they have been a greater boon to gold mining than to any other industry. In this connection it is interesting to note that at an early date the Crown Mines will be installing a 20,000 volt, 3-core vertical shaft cable to a depth of 6,500 feet. This will be the first occasion in the history of mining where 20,000 volts have been taken directly underground.

Great credit is undoubtedly due to the consulting engineer's department of the Rand Mines for their progressive policy.

In a broad survey of the industry's progress it is, of course, impossible to deal minutely with every phase, but I feel that a few words on electrical appliances for domestic purposes are necessary, especially as the improvement in this class of apparatus has been most marked, not only from the point of view of utility, but also in the increased beauty in design.

The increased use, however, of these appliances is creating a problem which sooner or later must be dealt with by the power supplier, who should regulate and control the standard of electric heating apparatus used on the supply mains, as the efficiency of such equipment affects the price they can obtain per unit. The sale of electric power to the domestic consumer is similar to the conditions met with in the gold mining industry. The householder can only afford a certain sum, according to the size of the house, and it is therefore necessary for the Electric Supply Department to

safeguard their interests by endeavouring to give complete service at minimum current consumption.

While for cooking purposes the most up-to-date appliances are on the market, which compare very favourably in cost with coal and gas cookers, the question of electric hot water heating is not so advanced, owing to the larger current consumption required. If, however, the heating of the daily water consumption could be done during the night, a cheaper tariff could be laid down by the supply company, which would give hot water service to the householder at an attractive price.

Municipal supply undertakings should endeavour to enlighten their consumers as to the economic uses of electricity for cooking and heating, the possibilities of which have not yet been fully realised by the average householder. Once the advantages were better understood, an increased development in the power supply would result. Johannesburg Municipality appreciate the necessity of educating the public in this direction, and are now conducting an active educational campaign at the Industrial Exhibition.

The greatest progress in the electrical industry has undoubtedly been made in illumination. Electric light was the first step in commercialising the use of electricity, and from that date a steady advance has been made, and there is no reason to suppose will not be continued. Unfortunately, South Africa is still behind in this respect, but our larger municipalities are alive to the position, and an improvement will no doubt result. The subject of illumination has become a special study, and it is impossible for the average electrical engineer to be *au fait* with all the latest developments; nevertheless, every engineer should make a point of grasping the general principles, since it is through them that, mine, factory and other classes of lighting, much of which is at present badly carried out, can be improved.

The enormous scope of our great industry,, a few achievements of which I have cursorily mentioned, makes it more and more essential for the young engineer to specialise in one or other of its many branches, but, if he is to make good, he must become acquainted with the two divisions—the purely technical and the commercial. However highly qualified a man may be, it is a fact that unless he has a certain amount of commercial ability, he will never rise to the higher positions. Every consulting engineer, manager of an electric supply undertaking, director of a company, etc., has not only to deal with the highly technical subjects, but has also to consider them from a financial and economic aspect. The inventor applies himself to research, the engineer makes his idea a practical possibility, but it is the man with technical knowledge and business ability who makes it a commercial success. There can be no doubt that engineers as a class have been so absorbed and engrossed in the technical side of their work that they have neglected or despised the business side. That is a view which has been considerably modified in the last few years. Most manufacturers of electrical machinery are now realising that the representative with technical, as well as business, qualifications is an essential part of their organisations. In South Africa this attitude has also been prevalent, and many technical heads of various undertakings have failed to appreciate the difference between the commercial engineer and the commercial traveller. This is rather surprising when you consider how many improvements and innovations have resulted from the work of the technical representative, who have been the channels through which the latest and most up-to-date knowledge has been conveyed to potential users.

In view of this lack of appreciation of engineers for engineers, it is not surprising that the profession counts for so little in the public eye. The time seems ripe for the engineer to take his place in the political arena and lend his technical knowledge to moulding the destinies of this country. There is no training more calculated to cultivate the intellect or broaden one's outlook than engineering, and if this fact is so little understood it is entirely due to the modesty of engineers themselves.

In conclusion, I would appeal to the Student Members to take full advantage of the facilities offered them by attending the monthly meetings of this Institute and

listening to the discussions, and joining in same. It is splendid training and promotes celerity of thought and readiness of speech; such experience gained will be found invaluable in after years. Attendance at meetings is useful also in making a man known to his brother engineers, and in familiarising him with his seniors.

It is extraordinary how few people appreciate or understand exactly what is meant by the term "engineer." The popular idea is that it is a man who has something to do with engines. Nothing could be further from the truth. Engineers existed long before there were engines. The word "engineer" is derived from the same root as the word "genius." It represents an attitude of mind. It is a way of looking at things. To be a successful engineer means one has the ability to study a problem concerned with the sources of power in nature, and to find a solution which will harness them to the service of man. The engineering spirit must be present in every one of us, if we are to advance and further our great profession. It is the spirit of the pioneer, of the man who gives his life to research. It is a spirit which ought to be more prevalent in every walk of life. It is the spirit which makes a man desire to leave the world better than he found it. It is the basis on which our civilisation has been built, and unless that spirit remains active, will eventually perish.

The prestige of the Institution was never higher than to-day. The Government recognise our value to the community. The South African-trained engineer is coming into his own, and the day is not far distant when membership of this Institute will be regarded as a recommendation of his ability to undertake any position in the engineering world.

Col. Stewart Ross (Vice-President): Gentlemen, you have shown by your applause that you have appreciated the Address of our President. I have now much pleasure in calling upon our immediate Past President, Dr. Van der Bijl, to propose a vote of thanks.

Dr. H. J. van der Bijl (Past President): Mr. President and gentlemen, it gives me great pleasure to propose a vote of thanks to Mr. Gregson for his very interesting address. He has raised a number of points that are very interesting, and on which I would have liked to have replied in a manner more worthy of his address; but, on account of the pressure of my work, I have not been able to give much thought to these matters to-day, and, therefore, if I talk more or less extemporaneously, I want you to understand that I mean it, nevertheless, just the same.

It is very refreshing to hear Mr. Gregson's little reminiscences of the early history of this Institute when it was formed. He is a man who has been interested in this Institute right from the very beginning, and he is one of the Foundation Members

He also mentioned Mr. Hubert Davies, who was one of the first engineers to come to the Rand to install a little plant of 20 kilowatts—which was then regarded as *something*. I remember, when I was a youngster, the name of Hubert Davies was almost a household word. Every one of the young friends that I had in those days was going to get a job with Hubert Davies. (Laughter.) I suppose those who now take charge of the firm of Hubert Davies will, to-day, say, "Well, thank goodness, there are other engineering firms who are willing to give jobs to these youngsters." (Laughter.)

Since Mr. Gregson brought up some of these early reminiscences, I cannot help mentioning that we owe a debt of gratitude to those people—those pioneers, who came here from abroad in the early days when South Africa was struggling to find its feet. I need only think of some of our Past Presidents, like Mr. Elsdon Dew, Mr. Botting, Mr. Bernard Price, and so on, who have come here and have made engineering. It is owing also to efforts of such men that, to-day, young South Africans can be trained in our Institutions to do their duty in the future in the engineering world in South Africa. (Applause.)

Mr. Gregson has mentioned the matter of railway electrification. In my valedictory address I mentioned something about railway electrification; I mentioned one instance where it has not been such a happy decision, although I had given a warning in good time. My mention of this has created a stir in the newspapers. It was not understood how I could object to electrification at any time. I am afraid many

people do not quite understand what the electrical engineer stands for. All I wanted to convey was this, that when we find that electricity cannot do the job, we must make a clean breast of it and tell the public so. (Hear, hear.) I believe that in doing that —which is the only right thing to do—we will gain more confidence with the public, and the true value of the greatest servant of mankind, namely, electricity, will be more appreciated.

Mr. Gregson has also mentioned a few other matters which I think, especially in this town, are of very great importance, that is, teaching the people the value and the use of electricity in their homes, and in their factories, and also in illumination.

There has been very great development taking place in South Africa in the past few years in the matter of electric power supply; but I think the time has now arrived when we should teach the people what the use of electricity means, not only in factories, but also in the homes; and in this respect I must say that it has been very gratifying to me, when I went to the opening of the Industrial Exhibition, yesterday, to find that the Johannesburg Municipality, through the efforts, I take it, of Mr. Sankey and his staff, has a fine exhibit to show people what electricity can mean in the home. It is also interesting to note the improvements that are now being made in lighting the Johannesburg streets.

Col. Stewart Ross (Vice-President): I will now call upon Mr. Sankey to say a few words.

Mr. Bernard Sankey (Past President): Mr. President and gentlemen, it gives me great pleasure to second the vote of thanks to our worthy President for his most interesting and instructive address.

One of the most interesting portions of that address to me was the history which he has given us of the early days of this Institute. It is very interesting to note that he was one of the committee of three who originally founded this Institute.

With exceeding modesty, he does not refer in any way to the part which he himself personally took in that formation; but we who know him can read between the lines, and we know that he played no small part in the creation of this Institute of ours (Applause), and it is a source of satisfaction to all of us that we have this year, as our President, one who played such an outstanding part in the creation of this Institute, and without whose assistance and that of the other two, possibly we should never have had an individual Institute to express and develop our ideas on electrical matters, and to develop our industry and profession generally.

Later on in his address our President deals with a subject which is somewhat of a domestic character, namely, the supply of electricity in Johannesburg, and the development of the uses of electricity, domestically, and in every other direction. I am very pleased to notice that he has referred to this phase of the supply of electricity, because in Johannesburg there is an immense field which is, as yet, hardly touched. It is said that in Durban one firm of agents have supplied over 2,000 cookers of one particular make alone; and, if that can be done in Durban, it shows what is the field in Johannesburg.

Mr. President, without taking up any more time, I wish to second most heartily the vote of thanks to our President for a most interesting and instructive address, touching, as it does, upon almost every phase of electrical activity.

Col. Stewart Ross (Vice-President): Gentlemen, we have with us to-night, as a visitor, a very old friend of ours, the President of the Associated Scientific and Technical Societies, Dr. McCrae, and I am sure you would all like to have a word from him.

Dr. McCrae (President, Associated Scientific and Technical Societies): Mr. President and gentlemen, I can assure you it is with very great diffidence that I express any remarks to the electrical engineers. I feel this diffidence because, on a previous occasion, when I had an opportunity of addressing some electrical engineers, ventured to suggest to them what my lay opinion was of an electrical engineer. I think I was complimentary; at any rate, I associated with the electrical engineer nothing of a specialist character; I attributed to him a very wide range of knowledge. Incidentally, I suggested that he was a person who must know all about the ion; he must know all about what happened when these millions and millions

of ions are started on their course whenever he establishes a potential difference. After the function at which this took place, I was taken aside by an electrical engineer. I would like to tell you what he said. He said, "You know, McCrae, that was an awful lot of 'bunk' that you told us (Laughter). I do not care a straw what happens about all these electrons; all I am concerned about is to get the 'juice" on to the line." Now, when my remarks are treated in that fashion, you will understand that it is with great diffidence I offer any remarks to-night (Laughter).

Well, I do heartily associate myself with the vote of thanks which has been proposed by Dr. Van der Bijl, and seconded by Mr. Sankey. I am just a little bit astonished that neither of them referred to the theme adumbrated by Mr. Gregson in his reference to your student members. I do hope, for the sake of your Institute, that Mr. Gregson's appeal to your student members to come forward and attend your meetings, and possibly take part in discussions, will have a very great effect. Personally, I feel that it is the duty of those of us who are past the student stage to assist the younger men of our professions, and I do most earnestly hope that the suggestion thrown out by Mr. Gregson will have very great effect. In conclusion, I wish Mr. Gregson the very happiest and most successful term of office as President of your highly appreciated Institute (Applause).

Col. Stewart Ross (Vice-President): Is there any other gentleman who would like to support the resolution? If not, before formally asking you to accede to this resolution, for Dr. McCrae's information, I would like to mention the fact that the Council have formed a committee to go into the question of student members, and they have the very able assistance of Professor Randall, who has had to deal with students all his life. I am quite sure, with this committee, which comprises the President, Professor Buchanan, Professor Randall, Mr. Pickles and another, the interests of the students are in safe hands.

Gentlemen, I would now ask you to accord Mr. Gregson a very hearty vote of thanks for his excellent address (Applause).

The President: Gentlemen, I am very grateful to Dr. Van der Bijl, Mr. Sankey and Dr. McCrae for the very kind words they have said about me and also my address. It is somewhat difficult, as I mentioned in an early paragraph in my Address, to choose a subject which would be of interest to members, and I am very pleased that you have appreciated my humble attempt. I thank you (Applause).

KLINGENBERG POWER STATION IN BERLIN.

By O. Feldmann (Member).

(*Journal*, June, 1927).

Contribution by Captain G. J. Moore, O.B.E., M.C., M.I.E.E.

I have read Mr. Feldmann's paper with great interest and have much pleasure in adding to the discussions that have already taken place on Mr. Feldmann's contribution to the Engineering papers that have been published in our "Transactions" from time to time, which are not only of interest and aid to us in South Africa, but in other parts of the world. I often send copies of the "Transactions" containing papers which I consider of interest to my friends in England and India, and always receive replies from them to the effect that the Engineering works in this country are sound. This shows the value of our Institute and its "Transactions," a fact, I think, that is generally acknowledged.

The historical notes in Mr. Feldmann's paper are of great interest as they briefly but effectively show what strides have been made in Electrical Engineering in Berlin within the past twenty years or so. A number of us here this evening can well remember what we thought of 1,000 KW. generating sets, both of the open and enclosed types, and to-night we are discussing a station containing three sets each of 70,000 KW. Imagine a station made up of sets of 2,000/5,000 KW. and boilers that were considered large twenty years ago. I believe I am correct in saying that I do not think any Engineer twenty years ago

visualised any such project, if he did he would have been considered a dreamer with views of no practical value.

To-day, however, we have units of 70,000 k.w. and larger, of course many of these are made up of multiples, but I believe there are 50,000 KW. sets that can be correctly termed one set, in other words as is generally termed with one shaft.

It is interesting to note that the decision to build one large station to replace seven stations was determined by three major considerations, namely, cost, reliability and the counter action of local strikes and economic disturbances. Some of our friends in Johannesburg will no doubt disagree with Mr. Feldmann on this question; my own point of view, however, is that reliability can be obtained in one station, which experience all over the world has proved.

There is a limit no doubt, but what that limit is it is difficult to say, as so much depends upon the local conditions, such as available space for cooling water, coal handling facilities, etc., etc., The Klingenberg Station appears to have made adequate arrangements as regards the electrical side by means of reactances inserted in the bus bar circuit so as to obviate this side being the limit anyway up to the ultimate capacity of 540,000KW. and it would be of interest to learn from Mr. Feldmann, what considerations—if they were considered—decided the ultimate capacity to be 540,000KW. as with the "T" layout, and its subsequent short leg extensions, a considerable output can be obtained without the boiler-house overstepping the turbine room, etc.

The construction period for such a large station as that at Berlin, say, fourteen months, is extremely good and reflects great credit on all concerned, but I cannot quite agree with Mr. Feldmann that it was mainly due to the work being entrusted to one firm of contractors.

I think I am correct in saying that the Electricity Supply Commission's Witbank Station was constructed in twelve months from start of construction period to one set running, and there was certainly more than one contractor on that job; given reasonable conditions, such as area of ground, handling facilities, etc., I would have thought the quickest construction would be obtained by splitting up the job amongst a reasonable number of contractors, in fact I note from Mr. Feldmann's remarks under "boiler-house," that the order for the sixteen boilers was divided amongst no less than eight different firms in order to get the job completed in time.

No doubt from the successful contractor's point of view it is advantageous to obtain the order for the complete station. I also note that Dr. Dobson, of Messrs. Dowson and Dobson, endorses the "one" contractor point of view; when I belonged to a firm of contractors I held exactly the same views.

It would appear that the main considerations that decided the installation of a powdered fuel plant were, variable coal sizing from the Collieries and irregular quality. We in this part of the world, thanks to coal owners and the Coal Grading Commisions, know exactly what limits of size we have to contend with, and when coal of a certain class, such as a mixture of peas and duff, we know that the coal delivered will be all that will pass through a $\frac{3}{4}$" square hole, so this is one factor less to be considered. With regard to quality, here again we are on a fairly safe wicket so that we can estimate within close ranges what we have to design for.

I can quite see, however, that the designers of the Klingenberg Station had to give this matter very great thought, and this one item of plant clearly demonstrates the need for considerations from all angles of the conditions that prevail in the particular place in which a power station is to be built, in other words what would be eminently suitable satisfactory in one part of the world would be unsound in another, these remarks of course apply more particularly to plant that has to deal with the products of the country.

With regard to the final steam temperature of 425°C. (798°F.) although the plant has only been in operation for about a year, perhaps Mr. Feldmann could tell us if any trouble has been experienced with what appears to me to be a rather high steam temperature.

It is particularly interesting to note that re-heating has not been adopted in the Klingenberg Station, although the designer no doubt knew all that was to be known about the stations in England and America

that are equipped, or partly so, with reheating plant; possibly something may be done in this direction later on with high pressure steam used as a heating medium, but it is difficult to see a coal fired reheating scheme following the load changes that are usually met with in some large power stations.

I quite agree with Mr. Feldmann that it is very unsound to "chase calories," if by doing so there is the chance of reduced liability.

With regard to the statistics given in the paper, these are of interest, but unfortunately there is not enough data given to discuss them. Perhaps Mr. Feldmann, will in his reply, give us additional information, such as steam consumption of the main and feed heating sets, quantity of cooling water and temperature rise across the condenser, quantity of drying steam per ton of coal, calorific value of the general run of the coal and temperature of the flue gases.

From the live steam diagram it is noted that ample provision is made to maintain the supply of steam to the main sets even if trouble was experienced on one or more portions of the ranges. The feed heating turbines do not, however, appear to have been treated in a similar manner; in my opinion they are as essential to continuity of service as the main sets. I hope Mr. Feldmann can give us, in his reply, some details of the live steam ranges, such as: are the joints riveted or bolted? are the flanges riveted or welded to the pipe body? Such information would be interesting in view of the steam pressure.

Another interesting feature is the draught plant, inasmuch as apparently the chimneys, which are no less than 230 feet in height, are of sufficient height and diameter to deal with half the load on two boilers, after which the induced draught plant is switched in.

It appears to me that from the wording and diagrams of the house sets and turbine heating plant, it is operated as follows:—

One house set is run on the house bars and entirely disconnected from the 30 k.v. bars, and should the feed water heating requirements necessitate additional steam over and above the steam required for the house set at that time, then another 10,000 set is run on the 30 k.v. bars, without in any way being connected to the 6 k.v. house bars, and that the loading on this set is arranged to keep the feed water at, say, 140°C. (284°F.). This appears to be both sound an economical.

Is the reason for disconnecting the 10,000 k.w. sets from the 30 k.v. bars, in case of trouble, to shut them down to avoid raising the feed water temperature above the predetermined limit? I do not see that any provision has been made to maintain the auxiliary service in the event of trouble on the one 10,000 k.w. set, which at that time is on the house bars. I would have thought it safer to have always had two sets on these house bars, even if they were smaller than 10,000 k.w. so that in the event of a fault on one, the instantaneous protection—such as the Merz-Price—would operate, leaving the other set to carry the auxiliaries on the overload rating of the set, which could be high, until another machine could be got on to the bars. We have used this method on all of the larger stations we have designed, on the transformers feeding the auxiliary bars and find that they function perfectly with artificial faults put on under service conditions. On the other hand, steam auxiliaries in important places could have been used with equal results, both from the thermal and reliability points of view.

I should be obliged if, in his reply, Mr. Feldmann has the time to amplify his remarks on the above interesting section.

Major Rendell has dealt very fully with the electrical side, and it would only be wasting time to discuss this again, as my remarks could not be other than a repetition of those already made.

In conclusion, I feel I am voicing the opinion of the members of this Institute by saying that we are all more than thankful to Mr. Feldmann for giving us such an interesting paper on such a well-designed station.

The President: Gentlemen, it is with pleasure that we have to record our appreciation to Mr. Moore for his very interesting criticism of Mr. Feldmann's paper. I am sure that Mr. Feldmann appreciates it, and will fully reply at a later date.

The President: Gentlemen, we have a contribution to discussion by Mr. J. N. Naylor. I will ask Major Rendell to be good enough to read it.

THE BLOEMFONTEIN NEW POWER STATION.

By G. J. Moore, O.B.E., M.C., M.I.E.E. (Member).

(*Journal*, September, 1927).

Discussion by J. N. Naylor (Member).

I have read with interest Captain Moore's description of the "Bloemfontein New Power Station," and very much regret that I was unable to take part in the Institute visit. I must say, from observation of the station, while passing through Bloemfontein by train, that it presents a very pleasing external appearance, which is rather added to by the reinforced concrete construction of the telpher system.

I agree very strongly with Captain Moore's paragraph dealing with facilities from getting from one part of the plant to another. Power Stations should always be designed with a view to rapid handling during times of trouble—valuable time is wasted and valuable plant is endangered when the men in charge of the plant have to travel from one point to another by circuitous routes. The provision of sliding roofs over the pump room and boiler house is also a move in the right direction. In tropical and semi-tropical climates, work in a power station is arduous at the best of times, and the better the operating conditions, the better will be the operation of the plant. In connection with the coal handling plant, I should like to know what spares are carried in the way of motors for the telpher hoist. Two motors are used, and it has occurred to me that these might be replaced, in the event of breakdown, by motors from the trackless tram system.

I am not familiar with the Vickers' boiler or the Illinois type of stoker, and would like to ask Captain Moore whether his mention of a suspended arch which can be raised or lowered at will, means that the arch can actually be moved while the boiler is in operation or whether the boiler has to be first taken off.

It is becoming a common practice nowadays to paint the pipework different colours according to the medium carried, and, in this connection, I am of the opinion that all valves should be either named or numbered and labelled accordingly. Great trouble is gone to in the correct labelling of electrical switchgear, but on the mechanical side of a power station it is rather the reverse.

I notice that the L.T. busbars are split by a disconnecting switch, and assume that this switch is on overload protection, as otherwise a busbar fault on these bars would mean a shut down to all the station auxiliaries until the faulty section could be isolated. To have all switches of a similar rupturing capacity may seem an extravagance at the first glance, but when one has had much experience in power stations, and has seen the lengthy stoppages to supply caused by the break down of comparatively unimportant and small switches, it is obviously a very wise precaution to take.

Finally, I am very interested to note that considerable trouble has been taken with the lighting system. Power stations run continuously, and it is essential that, for efficient operation, adequate lighting should be provided. As a battery is provided, I assume that the more important lighting circuits are provided with a change-over switch, as otherwise the station would be in darkness during a complete shut down.

The President: Gentlemen, we thank Mr. Naylor very much for his interesting contribution to the discussion on the Bloemfontein Power Station.

There being no further contribution to discussion on the remaining items on the agenda, the meeting was declared closed.

The meeting terminated at 9.10 p.m.