

H. Brown.

PROCEEDINGS
of the
Seventh Convention
of the
Association of
Municipal Electrical Engineers
(Union of South Africa and Rhodesia)



HELD AT JOHANNESBURG
From Monday, April 12th to Friday, April 16th,
1926

PRICE FIVE SHILLINGS.

PROCEEDINGS

of the

Seventh Convention

of the

Association of

Municipal Electrical Engineers

(Union of South Africa and Rhodesia)



HELD AT JOHANNESBURG

From Monday, April 12th to Friday, April 16th,

1926

PRICE FIVE SHILLINGS.

INDEX.

	Page
EXECUTIVE COUNCIL, 1926	5
RULES AND CONSTITUTION	6
PROGRAMME OF PROCEEDINGS	9
MONDAY'S PROCEEDINGS	11
Civic Welcome	12
Apologies	13
Retiring President's Address (Mr. John Roberts)	14
Report of Hon. Secretary and Treasurer ...	18
Financial Statement	20
Election of President	22
Election of Hon. Secretary and Treasurer ...	22
Admission of Rhodesian Members	23
Venue of Next Convention	24
Election of Vice-President	25
New Members	25
British Engineering Standards Association (S.A. Branch)	26
Presidential Address (Mr. B. Sankey) ...	26
Discussion on Presidential Address	36
Civic Luncheon	43
TUESDAY'S PROCEEDINGS	43
WEDNESDAY'S PROCEEDINGS	44
Telegram from Chairman, Electricity Supply Commission	44
Election of Council	45

INDEX.

	Page
“ Alternating Current Sub-Stations and Their Equipment for Urban Areas ” (Messrs. A. T. Rodwell and P. Fraser) ...	45
Discussion on Paper	61
“ Merits of Suction Gas Engines as Prime Movers in Municipal Power Stations ” (Mr. H. M. S. Muller)	71
Discussion on Paper	83
Joint Meeting with S.A. Institute of Electrical Engineers	87
THURSDAY'S PROCEEDINGS	87
FRIDAY'S PROCEEDINGS	87
Votes of Thanks	88
“ Licensing of Electricians, Wiring Rules and Regulations and Municipal Bye- Laws (Mr. B. Sankey)	89
Discussion	104
Height of Telephone Poles	131
Concreting of Poles	132
Standardisation of Pressure of Supply ...	132
Address by Mr. Bernard Price, O.B.E. (Power Supply Manager and Chief Engineer of V.F. & T.P. Co., Ltd.) ...	136
LIST OF MEMBERS	141

INDEX

Introduction	1
Chapter I	15
Chapter II	35
Chapter III	55
Chapter IV	75
Chapter V	95
Chapter VI	115
Chapter VII	135
Chapter VIII	155
Chapter IX	175
Chapter X	195
Chapter XI	215
Chapter XII	235
Chapter XIII	255
Chapter XIV	275
Chapter XV	295
Chapter XVI	315
Chapter XVII	335
Chapter XVIII	355
Chapter XIX	375
Chapter XX	395
Chapter XXI	415
Chapter XXII	435
Chapter XXIII	455
Chapter XXIV	475
Chapter XXV	495
Chapter XXVI	515
Chapter XXVII	535
Chapter XXVIII	555
Chapter XXIX	575
Chapter XXX	595
Chapter XXXI	615
Chapter XXXII	635
Chapter XXXIII	655
Chapter XXXIV	675
Chapter XXXV	695
Chapter XXXVI	715
Chapter XXXVII	735
Chapter XXXVIII	755
Chapter XXXIX	775
Chapter XL	795
Chapter XLI	815
Chapter XLII	835
Chapter XLIII	855
Chapter XLIV	875
Chapter XLV	895
Chapter XLVI	915
Chapter XLVII	935
Chapter XLVIII	955
Chapter XLIX	975
Chapter L	995

ASSOCIATION OF
Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA.)

Founded 1915.

EXECUTIVE COUNCIL, 1926.

President:

B. SANKEY (Johannesburg).

Vice-President:

J. MORDY LAMBE (East London).

Past Presidents:

JOHN ROBERTS (Durban).

G. H. SWINGLER (Capetown).

Other Members:

L. F. BICKELL (Port Elizabeth).

T. C. WOLLEY DOD (Pretoria).

T. MILLAR (Harrismith).

E. POOLE (Durban).

Hon. Secretary and Treasurer:

R. G. TRESISE, P.O. Box 699, Johannesburg.

RULES AND CONSTITUTION
OF THE
ASSOCIATION OF
Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA.)

As submitted and passed by the full Meeting of the Association held at the Town Hall, Johannesburg, on Friday, 19th November, 1915, with amendments as submitted and passed at the Durban, Port Elizabeth, Pretoria and Johannesburg Conventions.

1. **TITLE.**—The Association shall be called the Association of Municipal Electrical Engineers (Union of South Africa and Rhodesia).

2. **OBJECTS.**—The objects of the Association are to promote the interests of Municipal electric undertakings.

3. **HONORARY MEMBERS** shall be distinguished persons who are or who have been intimately connected with Municipal electrical undertakings, and whom the Association especially desires to honour for exceptionally important services in connection therewith.

4. **MEMBERS.**—Members of the Association shall be Chief Electrical Engineers engaged on the permanent staff of an electric supply or tramway undertaking owned by a local authority in the Union of South Africa or Rhodesia, and any duly qualified assistants whom they may recommend for election. Should any member cease to hold his qualification as above his membership shall cease.

5. **ASSOCIATE MEMBERS.**—Any member resigning under Rule 4 shall be entitled to apply for election as an associate member. Associate members shall not be entitled to vote on matters affecting the conduct and management of the Association, nor to hold office, but otherwise shall be accorded the privileges of ordinary membership.

6. CONTRIBUTIONS. — The subscription for members shall be £2 2s. for Chief Engineers and their Chief Assistants and £1 1s. for other members and associate members. Any member elected within six months after the Annual Congress shall pay the full subscription for the year, and if elected six months after the Congress shall pay half subscription.

7. OFFICERS.—The Officers of the Association shall consist of President, Vice-President, Hon. Secretary and the Hon. Treasurer.

8. COUNCIL.—The Council shall consist of the President, Vice-President, the two immediate Past Presidents and four members to be elected at the Annual Congress.

9. ELECTION OF OFFICERS AND COUNCIL.—Officers and Members of Council shall be elected by nomination and ballot at the Annual Congress, and shall hold office until the next Congress. In the event of a vacancy occurring during the year the remaining members shall have power to appoint a member to fill the vacancy.

10. All those who attended the Congress in Johannesburg in November, 1915, shall *ipso facto* be members of the Association.

11. ELECTION OF FUTURE MEMBERS.—The election of future members of the Association shall be vested in the Council and applications for membership must be made on the prescribed form.

12. The affairs of the Association shall be managed by the Council, who shall have power to incur any expenditure necessary for the objects of the Association.

13. The voting at the Congress shall be restricted to the members present at such Congress.

14. The financial year of the Association shall terminate on the first day of the Annual Congress, at which date all subscriptions for the ensuing year become due, and no member will be allowed to vote whose subscription is in arrear.

15. PRESIDENT.—The President shall take the chair at all meetings of the Association, the Council, and the Committees, at which he is present, and shall regulate and keep order in the proceedings.

16. In the absence of the President, it shall be the duty of the Vice-President to preside at the meeting of the Association, and to regulate and keep order in the proceedings. But in the case of the absence of the President, and of the Vice-President, the meeting may elect any member of the Council, or in the case of their absence any member present to take the chair at the meeting.

17. The local Press of the town in which the Congress is held shall be notified of the time and date of the reading of all papers, but the Association shall reserve to itself the right to resolve itself into Committee at any time during its proceedings; moreover, it shall be competent for any member to have his paper read and discussed in Committee if he so desires.

18. The Honorary Secretary and the Honorary Treasurer shall present a yearly report on the state of the Association, which shall be read at the Annual Congress.

19. The Honorary Treasurer shall be responsible for the funds of the Association, and shall present a Balance Sheet at the Annual Congress.

Association of Municipal Electrical Engineers.

(Union of South Africa and Rhodesia.)

Members and Councillor Delegates at Johannesburg (7th) Convention, 12th to 16th April, 1926.



Top row.—F. C. D. Mann (Worcester), B. Marchand (Paarl), L. B. Sparks (Pietersburg), C. K. Turner (Kimberley), R. A. Stoker (Kroonstad), R. J. Morris (Roodepoort), Cr. Dersley (Bloemfontein), R. Macaulay (Bloemfontein).

Second row.—Cr. Wilkinson (Mafeking), Cr. Paton (Kroonstad), A. S. Munro (Pietermaritzburg), G. C. Brown (Middelburg, Transvaal), T. F. Siebert (Uitenhage), Cr. Wearne (Roodepoort), W. M. Mail (Kokstad), R. D. Coulthard (Oudtshoorn), Cr. Reynolds (Dundee, Natal).

Third row.—J. G. Davison (Mafeking), Cr. Malan (Mayor, Worcester), Cr. Von Witt (Capetown), Cr. Millar (Pretoria), Cr. Prior (East London), Dr. Ganteaume, M.B.E. (Mayor, East London), Cr. Ericson (Kimberley), Cr. Low (Capetown), Cr. Clark (Durban), J. Younger (Vryheid), J. F. Kermack (Benoni), L. L. Horrell (Pretoria).

Fourth row (sitting).—A. T. Rodwell (Johannesburg), E. Poole (Member of Council, Durban), T. C. Wolley Dod (Member of Council, Pretoria), J. Mordy-Lambe (Vice-President, East London), B. Sankey (President, Johannesburg), G. H. Swinger (Past-President, Capetown), L. F. Bickell (Member of Council, Port Elizabeth), R. G. Tresise (Hon. Secretary and Treasurer, Johannesburg).

Bottom row.—R. D. Larter (Standerton), T. P. Ashley (Queenstown), H. A. Prevost (Somerset East), T. Sutcliffe (Benoni), H. M. S. Muller (Beaufort West), L. Ralston (Dundee), R. W. Fletcher (Krugersdorp), L. B. Proctor (Johannesburg).

SEVENTH CONVENTION

JOHANNESBURG.

PROGRAMME OF PROCEEDINGS.

Monday, 12th April, 1926.

- 9.0 a.m.—Council Meeting.
- 10.30 a.m.—Opening of Convention by His Worship
the Mayor of Johannesburg, E. O.
Leake, Esq.
- Valedictory Address.
- Secretary's Report and Financial State-
ment.
- Election of Officers.
- Presidential Address.
- General Business.
- 1.0 p.m.—Civic Luncheon.
- 2.30 p.m.—Visit to Power Station and Works of
Johannesburg Municipal Gas and Electric
Supply Department.

Tuesday, 13th April, 1926.

- Visit to Vereeniging (by special train provided by
Johannesburg Municipality). Inspection of Union
Corporation (of S.A.), Ltd., Steel Works; Vereen-
iging Brick & Tile Company's Works; Rand Water
Board's Pumping Station.
- Luncheon at Vereeniging, by kind invitation of Direc-
tors of the Union Steel Corporation (of S.A.),
Ltd., and the Vereeniging Brick & Tile Company.

Wednesday, 14th April, 1926.

- 9.30 a.m.—Paper on "Alternating Current Sub-
Stations and their Equipment for Urban
Areas," by Mr. A. T. Rodwell (Member)
and Mr. P. Fraser (Sub-Station Superin-
tendent, Johannesburg Municipality).
- Notes on "The Merits of Suction Gas
Engines as Prime Movers in Municipal
Power Stations," by Mr. H. M. S. Muller
Member, Beaufort West).

12.30 p.m.—Official Photograph.

2.30 p.m.—Tour of Inspection, Johannesburg Municipal Distribution System.

Alternative: Visit to the Works of the Boksburg Brick and Fireclay Co., Ltd.

8.0 p.m.—Joint Meeting, South African Institute of Electrical Engineers. Paper by Mr. R. F. Botting (Member, S.A.I.E.E.) on "Electric Light and Power Supply Schemes for Moderate Sized Towns in South Africa."

Thursday, 15th April, 1926.

Visit to Pretoria. Inspection of Municipal Power Station and portions of Electric Supply System.

1.0 p.m.—Civic Luncheon in Pretoria.

2.30 p.m.—Visit to Royal Mint.

8.0 p.m.—Civic Welcome and Dance, Selborne Hall, Johannesburg.

Friday, 16th April, 1926.

9.30 a.m.—Paper by Mr. B. Sankey, Municipal Electrical Engineer, Johannesburg, on "Licensing of Electricians, Wiring Rules and Regulations and Municipal By-Laws."

1.0 p.m.—Luncheon at Automobile Club, by kind invitation of Mr. H. Reynolds (President, Transvaal Automobile Club).

2.30 p.m.—Visit to the Rosherville Power Station of the Victoria Falls & Transvaal Power Co., Ltd.

PROCEEDINGS
OF THE
SEVENTH CONVENTION

MONDAY, APRIL 12th, 1926.

INTRODUCTORY.

The Seventh Annual Convention of the Association of Municipal Electrical Engineers (Union of South Africa and Rhodesia) was opened at the Scientific and Technical Club, Johannesburg, at 10.30 a.m., on Monday, April 12th, 1926.

In the absence of the retiring President (Mr. John Roberts, Durban), Mr. T. C. Wolley Dod (Past President, Pretoria) was in the Chair. There were also present His Worship the Mayor of Johannesburg, E. O. Leake, Esq., and the undernamed:—

Members.—T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), G. C. Brown (Middelburg, Transvaal), R. D. Coulthard (Oudtshoorn), J. G. Davison (Mafeking), T. C. Wolley Dod (Pretoria), R. W. Fletcher (Krugersdorp), L. L. Horrell (Pretoria), J. Mordy Lambe (East London), R. D. Larter (Standerton), R. Macaulay (Bloemfontein), W. M. Mail (Kokstad), F. C. D. Mann (Worcester), B. Marchand (Paarl), W. McDonough (Bethlehem), R. J. Morris (Roodepoort), A. S. Munro (Pietermaritzburg), E. Poole (Durban), H. A. Prevost (Somerset East), L. Ralston (Dundee), A. T. Rodwell (Johannesburg), B. Sankey (Johannesburg), T. F. Siebert (Uitenhage), L. B. Sparks (Pietersburg), R. A. Stoker (Kroonstad), T. Sutcliffe (Benoni), G. H. Swinger (Capetown), C. K. Turner (Kimberley), J. Vowles (Kingwilliamstown), and J. Younger (Vryheid).

Associate Members.—J. H. Dobson, E. T. Price, and G. A. Stewart (all of Johannesburg).

Delegates.—Councillors Dr. P. P. J. Ganteaume, M.B.E. (Mayor, East London), P. A. Malan (Mayor, Worcester), A. L. Clark (Durban), J. B. Dersley (Bloemfontein), T. Ericson (Kimberley), W. Fearnhead (Johannesburg), S. J. Halford (Kokstad), J. D. Low (Capetown), W. Millar (Pretoria), J. Paton (Kroonstad), G. W. Prior (East London), W. H. Reynolds (Dundee), E. H. Von Witt (Capetown).

W. G. Wearne (Roodepoort), F. E. Wilkinson (Mafeking), and Mr. J. E. Kernack (Town Engineer, Benoni).

Visitors.—P. E. Gregson, A. M. Jacobs (Electricity Supply Commission), G. B. Milford (all of Johannesburg).

R. G. Tresise (Johannesburg).

CIVIC WELCOME.

His Worship the Mayor of Johannesburg, Councillor E. O. Leake, said it was a very great pleasure to him to welcome the members and delegates to Johannesburg to this, the seventh, Convention of the Municipal Electrical Engineers, and to congratulate them upon the splendid progress their Association had made since they came here in 1915 to their first Convention. He was sorry that Mr. Roberts, their retiring President, was not there with them that day. He welcomed them, too, because he was a great believer in getting together in this way: it might cost a little in time, money and effort, but it was worth it. Each town or district had its problems, aspirations, and difficulties, but these were generally common, or similar, to all, and by meeting with each other and by frank discussions they should get larger vision, which might result in greater service and benefit to the whole community. Much good work had been done by the Association, such as the measure of standardisation which had been achieved, and which was largely the result of their work, but there was still much to be done. Electrical Engineers had an immense field before them: the marvels of electricity—light, power, telephone and wireless—had all come in a single lifetime. He had been attending science classes in England when the first incandescent lamp came into being, and it was marvellous that all this had happened in such a short time. He had pleasure in declaring the Convention open.

The CHAIRMAN, on behalf of the members of the Association, thanked His Worship the Mayor for the very kind way in which he had spoken to them, for the very fine programme, and for the hospitality which his Municipality had prepared for them. As His Worship had said, all these meetings were for the good of the towns they represented. In Johannesburg, which, he thought, was the youngest of the large cities of the Union, they would probably see more variety of electrical and engineering progress

than in any of the other towns, and they would all go away very much benefited by their visit.

Dr. P. P. J. GANTEAUME, M.B.E. (His Worship the Mayor of East London), stated that it was his privilege to thank His Worship very much, on behalf of the Councillor Delegates who were there that morning from the different towns in the Union. They all appreciated the welcome which had been extended to them. They had come to Johannesburg as Councillor Delegates to see and to learn for themselves, and he had no doubt that they would have ample opportunity for doing so whilst there. They were extremely pleased that they would be given the opportunity of seeing the large electrical undertakings, not only in Johannesburg, but in the surrounding country. He was certain he was expressing the views of his fellow delegates when he said they would take away with them to their respective cities and towns happy recollections of their visit to Johannesburg.

BUSINESS MEETING.

The CHAIRMAN said he was very sorry to have to apologise for the absence of their President, Mr. John Roberts, who had found it impossible to attend the Convention. Under the circumstances, Mr. Sankey had asked him to take the Chair. It gave him great pleasure, on behalf of the President, to welcome them all—members, new members and delegates—to this Convention. He trusted that when they left they would all have greatly benefited by their visit.

Apologies.

In addition to the President, the CHAIRMAN said he had to apologise for the absence of the following members, who had found it impossible to attend: F. Castle (Capetown), P. W. Dadswell (Cradock), W. Douglas (Ernelo), H. A. Eastman (Capetown), E. J. Hamlin (Stellenbosch), T. Jagger (Ladysmith), P. G. Kersten (Windhoek), T. Millar (Harrismith), P. H. Newcombe (Indwe), R. Royle (Rustenburg), J. T. Smith (Durban), and F. T. Stokes (Johannesburg).

Confirmation of Minutes.

The minutes of the Durban Convention having been circulated, were taken as read, and were confirmed.

In the absence of Mr. Roberts, Mr. POOLE (Durban) read the Retiring President's address.

RETIRING PRESIDENT'S ADDRESS.

(By MR. JOHN ROBERTS, M.I.E.E., Borough Electrical Engineer, Durban.)

I shall be very brief in this address to the Association of Municipal Electrical Engineers when retiring from the office of President, in favour of Mr. B. Sankey, to whom I wish every success in the year now beginning.

I think we may survey the interval since I was elected as your President with feelings of satisfaction from the point of view of electrical progress. I have visited several of the larger towns of the Union during the past few months, and one or two of the small ones also, and I found most encouraging signs of a considerable forward movement everywhere. Loads are building up in a most satisfactory manner, and there is every indication that the electrical industry is sharing in this country the prosperity which it has enjoyed all over the world since the conclusion of the Great War. The reason is, of course, mainly to be found in the undoubted industrial and agricultural progress which South Africa is now making, and all classes of the population are seeking the aid of the electrical engineer in taking the fullest advantage of this progress.

The slogan, "Do it electrically," is proving itself to be a sound one to a greater extent every day. Manufacturers and industrialists generally find that electricity is invaluable to them in improving and cheapening production its applications to processes being so manifold. The householder is beginning to demand as a necessity and a right what up till recently was considered a luxury, namely, a plentiful supply of cheap electricity, and I was very pleased to observe on my visits to other towns than my own that the public suppliers are showing a determination to meet this demand by such low rates as will enable consumers to use current for heating and cooking as well as lighting. The extraordinary improvements in generating plants which are taking place so rapidly make it possible to give this service at prices low enough to suit the consumer, and still high enough to provide a profit on the supply to the central station. These improvements are taking place so fast that it is difficult to keep an up-to-date record of them. Only a year or so ago, a consumption of 20,000 B.T.U.'s per kilowatt hour was reckoned to be an extremely high thermal efficiency for a generating plant; now we begin to hear of such figures as 15/16,000 B.T.U.'s

with a coal consumption of $1\frac{1}{2}$ lbs. per unit. While up to lately, improvements in turbines have been chiefly responsible for such striking economies, the boiler plant is now being brought up to date, and it is quite likely that the next decade is destined to see this part of the plant undergoing a revolutionary change brought about by the use of powdered coal.

The problem is thus no longer how to turn out the unit cheaply enough from our stations, but how to get it to the consumer without involving such expenses in distribution as will add too greatly to its cost by the time it is metered on his premises. This problem, I am satisfied, is not beyond us, and I am convinced that the next decade will see great improvements, and consequently great extensions, in electric distributing systems, and a vast increase in the use of electricity for both industrial and domestic purposes.

Another event on which I should like to touch in this address is the commencement of the work of electrifying the South African Railways, which occurred during the year I am so briefly reviewing. The equipment of the section of the Natal Main Line between Glencoe and Pietermaritzburg, which the Government determined to electrify, is now nearly finished, and is accomplishing all that, if not more than, was expected from it in the increased volume and speed of the traffic dealt with. Certain difficulties inseparable from a new system of this magnitude have been encountered, but that they will soon be overcome there can be no doubt, and when the whole line is working right through to the Port, I am confident that the Railway authorities themselves will be astonished at the tremendous improvement in carrying facilities of this important section of their system, which the application of electric working will have brought about. I, myself, have on more than one occasion been able to compare the performance of the steam and electric locomotives, and to gain, at first hand, the opinion of those who have actually handled traffic under steam and electric working, leaving no shadow of doubt, in my mind, that the General Manager, Sir William Hoy's, faith in electricity for his difficult traffic problems will be amply justified.

I consider that we, as those in charge of the chief undertakings in this country for supplying the needs of the people for electricity (leaving out the mines of the Witwatersrand), can look forward with hope of great development and greater opportunities for usefulness than ever before. We have advanced consider-

ably since we first formed this Association. It is interesting to compare the outputs of current from some of our stations when the statistics were first compiled by Mr. Poole, with the latest available, showing the progress made in a period of about ten years.

		UNITS SOLD.	
		1916.	1925.
Johannesburg	... ..	25,057,534	44,197,556
Durban	... ..	20,025,906	41,871,922
Capetown	... ..	13,424,594	27,873,443
Pretoria	... ..	4,875,299	10,171,685
Port Elizabeth	... ..	2,065,706	6,401,753
Bloemfontein	... ..	2,019,653	4,366,265
East London	... ..	1,474,736	4,123,421
Pietermaritzburg	... ..	2,103,277	3,501,805
		<u>71,046,705</u>	<u>142,507,850</u>

The increase in output from this group of stations of 100 per cent. is one which we can regard with satisfaction, particularly as the rate of growth in the next period promises to be still greater.

In closing this retiring address, I would like to take the opportunity of recommending to this Convention a report issued by the British Electrical and Allied Industrial Research Association, known as the E.R.A. This Association was formed in 1920 to take over and develop the important co-operative research work initiated by the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association with the assistance of the Department of Industrial and Scientific Research.

On incorporation, the British Government guaranteed for five years a contribution of £ for £ against the subscription of members of the Association, and on the Department appointing Inspectors to examine the affairs of the Association, the report received was so entirely favourable that the Government agreed to extend support to the Association for a further period of five years, but on a diminishing scale, with the expectation that increasing financial support would be obtained from those interests enjoying the benefits of the results of the Association's work.

The Association has conducted researches on, and published information on the following subjects, which are of the greatest interest and value to the electrical industry. Both manufacturers and electrical supply authorities have been furnished with information which

will be of great financial advantage to them. The subjects on which reports have been published have been as follows:—

- Heating of Bedded Cables.
- Insulating Oils.
- Overhead Lines.
- Electrical Control Apparatus.
- Insulation Research.
- Steam Turbine Research.
- Corrosion of Condensers.

The Association is now making an appeal for further financial support from the electrical industry generally, including the electrical supply branch of the industry, and a class of Associate Members has been formed, comprising British subjects representing municipal electric supply authorities, electric supply companies, railway companies, etc. It is suggested that, so far as supply authorities go, the subscriptions of these Associate Members should be graded according to the units of electricity sold, in accordance with the following scale:—

Minimum Subscription.	Units sold or used per annum.
£5	Up to 10,000,000.
£15	Over 10,000,000 and up to 30,000,000.
£25	Over 30,000,000 and up to 50,000,000.
£50	Over 50,000,000 and up to 100,000,000.
£100	Over 100,000,000.

I suggest to this Convention the desirability of every Corporation represented in this Association being asked to become Associate Members of this Electrical Research Association, in order to give support to a movement which, it has been claimed by many authorities, has been very backward in Great Britain, compared with what has been accomplished on a very large scale in such countries as America and Germany. I hope that a resolution will be passed recommending every Municipality owning an electrical plant in South Africa to contribute according to the scale laid down.

I regret that it is impossible for me to attend this Convention, but I wish it every success, and Mr. B. Sankey once more a happy and prosperous year of office.

The CHAIRMAN said that they owed a hearty vote of thanks to their Retiring President, Mr. John Roberts, for his very interesting address, reviewing the progress electricity had made in South Africa, particularly during his year of office. They also owed

to Mr. Roberts their sincere thanks for the excellent way in which he had carried out his duties during the period he had been president. It gave him great pleasure in moving this vote of thanks. This was carried unanimously.

The CHAIRMAN said it was not usual to discuss the Retiring President's address, but there were matters in it which members might like to bring forward for discussion later on in the Convention.

Report and Balance Sheet of Honorary Secretary and Treasurer.

Mr. POOLE read the following report:—

Mr. President and Gentlemen,

I have pleasure in submitting herewith my Annual Report and Balance Sheet for the period since our last Convention in December, 1924, during which time I have held office as Honorary Secretary and Treasurer.

The membership of our Association at present totals 50, made up as follows:—Members, 43; Associate Members, 7.

During the period under review, five new members have been elected, one member has resigned, two members have transferred to Associate Members, and one Associate Member has resigned. These additions and changes will come forward for confirmation at the present Convention.

The Balance Sheet shows a credit balance of £87 9s. 5d., so that our finances are in a very satisfactory condition, though, as usual, our heaviest expenditure is in the printing of the Proceedings.

A larger number of Proceedings than usual were obtained this year, so that our doings should be more widely known, and gratis copies were sent to the Town Clerk, Chairman of Committee, and the Electrical Engineer of all Municipal Electrical Undertakings in the Union, and the fact that a large number were purchased by the Municipalities speaks well for our publication, and this sale has added to our revenue.

By careful control of our expenditure, we are enabled to carry forward a balance little short of last year, and were it not for the fact that the item of £24 3s. for World's Power Conference expenses happens to be included, which item was really a charge against the previous year's figures, our balance would have shown a slight gain.

It is satisfactory to record that all outstanding debts have been collected, and that there are now no arrears.

We are indebted to the following Municipalities for donations to our General Funds:—

Ladysmith	...	...	...	£5	5	0
Kimberley	...	...	...	2	2	0
Worcester	...	...	...	1	1	0

and also to the Durban Municipality for the provision they made for us at our last Convention.

In conclusion, I wish to tender my thanks to the President and Members of Council for their kind co-operation in connection with the carrying out of my duties during the period under review.

I am, Mr. President and Gentlemen,

Yours faithfully,

E. POOLE,

Hon. Secretary and Treasurer.

REVENUE AND EXPENDITURE ACCOUNT—Period, November 15th, 1924, to March 15th, 1926.

Expenditure.			Revenue.		
Printing of Proceedings	...	£117 6 6	By Balance	...	£105 15 9
Stenographer	...	17 10 0	.. Subscriptions	...	96 12 0
Stationery and Sundry Printing	...	8 4 6	.. Municipal Donations	...	8 8 0
Honorarium to Capetown Typists	...	5 5 0	.. Statistical Tables	...	20 0 0
Delegates' Expenses, Western Province			.. Advertisements	...	22 1 0
Conference	...	24 3 0	.. Sales—		
Railage on Stationery	...	2 5 0	Durban Proceedings	...	29 5 8
Bank Charges	...	2 3 0	Chester Proceedings	...	1 12 3
Photographs	...	1 9 0	I.M.E.A. Reports	...	9 19 6
06 Secretarial Expenses—			Photos	...	0 11 6
Postage	£10 14 0		Bye-Laws	...	0 6 0
Statistical Tables	10 0 0				
I.M.E.A. Reports	5 2 11				
Telegrams	0 5 3				
Chester Proceedings	1 6 0				
Railage	0 19 8				
Sundries	0 8 5				
		28 16 3			
Balance to Balance Sheet	...	87 9 5			
		<u>£294 11 8</u>			<u>£294 11 8</u>

BALANCE SHEET.

Liabilities.		Assets.	
Revenue and Expenditure Account	... £87 9 5	Cash in Hand	... .. £87 9 5

I certify the above to be a true account of the Revenue and Expenditure of the Association of Municipal Electrical Engineers (S.A.).

(Signed) E. POOLE,
Hon. Secretary and Treasurer.

10 Durban, March, 1926.

I have examined the books, receipts and vouchers of the Association of Municipal Electrical Engineers (S.A.), and certify that the above Revenue and Expenditure Account and Balance Sheet are properly drawn up so as to exhibit a correct view of the affairs of the Association as shown by the books.

(Signed) GRAHAM COOK,
Hon. Auditor, R.P.A., Transvaal and Natal.

Durban, March, 1926.

Mr. SWINGLER (Capetown) moved, and Mr. RODWELL (Johannesburg) seconded, the adoption of the report and balance sheet, and this was carried unanimously.

Honorary Auditor.

On the motion of the CHAIRMAN, seconded by Mr. POOLE, a vote of thanks was passed to Mr. GRAHAM COOK (Durban), who had audited the accounts just adopted.

Gratuity to Durban Typist.

On the motion of Mr. MORDY LAMBE (East London), seconded by Mr. SWINGLER (Capetown), a gratuity of £5 was voted to the typist who had done the typing work of the Association at Durban.

Election of President.

On the motion of Mr. McDonough (Bethlehem), seconded by Mr. Munro (Pietermaritzburg), Mr. B. SANKEY (Johannesburg) was unanimously elected President of the Association for the ensuing year.

Mr. DOD then vacated the Chair, which was taken by Mr. Sankey.

Mr. SANKEY thanked the members for the great honour they had conferred upon him. He said that he would address them to a greater extent later on in the meeting. He wished to express his thanks to the Johannesburg Municipality for the whole-hearted way in which they had given him their support since the invitation to hold this Convention in Johannesburg had been extended to the Association at the Durban Convention. The Council had very kindly voted a sum of money to entertain the members and councillor delegates in Johannesburg. He also wished to thank His Worship the Mayor and his Secretary for the assistance they had given him in the preparation of the social side of the programme for the Convention.

Election of Honorary Secretary and Treasurer.

On the proposal of Mr. Munro (Pietermaritzburg), seconded by Mr. Swingler (Capetown), Mr. R. G. TRESISE (Johannesburg) was unanimously elected Honorary Secretary and Treasurer of the Association for the ensuing year.

Vote of Thanks.

Mr. MORDY LAMBE (East London) paid a high tribute to the work done by the retiring Honorary Secretary and Treasurer, Mr. Poole. He then moved

that a hearty vote of thanks be passed to Mr. POOLE for the excellent work he had done for the Association. This was carried unanimously.

Announcements.

The PRESIDENT stated that there were certain announcements he would like to make regarding the programme of the week and other matters.

Scientific and Technical Club.—The Executive of this Club had very kindly extended honorary membership of their Club to all members and delegates to the Convention. The Association was also very much indebted to this Club for its kindness in placing the committee rooms and lecture hall at their disposal during the period of the Convention. He stated that a welcome had also been extended to all members and delegates to attend the monthly Club Dance, which would take place on the evening of Friday, the 16th April. Provision would also be made for the entertainment of members who did not dance.

Pretoria Club.—The President read a letter from the Pretoria Club, stating that the Chairman and Members would be very pleased if members and delegates to the Convention would accept honorary membership to the Pretoria Club during the period of their stay in the Transvaal.

United Party Club.—The President stated that the Chairman and Members of this Club had asked him to extend to Members and Delegates a hearty welcome to a Dance to be held at their Club on the evening of Wednesday, the 14th April.

Printed Proceedings.—The President stated that the printing of the proceedings was a big expense to the Association, and asked members, as far as possible, to try and get their Councils to purchase copies for distribution amongst their Councillors. This would not only help the funds, but would make the utility of the Association more widely known.

Donations from Municipalities would also be of great assistance to the Association.

Produce Market.—The Market Master had asked him to convey to members and delegates an invitation to visit and inspect the Johannesburg Produce Market.

Admission to Association of Rhodesian Members.

The PRESIDENT stated that the wish had been expressed by certain Municipal Electrical Engineers in Rhodesia to join the Association. The Council had

considered this matter, and suggested that, in order to give effect to this, the title of the Association and its constitution should be altered by the addition of the words " and Rhodesia " after the word " Africa " in the title and in Clause 4 of the Constitution.

Mr. RODWELL (Johannesburg) proposed, and Mr. HORRELL (Pretoria) seconded, that the title and Clause 4 of the Constitution of the Association be amended accordingly, and this was carried unanimously.

Election of Council.

The PRESIDENT explained that in the past it had been customary for the members in each Province to elect their representative to the Council, and he suggested that this item should remain over until the Wednesday meeting in order to enable members to confer amongst themselves and put forward the names of the members they wished to represent them. This was agreed to.

Venue of Next Convention.

The PRESIDENT stated that it was necessary to arrange where the next Convention was to be held, and he asked if any member had a suggestion to make in this respect.

Dr. P. P. J. GANTEAUME, M.B.E. (His Worship the Mayor of East London) said he had much pleasure, on behalf of the Chairman of their Electricity Committee and the Town Council of East London, in giving the Association a hearty invitation to hold its next Convention in their town. If they accepted his invitation, he assured them that, in addition to a very strenuous week, they would have a very good time. In his City they had nothing of the magnitude Johannesburg had to show its visitors, but they had probably the most modern electricity plant in the Union, and they hoped by that time to have progressed so much that they would be able to teach the Engineers of the larger Municipalities how to reduce their cost of production. It would be the first time the Association had held its Convention in East London, and he had no doubt that they would be given every opportunity of enjoying the amenities of a small but modern city. He sincerely trusted that they would be able to accept East London as the place of meeting next year.

COUNCILLOR PRIOR (East London) stated that, as Chairman of the Electricity Committee of his town, he would like to endorse the invitation given to them by his Mayor. He assured them that if they did accept the invitation, they would be welcomed by the whole city, and everything possible would be done to make their stay a beneficial and enjoyable one.

The invitation for the next Convention to be held in East London was accepted unanimously.

The PRESIDENT thanked Dr. Ganteaume and Councillor Prior for their kind invitation. He felt sure that it would give all their members pleasure to meet next year in East London.

Election of Vice-President.

On the motion of Mr. Dod (Pretoria), seconded by Mr. Munro (Pietermaritzburg), Mr. J. MORDY LAMBE (East London) was unanimously elected Vice-President of the Association for the ensuing year.

Mr. LAMBE said he wished to sincerely thank them for the honour they had done him in electing him their Vice-President. He assured them that he would direct all his endeavours for the good of the Association, and would assist their President in every way possible in the work they had before them in the coming year.

New Members.

The PRESIDENT reported that, under the Rules of the Association, their Council had elected the following new members since the last Convention was held:—G. C. Brown (Middelburg, Transvaal), R. D. Larter (Standerton), B. Marchand (Paarl), R. J. Morris (Roodepoort), H. M. S. Muller (Beaufort West), H. A. Prevost (Somerset East) and J. Younger (Vryheid). J. Vowles (Kingwilliamstown) had re-joined the Association during the year.

Associate Members.

The PRESIDENT announced that during the year, W. A. Hodge (Standerton) and B. H. Sargent (Vryheid) had left municipal employment, and, at their request, they had been transferred to honorary membership.

Resignations.

The PRESIDENT stated that P. Finlayson (Member, Pietermaritzburg) and W. Bellad Ellis (Associate Member, Queenstown) had resigned from the Association.

Banking Account.

On the motion of Mr. DOD (Pretoria), seconded by Mr. POOLE (Durban), it was resolved:—"That the Account of the Association be transferred from Durban to the Market Square Branch of the Standard Bank, Johannesburg, and that the Honorary Secretary and Treasurer and one member of the Council be authorised to sign cheques and operate on the account."

British Engineering Standards Association (South African Branch).

The PRESIDENT reported that, as the representative on the above Association (which met in Johannesburg), he had attended as many of the meetings as possible. The ordinary routine business had been transacted, and the Association was endeavouring to assist, by standardisation, local production of machinery of every kind which came within their knowledge.

On the motion of Mr. POOLE (Durban), seconded by Mr. McDonough (Bethlehem), Mr. SANKEY was unanimously re-elected representative to the British Engineering Standards Association (South African Branch) for the ensuing year.

Papers for Next Convention.

The PRESIDENT asked those members who could, to give a definite promise to supply papers for the next Convention. One member had already kindly offered a paper.

Mr. LAMBE (East London) stated that he wished the next to be a strong paper convention, and urged upon members the necessity of doing their bit by contributing papers. He said he would make himself responsible for one paper.

PRESIDENTIAL ADDRESS.

By Mr. B. SANKEY, M.S.A.I.E.E., M.I.Mech.E.,
Municipal Electrical Engineer, Johannesburg.

I thank you for the honour you have done me in electing me for the second time as President of this Association, my first election to this office having taken place at the Port Elizabeth Convention in February, 1919, when I occupied the position of City Electrical Engineer at Port Elizabeth.

It is now over ten years since our Association was inaugurated, and our first Convention held here in Johannesburg in November, 1915, under the Presidency of Professor J. H. Dobson, our first President. We are fortunate in having with us to-day so many of those who took part in our early meetings in Johannesburg. Of the seventeen original members appearing in the photograph taken at that time, twelve are still in Municipal service and are active members of our Association, whilst others have transferred from Municipal to commercial business with, we hope, financial advantage to themselves.

During the ten years of this Association's existence, much useful work has been done, and I think it is fitting to recapitulate, for the information of those present and for record in our proceedings, some of our principal activities.

The question of standardisation is one which has always held a foremost place in our deliberations. One of our first efforts was connected with the tabulation of statistics of central station data, and forms of statistics drafted by our Association have been adopted by Government departments as their standard.

I would also call attention to the very complete statistics of Municipal electricity undertakings which appear each year as a supplement to the Official South African Municipal Year Book, and are compiled by our honorary secretary, Mr. E. Poole, of Durban, who deserves the thanks of all engaged in our profession for his work. These statistics are one of the results of our Association and the closer touch which it has brought about amongst members. The latest tables are particularly detailed and complete, but it is noticeable that there are still nine undertakings who give no return of the units sold. In some cases, I fear they have no clear idea of what they do sell or produce. The question of accurate metering and recording, as well as of accurate financial returns, is one of some importance, and I feel that all undertakings should be subject to some inspection and supervision in their own interests. I would direct the attention of the Electricity Commission to this matter. Some of our Municipalities expect a great deal from their electrical engineers for very little in the way of salary, but, generally speaking, the services rendered are of a high order. I would like to impress upon our councillor delegates, who are the responsible directors of Municipal undertakings, that though a capable man may sometimes be obtained at a low salary, it is

a sounder business proposition to pay him well and to keep him.

We have also published in our proceedings a standard form of accounts, with the idea that if Municipalities would adopt a form of accounts on the lines indicated (which are those of the British Board of Trade Standard Form of Accounts, adapted to South African conditions), it would greatly simplify comparative records of electricity undertakings and efficient business control. So far as I am aware, this standard form of accounts has not been received with great favour by Town Treasurers.

It is one of the difficulties associated with the conduct of Municipal electricity undertakings that the methods of account-keeping are not usually based upon requirements of the electricity undertaking, nor are they usually conducted in such a form as to enable the responsible manager to see from day to day or from week to week, how his business stands financially. Town Treasurers point out that, whilst the form of accounts suggested would no doubt be very suitable for the electricity undertaking, it might by no means be suitable for such activities as abattoirs, markets, sanitation and other Municipal concerns, and, consequently, the Municipal undertakings are handicapped by having to conform to a system of accounts which represents a kind of compromise, and it usually becomes necessary for the responsible manager to keep a second set of accounts in order that he may know from week to week the position of income and expenditure in the various branches of his business.

One of the useful productions of this Association is the standard set of bye-laws, conditions of supply and wiring regulations drafted and published in 1920, this work having been completed at the Pretoria Convention held in that year. These standard bye-laws, etc., have been very largely adopted throughout the Union, and were prepared and published by the expenditure of much time and labour given by members of this Association, and at the expense of the funds of the Association, which funds are provided by the annual subscriptions of members. We have also to acknowledge contributions which have been made to our funds by several Municipalities, without whose kind assistance we should have had some difficulty in meeting the expenditure involved.

During the present Convention, the question of bye-laws, wiring rules and regulations is again being brought

forward for discussion and consideration, and it is hoped that, as the result of such discussions, standardisation in this respect may become further advanced in the Union, to the advantage of electricity supply generally. There can be no doubt that the efforts of this Association in the direction of standardisation generally have had a material effect in improving the general efficiency of Municipal undertakings.

One question which now stands in the way of progress is that of standardisation of pressure of supply. This controversial question has been debated at length by our members at more than one Convention, and recommendations from our Association and other bodies interested, have been considered by the Electricity Control Board, with the result that standard pressures of supply have now been declared, and gazetted in the *Union Gazette* of 12th March, 1926. This notification is of such importance that I make no excuse for including it in full:—

“ It is hereby notified that His Excellency the Governor-General has, under the powers vested in him by section 53 (h) of the Electricity Act, No. 42 of 1922, been pleased to delete regulation No. 24 published under Government Notice No. 1,957, dated 4th December, 1922, and to make the following regulation in substitution therefor:—

“ 24. (a) The standard pressures at which electricity is delivered to consumers shall be as follows:—

- “ (i) For pressures below 500 volts, the standard pressures at consumers' terminals shall be 220/440 volts for direct current systems and 220/380 volts for three-phase alternating current systems;
- “ (ii) for pressures of 500 volts and over, the pressure shall, in the absence of agreement to the contrary, be the standard pressure mentioned in the licence, or, if two or more standard pressures are so mentioned, the standard pressure which the consumer selects, or, if it be otherwise agreed between the licensee and the consumer or directed by the Board, the pressure shall be the agreed and directed pressure; provided that for undertakings established before the

first day of April, 1926, the provisions of sub-paragraph (ii) shall apply in respect of any pressure.

"(b) In the absence of agreement to the contrary, the pressure at which electricity is supplied shall not differ from the standard or agreed pressure by more than five per cent. for a longer period than ten consecutive minutes.

"(c) The frequency of the supply of any alternating current, that is to say, the number of complete cycles per second, shall be fifty, and this frequency shall not vary more than $2\frac{1}{2}$ per cent. above or below fifty.

"(d) The Board may, on application, permit a departure from these standard conditions."

It will be noted from the above that the standard pressure of supply for lighting and domestic uses is now to be uniform both for alternating current and direct current systems at 220 volts, and I feel that this decision marks an important and definite step in the progress of electricity supply in South Africa.

Whatever may be our personal views, it now behoves us individually, as members of this Association, to accept the decision which has been made, and to take definite steps to bring all undertakings into line, and this is an object in which our Association can be of material service.

Personally, I rather regret that a pressure should have been chosen which is not standard either in Great Britain or in America, but represents the Continental standard. Nevertheless, the decision has been made, and I feel that it is our duty to accept it and to take measures without delay to bring the undertakings for which we are responsible into line, and to assist in any scheme which may be suggested for that purpose. I feel that the decision which has been arrived at will be of no practical use unless definite steps are now taken to bring all undertakings into line as soon as possible.

In Johannesburg we have two supply pressures, and neither of them conform to the declared standard. In the central area of the town, direct current is supplied at a declared pressure of 230 volts, and there are approximately 10,000 consumers using this supply; whilst the outer areas (comprising principally the outlying residential suburbs) are supplied at 200 volts.

alternating current, and in these areas we have approximately 18,000 consumers. It will be seen, therefore, that standardisation at 220 volts represents a problem of considerable magnitude.

The suppliers of electricity in South Africa to-day comprise three classes, viz., (1) the private companies (principally, the Victoria Falls & Transvaal Power Co., Ltd.); (2) the Municipalities; (3) the Electricity Supply Commission. Of the above, the Municipalities, at the present time, comprise by far the greatest number, but all supply and distribute, to a greater or lesser extent, electricity retail to the general public, and are, therefore, interested in the standardisation of the supply pressure, particularly for domestic and lighting uses. In this connection, it will properly be expected that the larger towns should give the lead, and should make financial provision as soon as possible for commencing the work of changing over their supply areas to 220 volts. Where the difficulties, however, are most likely to arise, and where the need for standardisation is greatest, is in the smaller towns, which have not the financial resources and profits to draw upon for expenditure in this direction, whereas, on the other hand, their requirements in the way of electrical domestic appliances are small, and, therefore, the difficulty of obtaining non-standard apparatus will be accentuated as time goes on.

I, therefore, suggest that amongst the three bodies of suppliers referred to, a small representative committee should be formed to frame practical proposals for the complete standardisation of supply pressures in South Africa, to be carried out over a period of years. This is a matter in which I feel the Electricity Commission could most effectively take the lead, and I know that it is one in which they are particularly interested. I feel that I can give them the assurance that they will have the heartiest possible co-operation and assistance from our Association in any efforts they may make in this direction. It is possible, if not probable, that Government legislation, and possibly financial assistance, may be necessary, and this matter, therefore, lies more particularly within the scope of a Government body.

With the many new schemes now in course of construction or about to be commenced, it appears to me that the time is most opportune for steps to be taken in this direction, and that if South Africa can take the lead in this question of practical standardisa-

tion of supply pressure, its electrical progress in future will place it in a leading position in comparison with other and older countries.

That South Africa is still in the early days of its electrical progress may be gathered from a study of the Municipal statistics previously referred to.

In South Africa, there are at present sixty-five Municipal undertakings running generating stations, thirteen who purchase bulk supplies, and two private companies.

The Municipalities between them operate 96,901 k.w. of generating plant with a total peak load of 52,801 kilowatts, equal to 54 per cent. of the plant capacity. It will be seen, therefore, that even assuming that all peak loads occur simultaneously, there is always 46 per cent. of the plant which is not in use. Taking the value of this plant inclusive of distribution at, say, £20 per k.w., this represents a value of £882,960 which is always lying idle or in reserve against emergencies.

The total units sold by the sixty-five Municipalities who are producing amount to 150,643,000, and they serve 101,900 consumers.

As regards the generation of electricity, this Convention marks a turning point in our history. The figures given above will probably indicate the high-water mark in Municipal output. Within the next few years, many of our small generating stations, particularly in Natal and the Cape Peninsula areas, will cease to exist, and two of our largest Municipal stations, viz., Durban and Capetown, will pass over into Government hands. Our sphere, therefore, in the future will become more and more that of distributors of Government-produced electricity, the price of which (as the Electricity Act at present stands) will be adjusted from time to time in accordance with the cost. It appears to me somewhat unfortunate that the Act, as it at present stands, prohibits the Electricity Supply Commission from entering into contracts with the Municipalities over a period of years. Where Municipalities are selling electricity for power, heating and cooking purposes at low rates, it is of vital importance to know the cost at which electricity can be produced or purchased otherwise there is a distinct danger that the small percentage of profit available on this class of supply may at any moment disappear with the annual readjustment of selling prices, as laid down in the Electricity Act. Under Section 10 of the Act, it is provided that if there is any surplus

or deficit in any financial year of the Commission, such surplus or deficit shall be carried forward into the next financial year, and an allowance made therefor in adjusting the charges of electricity to be supplied during that year. This section also provides that the Commission shall decrease or increase its price *for all classes of consumers in equal proportion* when making any adjustment of prices in accordance with the provisions of this section.

One of the difficulties with which Municipalities are faced is the provision of electricity supply in outlying suburbs and areas, and Municipalities are often forced by the pressure of public opinion to lay mains and to undertake supplies in areas where such supply cannot possibly reach the profit-earning stage for many years to come, but has to be given at a loss, and the tariffs and charges of the Municipality have to be such that the loss is made good by supplies in more profitable areas. It can only be assumed that the Electricity Commission will meet with the same experience and will be called upon to pioneer and supply in areas outside the big towns at a loss, and, presumably, as is the case within Municipal areas, the profitable supplies in the towns will have to be so adjusted that the loss in the unprofitable country areas is made good by the profitable supplies in the town areas. In other words, the Commission's concerns, in just the same manner as the Municipalities' concerns, will have to adjust their profits to cover their total expenditure, and the losses on the unprofitable areas will have to be made good by the profits in the more densely populated areas. This is already being experienced by the South African Railways, who are beginning to give serious attention to the drain on their financial resources caused by the mileage of pioneer lines laid for the purpose of opening up the country, and it can only be assumed, therefore, that the towns will be called upon to assist in pioneering electricity supply to the countryside in a similar manner. As a set-off, however, against such expenditure, it may be assumed that the new Government stations operating with the latest and most efficient plant, and on a considerably larger scale, will be in a position so to reduce the cost of generation as to obviate any necessity for increased cost of electricity in Municipal areas. There is, however, one further point to which Municipal electrical engineers have given great attention in the past, and that is the necessity of keeping down capital expenditure. Many

Municipal stations in the past have been constructed at remarkably reasonable capital outlay, and have, therefore, had the advantage of low capital charges, and it may be said that, in the past, Municipal central stations have served the public well in regard to overall cost of generation, including the capital charges on the generating plant.

Without particularising, it may be stated that Government engineering undertakings established in recent years have not created a reputation for low capital cost. Many of our Municipal electrical engineers have been called upon, or will be called upon in the near future, to advise their Councils in respect of agreements or charges to be made for the closing down of their generating stations and the substitution of purchased supply, and it is desirable to impress upon our members the great responsibility resting upon their shoulders when they are called upon for such advice. It is a question even whether the responsibility is one which any individual engineer should be called upon to shoulder alone and unassisted, and it is a debatable question, having in view the number of our members concerned, whether some sort of conference or collaboration of members on this question should not take place. It is one which deeply concerns councillors and on which the advice and opinions of our councillor delegates would be welcome.

In making these remarks, I do not wish for one moment to detract from the utility and good work which our Electricity Supply Commission is doing in its efforts to provide cheap electricity for wider areas than the Municipalities can at present serve. I am aware that electricity charges up and down this country vary considerably, but I question whether the super-station is likely to alter this condition of affairs. Those of us more practically interested in the development of the industry have watched closely the evolution of the large stations in Great Britain, and have patiently waited to observe the effect of the much-discussed economies on either the balance sheet or the tariff scale, but in vain. The moderately sized stations still lead the way, both in low cost and, what is of more importance, low charges. The bait held out to the consumers of electricity that, as soon as these super-stations have been established, they will have current supplied at about 1d. per unit, has not so far eventuated.

Whilst the advent of large Government power stations in South Africa may lead to useful supplies of electricity being given in additional areas, and to the opening up of industrial enterprise, as we hope, I do not see that it is likely in the near future to lead to any material reduction in the cost of electricity to the consumers in the Municipal areas.

There is another subject which is at present claiming universal attention in the electrical world, and that is the development of the use of electricity for domestic purposes. In this warm climate, electricity for heating purposes has a considerable advantage in that the quantity of heat required is small and over short periods (usually, early morning and late evening), whilst for other purposes, the small loss of heat externally in all electrical apparatus is of great advantage in hot weather.

One of the great difficulties of the central station engineer is to develop a night load, and in this direction, attention is being given to the design of electrical apparatus for the electrical heating of water and its storage for use as and when required. Such apparatus should preferably be automatically controlled and take its supply of electricity during the hours of minimum load, if specially low tariffs are to be offered. It must not be forgotten that hot water appliances taking a small current throughout the twenty-four hours add just as much to the peak load as to the night load.

The usual domestic tariff now in vogue is the two-part tariff, the consumer being charged at a high rate for the first X units, where X is fixed so that the consumer's share of the capital charges is met, or, alternatively, is approximately equal to his requirements for lighting only, and all subsequent units are charged for at a much reduced rate. The special low rate for night load for water heating is merely an extension of the two-part to a three-part tariff, the fundamental condition being that the consumer pays his share of the fixed charges over and above the special night load rate. Examples of low rates for heating water during the night are:—

Glasgow	...	...	¾d. per unit.
Clyde Valley Elec. Co.			½d. per unit.
Greenock Corporation...			¼d. per unit.

I believe that attention to the possibilities of this class of load has already been given by some of our members, and it would be interesting to hear their experiences, especially as to the reliability of apparatus they have in use.

Gas heated water appliances, automatically operated, are remarkably simple and reliable, and the gas supplier, with his ample storage capacity to meet peak loads, is in a very strong position. Electrical apparatus to compete successfully must, therefore, be reliable, automatic and fool-proof. The consumer, if he is going to use electricity for water heating, requires not only a cheap tariff, but a piece of apparatus that will not suddenly go out of order at inconvenient moments.

In developing the domestic, as well as all other, uses of electricity, it is essential to put the goods before the public; in other words, "It pays to advertise."

The most effectual way in which to educate the public in the uses of electricity is by the establishment of centrally situated showrooms. With these showrooms should be combined the collection of revenue, so that consumers, when paying their accounts, would be brought into contact with the showrooms, and the appliances exhibited and demonstrated to them. Municipalities in Great Britain are now giving great attention to this idea, and large sums of money are being spent in establishing central offices and showrooms. The results so far obtained show that the expenditure is fully justified and has given great satisfaction to the consumers generally. Councils are apt to forget that the fundamental idea of municipalising electricity undertakings is to give service to the public, and that they are not intended to be established for the purpose of making large profits for the provision of roads, parks, swimming baths and other public and non-profit-earning amenities.

I would say, in conclusion, that cheap electricity is of greater service to the public generally, and conduces more to the health and progress of any towns, than the production of large profits for other uses, and that the supply of cheap electricity to the public is, and always has been, the main object of our Association and its members.

Discussion on Presidential Address.

Mr. RALSTON (Dundee) stated that he had great pleasure in congratulating Mr. Sankey upon his address, in which were embodied some of the principal subjects Municipal Electrical Engineers had to deal with. The President had touched upon the question of wiring regulations. This was an important matter, as on the reliability of wiring and electrical apparatus, largely depended the faith of the public on the utility

of electricity. It was very difficult to convert people who had been using coal in such a satisfactory manner, to spend money on electrical apparatus unless it was proved to them that they would get a better article. This was particularly evident in a town like his, which was close to the coalfields, and where household coal could be obtained for about 7s. a ton to the trader, and about 12s. 6d. to 15s. delivered to the consumer.

Councillor MILLAR (Pretoria) stated that there was one point he would like to refer to. In Pretoria they had adopted the domestic rate, which had proved successful. Various kinds of cookers and heaters were being used, however, and he thought that something would have to be done to try and standardise spare parts, such as elements, etc., in order that any reputable firm would be able to replace one if it went wrong.

Mr. POOLE (Durban) said that in his town they had no difficulty in supplying the outlying suburbs. When a district applied for electricity, it was informed that this could be given if a certain number of consumers first guaranteed a minimum payment per month. They had been able to extend the mains to Escombe, a distance of twelve miles, on getting such a guarantee from one hundred consumers, which was a sufficient number on that section to warrant the extension. Their experience was that if they started with one hundred consumers, they would probably have one hundred and fifty the next year. One extension had been started with one hundred consumers, and they now had five hundred on it.

Regarding a special tariff for hot water supply, they already had a sufficient number of tariffs in Durban, there being ten or twelve different ones. If they added a special hot water tariff for night supply, this would mean still another one, and all these tariffs meant the complication of the administration of the department. He much preferred a domestic rate which was applicable to any hour of the day, and which, he thought, could be made to meet the case.

Mr. SWINGLER (Capetown) stated that as the President in his address had referred to the Capetown Municipal Electricity Undertaking, he would take the opportunity of explaining the position there.

In the first place, he would point out that the Electricity Supply Commission, with which body the Capetown Corporation had entered into a contract for

the interchange of power between their respective power stations, was not a Government body, for, although it was at present financed by the Government, it was a corporate body itself.

The contract entered into allowed of additional plant being installed in whichever of the two stations it was most economical to do so, and it would possibly be of interest to know that the Corporation had recently been requested by the Commission to instal in its station an additional set, as this was considered a more economic arrangement from the point of view of the supply as a whole than extending the Commission's own generating station at the present time.

With regard to the point raised by the President that the Electricity Act did not permit the Commission to sell electricity at a fixed rate, but laid down that the tariff should be varied from time to time according to the cost of providing the supply, he wished to point out that this practice was in operation in practically all municipal electricity undertakings. In Capetown, it was a condition of the contracts entered into with bulk supply consumers that the price per unit was not only subject to adjustment with the cost of coal, but the prices to such consumers were subject to the same percentage increases or decreases in tariffs as were made to apply to all other consumers. The tariffs generally were varied in accordance with the cost of giving the supply, and it would thus be seen that in the Capetown municipal undertaking all classes of consumers were treated alike in regard to bearing or receiving their proportionate share of losses or profits on the running of the undertaking, in the manner laid down in the Electricity Act as regards the Commission's undertakings.

With regard to the hint that the public would require to pay for any inefficiency which might appear in the Commission's undertakings, he did not think that there was any more likelihood of this occurring in its undertakings than in municipal undertakings. In fact, he thought that there was, if anything, less likelihood of this since the Commission was not subject to the changes in policy which occurred from time to time in some municipal undertakings, which, as those present would agree, was detrimental to the interests of any undertaking.

The Commission was at present working under a disability in that it had not yet had time to establish public confidence, but he could not imagine an arrangement more beneficial to the supply of electricity in the

Capetown District generally than that between the Commission and the Capetown Corporation, and he did not see why the same conditions should not apply to other towns similarly situated.

It is a *sine qua non* that, unless the circumstances are extraordinary, it is far better policy from every point of view that the generation of electricity should take place in one or two centrally situated stations from which a number of individual consumers are supplied in bulk than to retain a number of isolated plants for the same purpose.

This centralisation, however, in itself, would not necessarily produce a considerable reduction in the price per unit supplied to domestic consumers for lighting purposes only.

In the case, particularly of the supply for lighting purposes, the proportion of the actual generation costs to the total cost per unit sold would necessarily always remain small. Indeed, in this case more than in any other, it was not so much a matter of selling units of electric energy as selling a service. The question of service, of course, was involved in the supply of electric energy for any purpose, inasmuch as in giving a supply at all an admission of liability devolved upon the supplier to provide, at any time without notice, the maximum load requirements of the consumer, notwithstanding that his demands may occur simultaneously with maximum demands to their utmost possible extent of all other consumers in the area of supply. Thus, since storage of electric energy on a sufficiently large scale to supply sudden large demands for power was not an economic possibility at the present time, the supply authority must have sufficient generating and distribution plant and equipment available at all times to supply energy to all consumers to the extent of their maximum demand, taking into account such diversity as may apply to the classes of load supplied. The capital charges, maintenance and stand-by costs accrued constantly year in and year out on the plant and equipment installed, irrespective of the number of units sold or the number of hours during which the supply was given. The main portion of the lighting load lasted merely for a matter of two to three hours a day, and there was no diversity in this type of load, so that the cost of the service rendered in giving the supply was far in excess of other typical classes of load which continued for from 8 to 24 hours per day.

Mr. Swingler was satisfied that cooking by electricity, even in individual kitchens on a large scale, could be made successful if undertaken by competent persons, but he was disturbed at the thought of the large capital cost which would be involved in providing sufficiently heavy distribution plant and conductors to meet heavy domestic loads in such a straggling area of supply as that in Capetown. Ordinary types of domestic appliances were not important in this respect, but, unfortunately, the heaviest heating and cooking loads were generally situated on the fringe of the network.

Referring to the question of endeavouring to develop a night load in the shape of electric water heating, Mr. Swingler stated that in Capetown electric energy was supplied for this purpose at $\frac{1}{2}$ d. a unit at 100 per cent. load factor. The system had been an entire success since its inauguration a little over two years ago, and at the present date there was altogether 85 k.w. of load connected for this purpose and the rate of such new connections was steadily increasing. He appreciated the fact that this load increased the daily peak (but it was much larger by comparison with the ordinary night load than with the daily peak), and moreover, the water heating load was connected throughout week-ends and holidays so that it could not but improve the annual load factor appreciably.

With a view to still further developing the night load, the Capetown Corporation had provided in their tariffs for a limited hour supply (between 12 midnight and 6 a.m.) at $\frac{1}{2}$ d. per unit for any and every purpose, and he was prepared to consider the question of offering a still lower price to, say, $\frac{1}{3}$ d. per unit for supplies during those hours for certain classes of consumers according to their consumption.

At the prevailing tariff, a household in Capetown could obtain ample hot water for all requirements at a cost of upwards of 17s. 6d. per month.

It was not always appreciated how climatic conditions affected the question of the success or otherwise of electric heating. The temperature of the water as obtained from the mains was of paramount importance in determining the cost of the consumer's electric heating, and Capetown was more favourably placed perhaps than Johannesburg (which had a much greater variation in temperature from day to day), whereas Durban was in what could only be described as an ideal position in this respect. Comparing the development of the supplies for domestic purposes in

Durban with Capetown, he stated that Durban was a compact town compared with Capetown, and not only was the tariff quoted there for heating purposes less than he could recommend in Capetown, but the consumers actually required less heat from the electric undertaking for any given purpose, the remainder being provided free by Providence.

In order to encourage the use of domestic appliances, however, the Capetown Corporation had voted a sum of £20,000 for building an up-to-date showroom in the centre of the city on the lines of that recently built in Hackney, which will be equipped with all facilities for demonstrating the use of various electrical appliances to prospective purchasers. Advantage had been taken of the fact that it was necessary to erect a sub-station in the centre of the business portion of Sea Point, and the building was being so designed that the front portion would form an office and showroom, the sides would be display windows, and over the sub-station would be built a suite of rooms which they hoped to let to a professional man. The result would be a very attractive looking building.

In this showroom, it was intended to display and demonstrate the use of electrical appliances, which would be supplied for that purpose by local dealers. If the Corporation was instrumental in effecting a sale, it would receive the usual trade discount on the retail price of the article.

Mr. MUNRO (Pietermaritzburg) stated that his was one of the municipalities which was just on the point of taking its supply from the Commission and shutting down its own power station, the deciding factor being the increased load on their station and the large amount of capital expenditure required to increase the generating plant, in addition to which it would have been necessary for them to alter their site. By taking supply from the Commission, the Council would be saving this heavy capital expenditure. There was no reason why the Commission's supply should not be produced as economically as a municipal supply, and (as had been mentioned to him by members of the Commission) this body had to justify its existence, and he thought that they would see to it that they produced their electricity as cheaply as the municipalities did.

Another matter he would like to refer to was the unpayable extensions to the distribution system. In Maritzburg, the Council refused to carry out any unpayable extension unless a guarantee was given that

the revenue to be derived would be sufficient to cover the capital charges on the cost of the extension, plus the generated cost per unit. Each consumer on the extension had to guarantee to use or pay for a certain minimum amount of electricity.

Mr. DOD (Pretoria) stated that, in connection with the special rates for water heating, he was rather in agreement with Mr. Poole, namely, that the multiplicity of tariffs was not good, and that separate scales for lighting and for cooking were too burdensome for the householder. They had probably seen in the Press that in Poplar, the whole of the water for the public baths was heated by electricity on the off-load period. In this case, the Municipality had to compete against a gas company. In Pretoria, they were really in the experimental stage in so far as water heating was concerned. They offered an all-hour tariff to the public, but it was not too successful. There were difficulties in this system of water heating, such as the large waste of hot water by native servants. They had distributed about fifty questionnaires on electrical cooking to certain of their consumers and had asked if they were satisfied, and what comments they had to make regarding electric cooking. All these consumers had found that the electric cooking was satisfactory and, in many cases, cheaper than coal, which, in Pretoria, was about 25s. per ton. The radiator load in offices was a very useful one in the winter, as it was mostly used in the early morning for one or one and a half hours when there was little other electricity needed. With regard to electric cooking at the time of peak load, he had found that this was not a very great difficulty, as in most cases dinners were cooked before the peak came on. In connection with bulk supply from the Commission to municipalities, Capetown and Durban were in the favourable position of having these new super-stations erected right on the spot. The difficulty here was that the super-stations were being, and might be, erected at great distances from the towns, and atmospheric conditions had to be largely taken into account. Lightning troubles in this area were very prevalent during certain times of the year, and it had yet to be shown that these troubles could be satisfactorily controlled over such a huge area. As they would learn from some of the papers which were going to be read, the cost of generation did not very largely affect the consumer in the town—it was the cost of distribution and administration which really made up the cost of supply.

Mr. LAMBE (East London) said that he hoped it would not go out from this Convention that they looked upon the Electricity Commission as a Government body. The Commission did not deserve this, and such a name could only have harmful effects. He also hoped that the impression would not be gained that they were prepared to change electricity for gas. The latest developments in the use of electricity for heating and cooking were very considerable, and he had the greatest possible faith in the use of electricity for these purposes. He felt sure that the time was rapidly coming when electricity would take its proper place in the world. He agreed with what Councillor Millar had said regarding the standardisation of heating and cooking apparatus. Cases were not uncommon where a cooker or heater required repairing and had to be left idle for a long time until some part was obtainable from overseas. This was a very serious drawback to the utility of electricity for domestic purposes. As far as he could see, this could only be got over by municipalities themselves purchasing and selling heaters and cookers of a few makes only. They hesitated to take this action, however. With regard to tariffs, at the last Convention he had made an appeal for simplicity, and he again appealed to them to frame only tariffs which were understandable to the layman, and that those which were not should be discarded. They must not allow themselves to become hide-bound by wiring and other regulations. In East London, they had no regulations whatever, having merely their tariffs. They tried to get their consumers to fall into line with the I.E.E. rules, these being those contained in the old editions, and not the new ones, which he considered too elaborate.

Civic Luncheon.

At 1 p.m., members and delegates were entertained to luncheon by His Worship the Mayor and Town Council of Johannesburg.

Visit.

In the afternoon, a visit was paid to the Power Station, Gas Works and Workshops of the Johannesburg Gas and Electric Supply Department.

TUESDAY, APRIL 13th, 1926.

Members and delegates spent Tuesday at Vereeniging, where the following inspections were made:—
(a) The Steel Works of the Union Steel Corporation of

S.A., Ltd.; (b) The Works of the Vereeniging Brick & Tile Co., Ltd.; and, (c) The Pumping Station of the Rand Water Board. A special train, with breakfast served on board, was kindly provided by the Johannesburg Municipality, and luncheon was supplied at Vereeniging by the Directors of the Union Steel Corporation of S.A., Ltd., and the Vereeniging Brick & Tile Co., Ltd.

WEDNESDAY, APRIL 14th, 1926.

The Convention resumed its proceedings at 9.30 a.m. The President (Mr. B. Sankey) was in the chair, and there were also present:—

Members.—J. Mordy Lambe (Vice-President, East London), T. P. Ashley (Queenstown), G. C. Brown (Middelburg, Transvaal), R. D. Coulthard (Oudtshoorn), J. G. Davison (Mafeking), T. C. Wolley Dod (Pretoria), R. W. Fletcher (Krugersdorp), L. L. Horrell (Pretoria), R. D. Larter (Standerton), R. Macaulay (Bloemfontein), W. M. Mail (Kokstad), F. C. D. Mann (Worcester), B. Marchand (Paarl), R. J. Morris (Roodepoort), H. M. S. Muller (Beaufort West), A. S. Munro (Pietermaritzburg), E. Poole (Durban), H. A. Prevost (Somerset East), A. T. Rodwell (Johannesburg), T. F. Siebert (Uitenhage), L. B. Sparks (Pietersburg), R. A. Stoker (Kroonstad), T. Sutcliffe (Benoni), G. H. Swingler (Capetown), C. K. Turner (Kimberley), J. Younger (Vryheid).

Associate Member.—L. B. Proctor (Johannesburg).

Delegates.—Councillors A. L. Clark (Durban), T. Eriksen (Kimberley), J. D. Low (Capetown), W. Millar (Pretoria), J. Paton (Kroonstad), G. W. Prior (East London), W. G. Wearne (Roodepoort), F. E. Wilkinson (Mafeking), Mr. J. F. Kermack (Town Engineer, Benoni).

Visitors.—P. Fraser, G. J. Moore, W. Tredre, J. A. Vaughan (all of Johannesburg), and O. Rau (Lindley, O.F.S.).

Hon. Secretary and Treasurer.—R. G. Tresise (Johannesburg).

Telegram from Chairman, Electricity Supply Commission.

The following telegram from Dr. H. J. van der Bijl, the Chairman of the Electricity Supply Commission (who was then in Capetown), was read:—

“Reeret not possib'le to attend Convention. The benefits derived from more extensive use of electric power, not only in industry, but also for

domestic purposes and for better street lighting, are being appreciated to an increasing extent in civilised countries. To provide these facilities in manner commensurate with modern standards is the duty of all municipal electrical engineers. Your Conventions can be one of the most effective means of solving problems encountered in attempts to bring South African towns into line with world's most modern practice, therefore my sincere wishes for continued and growing success of your Association."

The Secretary was instructed to write to Dr. H. J. van der Bijl and thank him for his good wishes.

Election of Council.

The following members were elected to represent the different Provinces on the Council:—E. Poole (Natal), T. C. Wolley Dod (Transvaal), L. F. Bickell (Cape), and T. Millar (O.F.S.).

The Council was then declared to consist of the following members:—President, B. Sankey (Johannesburg); Vice-President, J. Mordy Lambe (East London); Past Presidents, John Roberts (Durban) and G. H. Swingler (Capetown); L. F. Bickell (Port Elizabeth), T. C. Wolley Dod (Pretoria), T. Millar (Harrismith) and E. Poole (Durban).

The following paper was then read:—

"ALTERNATING CURRENT SUB-STATIONS AND THEIR EQUIPMENT FOR URBAN AREAS."

By MR. A. T. RODWELL, M.I.E.E., M.I.Mech.E., Assistant Electrical Engineer, Johannesburg, and MR. P. FRASER, A.M.(S.A.)I.E.E., Sub-Station Superintendent, Johannesburg Municipality.

The subject of alternating current transformer sub-stations is one of primary importance in any modern distribution system.

In these days of Electricity Commissions, with their forward policy of scrapping antiquated and inefficient small D.C. power stations and providing a bulk supply of alternating current at high voltage, the use of static transformers for transformation to suitable voltages is becoming widespread. On existing alternating current distribution systems, where numerous transformer sub-stations are installed, the rate of change in their design and equipment over a period covering twenty years has been remarkable and finality has by no means been reached.

Transformer sub-stations range in design from the small cast-iron or steel pillar box usually seen at street corners, to two and three storey structures covering a very large ground area. The design of a sub-station largely depends on:—

- (a) Locality: *i.e.*, Residential or industrial.
- (b) Load: *i.e.*, Stationary or in process of being developed.
- (c) Primary voltage and method of protection.
- (d) State regulations governing the design and layout of electrical apparatus.
- (e) Possible K.V.A. behind the system.

The question of building transformer sub-stations underground will not be discussed, as it is felt to be a decided retrograde step, and only under extreme pressure should a transformer be placed underground, and then only as a temporary measure.

THE FACTORS AFFECTING DESIGN.

Locality.—The external architecture of a sub-station may vary greatly in any city according to the district served, and municipal and township companies' requirements. For the sake of standardisation of sub-station buildings and internal layouts, a suitable design can be got out applicable to any district; suitable external refinements to correspond or harmonise with neighbouring buildings can always be incorporated when required, at small cost. Obviously, an industrial sub-station erected on industrial sites would not justify the provision of unnecessary external elaboration. On the other hand, a substantial building of ample space should be provided. It is customary, both in residential and industrial areas, where the load to be dealt with is small, to erect what is termed a 'kiosk.' In Johannesburg, these kiosks are constructed of sheet steel, suitably braced and designed to house a maximum of 100 K.V.A. transformer complete with its H.T. and L.T. switchgear and fuses. These kiosks are of robust design and possess a neat and pleasing appearance when erected.

They are of great value for developing a growing load where the expense of a brick, or substantially erected, building is not immediately justified. They are easily transported and, should the occasion arise, can be moved to a new site in a few hours at very little cost.

Another valuable feature of the transformer kiosk is that where a suitable plot of ground is not obtainable for the erection of a sub-station, a kiosk, provided it can deal with the demand, can be erected on the foot-path, or an "island" in the centre of the road. No objections from the public (even in Johannesburg's most exclusive suburbs) have been lodged against this type of structure.



PRESSED STEEL TRANSFORMER KIOSK: CAPACITY 100 K.V.A.

Any necessary windows or openings in brick, masonry or concrete structures should have a backing of expanded metal, or other suitable material, fixed in such manner as to prevent the access of birds or animals, should the window be broken. Provision for future possible extensions should also be made.

The modern tendency on A.C. distribution systems is towards de-centralisation of supply. A few years back it was quite customary, not only in this country but in Great Britain, the Continent and the United States, to centralise a number of transformer units in

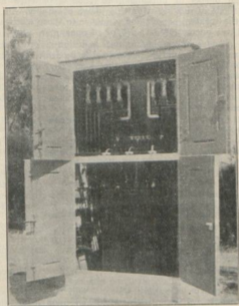
one comparatively large sub-station and distribute to distant points through heavy section low tension mains. This system was regarded as ideal, because it cut down building costs, enabled large and efficient transformers to be installed, and reduced the cost of supervision, etc. However, when loads crept up, heavy voltage drops began to be experienced on the long L.T. feeders and the centralisation policy had to be revised. In the United States, the difficulty was largely overcome by installing automatic voltage regulators, but European practice goes further, is claimed to be more reliable and gives greater flexibility, the system adopted being to decentralise, lay H.T. feeders and instal a number of small sub-stations in a given area formerly served from one point. The amount of copper utilised is reduced to a minimum, the capital cost is less, and correct and steady voltage is more easily maintained at the supply terminals. The growth of demand for industrial supplies and heavy supplies for large blocks of buildings sometimes necessitates each such connection being taken from the high tension mains. This policy is commendable, and the H.T. network has been of great value in developing heavy industrial demands which could not be dealt with satisfactorily by low tension connections. When H.T. supply is given under these conditions, having due regard to ventilation, access, and other essential features, it is desirable that the transformer sub-station should be separate from the main building, but in practice it is often found that the sub-station must be incorporated in and form part of the main building.

In large cities, where sites are costly, the question of obtaining sufficient and suitable space for sub-stations is a difficult problem. It is to be regretted that in the past, municipal authorities have failed to secure, in the early stages of development of their areas, sites suitable for the electricity supply requirements of the public. The position is further accentuated with regard to the provision of space for electrical equipment in large and valuable buildings. Whilst every other requirement appears to be met, the essential need of space to accommodate electrical equipment appears to be ignored by those responsible for the design of the building.

Whilst a few general principles for the proper design of a suitable transformer chamber in large buildings may be generally applied, basing the space

required on the load requirements and Government regulations, each building represents a problem of its own. The solution appears to be the close co-operation of the architect and electrical engineer, backed by legislation.

When it is impossible to build the transformer sub-station separate from the building, the architect must of necessity design the sub-station, and any ducts that may be required, in the main building. Bearing



PRESSED STEEL TRANSFORMER KIOSK: INTERIOR VIEW, L.T. SIDE.

in mind the increasing uses to which electricity is now put and the rapid growth of loads, co-operation, which will bring about better design, provide greater safety for the operator and occupants of the building and allow for future extension, is to be earnestly desired.

Reference to the possibility of an increase in the premium against fire risks being demanded by the Fire Insurance Company, should the space allowed be insufficient and the equipment defective, is the surest

method of securing improved conditions. This is to be deplored. It is an undoubted fact that Insurance Companies who are vitally interested can, and should, by inspections and regulations, improve the existing unsatisfactory conditions in this respect.

Those of you who are responsible for heavy supplies to individual consumers are aware of these difficulties, and it is hoped that members will discuss this problem of H.T. connections (with special reference to large blocks of buildings), as their experience and methods of dealing with this phase of supply will be of the greatest benefit and guidance to those who have not yet encountered this type of consumer.

Load.—When laying out a design a great deal depends on the nature of the load to be dealt with; the question as to whether the load has reached a stationary value or is capable of being increased; the nature of supply, *i.e.*, single-phase or three-phase; the nature of incoming H.T. supply, which may be either one, two, or three-phase.

Two-phase switchboards are usually built with standard three-phase switchgear. In the case of a three-wire two-phase system, however, care must be taken to see that the common (sometimes called the neutral) conductors and busbars have an area 1.41 times that of the outers. It is also to be noted that the voltage across the outers is 1.41 times that between any outer and the common. These ratios are elementary and well known, but require to be kept constantly in mind in laying out a reliable and efficient system.

In the case of a three-phase incoming supply, it is necessary to know whether the system neutral is earthed or not. If unearthed, protective gear is only required on two phases. If earthed, either direct or through an earthing resistance, then protective gear must be provided on all three phases.

One type of supply which is still largely in use, but which will eventually be looked upon as a relic of other days, is that of a two-phase high tension incoming supply, transforming to three-phase low tension, using the well known Scott method. Where this system has to be dealt with, more transformer space must be allowed, as, even for small loads, a bank of two transformers must be used for this standard method. With this arrangement, only 86.5 per cent. of the windings are utilised. That is to say, if a Scott connected bank of two 50 K.V.A. transformers is installed, the normal continuous output will only be 86.5 K.V.A.

There are several generating stations where both two-phase and three-phase current are generated, and it is quite usual to inter-connect the two systems at either the generating end, the sub-station end, or both. This is usually accomplished by the floating bank of Scott connected coupler transformers. Obviously, where this is done, a considerable increase in space is required for the transformer bank with its primary and secondary switchgear.

It is sometimes urged that transformers should be installed in a compartment separate from the operating compartment. Whilst this is good practice, owing to the additional initial expense and extra space required, this is not necessary for the voltages and loads usually met with in city areas. A.C. static sub-station buildings can often, with advantage, be incorporated in, and form part of, converter sub-stations which may exist on the system. This may occur in densely populated areas where large transformer units must be employed, when it may be advisable to provide sufficient clearance and facilities for the removal of the transformer cores for examination or repair. It will usually be found cheaper to remove smaller transformers to the workshop for internal inspection or repair. Accessibility and the ability to remove quickly and replace defective transformers is of vital importance, and regard must be paid to the elimination of possible nuisance due to the "humming" of transformers in residential areas. Modern transformers cannot be described as noisy, but it is possible to get a batch which are not too silent, and the "hum" given out may give rise to serious complaints from nearby residents. The sub-station building may form a sounding box and even amplify a "hum" into a roar. When this occurs, a very small alteration in the position of the transformer will often result in a cure, or at least a large decrease in the volume of sound produced.

Silent running transformers may develop a hum. This is usually through vibration loosening the core clamping bolts. When this occurs, the only remedy is to tighten up carefully all core bolts. Transformers which have a slight hum before being filled with oil should not be treated too seriously, as after being filled with oil the damping effect is usually sufficient to eliminate the noise entirely.

In transformer sub-stations housing two or more transformers supplying, say, a domestic load which is greatly augmented at night time for a period of two or three hours when the general lighting peak is on the

system, it may be desirable, in the interests of efficiency, to instal automatic time controlled switch-gear on both sides of the transformers, so that one or more transformers can be cut in or out of service as the load varies. Where this type of transformer switching is installed throughout an entire system, considerable saving of transformer losses will be effected, but it is suggested that savings can only be shown when an entire system is so equipped.

The capital expenditure and subsequent maintenance and supervision for a system so equipped will be heavy, and serious consideration to the probable savings in losses, as against the outlay, must be given, as the losses which it is proposed to save are often more apparent than real.

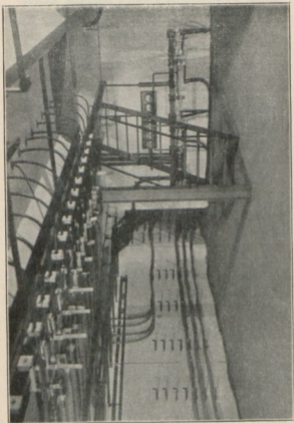
The Berry, or series system of connecting transformers, is claimed to show considerable saving in the first cost of mains. In multiple or parallel circuits, the voltage is at its highest value near the generator or supply transformer and decreases towards the end of the circuit, due to the C^2R drop. The result of this condition is to lower efficiency as compared with the series system.

With this later system, the presence of the automatic feature in the constant current transformer overcomes the heavy voltage drop experienced in the parallel system.

Power factor improvement can be effected by the installation of batteries of condenser elements built into a suitable frame, and the whole immersed in oil in a tank, when it resembles a transformer. Where power factor cannot be improved on consumers' installations, the condensers can be arranged in any ordinary transformer sub-station with the provision of very little more space.

Busbars may be of flat, round or tubular copper, and aluminium is now largely used. Tubular copper is used to reduce any possible loss due to what is termed "skin effect." Further, the tubular construction provides ample ventilation, providing the ends are not closed.

Busbar clamps for flat copper laminated bar construction, should be of brass or other non-magnetic metal, as it is well known that the usual iron clamp used generates heat due to its magnetic properties, and may be a danger to porcelains and other insulators. Aluminium is used on account of its lightness permitting a light supporting structure at lower cost.



SUB-STATION : CABLE BASEMENT.

The extra sectional area required, however, as compared with copper, requires more space to preserve correct distances between phases.

Many so-called lightning and surge arrestors are on the market, each manufacturer claiming special features for his apparatus. Such appliances function satisfactorily and act as a safety valve against surges in many instances, and great relief from minor disturbances has been experienced on the system with which the writers are connected, due to their installation. The ideal arrestor has, however, yet to be designed, more especially for areas where atmospheric disturbances are unusually severe. Generally, arrestors should be installed in a place of safety, if possible, external to the sub-station. If this is impossible, they should be removed as far from important apparatus and plant as possible, taking into account the necessity for a direct line to earth for the discharge current.

A very important factor affecting the design is whether the incoming and outgoing conductors are to be cables or overhead conductors. Outgoing overhead conductors should be avoided, wherever possible. Should the outside system be on the overhead principle, then the connections from lines to sub-station equipment should be carried out in cable laid to the sub-station through ducts cut in the floor, or in the case of a large sub-station, through a cable tunnel situated below the floor level.

PRIMARY VOLTAGE AND METHOD OF PROTECTION.

The type of equipment to be installed, and in a lesser degree, the method of protection applied to the system for the various commercial voltages now in vogue, determines the internal arrangements to a very large extent.

The low tension switchgear equipment may be of the flat back type with air-break knife switches and fuses, or it may take the form of masonry or sheet-steel cubicles containing isolating links and an oil-switch circuit breaker suitably calibrated and time lagged. Low tension oil-switches of this description, for operation on anything up to 600 volts, are usually provided with series overload trip coils, and, if series type ammeters are used, current transformers are dispensed with.

These low tension oil-switches are usually selected on an ampere-carrying basis plus short period overloads. The question of K.V.A. rupturing capacity is of no account, and the expense of providing heavy

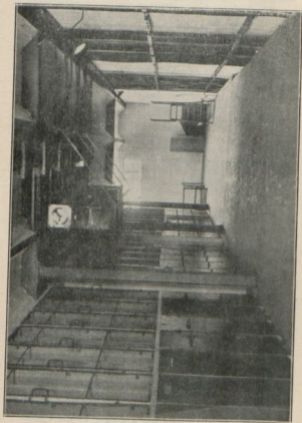
rupturing capacity oil-switches is avoided. This does not mean that any cheap or flimsy switch should be installed; on the other hand, robust design, with plenty of contact area and ease in renewing a broken insulator, should be a guiding principle.

The high tension switchgear can take a variety of forms, depending on circumstances and experience. Plain sheet steel cubicles, draw-out truck type cubicles, drop-down cubicles, compound filled ironclad gear and masonry, or concrete cubicles, all have their respective advocates and uses under different conditions.

The drop-down cubicle for voltages up to 6,000 volts is a great space saver and very accessible. In the construction of the majority of high tension cubicles, the guiding principles are safety to life, efficiency, reliability and the exclusion of all vermin. Extensive use of mechanical interlocks, which are claimed to make the apparatus foolproof, is a feature of the majority of these cubicles. Any of the cubicles mentioned can be arranged to accommodate any of the present-day systems of protection, and the split conductor system is a standard fitment on almost any of the commercial cubicles.

Protective systems, whether for banks of transformers, feeder systems, or against surges and lightning, should be able to clear a fault with the least possible disturbance to the rest of the system. Safety and continuity of supply are of paramount importance. They should be simple in construction and operation, instantaneous in action under short circuit conditions, and should be easily adjusted and replaced. The relative value of the different protective systems is a very controversial subject, and it is not the intention here to enter into a discussion on their relative merits; suffice it to say that any system which may be installed must be thoroughly tested out previous to going into operation, and thereafter subjected to regular and rigorous inspections and tests. No protection system is infallible. A given system may have been brought to a very high degree of perfection, but this degree of perfection must be constantly maintained. With the exception of protection for potential transformers, it is generally agreed that fuses as overload protection on high tension circuits are a danger to the system and very unsatisfactory with regard to their calibration.

The division of an H.T. switchboard into cubicles is intended (1) to minimise the fire hazard; (2) to protect workmen from adjacent live gear when working



SUB-STATION : H.V. SWITCH GALLERY. CONCRETE BELL CONSTRUCTION.

on a dead circuit; (3) where phase barriers are used, to protect from accidental phase to phase short circuits.

High voltage design problems are, in the main, insulation problems, and this leads us to the question of space, which, under no conditions must be cramped. For the very high voltages, the outdoor sub-station has solved a big problem, and its attendant success in all kinds of climates is inducing engineers on the lower voltage systems to contemplate its installation where circumstances permit. It is a fact, however, that outdoor equipments for voltages from 3,300 to 11,000 volts require well over double the space for an equivalent indoor equipment. There are also a certain number of instruments which may require weather protection in the form of a small steel or brick house.

It is a matter of prime importance in outdoor work to safeguard structures and apparatus from rust, and this means continual supervision of all parts subject to rusting.

From the foregoing few remarks, it will be obvious that low voltage outdoor sub-stations are comparatively expensive adjuncts to a system. Where the voltage exceeds 33 k.v., however, and ground can be purchased cheaply, the outdoor sub-station is the better commercial proposition, a saving of 15 per cent. on the total capital outlay being in favour of the outdoor type where the cost of ground is identical in both cases.

STATE REGULATIONS COVERING THE DESIGN AND LAYOUT OF ELECTRICAL APPARATUS.

There can be little doubt that the various regulations, Governmental and Fire, which have been promulgated from time to time and which have to be observed and kept constantly in mind, are responsible for a great deal of the progress (from a technical point of view) in evidence to-day. On the other hand, due to the heavy expense involved in meeting the regulations, they have been a serious hindrance to progress from the commercial and development point of view. Responsibility for the proper enforcement of regulations is usually delegated to the responsible engineer in charge of an undertaking, and in the case of large systems, a splitting up process whereby sections of the undertaking are allocated to separate members of the engineering staff is, or may be, desirable. Dual responsibility for an undertaking, or sections of an undertaking, is not permitted in the Union of South

Africa. It is, therefore, imperative for the engineer in charge to see that his designs are worked up in conformity with any regulations in force in his district or State.

The urgent need for Government regulations for the proper construction of sub-stations, more especially when these are installed in buildings, is exemplified by the following example recently brought to the writers' notice.

A large building block was supplied by means of a high tension cable laid and connected to two 50 k.v.a. transformers. The transformers and equipment were installed in a very small confined chamber under the main stairway leading to a large gallery, which is daily filled by hundreds of people. No ventilation whatever was provided, and access to the chamber was through a narrow passage, the entrance to which was utilised as a paybox. It was found that for special occasions the transformers had been overloaded 50 per cent. without permission or proper authority, and were operating at extremely high temperatures. Had the transformers gradually broken down between turns, thus gassing the oil (as sometimes happens in practice under continuous overload conditions) the confined chamber would have become filled with gas which might be of an highly explosive nature. Under these conditions, the disastrous result of the fuse "blowing" can be better imagined than described. Possibly the plight of the persons marooned in the gallery with all the possibility of a fire in the building would not be worse than that of the person who formerly sat in the paybox at the entrance of the passage to the transformer chamber.

It is the privilege and duty of the electrical engineer to endeavour to protect members of the public against such dangers, but it is regrettable that in many such cases at present the owners of property will only alter defective apparatus and instal satisfactory equipment upon the possibility being pointed out of the insurance companies refusing to take fire risk or accept liability for damage from this cause.

Regulations in the first place are usually designed with a view to minimising any hazard to life or property, but it must be remembered that in giving effect to these, many things are done which increase the reliability and efficiency of a given system, thus giving greater satisfaction and continuity of supply to the consumer and a maximum of revenue to the undertaking.

In so far as transformer sub-stations are concerned, regulation distances behind switchboards, separate brick partitioned chambers for the housing of transformers away from the main switching room, earthing of all exposed metal, such as frameworks, containing tanks and the roof of the building, etc., provision of first aid emergency box and fire or arc extinguishing apparatus, ample ventilation and outlets to the open air for any dangerous gases evolved from oil-switches or transformers, and installation of earth leakage detectors, are among some of the many points to be given careful consideration before commencing construction.

Building rules and regulations have to be observed, particularly with regard to fire risk, and it may not be out of place here to put members on their guard not to contemplate slate or tile roofs in any locality subject to severe hailstorms, and where louvre ventilation is installed, to see that the louvre vanes are inclined at a sharp angle, efficiently to baffle drifting rain.

Possible K.V.A. behind the System.

To a large extent the class of high tension apparatus and switchgear to be installed is determined by the possible k.v.a. behind the system, and the breaking or rupture capacity of the switchgear required should be as nearly as possible computed accordingly. Under short circuit conditions, the possible k.v.a. to be ruptured on various systems differs greatly, according to the capacity of the generating plant, reactance of the generators and the feeder system and the time lag of the switch. In some cases, reactances to limit the current are inserted on the system between the generators and sub-station switches. This will permit of a switch of lower rupture capacity being employed.

Not only must the generator capacity of the plant be considered, but also the total amount of synchronous machinery connected to the system. This would supply additional current to the system, increasing the magnitude of the fault.

It is impossible to determine exactly the rupture capacity of a switch, and none are perfect. By means of experience and test and after testing the apparatus to destruction, approximations are reached and given by the leading manufacturers. These may be generally accepted.

The reactance of apparatus and equipment varies considerably. Assuming the generating plant consists

of modern high speed steam turbo alternators and the reactance of the plant and sub-station connecting cables is 20 per cent., the current flowing under fault conditions may exceed five times the capacity of the generating plant. Where sub-stations are at some distance from the generator station, the impedance of the connecting cables may lower this value, but with high speed turbo generating plant of older design, the fault current will be increased. The enormity of the effects and forces involved can be appreciated by those who have seen them on badly designed apparatus and switchgear connected to systems having large generator capacity. On such a system, conductors should be properly fixed to prevent displacement due to repulsion.

To reduce fault currents, recourse to either air-core or iron-core reactors is made. The iron-core reactor is favoured chiefly on account of having no stray field, thereby cutting down the space required for its accommodation. Generating and transforming apparatus can be designed for the requisite reactance required, but at greatly increased cost. Care must be taken when incorporating reactance in an existing system, as the effect is sometimes to give poor regulation. It has been stated that reactance improperly proportioned, has aggravated, rather than minimised, trouble during fault conditions.

The rupturing K.V.A. of an oil switch would appear to depend on a number of factors, such as:—

- (1) Speed of operation;
- (2) Head of oil (above contacts);
- (3) Volume of oil sufficient to cool any explosive gas, which may be generated before it reaches the atmosphere;
- (4) Sub-division of phases in separate tanks or compartments of main tank;
- (5) Type of contact, *i.e.*, laminated brush or wedge shape contact;
- (6) Length of travel;

and many others.

A usual clause in specifications for oil switchgear is that the oil-switch shall be capable of interrupting any fault which may occur on the system twice at a two-minutes' interval, and shall then be in a condition to be closed to carry the rated current until such time as it is practicable to inspect it and make the necessary adjustments.

To obtain high break speeds, special attention should be paid to acceleration and retardation after the moving contact reaches the end of its travel, otherwise the rebound may cause trouble.

Where heavy fault current can flow on E.H.T. systems, isolating links should be fitted with an automatic locking device to prevent them being blown open, and conductors on such a system should be properly secured to prevent displacement due to repulsion.

In conclusion, the requirements for which sub-stations are erected and the conditions under which they must be installed and operated, vary so widely that great ingenuity must be exercised by those responsible for their design and successful operation. It is impossible to standardise a sub-station to suit all conditions. Large numbers of comparatively small urban areas are rapidly developing, and the electricity supply demands are increasing, which can only be met by the installation of sub-stations as well as generating plant.

In the foregoing, certain essentials in sub-station design and requirements are dealt with, which it is hoped may be of use to those who may be called upon to undertake such works.

DISCUSSION.

Mr. SPARKS (Pietersburg) thanked the authors of the paper for bringing up this important subject. Alternating current was being used increasingly in the smaller towns, where it was not an uncommon thing to find quite a number of sub-stations. Small towns were usually very short of funds, and any contribution which would help their engineers to cheapen the cost, without introducing additional risks, was always welcome. He would be pleased to know if there was any reliable type of h.t. fuse on the market suitable for 3,000 volts, as he found the ordinary plug type in use was not reliable. With regard to leading in h.t. overhead wires, in his town this was done with cable, but in the case of a line five miles long the lightning had entered the station on more than one occasion, which was probably due to resonance.

Mr. MUNRO (Pietermaritzburg) said he had listened with particular interest to the paper, for the reason that he had in hand at the present time the changing over of his high tension distribution system (covering an area of 26 square miles) from single-phase 100 cycles to three-phase 50 cycles, and the provision

for a rapidly increasing demand during the next few years.

The method of distribution in Pietermaritzburg, some 25 years ago, had been by means of small underground transformer pits, each feeding a limited area of low tension supply; at a later date a number of these separate transforming points were grouped into larger above-ground brick chambers, which met the conditions with satisfactory results. To-day, however, with a rapidly growing demand for current for heating and cooking purposes, he found the low tension mains were over-long and overloaded, consequently, he was returning to the policy of decentralisation and reducing the length of the low tension supply cables, and in the case of large blocks of buildings and industrial undertakings in the centre of the town, he was giving a high tension supply and installing the necessary transformer and switchgear without any extra charge to the consumer, on the stipulation, however, that the consumer provided a fireproof cubicle of sufficient capacity for his requirements. His experience was that this class of consumer was only too ready to meet the Municipality in this respect.

Mr. FLETCHER (Krugersdorp) said that the authors had given them a paper on a very interesting subject which most of them were constantly having to deal with, but he would have liked to hear the subject dealt with in more detail. In the case of a sub-station of, say, 500 k.v.a. capacity, one could afford to spend money on ironclad H.T. gear, but if the capacity was, say 50 k.v.a., the cost of the ironclad gear would be as much as the cost of the transformer, and would not be justified. A point on which there was a great diversity of opinion was the use on voltages of 2 to 3,000 volts of switches with series trips as against current transformer trips. There was no doubt the current transformer type was less liable to break down, but against this it was more difficult to instal, took up more space and cost more. The series type of switchgear could be fixed on the wall of the transformer house, and it required no cubicle; the leads need not be exposed, but could be taken straight into the switch, and from thence to the transformer, and a neat job, taking very little space, could be made. He had had a number of these switches in use for the last two years, and although he had had a few breakdowns, due to faulty coils, on the whole they had been satisfactory. The faulty coils had been made locally, which he had not found out until afterwards. When a cable

or overhead line was feeding a single transformer, did the writers think it necessary to have H.T. switch-gear at each end of the line? In his opinion, it was not. The best and cheapest method was to treat the cable and transformers as one unit, and instal the H.T. gear at the point where the cable taps the main system, providing only links in the transformer house. He did not agree with the authors in using air break knife switches and fuses on low tension distribution, except for transformers up to, say, 5 k.v.a., as, in his opinion, the low tension system should be protected with automatic oil break switches of ample capacity. On most systems in this country, the H.T. mains were underground and the L.T. were overhead, and most of the faults occurred on the L.T. Therefore, the protection on the low tension should be capable of clearing the fault without affecting the H.T. He thought they would all know how impossible it was, with the ordinary air break 100 ampere fuse, to know when it would fuse—it generally blew at about 8 o'clock at night, just as all the shops, hotels, etc., were in full swing. The authors mentioned the difficulty of voltage regulation with the parallel system of connecting transformers, and he took it that they had in mind a system where the voltage could be regulated to a certain extent at the power station, and not, as was the case with many of them, when the voltage was altogether out of the control of the operating engineer. This referred to a bulk supply. As he had had considerable trouble with voltage regulation since changing over to a bulk supply, he thought it might be interesting to members to hear some of his experiences. When the change-over from D.C. to A.C. bulk supply was first made at Krugersdorp the system was run without any regulator, with the result that the sale of lamps in town went up 100 per cent. as compared with the old D.C. supply. A hand regulated induction regulator was then installed at the point of supply, having a regulation of 5 per cent. + or -, but it was found that hand control was of little use. It was then decided to convert the hand regulation to automatic, and a standard American equipment was fitted to the existing regulator and had been most satisfactory. The contract with the Power Company, when the supply was first taken, allowed a variation in voltage of 10 per cent. + or -, a range of voltage which was altogether too large for town service, but in the new contract the variation allowed was $7\frac{1}{2}$ per cent. One difficulty of a bulk supply was the impossi-

bility of raising the voltage at the point of supply as the load increased to compensate for the loss in the mains, and this is where an induction regulator was most useful, as it is fitted with a compensating device which automatically increases the voltage as the load increases.

Mr. POOLE (Durban) took exception to underground sub-stations being a retrograde step, as on the Berea in Durban (the residential quarter) they had many such, having a single (100 k.v.a.) transformer in a pit under the pavement. They had experienced no trouble with their use. The H.T. and L.T. switchgear are contained in separate pillars on either side of the pit, the pillar acting as vents, with a short drainage pipe laid down hill, with its exit in the storm channel, thus serving as a drain as well as an air inlet for cooling the transformer. The Berea was particularly suited for this type of sub-station as, being hilly, no trouble was found in selecting positions where a suitable fall in the ground is available.

In regard to decentralising transformer positions, Durban was experiencing the same as other towns, only perhaps more so, and whereas 20 years ago there were 12 positions in various parts of the residential area, say, $\frac{1}{2}$ -mile apart, these have now practically become switch stations, supplying six or eight positions around the central point, about 300 yards or so apart, to meet the heavy demands for cooking purposes. In Durban they took all the advantage they could of using large buildings in which to house transformers, and by arranging a duplicate H.T. supply by looping the cable in and out, they generally managed to arrange that the transforming point could also be used for other consumers in the vicinity.

Regarding the question of architects being asked to make provision for the electrical equipment in buildings, he would remind members that a resolution was passed at their last Convention on this matter.

In Durban, Scott-connected transformers are also in use, but in this case the transformation is from 3 to 2-phase, with single-phase distribution.

He endorsed the authors' remarks in regard to the use of a short incoming or outgoing cable as a protection against lightning in connection with supply to overhead mains.

Councillor CLARK (Durban) said that it had pleased him very much indeed to learn, from the discussions which had taken place since the Convention had opened, that the engineers in charge of the municipal

electricity undertakings did not only concern themselves with the production of electricity, but dealt very seriously with the questions of capital cost and low maintenance charges; their chief object clearly being to give to the public the cheapest possible supply of electricity. He congratulated the writers of the paper which had just been read. Referring to some of the buildings shown on the screen, Mr. Clark suggested that more consideration might be given to the appearance and design of the sub-stations in order to make them more pleasing to the eye and in keeping with the residences around them. In Durban, they had a sub-committee which saw that new buildings were erected in accordance with the general outline of the street, and in harmony with the surroundings.

Mr. SWINGLER (Capetown) thought it was rather a pity that this paper was confined to alternating current distribution instead of covering the whole field of both alternating current and direct current.

The system to be adopted for distribution purposes, even with the now universal practice of alternating current generation, would depend upon several factors. Most large cities had a certain amount of direct current distribution, and to change this for alternating current meant, in many cases, the complete scrapping of all underground cables and a large proportion of the consumers' apparatus, and there were very few cities that would be prepared to meet the expense involved. In Capetown, they had been particularly fortunate in that the whole distribution network, with the exception of a very small piece in the centre of the town, had, up to the present, been overhead; and, further, that this overhead distribution had now reached the limits of its useful life. They had, therefore, been able to select the system of distribution which appeared to be most satisfactory, without having to include the complete renewal of the underground mains.

There were two factors, either of which would limit the output from any given distribution point, whether A.C. or D.C., and these were: (a) the total current in amperes to be dealt with, and (b) the economic distance over which low tension current could be distributed. In regard to (a), Mr. Swingler mentioned the Capetown Burg Street sub-station as an instance. This was designed for a total lighting and power load of 6,000 amperes, in addition to a tramway load of 2,000 amps. A considerable amount of thought had been given to the most satisfactory

method of leading the cables into the sub-station, and the present arrangement was such that they were unlikely to experience trouble through a fault on one cable spreading to others. If the output from this sub-station had to be materially increased, he did not think it would be possible to make a cable job which could be considered reasonably safe. In his opinion, therefore, this sub-station was distributing as much current in amperes as could be safely distributed from any one point. With regard to (b), he stated that five years ago, for general A.C. distribution in Capetown, a general limit for sub-stations was fixed at approximately one mile apart, giving a length in distance of approximately half-a-mile in either direction. The general layout of the individual sub-station networks had been by means of underground feeders approximately one quarter of a mile long, and distributors (overhead) feeding inwards and outwards for the same distance. Generally speaking, this had been found to give a very reasonable pressure distribution. In fact, pressure drop from the sub-stations at the present time was by no means so important a question as that of pressure regulation on the 11,000 volt system.

The value of land in the centre of a large city was such that the cost to supply the whole of the load by means of low tension distributors from sub-stations was prohibitive, and, for this reason, many large cities had adopted a medium pressure alternating current distribution system, with transformers in individual buildings having a heavy load, but he did not think they would have to adopt this method in Capetown for some years to come. In developing any new area it might be taken for granted that land was reasonably cheap, and it was advisable to obtain a sufficient area of ground to erect a sub-station of reasonable size. If this were not done at the beginning, it became a much more costly job at some later date.

He was by no means in agreement with the authors as regards the suitability of sheet steel kiosks for development work. Supply points of this nature, put up to meet and develop a load, had a nasty habit of becoming permanent, even when the load had much outgrown the original dimensions. A further point was that nine-tenths of the trouble experienced on a supply distribution system occurred during dirty weather, of which the trouble was usually a direct result. The idea underlying the design of any sheet steel kiosks was to do the whole of the operations re-

quired from the outside, and the carrying out of any operations, either on the high tension or low tension system, in driving rain with half a gale of wind blowing, was to be avoided if in any way possible.

The suggestion to put up these kiosks on islands in the centre of the road in a developing area was, he thought, particularly bad practice. This has been done in one or two instances in Capetown, but in less than three years the building so erected has become too small.

Regarding the provision of space for electrical equipment in large buildings, Mr. Swingler considered this was a matter which the supply authority could deal with by insisting that the necessary space was provided at a suitable point in the building. It seemed to him somewhat unreasonable to expect the ordinary architect to know what space he must allow, and the number of really large buildings which were erected was not so great as to make it difficult for the supply authority to satisfy itself at an early stage that the necessary provision had been made.

The authors referred to the saving of transformer losses by installing one large and one small bank of transformers in individual sub-stations, with automatic time control switchgear on both sides of the transformers. Generally speaking, losses in transformers occurred during the time that the system itself was lightly loaded, and when transformation losses had no other effect than to reduce the power factor of the whole system. The approximate cost of such an arrangement in any sub-station at Capetown might be stated roughly as follows:—

H.T. switchgear, extra cost of electrical operation on one panel, say	£50
One additional S.F. ironclad switch with electrical operation	250
Extra cost of electrical operation on one low tension switch	50
Cost of one additional L.T. switch	150
Extra bank of transformers, say	200
	<hr/>
	£700
	<hr/>

Capital charges on this sum at 10 per cent. represented £70 a year, without any allowance for increased maintenance either on switchgear or transformers. Even if the high price of 1d. per unit was taken as the value of the losses, it would be necessary to save 17,000 units per annum to balance capital charges.

A short time ago this question was raised in connection with a small supply at 4d. per unit, and even at this price there did not appear to be any saving by the installation of the second bank of transformers, without the automatic switchgear.

The next part of the paper, up to the middle of page 14, dealt with details of construction. In Capetown, the methods of construction of sub-stations and sub-station apparatus had been more or less standardised, and differed very considerably from those referred to in the paper. There was no doubt that the standardising of armour-clad solid-filled H.T. switchgear and completely ironclad L.T. switchgear, as they did in Capetown, was more expensive than the more usual type of sub-station design; but, on the other hand, he considered the advantages gained by the ironclad construction worth the extra cost involved.

Regarding the necessity for using high tension switchgear capable of dealing with any possible short circuit which might occur, this would be accepted by all engineers who had had experience on systems of any size, and he thought there was little doubt that before very long the whole question of sub-station design would be controlled by making the necessary accommodation to instal switchgear capable of standing up to all possible fault conditions.

Mr. RODWELL, in reply to Mr. Sparks, said there were several reliable high tension fuses on the market. These fuses had only recently been developed on a commercial scale, after many years of costly experiment, and could be guaranteed by the makers to successfully rupture, if necessary, many thousands of KVA at 6,000 volts. In connection with this we refer Mr. Sparks to the *Electrical Times* of March 25th, 1926.

Mr. Sparks would appear to have an ideal proportioning of inductance and capacity on his five mile overhead line, and he suggested that a properly proportioned choke coil in circuit would upset his present line constants and give greater stability during atmospheric disturbances.

Mr. Rodwell said it was interesting to hear that Mr. Munro had found de-centralisation necessary on account of the growth of load. He entirely agreed with Mr. Munro that the cost of connection to consumers taking bulk supply from the high tension mains should be reduced to a minimum, thereby reducing the cost of distribution to the supply authority.

Referring to the remarks made by Mr. Fletcher, Mr. Rodwell said the type of switchgear to be installed in any sub-station depended, not only on the transformer K.V.A. installed, but largely on the K.V.A. of the supply system. It, therefore, followed that in many cases the 50 K.V.A. layout mentioned would require H.T. switchgear identical to that for the 500 K.V.A. layout. The H.T. switchgear must be chosen to deal with fault conditions and not with normal loading only.

Switches having series trips had their applications particularly on the lower voltages, but they could not be used on modern H.T. protective systems where the tripping was performed through relay apparatus. For plain overload protection with short time lag, they had given every satisfaction.

As regards switchgear at both ends of the line for sub-station working, the proposal put forward by Mr. Fletcher was the cheapest, but not the best. Switching operations on a H.T. network should be performed by means of switches and not by slow break isolating links. Assuming a fair length of line, considerable time might be wasted in getting from one end to the other, rectifying a fault and returning to the switching point. He agreed with Mr. Fletcher's contention only when continuity of supply was a secondary consideration.

Air break switches and fuses were not generally recommended, but might be perfectly satisfactory providing due consideration was given to the loads they might be called upon to deal with and that periodical inspection was made for sealing. On account of capital cost, they might be most desirable in the case of small municipalities where the cost of automatic oil switches might be prohibitive.

He considered Mr. Fletcher's remarks on voltage regulation were interesting, and should be of value to those who might be required to take power in bulk from a super system.

Replying to Mr. Poole, Mr. Rodwell said he agreed that underground sub-stations might function satisfactorily under the special conditions appertaining to the Berea, Durban, where the drainage and ventilation were satisfactory, due to the pits being on an incline. Generally speaking, however, he

considered their remarks on this type of transformer sub-station were justified.

Where these special advantages did not apply, it would probably be found that the cost of a pit and the two pillars fitted with switchgear would be greater than the cost of a kiosk. With this latter type of housing, the switchgear was not in a confined space, there was more efficient ventilation, accessibility and ease of control.

Mr. Rodwell said that Mr. Swingler, in his remarks, covered a large field of distribution which was outside the scope of this paper. To deal with the distribution problem in all its varying aspects would require considerably more than a paper of this description could possibly manage, and this had not been attempted.

Regarding the point raised that the total current in amperes dealt with would limit the output from any given distribution point, Mr. Rodwell said it was not possible to apply the conditions of one particular sub-station to all sub-stations, and that each problem had to be dealt with on its own merits. He appreciated Mr. Swingler's remarks on the prohibitive cost of supplying large individual buildings from heavy low tension distributors, and thought that in the near future all large buildings would, of necessity, be supplied at high voltage.

After many years of development work, both Mr. Fraser and he had unshaken confidence in the sheet metal kiosk as a means of further development. This more especially applied to outlying suburbs where progress would be retarded if it were necessary to wait for supply until the capital for the larger and more substantial sub-station described in the paper could be provided. In all cases, where possible, on the Johannesburg system, a plot of ground was purchased, on which the kiosk was erected, and when the limit of capacity was reached, a larger and more substantial sub-station was erected and the kiosk removed bodily to do duty elsewhere.

The costs given of sub-station equipment were interesting, and appeared to prove the urgent necessity of the kiosk system for small communities and areas which were just developing. These remarks also bore out their contention that the losses which it was proposed to save were more apparent than real.

NOTES ON THE MERITS OF SUCTION GAS ENGINES AS PRIME MOVERS IN MUNICIPAL POWER STATIONS.

(By Mr. H. M. S. MULLER, Municipal Electrical Engineer, Beaufort West.)

Of the actual operation and merits of municipal power stations in South Africa, having suction gas engines as prime movers, very little is heard, and the information received at haphazard serves only to instil into the minds of the recipients the idea that suction gas plants are somewhat of an evil necessity due to locality—that is, where the distance from the coast or railhead precluded the installation of oil or steam plant.

Few municipal engineers, and possibly engineers in general, are willing to dispute the high efficiency of well-designed suction gas plants, but they are generally prepared to question their reliability in comparison with oil or steam plants. This opinion is often based on actual experience with certain plants which may not have had a fair start in design and construction consistent with South African requirements, or even in the original scheme where false economy may have been the ruling factor. It is to be hoped, therefore, that present day improvements, greater attention to detail, and more rigorous inquiry into the merits of a proposed scheme, will do much to establish the reliability of suction gas plant as a close second to steam plant.

To this end, the writer is of opinion that the records of the Beaufort West Municipal Power Station (though not of general interest) will be of interest to some of those attending this Convention. It must be clearly understood that there is no intention to advertise the plant in any way, but rather to show that the scheme, so far as it has gone, appears to justify the choice of prime movers.

The plant consists of two high speed, four-cylinder, four-cycle vertical National gas engines, direct coupled to 460 volt D.C. generators of 100 K.W. capacity each. The engines are rated at 200 B.H.P. at sea-level—guaranteed to develop 155 B.H.P. at 3,000 feet altitude, and to carry a 20 per cent. overload for two hours. The gas producers, fitted with wet (coke) and dry

scrubbers, are designed to burn South African anthracite coal, and are fitted with hand-driven force fans. The A.F.A. storage battery of 250 cells has a capacity of 435 ampere hours. The nine-panelled switchboard, with its attendant fittings, is of black enamelled marble on steel framework. The usual booster set is an "isolated" unit when charging one side of the battery only. The engines start on compressed air (300 lbs. per sq. in.), the air compressor being driven from a 7-h.p. electric motor. The H.T. ignition system of the engines is dual, starting on battery.

The cooling of the water from the engine cylinder jackets (and partly from the exhausts) is effected by means of centrifugal pumps and two "Surrey Premier" water cooling towers.

The engine room is equipped with a 5-ton travelling crane, which can reach any part of the room.

Distilled water for the battery is obtained from a highly efficient distilling plant, having a capacity of 7 gallons per hour, designed for burning wood or bituminous coal.

The power station building has been built to accommodate a third generating set. The capital cost of the station is £14,000, and the period of the loan is 25 years at 6 per cent. interest. The attendant 3-wire distribution system is part of the original scheme, which received a bulk supply from the S.A.R., converting from 2,200 volts A.C. to 460 volts D.C.

The town was first served from the new power station on the 23rd October, 1925, after the test runs had been duly completed, fully conforming to all requirements and guarantees. Appended are some average figures compounded from some of the results of the test runs, which are practically the same for both sets.

Calorific value of fuel, 12,107 B.Th.U's.

Running from 10.15 a.m. to 9.15 p.m., made up in continuity as follows:—(A) 4 hours full on load; (B) 2 hours on 20 per cent. overload; (C) 2 hours on quarter load; and the remaining (D) 3 hours on half load. Quarter hourly readings taken.

“ELEVEN HOURS RUN.”

Hrs.	Units Generated.	B.H.P. Hours.	Fuel Used (lbs.)	Avg. Temperatures °F.			Fuel per B.H.P. (lbs.)	Fuel per Unit. (lbs.)
				Engine Room.	Jacket Water Inlet.	Jacket Water Outlet.		
A. 4	407.0	604.8	607.5	78.0	69.0	124.0	1.005	1.49
B. 2	241.0	357.4	348.0	85.3	71.3	133.0	.975	1.442
C. 2	51.0	84.25	191.5	79.7	64.3	122.0	2.275	3.76
D. 3	151.0	234.75	357.0	79.0	66.1	131.5	1.52	2.37
Total 11	850.0	1,281.2	1,504.0	80.5	67.5	122.6	1.17	1.77

Water jacket temperatures were taken after flowing through the exhaust pipe jacket. The vaporiser and scrubber water was not "metered," but could not have been more than three gallons per unit generated.

The following brief facts pertaining to the choice of prime movers were given me by the Consulting Engineer, Mr. G. V. Adendorff, of Capetown.

- (a) Steam.
- (b) Suction gas.
- (c) Oil.

(c) Oil was ruled out for the usual reasons—foreign market price of oil and, chiefly, the distance from the coast. On paper, the actual capital costs and operating charges were about the same per unit sold, based on a fuel consumption of 3 lbs. per unit for gas and 10 lbs. per unit for steam. This was at the time the scheme was drawn up, nearly three years ago, but, as the Beaufort West water in its ordinary state is a menace to steam plant, tenders were actually called for (a) and (b) to see how capital costs would work out.

Though it is generally assumed that suction gas plant costs more than steam plant—rightly, too—since horizontal gas engines are more expensive, nevertheless the introduction of vertical high speed engines made all the difference. As a matter of fact, when the choice fell on gas engines, a saving of approximately £900 was effected on the building and high speed generators in comparison with steam plant. Of course, the same generators would have been used with steam plant but not with horizontal gas engines. Twenty per cent. "overload" for two hours was called for in the specifications, and to allow for this, the makers supplied engines and producers with larger capacity than the 100 k.w. called for, the capacity being based on an altitude of 3,000 feet above sea level, and engine room temperature of 70°F.

The somewhat large storage battery was installed principally to meet the demands of the S.A.R., which at present is a constant 12 k.w. from 12 midnight until daylight. Incidentally, it may be stated that the battery costs £2,200, and the amount of depreciation allowed over a period of six years is £1,500—the actual cost of replating the whole battery.

POWER STATION—OPERATING FIGURES AND CHARGES.

Calorific value of fuel, 13,000 B.Th.U's.

Average daily machine load factor (for 151 days), 90.1 per cent.

Average monthly load factor (for 5 months), 25.1 per cent.

Average thermal efficiency, 13.7 per cent.

75

Days.	Engine Hours.	Units Generated.	Units Sold.	Fuel (tons).	Water (gals.).	Oil (gals.).	Per Unit Generated.		
							Fuel (lbs.).	Water (gals.).	Oil (gals.).
151	1,213	66,460	52,130	64	335,000	24	1.92	5.04	.0003.
1	8	440	344	.42	2,200	.158	Average daily figures.		

GENERATION CHARGES ON FIVE MONTHS (151 DAYS) BASIS.

Capital Charges (£14,000).	Per cent. of Capital Cost.	Amount in pounds.	Cost per unit (in pence).	
			Generated.	Sold.
Interest	6.00	£350 0 0	1.26	1.61
Redemption	1.82	£106 1 0	.38	.48
Depreciation	4.36	£254 9 0	.92	1.17
Operating Charges—				
Fuel (£2.04 per ton)... ..	2.23	£130 0 0	.46	.59
Maintenance and Repairs ... ..	.17	£10 0 0	.03	.04
Oil, Waste and Stores ... ..	.21	£12 0 0	.04	.05
Water ... ..	.35	£20 9 0	.07	.09
Clerical Assistance, Taxes, Insurance, etc. ...	1.07	£62 5 0	.22	.28
Salaries and Wages	5.48	£320 0 0	1.15	1.47
			4.53	5.78

NOTES.—The coal consumption and costs are based upon delivery of coal in the bunkers, and money paid to the collieries respectively, *i.e.*, no weights are checked. The power station is in proximity to the S.A.R. A small amount of anthracite coal and "dirty" oil is used as fuel for the distiller plant. These are included in the above, as well as cinders and fine gradings of coal, which are sold to the brick fields as a credit to coal account. This amounted to six tons during the five months.

A great deal of "cooling water" is lost due to evaporation and off the cooling towers during windy days. The actual scrubber and vaporiser water is 3.5 gallons per unit generated. This amount can be cut down to 2.5 gallons per unit generated, and has no visible effect on the running of the plant. It is a question of which is the most expensive item, water, or more frequent renewal of coke in the scrubbers.

Finally, it must be borne in mind that the foregoing records are only for the commencement of a new scheme—moreover, "summer" records. The accompanying figures showing units generated and sold during the five months are sufficient promise for the future:—

Month.	Units generated.	Units sold.
November, 1925 ...	12,240	8,560
December, 1925 ...	12,260	9,220
January, 1926 ...	12,400	9,370
February, 1926 ...	12,560	10,000
March, 1926	17,000	14,980

The only trouble experienced with this plant developed during the first month, and took the form of difficulty in starting up the engines. Once full speed was attained, however, there was not the least trouble throughout the shift of approximately eight hours, usually under three-quarter load conditions. This trouble was readily traceable to the comparatively feeble effect of the "hand" driven fans when operating on an old fire. A small power blower, direct coupled to an 0.5 h.p. electric motor solved the difficulty at once. Moreover, at starting up of the shift, an engine can be running on half load within ten minutes from the commencement of fanning up an old fire, which has been cleaned only during the course of the morning and left on sufficient draught. This time is extended to fifteen minutes when dealing with a full

now fire, that is, from the time the fire is lit. Ordinarily, twenty minutes is the full time allowed in the shift hours to have the engines on load under all conditions from the commencement of fanning.

Bearing in mind that the foregoing includes the time of actual gas production as well as the many attendant necessities incident to starting up, and involves no more labour than that of the shiftman and a native, the comparison with an oil engine is quite favourable. The actual labour involved, prior to starting up, consists of poking down and cleaning the fire of clinker. This affords one native ample time in which to screen old coal and clean up in general during the course of the day's work. During the actual running, there is very little to do bar cleaning up.

The ignition and lubricating systems of the engines have given no trouble whatsoever, and with due attention to the former, not even temporary misfiring of a cylinder has occurred during shift.

The writer wishes to conclude his remarks on the operation of this plant with the hope that his attitude will not be misconstrued. Possibly there are several makes of gas engines on the market to-day that are every whit as good, but as the question of reliability chiefly depends on the gas producers, the writer trusts that he will be forgiven his presumption for entering upon a short treatise on the design and construction of suction gas producers. Realising that most of his readers are better versed in its general principles, and for more competent to deal with the matter, the writer will submit his opinions only as based upon actual experience of the relative merits and requirements of suction gas producers and the frequent causes of dissatisfaction. Frequently, the direct causes of dissatisfaction are undersized and poorly designed gas producers, occasioning a keen desire on the part of the much-abused engineer in charge to get to an oil or steam station where he can at least expect reliability.

Some of my readers will appreciate the fact that small municipalities are often more concerned about half-a-minute's cessation of light (say, during pre-ignition of a gas engine) than a month's general inefficiency and high maintenance charges. Moreover, such not infrequent occurrences do not enhance the prestige of the power station staff in the eyes of the public. Small wonder that the much-harassed engineer in charge, who has probably to depend upon a staff composed of somewhat unskilled local talent, is thankful

enough to be able to carry on with, say, small steam plant, regardless of efficiency, provided he can scrape through another year and remain within estimates that leave no room for improvements. Meantime, he speculates upon the chances of finding himself in a more fortunate position by the time the plant should be worked to a standstill, and optimistically hangs just another little piece of scrap iron to the safety valve in order to meet the immediate demands.

From the writer's previous remarks, it can be inferred that, in his opinion, the design and construction of gas producers are largely responsible for the future success or failure of a power station having suction gas prime movers. A consumption of .9 lbs. of coal per B.H.P. is quite a common claim for most makes of suction gas plant, but in actual operation (after the test runs) this figure is only too often trebled.

The open hearth producer has three great advantages over the enclosed hearth type, viz., the ease with which the fire can be cleaned, its accessibility, and the long periods of operation on the same fire, often extending into months. Nevertheless, the advantages are entirely eclipsed by the inconsistency of the gas supply while poking or raking the fire, and very often while adding fresh fuel, should the fire have become fully incandescent to the top.

Enclosed hearth, or a combination of the open and enclosed hearth producers (the latter is virtually enclosed) have not this disadvantage, because, although in all suction gas producers the amount of draught is regulated by virtue of the suction from the engine, the free admission of air is nevertheless somewhat restricted in these types, which have definite entry ports for air and water vapour or steam: hence, some regulation can be effected.

In all suction gas producers, rapid raking of clinkered fires or removal of clinker while the plant is in operation, is attended by serious pre-ignition on the part of the engine. This, however, will not readily occur with an enclosed hearth producer if the removal of clinker is done through ash pit doors at short intervals, due care being taken that the fire is kept compact by poking from the top. That is, a clinkered fire must not be allowed to form voids due to falling down of big lumps of clinker. If this happens, pre-ignition of the engine cannot be avoided for the next minute or so, even at "turning over speed." Hence, a minute's cessation of lights, should the station not be

equipped with a storage battery. Another great advantage of the enclosed hearth producer is that clinkers on the fire grate can readily be broken up, if not removed, without undue disturbance of the fire and without visible effect on the supply of gas.

Contrary to popular opinion, a full fire that is fully incandescent to the top does not necessarily affect the quality of the gas, that is, on the poor side, and with a well-designed enclosed hearth producer, powerful running, or a tendency to pre-ignite on the part of the engine, is only too often the first indication a negligent shiftman has of a fully incandescent fire. In this respect alone, gas producers are greatly abused; and as a rule shiftmen rarely pay sufficient attention to the fires, so that occasionally a few minutes of pre-ignition on the part of the engine during a shift is accepted as unavoidable, whereas pre-ignition can be eliminated if the fire is poked down and fuel is added at least every two hours.

The most important factors governing the successful design of a generator, viz., the shape of the fire brick lining, the type of grate, the position of the vaporiser and the size and accessibility of the fire doors and poke holes (relative to the interior of the generator) can be outlined as follows:—The greatest care should be exercised in the design and building in of the fire bricks, as the clinker that is formed, due to the fusion of the ashes, does not confine itself to the fire, but also adheres to the lining bricks. Upon this, and the size and position of fire doors and poke holes, depends the facility with which clinker can be broken up or removed from the whole interior occupied by the fire while the plant is in operation.

The interior of the producer should be easily accessible, so that any defects in the lining bricks can always be remedied. To minimise heat radiation and to obtain approximately airtight conditions, silicate of cotton is generally forced between the lining bricks and producer casing, but the obstinacy with which clinker adheres to the lower lining bricks and the resultant force used to poke these off, soon result in leaky conditions due to the fire clay between bricks giving in, with a consequent inward movement of the bricks. The loosening of the bricks results in the admission of air not drawn through the fire. This causes intense heat to develop at the points where air enters, with consequent formation of clinker and possible destruction of the fire bricks. Several such leaks, though

large, may not visibly affect the running of the plant, but will surely cause trouble in starting up on an old fire and will certainly result in a greater consumption of coal, because the engine will demand in quantity what the gas lacks in quality.

The writer attaches no importance to the shape or type of grate as affecting the production of gas, and maintains that each type will give exactly the same quality of gas—commencing with a clean fire—because it affects the quality of the gas no more than separate entries for air and steam or water vapour, provided the latter is in proportion to the load on the engine. Even a dual air and vapour entry still needs adjustment of air to meet exact requirements (depending upon the load on the engine and the condition of the fire) if the best results are desired. Reverting to grates, it is certain that whatever advantage that may be temporarily gained with the flat grate, by more even distribution of the vapour-laden air over the whole of the fire space, is soon lessened by the inevitable formation of clinker when using S.A. anthracite, and is entirely lost by the difficulty of removing clinker from the centre of the fire. This difficulty is lessened with the conical grate, and is hardly in evidence with the step grate.

The all-important factor pertaining to the constant production of good quality gas, is the position of the vapouriser relative to the generator. The vapouriser supplies the essential steam or water vapour to the fire, thereby controlling the spreading of the fire and the formation of clinker, incidentally protecting the grate and fire bars from the intense heat of the fire. The passage of the steam through the fire also causes secondary chemical reactions to take place, thereby enriching the gas.

It is most important that the entire supply of steam or water vapour supplied to the fire should be determined by the heat of the gas supply as required by the engine. In view of this, it is important that the vapouriser be built external to the generator and not be housed within it. If built "external" to the generator, the heat supplied to it in order to form steam or vapour is derived from the gas supply to the engine. Whereas, if it is built "internal" to the generator, it obtains its heat partly or wholly from the fire. If the fire is in a highly incandescent state, due to heavy load on the engine, an internal vapouriser will be responsible for a superfluous supply of steam or vapour

should the load on the engine suddenly be taken off. This will have the effect of damping the fire to an extent that may make it difficult to revert to full load conditions immediately, even with due regard to the decreased suction from the engine when the load is taken off.

The external vapouriser gives greater flexibility, though still within limits. Obviously, "lagging" of an external vapouriser to compensate for atmospheric changes will not be one of the future improvements.

From past experience, the writer has no hesitation in condemning gas generators having internal vapourisers for the reasons stated above.

A good type of hopper, large and well-designed fire doors, well braced against probability of warping, and poke holes so arranged that the whole interior occupied by the fire can be reached with the pokers, good types of wet (coke) and dry scrubbers, readily accessible and easily cleaned—these are the last essentials for the successful production of a constant supply of clean and uniform quality of gas while the plant is in operation.

If it appears from the foregoing that, given a good, well-designed suction gas plant, there is still a probability of inconstancy of gas supply and pre-ignition of the engine on occasion, then the writer would point out that, in his experience, pre-ignition very rarely occurs through causes which are believed to be common, viz., overheated engine, accumulation of carbon, small points of carbon which become incandescent (especially in the holes of pistons or valves where they have been tapped for ring bolts), dirty valves, or, lastly, uneven cutting of the fire joint gasket, which may leave protuberances that become incandescent. The trouble is practically always due to the state of the fire in the producer. Therefore, in large power schemes embarking upon suction gas plant, with three or four like sets, having an extra producer and all producers inter-connected, it would be an easy matter to cut out a producer that has become clinkered and parallel a clean one. Half-an-hour is sufficient to trim a clinkered producer and have it ready for another long run.

The following figures appear in a summary of the returns of fuel consumption for 508 power stations in Great Britain, as published in 1924 by the Electrical Commissioners:—

No. of Stations.	Average Fuel Consumption (lbs.) per K.W. Hour.	Average Thermal Efficiency.	Calorific Value per lb.
Steam ... 236	5.74	10.4 %	10,500 B.Th.U's
Gas ... 60	2.64	10.75%	12,000 B.Th.U's
Oil ... 52	2.08	9.1 %	18,000 B.Th.U's

It must be borne in mind that the size of steam plant directly affects its economy and overall efficiency, which is direct contrast to suction gas plant, where efficiency and economy are independent of size. Though the above results do not include sixty of the largest steam stations, it must be noted that the calorific value per lb. for gas station fuel is exceptionally low, due no doubt to the use of a large percentage of gas coke. If only anthracite was used, the coal consumption would no doubt be within 2 lbs. per k.w. hour, considering the high calorific value of Welsh anthracite. It must also be borne in mind that the English prices for fuel oil per ton are approximately 150 per cent. higher than the prices for anthracite per ton.

The following is from the records of the Leek Power Station:—

900 K.W. GAS STATION.

Year.	Total Units Generated.	Fuel Consumption per Unit generation.	Thermal Efficiency
1924 ...	1,622,034	1.88 lbs.	13.64%
1925 ...	1,894,736	1.81 lbs.	14.45%

In conclusion, the writer wishes to remind his readers that he set out only to record the facts pertaining to a small "Gas Station" being the first of its kind in South Africa, and that he is not prepared to contest the supremacy of large steam stations.

However, the foregoing figures of the Leek Power Station should augur well for the future of gas stations.

DISCUSSION.

The PRESIDENT thanked Mr. Muller for his very interesting paper, which should be of particular use to their members who were running gas engine stations.

Mr. DAVISON (Mafeking) said he had just taken over a new suction gas station, and would like to ask Mr. Muller whether he had ever noticed the gas affecting the commutator bars. He attributed a lot of the undue wear to the sulphur in the anthracite. Another question was whether it was

possible to use the water again after it had passed through the wet scrubbers and, if so, what treatment it should receive.

Mr. SPARKS (Pietersburg) said he would like to thank Mr. Muller for his paper, which contained some very valuable hints. One of his first difficulties had been the smell caused by the gas plant, but after running the engine for a month on end without stopping, he had received no further complaints, which showed that people became familiar with these various odours. There was another point he would like to refer to. Mr. Muller's station had a nice battery to rely on, to take any kicks and to help him out of any difficulty. That had been the saving grace of suction gas driven stations in the past, but he thought that this had hindered their development from the reliability point of view. Another trouble was that they had not sufficient time to educate shift engineers in the running of this type of plant, as they had to gain all their experience whilst supplying the load. In putting up high speed suction gas engines, a very important point to be considered was the cleaning of the gas. One could understand that high speed gas engines had very much smaller ports and that the governors were very much lighter. That was their trouble at Pietersburg, it being necessary to clean the governor valve frequently. He thought this difficulty could be overcome if all suction gas generators supplying high speed engines had a tar extractor, as the ports were so small. They had no difficulty with the parallel running of these gas plants, which were simply paralleled on to the steam plant. Shorts were sometimes experienced, but, these being intermittent, the steam engine and gas engine ran quite well. One advantage of having the steam engine was that they could open full steam into their cylinders and the governor took all the kicks while the gas engine ran steadily along. He did not think the makers of their present engines had had sufficient experience in connection with the suction gas engines, apart from the storage batteries.

Mr. MAIL (Kokstad) said that in the paper mention was made of a fuel consumption of 10 lbs. per unit of steam. He thought that must be for non-condensing plants, as his super-heated condenser plant showed the matter in a much more favourable position. He had been weighing his coal, and the average was 5.5, and on some nights, 4.6. He thought

that compared favourably as regards bituminous coal as against anthracite. Prior to steam, he had had two suction gas engines running for eight years. He knew what the producer life was, but he did not know if the depreciation figures given were heavy enough to cover the producer plant, owing to the amount of replacements in connection with wear and tear. If one were running a plant very heavily, there would be a certain amount of corrosion, and when the bolts and other parts were rusted up and they came to strip the plant and chip them out, it became a very big job. The only satisfactory thing he found when running a suction gas plant was to have a producer plant in duplicate, so that one could substitute the one for the other when necessary, without loss of time. For power station work, especially with a battery, this had a lot of flexibility and was useful for taking up any loads coming on quickly. At present his station was running only six hours a day, the rest of the time being on the battery. He could not work banked fires on the particular boilers he had owing to the water capacity being too small. The biggest amount of coal was for starting up the new fires, but even then he could get the consumption figures he had mentioned. If the plant ran for 24 hours, he would be able to get still better figures than these. He also thought the price of bituminous coal as against the price of anthracite would show up very favourably for steam.

Mr. MULLER (Beaufort West) in reply, said he would first like to answer the gentleman who considered the maintenance of gas producers rather excessive. He entirely agreed with him that this was generally so where (as he had seen in many instances) the producers were undersized. On account of engine requirements (in cubic feet of gas) it often happened that, in time, these producers were burnt out, besides giving rise to various troubles. As to the maintenance of a producer of correct design and size, he really did not agree with the previous speaker's remarks. Apart from the firebricks, he did not see why a producer should burn out or corrode excessively, and he recommended the virtues of graphite grease and black lead. Without due care, the wear on any steam boiler would be as great, and he considered the maintenance of steam plant could not compare with it.

Replying to Mr. Sparks, Mr. Muller said that it appeared that this member saw the chief difficulty with

labour. If one had a man who knew his work, one need not fear trouble or pre-ignition; and one could certainly carry on just as well without as with a battery. As he had already pointed out, producers were greatly abused by having no attention. A shiftman came on shift while the engine was running, left the care of the producer to the boys and was only attentive when things went wrong. If a producer only received a little of the attention which must be given to a steam boiler, nothing would go wrong. He admitted that in a small steam station they could readily put men in charge whom they could not put in charge of a gas station. At the same time, an equivalent amount of damage would be done by an inexperienced person in charge of steam plant.

With regard to Mr. Davison's question, he had certainly experienced the evil and visible effects of gas on commutator bars and switchboard fittings, and in one very badly-designed gas station there had been danger to the men working there. In this instance, the producer plant was housed under the same roof as the engines, with only a division wall of sorts, which had several openings, the producer room also being totally enclosed instead of having at least one side open. The effect of gas on metal was not necessarily due solely to the presence of sulphur in the anthracite, but it might be stated that in the experience of most engineers, tar was preferable to the presence of excessive sulphur. When using certain South African anthracite, the so-called "tar deposit" was of a greasy consistency and did not interfere with the free action of valves, etc. Naturally, periodical cleaning of valves (to rid them of this deposit) is necessary, but it is very easily removed by merely wiping off. In a power station of correct design, there could be no danger of gas affecting metal, or persons working in the station. The producer room should be partly open and isolated from the engine room by a good division wall, and the engine exhaust outlets and producer flues should be carried out above the roof of the building, when all danger would be minimised. Water from wet scrubbers was generally run to waste. Nevertheless, with suitable apparatus, it could be circulated the same as engine cooling water, but with average suction gas plants this was not worth while unless water cost more than 5s. per 1,000 gallons.

The Convention then adjourned, in order that the official photograph might be taken.

VISITS.

In the afternoon, two visits were made, one around the Johannesburg Electricity Distribution System, and the other to the works of the Boksburg Brick and Fireclay Co., Ltd. Members and delegates selected which of these two visits they took part in.

Joint Meeting with S.A. Institute of Electrical Engineers.

At the invitation of the S.A.I.E.E., a joint meeting was held at 8 p.m. at the Scientific and Technical Club, when a paper on "Electric Light and Power Schemes for Moderate Sized Towns in South Africa" was read by Mr. R. F. Botting (Member, S.A.I.E.E.), and discussion ensued.

THURSDAY, APRIL 15th, 1926.

Members and delegates left Johannesburg by motor-car for Pretoria at 9 a.m. Visits were paid to the various electricity works and new Power Station of the Pretoria Municipality, and also to the Royal Mint. Lunch was provided at the Pretoria Club by His Worship the Mayor and Town Council of Pretoria, who also supplied afternoon tea at the Union Mansions.

Civic Reception.—At 8 p.m., a civic reception and dance were given in honour of the members and delegates by His Worship the Mayor and Town Council of Johannesburg.

FRIDAY, APRIL 16th, 1926.

The Convention resumed its proceedings at 9.30 a.m. The President (Mr. B. Sankey) was in the Chair, and there were also present:—

Members.—J. Mordy Lambe (Vice-President, East London), T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), G. C. Brown (Middelburg, Transvaal), R. D. Coulthard (Oudtshoorn), J. G. Davison (Mafeking), T. C. Wolley Dod (Pretoria), R. W. Fletcher (Krugersdorp), L. L. Horrell (Pretoria), R. D. Larter (Standerton), R. Macaulay (Bloemfontein), W. M. Mail (Kokstad), F. C. D. Mann (Worcester), B. Marchand (Paarl), R. J. Morris (Roodepoort), A. S. Munro (Pietermaritzburg), E. Poole (Durban), H. A. Prevost (Somerset East), L. Ralston (Dundee), T. F. Siebert (Uitenhage), L. B. Sparks (Pietersburg), R. A. Stoker (Kroonstad), T. Sutcliffe (Benoni), G. H. Swingler (Capetown), C. K. Turner (Kimberley).

Delegates.—Councillors A. L. Clark (Durban), J. B. Dersley (Bloemfontein), T. Eriksen (Kimberley), S. J. Halford (Kokstad), J. D. Low (Cape-town), W. Millar (Pretoria), J. Paton (Kroonstad), G. W. Prior (East London), E. H. Von Witt (Cape-town), F. E. Wilkinson (Mafeking).

Visitors.—P. G. Fisher, R. Howden, H. M. Missing, W. B. Phelps, W. G. Ward (Johannesburg), and O. Rau (Lindley, O.F.S.).

Hon. Secretary and Treasurer, R. G. Tresise.

NEW MEMBER.

The President announced that the Council had elected Mr. J. G. Davison (Mafeking) as a member of the Association.

Votes of Thanks.

On the motion of Mr. SWINGLER (Capetown), seconded by Mr. POOLE (Durban), it was unanimously resolved that the Honorary Secretary and Treasurer write to the undermentioned and thank them for their courtesy to the Association:—

His Worship the Mayor and Councillors of Johannesburg, for their welcome and hospitality.

His Worship the Mayor and Councillors of Pretoria, for their hospitality on the occasion of our visit to Pretoria.

The President and Members of the Associated Scientific and Technical Societies, for conferring upon our members and delegates honorary membership of their Club, and for placing their Hall and Committee Rooms at the disposal of the Association during the Convention.

To the Pretoria Club, for conferring Honorary Membership upon members and delegates during their stay in the Transvaal.

To the United Party Club for their invitation to members and delegates to attend the dance on Wednesday night.

To the Directors of the Union Steel Corporation (S.A.) Ltd., the Directors of the Vereeniging Brick and Tile Co., Ltd., and to the Chairman and Chief Engineer of the Rand Water Board, for their kind invitation to visit their respective works at Vereeniging, and for their hospitality whilst there.

To the Directors of the Boksburg Brick and Fire-clay Works, for their kind invitation to visit their works at Boksburg, and for the hospitality extended when there.

To the General Manager, Chief Engineer and Staff of the Victoria Falls and Transvaal Power Company, Ltd., for their kind invitation to visit the Power Station at Rosherville, and for their hospitality whilst there.

To the General Manager and Staff of the Electricity Department, Pretoria, for showing the members over the Power Station and system in Pretoria.

To the Master of the Royal Mint, Pretoria, for his kindness in showing us over the Mint.

To the following, for their kindness in placing their motor cars at our disposal:—

Messrs. Saaler & Franks.

Messrs. Rice & Diethelm.

Messrs. Metropolitan-Vickers Electrical Co.

Messrs. British General Electric Co.

Messrs. Wilson & Herd.

Messrs. Reunert & Lenz.

Messrs. Hubert Davies & Co.

Messrs. The Telegraph Manufacturing Co. (Colonial) Ltd.

Messrs. S.A. General Electric Co.

Mr. N. O. Curry.

Messrs. English Electric Co.

Messrs. Siemens (S.A.) Ltd.

To the Institute of Electrical Engineers, for the joint meeting arranged by them and the paper submitted.

To Mr. H. Reynolds, President, Automobile Club, for entertaining us to luncheon.

To the Witwatersrand Commercial Exchange, for their invitation to members to visit the Exchange.

To Mr. W. Tredre, for assisting with the lantern and slides.

To the Market Master, Johannesburg, for offering to show members over the Municipal Market.

MEMORANDUM ON LICENSING OF ELECTRICIANS, WIRING RULES & REGULATIONS AND MUNICIPAL BY-LAWS.

[By B. SANKEY, M.S.A.I.E.E., M.I., Mech.E.,
Municipal Electrical Engineer, Johannesburg.]

At the last Convention, held in Durban in December, 1924, it was suggested that the members for Pretoria and Johannesburg should be asked to draw up what would appear to be the most satisfactory form of bye-laws (which could be promulgated through-

out the Union) for submission to the next Convention, and that the Convention should then take steps to bring about an Act of Union for the enforcement of such bye-laws.

During the past 12 months, the Johannesburg Electricians' Licensing Board has been giving considerable time and attention to this matter, and has compiled a draft Bill (a copy of which is included with this paper) for the consideration and discussion of members and delegates.

A subject of equal importance, and closely allied to the working of any Act for the Licensing of Electricians or the Registration of Electrical Contractors, is that of Standard Wiring Regulations and Municipal Bye-Laws, which, if enforced under an Act of Union, must, obviously, be uniform throughout the country.

The object of the licensing of electricians is to ensure that all wiremen shall be men who are properly qualified in their trade, and to ensure that these men shall carry out their work in a capable manner and in accordance with the Municipal and other rules and regulations.

Whilst the effect of this, on the one hand, is to protect the public, and, incidentally, the Insurance Companies, there is no doubt that the cost of installations is materially increased thereby. In addition to the increased cost to the public, there is the increased cost to the Municipality, all of which goes into the overhead charges, and has to be recovered in the cost per unit to the public.

Consideration of these matters brings up the thought whether we are not in these modern times suffering from a surfeit of legislation.

In South Africa, we have the House of Assembly, four Provincial Councils and innumerable Municipalities engaged in the production of Acts, Statutes, Bye-Laws, Rules and Regulations of all kinds for the guidance of the citizens of this country in the way they should go. If quantity is any criterion of efficiency, then the public are no doubt satisfied that they are getting value for the money expended on legislative production. What legislative bodies, however, seldom give consideration to, is the effective carrying out of the laws and bye-laws they create with such facility. Engineers know quite well that very little is done to enforce the Mines and Machinery Regulations, and that they remain, more or less, a dead letter until accidents occur. That accidents due to breaches of these regulations are so few merely

shows that half the rules and regulations are unnecessary, and could be abolished without serious disadvantage.

If all the rules and regulations now in force in the Union were efficiently carried out, we should need to create such an army of police, officials and inspectors that we should nearly all be engaged in inspecting each other.

This brings us to the consideration of the question as to whether the licensing and other regulations and bye-laws which form the subject of this paper are really worth the expense incurred by the suppliers in administering them, or whether, on the contrary, the majority could not, with advantage and economy, be abolished.

Is the general use of electricity, however cheap per unit, to be encouraged by hedging in the use of it by innumerable and vexatious rules and regulations, and what object has the supplier in view other than the adoption of what is fast becoming an almost slavish custom?

Is there any sound reason why any private citizen should not engage any workman he pleases to wire his house, or why he should not look to his fire insurance company to see that his wiring is properly and safely carried out, in order that his fire insurance may be accepted?

Is it the business of the Municipality, or other supplier, to maintain expensive staffs to prevent fire or accident risks, and does such inspection really prevent fires or accidents? What rules, or what inspections, will stop some people from putting electric irons on wooden tables and leaving the switch on, or from inspecting the petrol tank with a lighted match, or looking for a gas leak with a candle, or walking across a street reading a newspaper?

The Johannesburg Municipality to-day employs three Wiring Inspectors, who, together with locomotion, Licensing Board expenses, etc., cost the Department £2,000 per annum. It is admitted that three men cannot do much more than test and inspect new installations or additions on completion. Efficient inspection and supervision of old installations, and of new installations and additions during the progress of the work, would require double the staff, and would cost £4,000 per annum, at least. What return would the Municipality get for this £4,000 per annum, and would not the public be equally well and more

cheaply served if inspection of wiring beyond the supplier's terminals were abolished?

In America, according to the writer's information, this inspection work is carried out by the Insurance Companies, and the consumer, when wiring his premises, stipulates that the work shall be done to the Insurance Company's requirements, and only when the work has been passed by the Insurance Company's Inspector is the fire insurance policy accepted. These Inspectors also presumably inspect flues, gas pipes, fires and any other points about the premises affecting fire insurance risks, for which a fee is charged.

It appears to the writer that such inspection carried out by the Inspectors of a Company who are carrying a fire risk on buildings, furniture, machinery and other effects of considerable value, is likely to be a more efficient arrangement than anything that a supply authority can do. After all, the risk involved to the supplier is small, viz., the loss of the sale of electricity to the premises until the damage is made good. The present bye-laws even cover the supplier against loss or damage to the meters, fuses and other property on the consumer's premises.

There is also the consideration of the protection of the consumer against electric shock. This appears to be amply covered by the fire insurance rules. If the installation is properly carried out to insurance requirements, then the risk of leakage, which is the usual cause of fire or shock, is reduced to a minimum.

Consideration of these points brings one to the question of the alternative suggestion raised above, viz., that the Municipality or other supplier should not be concerned in the operation of any regulations or bye-laws beyond the limits of its own property, viz., the supplier's meters and cut-outs; the consumer's property commencing at the consumer's main switch.

The supplier's test would, in this case, merely consist of an insulation test to earth to see that the insulation was sufficiently sound to prevent leakage of the supplier's electricity supply and consequent interference with telephone circuits, electrolysis of cables or pipes, etc. No detailed inspection of the wiring would be necessary, except to see that the whole of the installation was included in the insulation test, thus effecting a considerable saving in overhead charges.

In connection with the proposed Bill for the Licensing of Electricians, it might be pointed out that the Wages Act No. 27 of 1925 to a large extent covers the ground, as it prescribes minimum wages in certain trades. In view of this Act, private firms will not employ and pay standard rates to incompetent or unqualified men.

What is not covered is the quality of the material and fittings used. This matter, however, is surely within the scope of the Architect and the Insurance Company rather than of the supplier, as, unless the fittings and materials used are of a quality suitable for the supply pressure, the risk of fire is considerably increased.

There is another consideration affecting this question, which at present applies to Johannesburg only. This is the competition of an outside supplier, unhampered by any such rules or regulations. Two instances can be cited to illustrate this contention.

Case No. 1.

This Department recently inspected an industrial undertaking with a view to changing the supply over to the Council's mains, and found the consumer's wiring to be in a condition contrary to the rules and regulations, and constituting a serious fire risk. It was suggested that, before being connected up to the Council's mains, the installation should be put in proper order. The consumer strongly objected to spending £200 or £300 in this manner, stating that his supply had been perfectly satisfactory, and no objection had been raised, either by the suppliers or the Fire Insurance Company, and rather than spend this sum he preferred to continue with his existing supply.

Case No. 2.

Some two years ago a township was proclaimed on what was formerly mining ground, and the Council was called upon to give supply to a number of wood and iron houses. The supply as existing was given by wires slung from house to house in the most primitive fashion, and the house wiring was in flagrant defiance of fire insurance risks. In the street, between two rows of houses, was a street lamp on an iron pole with a switch minus a cover, with live terminals exposed about four feet above ground, within easy reach of young children. That the children escaped injury or death by electric shock in wet weather can only be ascribed to a merciful providence.

The Council's officers were considered to be very harsh and unreasonable when they insisted that the township owners provide overhead distribution lines to comply with the Mines and Machinery Regulations, and that the house owners rewire the houses in accordance with the Municipal and Fire Insurance regulations. Again the contention was raised that the conditions had been in existence for some twenty years without protest either from the supplier, the Inspector of Machinery or the Fire Insurance Company.

It would be interesting to know in both the above cases, in the event of a fire occurring due to faulty wiring, what would be the respective liability of the Insurance Company and the insured party under the fire insurance policy.

In view of the points raised above, the question to be considered is whether the supplier is justified in spending large sums of money in enforcing rules and regulations on wiring and apparatus which is the consumer's private property, provided always that the consumer's installation is not in such condition as to cause leakage of the supplier's electricity, or that electricity is not used in such a manner as to cause interference with the supply to other consumers.

Beyond this, it appears to the writer that the supplier's jurisdiction over the consumer's private property is by no means too sound in law, and that many of the bye-laws, rules and regulations dealing with consumer's private property would, if seriously contested, be judged to be ultra vires, and an interference with the liberty of the subject.

Summary of Conclusions.

The questions put forward in this paper for consideration are:—

(1) Is it necessary to have Municipal bye-laws, rules and regulations covering the whole of the consumer's installation?

(2) If the answer to No. (1) is in the affirmative, should the Municipal Electricity Undertaking or other supplier be required to undertake the expense and responsibility of enforcing these bye-laws, rules and regulations?

(3) If the answer to No. (1) is in the negative, should not the standard set of bye-laws, rules and regulations, as drafted by this Association, be revised to cover the Municipal Electricity Undertaking's or other supplier's property only, together with such bye-laws as may be necessary to ensure the proper

use of the electricity supplied to prevent leakage or interference with the supply to other consumers?

(4) Does not the efficient and safe carrying out of an electrical installation more properly belong to private enterprise in the persons of the Consulting Engineer, Architect, Builder, Fire Insurance Company and Electrical Contractor, and why should a Municipal Electricity Undertaking or supplier usurp their functions and spend large sums of money in doing so?

(5) Is there any necessity for, or obligation upon, a Municipal Electricity Undertaking or other supplier to seek to enforce the Government Mines and Machinery Regulations, except in regard to its own apparatus on a consumers premises?

DRAFT.

BILL

to

Provide for the Licensing of Electrical Wiremen and the Registration of Electrical Wiring Contractors and Contracting Wiremen.

Definitions.

1. "Local Authority" shall mean and include a City Council, Town Council or Borough Council.

"Electric Undertaking" shall mean the electric undertaking belonging to any Local Authority, Company, Body or Person supplying, employing or distributing electricity for public purposes within the area of a Local Authority.

"Public Purposes" shall mean any public scheme or system providing for:—

- (a) The application of electrical energy for lighting or other purposes to or in connection with any street, place, hall, building or structure belonging to or subject to the control of a Local Authority.
- (b) The supply of electric light or electrical energy for private purposes to consumers generally within the area controlled by any Local Authority.
- (c) The application of electricity or electric current as a motive power for tramways, lifts, cranes and other like purposes within the area controlled by any Local Authority.

Local Authorities to make Regulations.

2. Within four months of the date of this Act coming into force (or in the case of a new Local Authority within four months of the date on which such Local Authority is gazetted), all Local Authorities shall adopt and put into force regulations as set out in the Schedule appended hereto:—

- (a) For the licensing and registration (with power to charge a fee not exceeding ten shillings therefor) of wiremen approved by the Local Authority for employment upon electrical work for the installation, alteration or repair of any system of wiring connected or intended to be connected up to and to take electric light or power from any electric undertaking, and for the prohibition of the employment upon any such work of any unlicensed wireman other than a duly indentured apprentice working under the continuous and personal supervision of a licensed wireman engaged upon the same work.
- (b) For the registration (with power to charge a fee not exceeding £5 therefor) of contractors and contracting wiremen undertaking electrical work in or upon premises which are, or may be intended to be connected up to any electric undertaking, and for the prohibition of the undertaking of any such work as aforesaid by any unregistered contractor.

Appeal against refusal to grant Licence or Registration

3. Any person to whom a licence or registration as aforesaid has been refused by a Local Authority, may appeal against such refusal to the Magistrate, and in the event of the Local Authority failing to satisfy the Magistrate that the licence or registration was refused on good and sufficient grounds, such Magistrate may order the Local Authority to grant such licence or registration.

Penalty for Non-Compliance with Act.

4. Any Local Authority failing to carry out the provisions of this Act shall be guilty of an offence, and shall be liable to a fine not exceeding £50 for each month during which it is in default.

SCHEDULE.

COUNCIL OF

Bye-laws for the Licensing of Electrical Wiremen and
the Registration of Electrical Wiring Contractors
within the
of

(Issued under Act No. of 192 .)

Definitions.

1. For the purpose of these Bye-laws:—
 - (a) " Council " shall mean the
(here state the designation of the Local Authority, as defined in Section 1 of the Act).
 - (b) " Municipality " shall mean the area over which the Council has jurisdiction.
 - (c) " The Electrical Engineer " shall mean the official for the time being holding the office of City, Municipal or Borough Electrical Engineer, or, when no such official exists, the Electrical Engineer in responsible charge of the distribution of electricity within the Municipality.
 - (d) " Electric Undertaking " shall mean the electric undertaking distributing electricity for public purposes within the Municipality.
 - (e) " Wireman " shall mean any person employed by a contractor and engaged on the installation, alteration or repair of any electric wiring in any premises for the purpose of using electric energy supplied by the electric undertaking.
 - (f) " Contractor " shall mean the responsible person or firm employing licensed wiremen or apprentices coming under the provision of these Bye-laws, for the purpose of doing work or placing materials in or upon premises for the purpose of using the electric energy supplied by the electric undertaking.
 - (g) " Contracting Wireman " shall mean any licensed wireman conducting the business of contractor, as defined in Section (f) hereof, or who shall undertake work as defined in Section (e) hereof.

LICENSING OF ELECTRICAL WIREMEN.

Work Holder of Licence is Entitled to Perform.

2. A wireman's licence shall entitle the lawful holder actually to perform any electrical wiring work for the installation, alteration or repair of any system of wiring connected, or intended to be connected up to, and to take a supply of electric energy from being the electric undertaking within the meaning of the Act.

Unlicensed Person not to Undertake such work unless under Supervision. Penalty for Contravention.

3. No person shall carry out, and no person shall cause or allow to be carried out any work of the kind referred to in Clause 2, unless such person is in lawful possession of a licence obtained from the Council duly authorising him thereto, provided that this restriction shall not apply to the replacement of fuses or the adjustment of switches and lamp-holders. Any person convicted on a charge of contravening this Bye-law shall be liable to a penalty not exceeding £5 for the first offence, and to a penalty not exceeding £50 for every subsequent offence. Nothing in this Clause shall be held to exclude the employment of an indentured apprentice, providing that such apprentice is working under the continuous and personal supervision of a licensed wireman engaged upon the same work.

Qualifications Necessary to Obtain a Licence.

4. Any person of the age of 25 years and under, wishing to obtain a licence under these By-laws, shall be required to submit proof that he has served an apprenticeship of not less than five years in the electrical trade and has had not less than one year's actual experience as a wireman during his apprenticeship; and shall thereafter submit himself to an examination by the Council in such manner and at such times as the Council may from time to time appoint. The subjects upon which such examination will be made are given in Section 14 of these Bye-laws. Any person over the age of 25 years will be required to submit proof of five years' experience in the electrical trade, and at least one year's actual experience as a wireman, and the Council shall have power to deal with his application on its merits.

Fees Payable for Licence and for Examination.

5. A charge of (not to exceed ten shillings) will be made for the original issue of each licence. Every applicant for examination shall lodge with the Council a sum of ten shillings for each occasion on which he submits himself for examination.

Annual Renewal of Licence.

6. Licences shall be issued for the whole, or any part of, a calendar year. All licences shall expire on the and shall be renewed as from the for which purpose they shall be returned to the Electrical Engineer not later than the of each year. No charge will be made for the renewal of a licence.

Licensee to Sign Register.

7. Prior to the issue of a licence to any successful candidate, he will be required to sign a register containing a declaration that he accepts such licence subject to, and that he will conform with, the conditions thereof, and with any regulations and bye-laws from time to time in force within the municipality with regard to such licence.

Duplicate Licences.

8. Upon a licence being lost or accidentally destroyed, the licensee shall submit to the Council an affidavit setting out the circumstances under which such licence was lost or destroyed, and the Council shall cancel the original licence, and, if satisfied with the explanation given in the affidavit, shall issue a duplicate licence, for which a charge of (not to exceed ten shilling) will be made.

Licence to be Produced for Inspection.

9. Any licensee, if called upon at any time to do so, shall produce his licence for inspection by the Electrical Engineer, or his duly authorised representative.

Examining Board.

10. The examination under these Bye-laws shall be carried out under the direction of an Examining Board, which shall also act in an advisory capacity to the Council on all matters concerning these Bye-laws. The Board shall consist of the following persons, all of whom, with the exception of the first named, to be appointed annually:—

- (a) The Electrical Engineer, or a representative appointed by him.
- (b) One representative from the electrical contractors registered in the Municipality.
- (c) One representative nominated by the recognised trade union or body of electricians employed in the area.
- (d) One electrical engineer from the staff of a university, if such exists in the neighbourhood, or otherwise some qualified person agreed upon by the first three mentioned, and approved by the Council.
- (e) Any additional representatives recommended by the Examining Board and approved by the Council.

Examining Board may also Act for Another Municipality.

11. In the event of a Municipality not being sufficiently large to make it possible, or justifiable, to appoint an Examining Board as provided for in Section 10 hereof, the Council of such Municipality may arrange with the Council of a neighbouring Municipality where an Examining Board has been, or is to be, appointed, for such Examining Board to hold examinations on its behalf and to advise it on applications for licences and other matters coming under the scope of these Bye-laws.

Cancellation of Licence.

12. The Council shall at any time cancel any licence granted to any wireman if the Examining Board shall satisfy the Council that such person has done any electrical work in an unworkmanlike or negligent manner, or contrary to any of the Council's regulations or Bye-laws; provided that prior to such cancellation, the person whose licence it is proposed to cancel shall be given an opportunity of appearing before the Examining Board concerned and being heard in his own defence, and shall have a final right of appeal to a committee of the Council.

Licence Granted by Another Council.

13. Any applicant who, at the date of application, holds a licence from another Council may, upon the recommendation of the Examining Board, be granted a licence without being required to undergo an examination.

Syllabus of Subjects of Examination.

14. The general syllabus embracing the subjects of examination, as referred to in Section 4 of these Bye-laws, shall read as follows:—

- (a) Pressures of supply and systems employed in Municipality.
- (b) A general knowledge of the rules and regulations of the Electric Supply Department in regard to the installation of cables, meters and extra meters.
- (c) Definitions of, and elementary calculations involving the use of, the various electrical units, more particularly the application of Ohm's Law and the calculation of pressure drop.
- (d) Materials—the uses of:—
 - (i.) Cables and flexibles, their carrying capacity, sectional area and types of insulation.
 - (ii.) Switches and cutouts; their carrying capacity, types and areas of contact and length of break required on various voltages and amperages.
 - (iii.) Distribution Boards: carrying capacity of bus-bars of copper and other material; fusing points of fuse wire, copper and other material; relative advantages of marble, slate or panels of other material.
- (e) A knowledge of the uses, methods of application and the principles of operation of, ammeters, voltmeters, supply meters, automatic cut-outs, arc lamps, heating appliances, insulators, ceiling roses, wall plugs, lampholders, conduits, etc., together with an elementary knowledge of the uses and general construction and principle of operation of motors, motor generators, transformers and electric lifts.
- (f) General methods of wiring; a knowledge of balancing of large installations; buried conductors (underground, in concrete, plaster or under floors, etc.); conduit, open wiring and looping systems; size of lighting circuits, motor circuits, insulation resistance between wires and earth, earthing, joints, bushing, protection from shock.

Form of Licence.

15. The form of the wireman's licence shall be as follows:—

. **COUNCIL OF**

ELECTRICITY SUPPLY.

No. 19

Mr.

is hereby licensed as a practical Wireman under the Bye-laws for the Licensing of Electrical Wiremen within the Municipality of

and is entitled to perform any electrical wiring work for the installation, alteration or repair of any system of wiring connected to, or intended to be connected to, and to take electric light and power from the Electric Undertaking of the

within the meaning of Act No. of 19

Signature of Licensee. Electrical Engineer.

NOTE.—This licence must be produced at any time when asked for by the Electrical Engineer, or his duly authorised representative.

This licence is issued for a period of not longer than twelve months, commencing on the day of

each year. The licence will be renewed by the Council on the return of the current licence to the Electrical Engineer on or before the in the year for which it was issued.

Licences issued at any time during the twelve months ending will be held to have automatically expired on that date, and will require renewal as from

No charge is made for the annual renewal of a licence.

This licence is issued without alteration or erasure of any kind.

REGISTRATION OF ELECTRICAL WIRING CONTRACTORS AND CONTRACTING WIREMEN.

Contractors must be Registered.

16. No person or company shall engage in or conduct the business of installation contracting for electrical work for the purpose of using electric

energy supplied by the Electric Undertaking of either as a contractor or contracting wireman, unless he or they are registered by the Council.

Penalty for Contravention.

Any person contravening this Bye-law shall be liable, on conviction, to a penalty not exceeding £5 for the first offence, and to a penalty not exceeding £50 for every subsequent offence.

Application to be made on prescribed form.

17. Every applicant for registration must make application on the prescribed form, and sign an undertaking to carry out all wiring and installation work in accordance with the rules and regulations of the Council.

Persons or firms contracting when Bye-laws come into force.

18. All persons or firms engaged in the business of contractor or contracting wiremen at the date when these Bye-laws come into force, shall be registered on application.

New firms or persons commencing business.

19. All persons or firms wishing to commence the business of contractor or contracting wiremen after the promulgation of these Bye-laws, shall give notice of their intention so to do in at least three copies of a newspaper circulating in and thereafter make application on the prescribed form.

Cancellation of Registration.

20. The Council may at any time cancel the registration of a contractor or contracting wireman, if the Examining Board for the Licensing of Wiremen and Registration of Wiring Contractors shall satisfy the Council that he has carried out his contracts in an unworkmanlike manner, or broken the Bye-laws and regulations of the Council, or has allowed those in his employ to do so, provided that prior to such cancellation, the person whose registration it is proposed to cancel shall be given an opportunity of appearing before the Examining Board and being heard in his own defence, and shall have a final right of appeal to a committee of the Council.

Fee for Registration.

21. A fee of shall be charged for the original registration of each contractor or contracting wireman.

Form of Application for Registration.

22. The form of application for contractor's or contracting wireman's registration shall be as follows:—

I/We (here state full name of person or firm, and address at which business is to be carried on) hereby notify that I/We intend to conduct the business of contractor/contracting wireman (as defined in the Bye-laws for the Licensing of Electrical Wiremen and the Registration of Electrical Wiring Contractors), and have advertised to this effect in the dated

I/We hereby apply to be registered in accordance with the Council's Bye-Laws and Regulations, and undertake that all work carried out by me/us will be strictly in accordance with the Bye-laws and Regulations, or any amendments thereof.

Signed.....
 Address.....
 Date.....

Date Bye-laws come into Force.

20. These Bye-laws shall come into force six months from the promulgation thereof in the Provincial Gazette.

DISCUSSION.

Mr. HORRELL (Pretoria) said he did not think the time was yet ripe for Municipalities to give up their Installation Inspection Departments to the Insurance Companies.

One heard conflicting reports of the methods by which the Insurance Companies did their work in America, and he thought they would be well advised to get more information on the subject before taking such a drastic step.

Would it be justifiable to give up these inspections on account of the expenditure involved? According to statistics, this service costs the consumers in Johannesburg only .01d. per unit sold.

He was afraid there would be only a few cases where the consumers would get the benefit of this rebate, and even if they did, would they appreciate it if they knew that they were not getting the assistance of the Council's Inspector to see that their installation was in order?

It was unlikely that an Insurance Company's Inspector would look after the Council's interest as well as the Council's Inspector.

He considered that Municipalities had a duty to perform and were morally bound to protect the public, as well as themselves, by seeing that the work done for the consumer was safe and satisfactory. Supposing, for instance, a consumer installed an electric stove which was not efficiently earthed (even now, with close inspection, it was difficult to get this work well done), and the lady of the house received an electric shock which proved to be fatal, would not the Municipality be blamed, and rightly so? To his mind, the Municipal Electrical Installation Inspector was as important an official to the community as the Health Inspector.

To-day, when two or more services were given to a house or building, under different tariffs, it was of the utmost importance to see that the installations were coupled up correctly, and undoubtedly the servant of the supply authority was the best man to see that this work was carried out.

There was no denying the fact that the Insurance Companies did reap a considerable benefit by the Municipality doing this work. He did not know of a single instance during the last few years where the Insurance Companies had inspected the wiring of any building in Pretoria.

In most of the big installations in Pretoria, particularly those of big blocks of offices and shops, the Municipality had assisted the architect in drawing up the specification, and it was from a scheme evolved from the Electric Supply Department, that all rooms were separately wired back to common points, making it possible to meter any one or any number of rooms with one or more meters at will, without having to re-wire each time a different set of rooms was let to a new tenant.

Mr. POOLF (Durban) said that he felt that it was the duty of the Municipality to see that the public was protected against such dangers as occurred through defective wiring, and he considered it unwise to allow any relaxation in the Wiring Rules. The public had only the Municipality to look to, and in the event of

fatalities occurring as a result of such relaxations, the Government might force these regulations on them, as the supply authorities in the towns. He, therefore, thought they should continue to carry out the supervision and inspection of electrical wiring. Whether they could get the Insurance Companies to contribute towards the cost of the inspection or not, was quite another matter.

Mr. SWINGLER (Capetown) said that, for the information of members, he would give an outline of their experience in Capetown under Regulations for the Licensing of Electricians and the Registration of Electrical Wiring Contractors.

In Capetown, they had a most cosmopolitan lot of contractors and electricians, and prior to the introduction of the revised Electricity Supply Regulations and the Licensing of Electricians Regulations in July, 1922 (both of which were modelled on those recommended by this Association), the wiring work frequently carried out could only be described as scandalous.

Since the regulations had been in force—and they were enforced strictly—the average standard of workmanship had improved out of all recognition, and the representatives on the Examining Board, of the Local Association of Electrical Wiring Contractors and of the Electrical Trade Union had testified to the benefit of the introduction of the regulations from their respective points of view, while the Insurance Companies had also expressed their satisfaction in that they felt that to-day the installations were receiving better supervision than ever.

At the present time there were 266 licensed electricians and 111 Registered Electrical Wiring Contractors in the Capetown area of supply.

In his opinion, it was the duty of the supply authorities to protect the consumers, most of whom knew very little about electric installation work, and he felt that the municipalities or civil authorities were the people who could best carry out the necessary inspection work, which, in Capetown, cost approximately £1,785 per annum.

Since the Fire Insurance Companies gain very largely by the efficient inspection of installations, he thought it only reasonable that they might consider making a contribution towards the cost of such inspections, and suggested that this might take the form of a nominal amount of, say, 10s. 6d. per inspection.

As an instance of the municipality's responsibility in the matter, he instanced a recent case where a man took hold of a 220 volt live wire and was killed. At the inquest, although the municipality was in no way to blame for the circumstances leading to the fatality, the magistrate expressed the opinion that the municipality should not have allowed such a possibility to occur.

As far as the cost of installations was concerned, they had not found in Capetown that the introduction and enforcement of the regulations had increased this. As a matter of fact, taking as a basis the cost of the installations fixed to a standard specification under the Free Wiring Scheme, the cost had been reduced slightly from a flat rate of £2 per point ruling before the introduction of the regulations to a sliding scale at the present time of £1 18s. to £1 12s. per point according to the number of points installed.

Mr. DOD (Pretoria) said he was a believer in the inspection of wiring work, and he did not really think they were going to gain very much by licensing if they had good inspection. If one had proper inspection and a workman or contractor failed to put faulty work right, supply would be refused, which would soon become known, and he would get no employment. Such a man would either become insolvent, through having to do work over again two or three times, or by losing his customers. Personally, he thought that was sufficient protection. With regard to the cost of inspection, he found that the figure given by Mr. Sankey came to very much the same as in their case, viz., 2s. 6d. or 3s. per consumer per annum, and that was not a great deal. The inspection, they found, was important, not only in the first instance of wiring, but in alterations done. As a rule there was much more shoddy work done in additions or in alterations to an installation than there was in the original installation. Very often those alterations were done without notification to the municipality, and, in such cases, the only redress one had was to have them disconnected and re-done in cases where they were unsatisfactory. This, again, reflected on the contractor who had done the work. Personally, he believed that that was good enough protection.

Mr. MANN (Worcester) pointed out that they had three questions before them: the questions of inspection of installations, the licensing of electricians and the licensing of contractors.

Speaking from the point of view of the small municipalities, he could not help feeling very strongly that the licensing of wiremen was unnecessary, and, as the draft bill stood, it was undesirable and unworkable. The inspections of installations as they were now made were generally carried out by the municipal staff. They could trace a certain amount of shoddy work, but they could not survey the work right from the beginning, and their regulations did not require them to guarantee that the work was in accordance with the wiring rules of the Institution of Electrical Engineers, to which all installations were, he thought, supposed to conform in most municipalities. In those circumstances, if they professed thoroughly to examine and inspect all the installations, they would be taking upon themselves a responsibility that they could not properly carry out. Therefore, he thought, from experience, the risk to the consumer was not very great, and it was not fair to bind themselves to do that which they could not properly carry out.

With regard to licensing, most of their regulations, he thought, demanded a certain standard of work. If they found, on inspection, the work was not carried out to that standard, they had their remedy by way of prosecution, and, if the man repeated the offence, they could again prosecute, and that was generally a sufficiently severe penalty, preventing his doing any more work in the town.

The machinery set up by the suggested legislation seemed to him to be very unwieldy, and, as he had said, in the small towns, unworkable.

In the regulations for the licensing of wiremen, it was arranged that only a duly indentured apprentice working under continuous supervision should be an assistant to a wireman. That was a question which he did not think they should interfere with. In the small towns apprenticeship of that nature was not usual. He thought the apprenticeship question was already dealt with by existing legislation.

Referring to Clause 4 of the Draft Bill, providing for a penalty on municipalities which did not adopt licensing bye-laws, this was most objectionable. Referring to Clause 3 of the draft bye-laws, Mr. Mann pointed out that if a man had his licence cancelled or suspended, he would still be able to carry out certain small additional points and certain other work without notifying the Council. They could

not maintain a sort of inquisition to inspect all houses to see whether any unauthorised work was being done; and they could not, therefore, guarantee the consumer against any shoddy work.

Again, the standard of examination required for licences did not apparently include any practical test. They had several competent wiremen—that was to say, they could carry out simple installations—who could not possibly pass that examination, but their actual handicraft—which mattered more than anything—was possibly better than that of the men who could answer questions. Where the qualifications insisted upon a five years' apprenticeship, it meant no local men would do any work, and that somebody must be imported to carry on. Probably, even the municipal staff could not carry out any work, which would be rather a handicap in small places. It seemed unfair that a competent, practical wireman could not carry out any work in his own town because he had not had the necessary five years' experience.

The board which had to be set up consisted of the electrical engineer, one representative from the contractors—from the electricians, another electrical engineer or otherwise qualified person, and any additional representatives. Well, in his town, they could not constitute such a board. Probably the one electrician—or contractor—would be sitting on his own application for a licence. In the case of bad work being detected, Section 12 of the draft bye-laws provided for the cancellation of the man's licence on the Examining Board satisfying the Council that such person had done any electrical work in an unworkmanlike or negligent manner. Who was going to satisfy the Examining Board? How were they to know anything about that work? It seemed to him this would throw a lot of unnecessary work upon the electrical engineer which could be handled quite well under their existing regulations. It seemed to him rather a round-about way of dealing with the matter.

Then, again, there was the question of one town acting for another. Supposing they were to accept the proposed draft as it stood—that was, the uniform regulations right throughout, if a man was granted a licence for any one town, he should, presumably, be able to practice in any town. He supposed the syllabus would be the same; the licensing authority would probably act on the same standard throughout. Why then was the licensing purely local? Again, why, if it was local, must they all be forced to accept it?

He would like to say a few words about the registration of wiring contractors. The granting of licences to a contractor would suggest some sort of measure of protection against competition by the municipality—that was, for a licensed contractor; it suggested that he should have full opportunity to sell and develop in the municipal area without, as it was often called, "rate-aided" competition. Now, the contractors had been considered the natural selling agents of the authority. If one compared the conditions in this country and in England and America, one would find that where the selling of electricity and its appliances had been left to the contractors, the development had been practically nil. Anybody who had cared to come along had perhaps been assisted, but, in general, their staffs could not assist the consumer, and they had not the same financial interest in helping as the Municipality. The Municipalities have a great variety of services to sell, most of them unknown to the public, and they did not try to sell them or to tell the public what they had to sell. Did members think they could justify their position? They paid much attention to the manufacture, but paid little or no attention to the selling. He felt, therefore, they must not be hampered in any way. They must develop their selling side; they must carry out their duties to the public and encourage in every possible way the installation of points; not increasing the difficulty of obtaining those services or obtaining the necessary installations. He felt that, while they should not eliminate the contractor, they could use him as a sub-contractor, but they should, by every means in their power, develop their selling side and endeavour to render themselves independent of him. Therefore, he did not feel they could offer him in any way any sort of licence which might mean a sort of measure of protection against municipal competition.

Mr. RALSTON (Dundee) said that he agreed with what the previous speaker had said. It would be inconvenient and difficult to adopt any licensing bye-laws in a small town like his where there was not sufficient electrical work to warrant a contractor remaining there unless he also had some other business. The result was that, at the request of the public, the Corporation now did the wiring work. Referring to the examinations required to obtain a licence, he considered that more attention should be paid to the practical side than the theoretical. It was not necessary for an electrician to have a fine memory

for complicated formulae, because, if he had a pocket book handy, he could refer to it and ascertain exactly the size of the wiring to be put in. He considered inspection of wiring absolutely necessary for the protection of the public. If this were abolished, a disgraceful condition of affairs would result in years to come. With regard to the cost of inspection, he thought that both the Insurance Companies and the Contractors should contribute something towards the salaries of the inspectors.

Mr. MAIL (Kokstad) said that in his town practically all the houses were wired, which meant that there would be no work to warrant a wireman residing there. He considered it was much better for the municipality to do the wiring work with its own staff. He thought the suggested bye-laws should apply only to the large towns.

Mr. BROWN (Middelburg) said that the question of the licensing of electricians, wiring rules and regulations, was of considerable importance to all connected with the profession. He wished to put before them his point of view as the engineer of a small town. Referring to the standardisation of municipal bye-laws and the standard wiring regulations, he considered these most essential. At the present time, if a contractor went to any other town than his own to carry out installations, he paid little or no attention to the local municipal bye-laws, but carried out his work in accordance with the bye-laws of the municipality to which he belonged. These bye-laws, not being standardised, created no end of trouble in this manner, and for this reason he considered that if they had bye-laws these should most certainly be standardised.

With regard to the question of the licensing of wiremen, he was of opinion that this was most necessary from many points of view. Firstly, it gave every workman who might not have served a full apprenticeship in the trade, an opportunity of becoming qualified in a portion of his trade, namely, wiring. Secondly, it gave the consumer a greater confidence in the workman, and was more or less a guarantee of the workman's ability to carry out the work. Thirdly, it gave the electric supply authority a hold on the workman, which would eventually ensure that good work would be carried out. The result of licensing wiremen would raise the standard of the wireman and improve the quality of the work being installed.

In connection with the inspection of house services, he considered that in small towns, the ratepayer looked upon the electrical engineer as a kind of consulting engineer, and he thought it was necessary that engineers of the smaller towns should accept that attitude, and give the ratepayer the full benefit of their knowledge and experience, so ensuring that the installations which were installed were put in in accordance with the best practice. After all, as municipal officials, it was their duty to give to the ratepayers every assistance in this respect, and by coming in closer contact with their prospective consumers they could advise them as to their requirements, and this, in his experience, had led to considerable increase in business. It was stated that the inspection by the supply authority would tend to bring up the cost of installations and the cost per unit, but he thought that the increase of cost in installations, and cost per unit, would be considerably less than the increase in insurance premiums, should the inspection of these installations be carried out by the insurance societies. If the matter of house wiring inspection was left to the insurance societies, it would necessitate the appointment of an inspector, who would probably have to cover a large district. This would lead to no end of trouble, as house installations would be completed and would then have to wait for days to be inspected by the insurance inspector before such installations could be put into commission.

With regard to Clause 11 of the Draft Bye-laws, namely, the appointment of an Examining Board, he suggested that in the case of small towns, where the electrical engineer held the Government certificate, he, assisted by two assessors, should form an examining board. The examination should consist of the carrying out of a practical wiring scheme, and thorough knowledge of the latest rules and regulations and the standardised municipal bye-laws. A certificate of competency should be awarded to the candidates if successful, licensing them as wiremen for that particular municipality.

THE VICE-PRESIDENT said that they, as electrical engineers, were out to sell electricity, and to increase the sales as far as possible. An article brought into disrepute naturally suffered, in so far as sales were concerned. Electricity on the consumer's premises, could be brought into disrepute in two ways: one, by doing injury to life and limb, the other by unsatisfactory service, caused by defective wiring or workmanship in connection with the installation itself.

So far as safety to life and limb was concerned, he thought there could not and should not be any question but that that must be taken care of. The question as to who was responsible, he thought, must be left to be settled later. The supply authority was on the spot, and he thought, in the absence of any other provision, it was its obvious duty to ensure every protection being given to safeguard the lives of those who, ignorant of the appliances they were dealing with, might very easily suffer injury or loss of life.

In so far as quality of work was concerned, apart from the question of safety to life and limb, there was brought about by bad work, unsatisfactory service; and he thought they would all agree with him when he said the day had gone by when they considered they had finished their work by delivering current at the power station door, or, later on, at the consumer's door. They must follow up that current and must take every step to see that it was utilised in the most satisfactory and efficient manner, and by so doing they would increase the sale of electricity. By increasing the popularity, therefore, the electricity undertaking benefited, and there was no doubt, in his mind, that it should be responsible for, and should bear the cost of, the inspection required to ensure this result. There was a third point, namely, the protection of the buildings against fire risk. He felt very strongly that there was a duty devolving upon the insurance companies to bear a share, at any rate, of the burden of ensuring the quality of work which would reduce the fire risk to a minimum. There was, in his opinion, a danger of too much regulating or regulations. Mr. Sankey had emphasised that point, and South Africa was, to his mind, becoming an outstanding instance of government by regulation, in many cases, conflicting regulations. It was essential, he thought, if wiring regulations were brought into force, to secure some degree of uniformity, if only in the direction of popularising the use of electricity.

They, as an Association, had, to-day, a model code of bye-laws, but he did not think those bye-laws were adopted throughout the Union. In many cases they were elaborated, in others they were departed from; and, just to digress for a moment, an instance he had in point was the difficulty one found in securing electric power apparatus which was, in any way, uniform, because of the varying requirements of different supply authorities. One authority would require a certain type of motor, and another a different

type, which would not assist in bringing down the cost of installation work. In so far as the licensing of electricians was concerned, the difficulty which had been mentioned in regard to the small towns was one which, he must confess, he could not see any way of overcoming, and he felt they should put themselves more on the lines of other trades that required a man to be sufficiently trained, rather than to ensure, by inspection, that he did his work in accordance with the best practice. This, he thought, was as far as they could go.

As he had already mentioned, they had with them that day: Mr. Howden, representing the Architects; Mr. Missing, representing the Master Builders; Mr. Ward, representing the Insurance Companies; and Mr. Fisher, representing the Johannesburg Electricians' Licensing Board. He was sure the members would welcome the contributions these gentlemen had to make.

Mr. R. HOWDEN (Transvaal Architects' Association) said he had read with interest Mr. Sankey's paper, and had listened with great interest to the discussion.

It seemed to him the first question to be decided was whether it was desirable that tests should be made. That, it seemed to him, was a matter which should be decided amongst the electrical engineers themselves; and, so far as he could understand from the discussion that morning, it seemed pretty unanimous that it was desirable that such tests should be made.

The next point seemed to be, who should do those tests? In Mr. Sankey's paper were mentioned several individuals who might be responsible for those tests being made. The poor architect was mentioned as one. He took it, of course, that the object in mentioning those different names or different individuals or bodies or trades was with the view to that responsibility being saddled upon them chiefly regarding the saving of cost; which, of course, was an important matter; and that, if the architect would give the necessary supervision, the cost of that supervision and test would undoubtedly be saved. But the architect's position was a totally different one. The architect, as most of them might know, was held by the courts to be an individual who prepared his plans and specifications and gave occasional supervision. If more than occasional supervision were required, the employer must then employ a clerk-of-works, or have someone in

the nature of a policeman to look after his particular interests. But that particular duty was not the architect's. His duty was simply an occasional visit necessary to see that, as far as possible, the main part of the work was being carried out.

Now, of course, if such an individual as a clerk-of-works were employed, that, of course, would be an extra charge upon the building employer. That must be distinctly understood.

It was mentioned, further, that the Master Builders might be held responsible. In his opinion, the last man he would look to to supervise the work of the sub-contractor was the master builder—whether it be from incompetence, negligence, or lack of attention, but, from 30 to 40 years' experience in the profession, he would look upon the master builder as the last man to depend upon to supervise the work of the sub-contractor.

Then, mention was made of the consulting engineer. Well, on works of decent size, most of them employed a consulting engineer; but, if they took the averaged sized house—which, he took it, was the one mentioned in that particular paper—say, a house of about a thousand pounds, the cost of the electrical installation would be about £30. Well, he would be most willing, and he thought most architects would, to hand over the 5 per cent. on that £30 to the consulting engineer, who would take upon himself the responsibility of preparing a plan, blue-print and specification, and who would undertake to supervise, and to consult with the lady client concerning the electrical fittings, and indulge in all the correspondence with the municipality as to when they could get the cable, and so on! Of course, anything in addition to that would be a further charge upon the building employer.

Reference had also been made to the insurance companies. He did not know the particular details about that; but he did know that some companies were not only saddled with expenses of that kind but also the expense of maintaining fire stations in particular localities. So he thought it was quite a feasible proposition to suggest that that expense might be thrown upon the insurance companies.

That brought him to the last point, which was the point as to who should pay for that particular work. They all agreed, he thought, that this work of testing should be done. He maintained there was nobody able to do that work and do it so well as the municipalities themselves. He did agree—and he thought

Mr. Sankey was quite right in saying—it was unjust to make that an indirect charge on the whole community using electricity. It should be, in his opinion, a direct charge on the building employer. He saw no difficulty in doing that. They had a distinct parallel in the case of the Building Surveyor's Office and the Sanitation Department. When a building employer lodged his plan, he was charged at the rate of 5s. a room, or thereabouts, for the purpose of maintaining a staff who did that particular building inspection. His plans then went to the Sanitation Department: he was then charged so much—he did not know exactly how they arrived at their rate—for the inspection and testing of his drainage in that particular house. Those inspections were made by a staff kept by those respective departments, and the maintenance of those staffs was paid for by the building employer. To his mind, the most just way seemed to be for the municipality, when they made a charge for connecting up, to also make a charge for this particular inspection. So far as the clerical work was concerned, the applicant had to submit a form, when a charge was being made for a connection, showing the number of lighting points in a particular house—in a house of say, £1,000, there would be about 20 points—then it would be no great crime to charge, say, £1 for that particular inspection.

He thought it was very evident, from their point of view, at all events, and, he thought, generally speaking, that that inspection should take place and continue to take place. At the short discussions they had been able to have round their table, the architects were unanimously of opinion that the inspection should be continued, and they certainly thought it should be continued by the municipality. Regarding the charge, although they felt it was no particular business of theirs, at the same time, they were unanimously of opinion it should be a direct and not an indirect charge, as in the case of building and sanitation charges. (Applause.)

The VICE-PRESIDENT said he was sure they had listened with extreme pleasure to Mr. Howden's exposition of the matter, as the architects saw it; and he thought their sincere thanks were due to Mr. Howden. (Applause.) He thought it would be very appropriate that Mr. Missing should follow Mr. Howden, in so far as the Master Builders were concerned.

Mr. MISSING (Master Builders' Association) said that he must endorse Mr. Howden's remarks as regards the testing, and, to some extent, the paper.

At present the Municipality of Johannesburg undertook the supervision of plumbing, area of window lighting, ventilation, and other items for the protection and benefit of the public, and, he felt, they should carry out the inspection under discussion. To make it more efficient, he would suggest that a copy of the specification for any such work, signed either by the architect or the owner, should be lodged with the Municipality, together with any fee which was decided on, before the work was commenced, and that this specification should have to be accepted before the work was commenced. In his opinion, it was quite impossible for inspectors to inspect work efficiently so long as they had simply the contractor's word for the size of lamps which were to be installed, or the purpose for which plugs were to be used, and consequently the size of the mains, and he contended that no inspector, electrical or otherwise, should attempt to inspect and pass any work unless in possession of a signed specification for such work.

He believed he was voicing the views of other contractors in Johannesburg when he said that they would be pleased to include in their estimates to architects or owners the sum of one guinea for testing and inspection on the lines indicated. In the case of very large premises, the fee might be based on one guinea for every 25 amperes of load, it being necessary from the suppliers' point of view to have such loads balanced. If the inspection were done away with, serious consequences might result to the suppliers. The Master Builders considered it very necessary that the test should take place and that the specification should be lodged. He had had other remarks to make, but Mr. Howden had said practically all he intended to say with regard to installations.

With regard to licensing, he personally was very much in favour of the men being licensed, but he felt that the test should be more in the nature of a practical test than so much theory. The master should hold the licence for theory as well as practice, because he must calculate the size of wires, capacities of switches, etc., and be responsible for the proper carrying out of all work; whereas the man, no matter how good he might be, must take his orders from the master. Besides (as many of the municipal electrical engineers had pointed out) many a first-class mechanic would fail to pass a purely theoretical examination, and, on the other hand, a man who would have little difficulty in passing such an examination might give very little

satisfaction in practical work. He had had much experience of both classes of men, and had found that many first-class tradesmen, especially of the older school, were quite incapable of taking a theoretical examination. (Applause.)

The VICE-PRESIDENT remarked that the valuable contribution by Mr. Missing, as representing the Master Builders' Association, only served to confirm his (the speaker's) impression as to the wisdom of the action the Association had taken in inviting those gentlemen to be there that day. He felt sure they would listen with equal pleasure to a contribution by Mr. Ward, as representing the Insurance Companies.

Mr. WARD (Insurance Companies) said he was afraid the Insurance Companies were opposed to accepting financial responsibility for inspections. He would like to speak more generally on the question of inspection. They all seemed to be of the opinion that these inspections should be continued, and he thought Mr. Howden had put the case very well. After all, it was largely a question of the public interest, and, as the Chairman had pointed out, it was also in the interest of the suppliers themselves. For that reason, he thought the expense should fall either on the supplier or the consumer, in the manner that had been indicated by the previous speakers. If the inspection was going to be dropped, it seemed to him it would be a very great step backward, because they might attempt to drop all inspections, and then they would go back to where they started from in the year dot.

He believed it was a fact that, in the United States, the insurance companies undertook the inspection of premises that were being wired or that had been wired. Well, he did not quite know whether that had got anything to do with it, but he would just mention it as a matter of interest—it was certainly news to him—that he understood most of the leading companies here drew at least half their income from the United States of America; so they could afford to do a great deal more under conditions of that sort than they could, say, in this country. It had been stated to him (he had not been appointed to that position very long, so he could not tell them from his own personal knowledge as to what had happened in the past) that the number of fires which had occurred in Johannesburg in past years, owing to faulty electric wiring, or things of that nature, had been extremely

small. (Hear, hear.) That being so, they would see the inspections were not being done for the benefit of the Insurance Companies quite to the extent Mr. Sankey suggested.

Then there was also the question that a certain manager had put to him with reference to the effect on the price of current of the actual expense of £2,000 a year. He said that could only represent a very small proportion of the total expenditure, and the total increase per unit was very negligible. He thought that was confirmed by one of the previous speakers. It might be said it had nothing very much to do with the matter. Of course, it did not touch the question of principle, but it was a fact, all the same.

Insurance, so far as South Africa was concerned, was not such a very paying proposition, after all. Most of the companies were established in Great Britain or some other large country; and it seemed to be a popular idea—he did not know whether it was so amongst those present—that Insurance Companies had money to burn, so to speak. (Laughter.)

With regard to the question raised in Mr. Sankey's paper as to what would be the position of the respective parties should a fire take place owing to extremely bad wiring in a house, of course, that was the Insurance Company's responsibility entirely. After all, the question of insurance largely depended upon the premium and rates; and if, for example, the wiring in a town became so frightfully bad that they were having a good many fires, the answer to that would be that the Insurance Companies would put up the rates all round. But, of course, that was not in the public interest, and, on the other hand, it was a state of affairs which was extremely unlikely to occur. He thought that was about all he had to say with respect to the Insurance Companies themselves.

He thought they would find the Fire Insurance Committee was opposed to making any contribution in aid of the expenses for inspection, largely because they thought it was a public duty to inspect those installations, and was also in the supplier's own interests. The persons who should pay were either the supply authorities or the consumer, or possibly both.

The VICE-PRESIDENT was sure they would all thank Mr. Ward very sincerely for his contribution to the discussion. He did not think any of them—if he might mention it—had ever thought Insurance companies had money to burn, but he would like to point

out that they realised they had money to build.
(Laughter.)

He would now ask their fourth visitor, Mr. Fisher, as representing the Johannesburg Licensing Board for Electricians, to give them a contribution to discussion.

Mr. FISHER (Johannesburg Electrician's Licensing Board) said that he was there to give them, as far as possible, the opinion of the members of his board. Personally, he was not interested either from the financial side or as an official of the Municipality who would be called upon to carry out these regulations, so he was perfectly unbiased on this question. He was very pleased to note the trend of the meeting with reference to the question as to what was going to be for the public benefit. With reference to the question raised by Mr. Sankey that they had a surfeit of legislation, he considered that they could not have too much good legislation, and, after all, whether legislation was good or bad depended, to a great extent, on whether they were trying to make the best use of it or not.

He would like to divide Mr. Sankey's first question into two parts, firstly, whether this was necessary for the protection of the distribution system and plant. They had evidently decided that this was not so, and that their own protective devices were quite sufficient for this purpose. The second point was the important one, namely, whether the regulations were necessary for the benefit of the public.

He submitted that the obvious answer was in the affirmative. They must recognise that every member of the community, particularly municipal officials, had a duty to their fellow creatures. It would be rather an intolerable state of affairs if public bodies were to state that only those services were to be rendered which were revenue-producing. For that reason, he said they must not stress too much the point of cost. There were other municipal bye-laws besides the bye-laws covering the supply of electric current, and it surely was just as desirable to prevent death by electric shock or electrically-produced fire as it was to prevent death by disease. They contributed, as taxpayers, an enormous amount of money towards the upkeep of the Health Department of this town; but he did not think any of them would suggest that, in order to save that money, they should discard the Health Department and do away with its activities. If they did, they would no doubt suffer very severely in

the long run. The same applied to their Traffic Bye-laws. Traffic Bye-laws did not produce revenue. He did not think any member present would suggest, if a man cared to purchase a motor car and pay for a driver's licence, he was at perfect liberty to drive how and where he liked, and that they should not pay for the upkeep of those bye-laws because they were not producing revenue. If they did, there was no doubt that they would very soon all be classed under one of three headings, which, he suggested, would be "athletes," "cripples," or "corpses." If they were to suggest to the general public that municipal bye-laws controlling traffic were unnecessary, because costly, there would be an enormous outcry.

With regard to the question of cost: that had already been covered by other speakers. It was rather a paltry amount compared to the total cost of the upkeep of the Johannesburg Municipal Electric Supply.

There was another point. Assuming that the saving of that £4,000 and the discarding of the bye-laws did cheapen current, he was sure they would agree that one fatal accident, due to the use of electric appliances, would counteract and more than counteract that cheapness which tended towards the universal use of electricity.

Mr. Sankey had made a point as to why a householder should not be allowed to engage which man he liked. The reply was: Simply because it would not be for the public benefit or for the public safety. It had been mentioned that previous to municipal bye-laws being in existence, the class of work which had been done in this particular town was deplorable. In some of these cases he remembered the actual build-ings, the occupiers and the men who did the work, where the wiring consisted of bell wire, or something very little better, and where fittings and wires were put in while the roof was non-existent. That took place when there were no municipal bye-laws to deal with the matter.

He thought the general trend, so far as he could gather that morning, was that the municipal bye-laws were necessary as a check on bad work—or, should he put it, to ensure decent work being done.

If they agreed on that point, they then came to the point of the administration of those bye-laws. He wanted to endeavour to convince those present that the municipal council, or a similar body, must administer those bye-laws, and no one else. Perhaps

the strongest point in the case was that they must eliminate any chance of their being used for dividend-producing purposes. He did not wish to infer that insurance companies or their agents would be deliberately dishonest: but there was no doubt that an agent, anxious to secure business in the face of a rival agent, would be severely tempted to suggest—what should he say?—well, the telescope to the blind eye of the inspector, so that he might obtain the business. That would not be to the public benefit. In the case of municipal inspection, provided they had a sufficient staff available, the inspection should be thorough and uninfluenced by any outside consideration provided the municipality paid their staff a decent salary. There was no question of competition or of obtaining business; all an inspector had to do was to carry out his duties properly and safeguard the public—the people who were employing him.

At first glance, it seemed rather an important point as to whether the insurance companies, who appeared to depend on municipal inspection and to make use of it, should not pay something towards it. Mr. Ward had made his case, so far as the insurance companies were concerned. But he (the speaker) thought they could go a little deeper into the matter. It did not really concern them as to where they placed the actual cost for the carrying out of those bye-laws; whoever carried them out must be paid, and the taxpayer was the only person who could pay. In that case, it did seem to him that the best people to employ to carry out those bye-laws—seeing they had to pay whoever did it—were the municipal people, because they should get the best service and unbiassed opinion from them.

It was a very wide question to suggest the insurance companies should take over that duty. If they were to take over that particular piece of legislation, then why should not they maintain the fire brigade? Why should they not maintain the Health Department? There was not the slightest doubt that the Health Department did assist the insurance companies, inasmuch as it prevented the spread of epidemics, and so on, and reduced the number of deaths which would otherwise take place during epidemics. It was a very, very wide question. But, as he had said before, it did not really matter whether they paid directly or not. For that reason, he did not quite agree with the suggestion that the fee should be charged for inspection only on connection; and,

again, he did not agree for this reason, that it was one of the points where they missed a chance of getting at the insurance companies. They had large buildings in all the cities, they employed fairly large staffs, and they were fairly heavy taxpayers; so let them help to pay, with their other taxes, for the municipal inspection of installations.

The American practice had been mentioned of handing that work over to the insurance companies; but he did not know that he was quite prepared to accept that everything which came from America was necessarily good. It was, perhaps, best for them to use their own intelligence and decide what they thought was best.

It had been suggested that the employment of a consulting engineer might get over the difficulty. In connection with small buildings, that was, obviously, out of the question. In the case of large buildings, he believed the practice was to employ a consulting engineer, but he did not think that they, as municipal officials, would agree to the consulting engineer being allowed to do just what he thought fit, irrespective of the public benefit. In any case, the consulting engineer would have to be paid instead of the municipality.

The question had been raised of handing over the inspection to the architect or builder. He suggested that these two people were unsuited and unqualified to undertake this important work. It had also been suggested to leave the matter in the hands of the electrical contractors. Again, he could not agree. He thought this would be a direct incentive to unfair competition, and, in any event, would mean that they were allowing the contractor to inspect his own work.

He felt sure, as municipal officials fully recognising their duty to the public, they would insist on retaining their authority in this matter, and would endeavour to assist in strengthening the position by urging in every legitimate way the passing of a suitable Act for South Africa—one which would require to be much more stringent and definite than the present Provincial Ordinance under which they, in Johannesburg, were working.

So far as the Provincial Ordinance was concerned, that was a very big thing to go into at the present time. The Johannesburg Board had spent many, many hours, and had got many headaches over that very same draft; but he was sure the members of the

Association could give very valuable advice on that draft, and that, as a result of that advice, the draft Act which it was proposed should be put before Parliament could be amended in such a way as to suit not only large cities, but so as also to overcome the difficulties with reference to small municipalities. Reference had been made to the licensing of electricians. As they all knew, the Apprenticeship Act had been passed, and was law all over the country. The qualifications called for in the draft Bill for the licensing of electricians were not anything like the qualifications which an apprentice would be able to obtain if the Apprenticeship Act were carried out in its entirety by the different Apprenticeship Committees of the country. The technical education of the apprentice was particularly stressed in that Act, and it was laid down very carefully what technical education he should have. In a very few years, he thought, the electrical contractor would find there was no necessity for him to give instructions on those small technical details to any competent artisan that he might employ. If an artisan had served a five years apprenticeship in this country, and had had the facilities for obtaining the technical education as intended under the Act, he would be perfectly competent to carry out, should he say, any minor calculating work. (Applause.)

The VICE-PRESIDENT said, to Mr. Fisher, as also to the three previous visiting speakers, the very best thanks of the Association were due for, in his opinion, their most valuable contributions to the debate. The members of the Association had their own points of view, and they had now heard four other points of view which could not help but be of value to the Association in coming to a decision in that matter.

He then asked if there were any of the Councillor delegates who would like to make any remarks on the discussion they had had that morning. In view of the short time available for discussion, he suggested that the draft Bill be not discussed that morning, but that it be circulated, and that members send in their comments in writing to the President.

Councillor ERICSEN (Kimberley) stated that in Kimberley the question of the licensing of electricians had been dealt with on several occasions, but had not been considered a forward step. He was pleased to hear that some of the largest suppliers in South Africa held the same views as Kimberley, not because

they did not realise it was necessary, but because they felt they must also take into consideration the smaller municipalities throughout South Africa. If they were going to legislate and draft a Bill which would become an Act, compelling municipalities to license electricians, he felt sure that, instead of making progress in the way of electricity they were simply going to kill the object they had in view, namely, the encouragement of the development of electricity in every and any way. It would mean that the smaller municipalities would not have any licensed electricians in their towns, and would have to go to the larger towns to get an electrician to come and wire a house—which would be very costly. In Kimberley they felt that by introducing such restrictions they would be increasing the cost per point by 100 per cent. Mr. Swingler had told them that he was paying £1 12s. to £1 18s. in Capetown, but even that was heavy, as in Kimberley the contractors were only too glad to get a sovereign a point, and even then they made a handsome profit; that was for "open wiring." A considerable number of electricians were employed in the mines in Kimberley who were more qualified, perhaps, than the licensed contractor, and in stopping these men from wiring their own houses they were going to kill progress, so far as electricity for domestic purposes was concerned. The same applied to the electricians employed in the railway, who were equally qualified to wire a house. In his town, no premises would be connected to the mains unless under the strictest supervision and stringent test the municipality enforced. He felt that the larger towns should not be selfish. Let them have their own rules and regulations in connection with wiring, but let them also assist the smaller municipalities to go ahead and to legislate as they themselves thought fit, to further their own interests. He had great pleasure in supporting those who were against the licensing of electricians.

Councillor PATON (Kroonstad) said he was very much opposed to the licensing in the smaller municipalities. In his town, they were in the fortunate position of having an electrician who was a member of this Association. All plans and specifications were submitted to his department and inspected, and he saw that they were drafted in accordance with the rules and regulations of the municipality. He inspected the work and, at the completion, he went along and tested and saw everything was correct. Of course, they understood he could not trace out the

whole thing from point to point unless he were continually on the work; but the testing he did gave satisfaction. For the passing of plans they charged a small nominal sum, which helped to cover that.

He would also like, with their permission, to digress from the point at issue just now, and to say that, in the Presidential Address, Mr. Sankey had brought out one point which appeared to him to be a very good one; that was, the question of municipalities extending their area of supply beyond their own municipal borders. In Kroonstad, they received from the farms and outlying districts a number of applications for light and current. Estimates were made up on the basis of a *pro rata* share for every person who applied for the current. This proved a very satisfactory way of meeting the position.

He would also like to take the opportunity of thanking the Municipal Electrical Engineers for the courtesy they had extended to the Councillor delegates in inviting them to their Conference. There was no doubt in his mind that a great deal of work had been done in getting everything to work so amiably and smoothly as it had done. The Association's "kilowatts" had been working up to their peak point. (Laughter.) There was no doubt about it that the generation of current brought a sociability to them all when they met one another in a social capacity. They had enjoyed every moment they had been there, and he was sure they would return to their respective destinations, not only much impressed, but having learnt a good deal in connection with their visit to this centre. He, therefore, had much pleasure in according his best thanks to the President and other members of the Municipal Electrical Engineers' Association. (Applause.)

Mr. DOD (Pretoria) asked whether he might say one word before the writer of the paper replied. After all they had heard, it had struck him that all their objects and difficulties might be met if they were to recommend that the Act should be an enabling Act and not a compulsory Act.

Councillor LOW (Capetown) stated that, as representing one of the larger towns where such control as was set forth in their draft Bill was enforced, he could only say, so far as they were concerned, it had proved an entire success. He was sorry that the Councillor delegates who had spoken should appear to be against it, for he thought it displayed one of the first principles in local government—that was, where

the desires of an individual or small section of the community were against the interests of the community as a whole, then, of course, their desires had to be subordinated and the public interests protected. From the former addresses at the meeting, it seemed to him perfectly clear that some control was necessary and desirable; and, so far as he could judge, the consensus of opinion that had been expressed there that morning seemed to boil itself down to a question of making some provision for dealing with the smaller municipalities. In various professions that had been recognised already throughout South Africa in the initial stages they had a large number of men who had been engaged in their particular work for a number of years; and, of course, it was unfair that those men should be deprived of their experience and the opportunities they had gained for carrying out that work. He remembered well, in connection with the Incorporated Law Society, when he first came out to South Africa, there was in existence in the Cape Province quite a large number of law agents who were practising there. When the Incorporated Law Society introduced their Bill, the men then in practice were permitted to carry on, but there was provision made that the unqualified men should only do that during their lifetime and, if more than two qualified men came into a district, no further licences to unqualified men were granted. Such an arrangement, it seemed to him, would meet the case of the small municipalities.

In so far as inspection by the municipalities was concerned, he was of opinion that the cost should be borne by the municipalities themselves, because they were carrying out a service which was in the interests of the community as a whole.

He agreed with Mr. Dod that if, in the first place, the Bill were put through as an enabling Bill, he had not the slightest doubt that in the course of a few years, with the Apprenticeship Act in force and the technical training which the younger men were going to receive, the benefits they would derive therefrom would quickly be shown. (Applause.)

Councillor CLARK (Durban) remarked humorously, that the purpose in life of the members of the Association was to manufacture electricity and to give light to the people; but their duty, as town councillors, was rather in a different direction. They were slightly in opposition to the members. They were manufacturers of gas. (Laughter.) He could say, however, that he did not think the town councillors who were

present that day had worried them too much in regard to the "gas" they had let off. (Laughter.) It was not his purpose to say very much, but there were just one or two points in connection with the very interesting debate that he would like to say something upon.

The first was with regard to the question of wiring licences. There appeared to him to be a division of opinion in the meeting in regard to whether or not wiring contractors or journeymen wiremen should require different licences. His view rather tended to agree with that of Mr. Missing, the building contractor who had spoken, when he said that he thought it was sufficient if the contractor, who was a licensed man and had his employees under him, could guarantee to carry out the work. One looked to the man who undertook the contract to see it was rightly carried out. He, of course, would see that he had competent men under him to carry out the work. If that were done, he thought a good deal would be accomplished. At the same time, he did think it was necessary that there should be competent men to do that class of work in their towns. He thought it would be intolerable to say every man should be able to go about, say, in Durban, for instance, and do his own wiring. He knew, for a fact, before the wiring bye-laws came out, all kinds of wiring was put in the town by all kinds and conditions of people, who put wires across their backyards and from one room to another, outside buildings, and all that kind of thing, which was never contemplated when the house was wired in the first instance.

Then, again, he thought it was absolutely necessary that an inspection of the wiring should take place, but the inspection should be done by the Municipality and the payment for that inspection should not fall upon the man who was getting his house inspected, because it was not only to his benefit, but to the benefit of the town and the electricity department to see that his wiring was up to the mark.

There were many aspects, of course, in regard to the paper which one might easily deal with. There was just one hint, however, he would like to throw out to those present. With regard to the wiring of houses, they were tending, in Durban, he thought, to bring in some kind of a law to make it a condition that all new houses should be wired and equipped for electric light while the houses were being built, and also that they should be wired for cooking purposes. (Applause.) So far as they in Durban were concerned, they had built a very large number of municipal houses. Up

to now, they had not made it a condition that the houses should be wired for cooking, but he thought they were building now 19 houses and that there would be a condition that every one of those houses should be wired for electric cooking. In that way, a very great deal would be saved, because, as they knew, this method cost least. If that were done it might be said that it would be interfering with the prerogatives of the people to do what they liked in their own houses; but he thought it was for the benefit of a town to have all those amenities at the cheapest cost, and it was certainly the cheapest to have the houses wired when building. Here, in Johannesburg, of course, they had the gas. While the same might apply to new houses with regard to gas, a man should have his choice as to whether he wanted gas or electricity. He thought it was worth their consideration as to whether or not they could advocate the wiring of houses, when they were being built, for electric cooking, and so on.

He would just like to say, in conclusion, it had given him very great pleasure to attend the Conference, and he was going away, like, no doubt, many of the other delegates there, with a great deal more knowledge in connection with electricity than when he came to the meetings. He thought it was a good thing that their councillor delegates should have the opportunity of getting to those conferences and learning something about the departments over which some of them had control, as chairmen. Speaking for himself, he had appreciated every minute he had been with them. They had been well feasted by everybody all round, and he thought he could go back to Durban and say they had been absolutely well treated. (Applause.)

Mr. FISHER (Johannesburg Licensing Board) said, in reference to Mr. Dod's suggestion that the Bill should be an enabling Bill, he would like to suggest that the enabling part of the Bill be applicable to the smaller municipalities and not to the larger ones.

The VICE-PRESIDENT was sure members would agree with him when he said they had listened with especial interest to their councillor delegates; that was the other point of view he had mentioned.

Mr. Sankay, their President, was responsible for that paper which had provoked, in his (the speaker's) opinion, such a very useful and full discussion as had taken place that morning, and one which could not but have the effect of considerably clearing the air.

He would now ask Mr. Sankey to reply to the debate. (Applause.)

The PRESIDENT, in reply, said that, as time was getting short, he did not propose to deal individually with all the points raised. There had been many and most useful points brought out in that discussion. He, personally, had derived some most useful and interesting information from the debate. The reason why this matter was brought forward was really on account of the impossible position in which they found themselves in the Transvaal. They, in Johannesburg, had a Provincial Ordinance authorising them to license wiremen and, when, after two or three years, they had applied to the Provincial Council to make certain amendments and improvements which they found necessary as a result of experience, they were faced with a reply to the effect that the Ordinance was entirely *ultra vires*, and the Provincial Council regretted, therefore, it could not make any alteration. (Laughter.) The result was, therefore, that they had been granted an Ordinance which had passed the Provincial Council, who, later on, told them it had passed something which, presumably, was not worth the paper it was written on. Therefore, no other municipality in the Transvaal could get these bye-laws. His Council thought very strongly that the bye-laws should either be dropped or made uniform right throughout the Union. He suggested the members of the Association should go into the matter carefully with their licensing boards, where such existed; if not, with their chairmen and councillors, and should then send in any suggestions in writing, for the alteration or improvement of the Bill. He took it that the general concensus of opinion of the meeting was that licensing should be carried on. The chief difficulty which seemed to arise, and which had been elucidated that morning, was the case of the smaller municipalities. That showed the great value of the discussion which had taken place. He, for one, had seen the points of view of the other people in a way he had never seen them before. They, of the smaller towns, had seen the point of view of those of the larger towns, too. He thought the suggestion to make this an enabling ordinance, and then possibly to just have licensing boards in the larger towns, would probably meet the difficulties of the smaller towns to a very large extent.

They were indebted very much, he thought, to the gentlemen who represented other than municipal

interests and who had come there at the cost of considerable valuable time to themselves and given them some most interesting viewpoints. (Applause.) He thought it would be a great benefit to the Association, in drafting the Bill and in carrying on in the future, to have on record the contributions which had been made by these gentlemen. He thought that was all he need say. He would like to thank Councillor Clark for the very kind way in which he had referred to the visit, and also the other councillors who spoke.

The PRESIDENT (Mr. Sankey) then resumed the chair.

GENERAL BUSINESS.

The PRESIDENT pointed out that this would be the last meeting of the Convention, and asked whether there were any matters any members or delegates would like to bring forward for discussion.

Height of Telephone Poles.

Mr. BROWN (Middelburg, Transvaal) said a new trunk telephone cable was being brought through his town necessitating the putting up of a 4ft. 6in. bracket on top of a roof to just clear the telephone wires. The Telephone Department told him that there was no limit to the height at which telephone poles could be put. In small towns, this was a great inconvenience, and he would like to know if the Association could do something in the matter.

Mr. SIEBERT (Uitenhage) endorsed what Mr. Brown had said. He also had experienced the same trouble.

The PRESIDENT remarked that the Telephone and Post Office Departments were working under the Post Office and Shipping Combinations Discouragement Act of 1911, which gave them power to do almost anything they pleased.

Mr. POOLE (Durban) stated that in his town they worked under the Mines and Machinery Regulations as far as practicable, and this practically covered the Post Office Regulations, which laid down that crossings must be above the telegraph lines, and must be guarded. To him, there seemed to be little alternative.

The PRESIDENT remarked that apparently in many towns the electric light wires were not run at the minimum height. If that were the case, they simply had to move them to suit requirements.

Mr. SWINGLER (Capetown) said their experience in Capetown was that the essential requirement

was that they complied with the Mines and Works Act, and his view was that if the conductors were installed prior to the Post Office Act coming into force it was up to the Post Office authorities to pay the cost of any alteration they might now require.

Mr. RALSTON (Dundee) said that in his town the plant was installed in 1902. He believed the Act stated that in the case of any installation put in after 1911, alterations must conform with the requirements of the Act. In every case they were forced to put in a pole to meet these requirements. In one case, the Telephone Department ran a trunk line up the main portion of the town, crossing the municipal lines, which they asked him to lower. After he had lowered the lines, they came along and asked him to raise them.

Concreting of Poles.

Mr. SIEBERT (Uitenhage) remarked that he noticed several of the municipalities at the coast experienced trouble through their poles corroding at their bases, owing to their friends the dogs. He was wondering if any of the engineers would drop him a line as to their experiences, and any means and ways they might have adopted for dealing with the matter. What he had done to some of their poles was to concrete their bases. In connection with the cleaning of the poles before the concrete base was put round, he found that if the pole was thoroughly cleaned and then given a coating of strong washing soda solution and left over-night, on applying a steel brush the following day quite a lot of pitted holes were discovered which could not be detected if the washing soda had not been applied. He found from some actual tests that, if the concrete was put round after the first cleaning and the pole was not treated with washing soda solution, corrosion would still continue under the cement and ultimately work its way through the pole.

Standardisation of Pressure of Supplies.

The PRESIDENT thought that, before the Convention broke up, they should deal with the question of Standardisation of Pressure of Supplies, as referred to in the Presidential Address. He thought they should consider the desirability of some sort of committee being formed, or that they should make a formal offer to the Commission to assist them in any way they thought desirable in bringing about standardisation. He rather felt that an important point like

this, having in view the leading part their Association had taken on the standardisation question in every direction, should not be allowed to pass without some resolution being passed, or a communication, authorised by the meeting, being sent to the Commission. He would like to know if members had any suggestion to put forward on this matter.

Mr. SWINGLER (Capetown) asked whether members did not think that the S.A. Branch of the British Engineering Standards Association (on which their President was their representative) would be the proper body to offer their services to the Commission in this matter. The Association of Municipal Electrical Engineers was the most representative body of those affected, and he had no doubt that they would also be of some service to the responsible body handling the matter.

It was obvious that something required to be done to try to bring existing undertakings into line with the recommendations, and he suggested that the Provincial Councils might be asked to assist those municipalities concerned. He pointed out, as a matter of interest, that in Canada one-half of the cost of providing a supply in the rural districts was borne by the Government, and he thought that the municipalities should make representations on the same lines to the Provincial Councils in connection with the standardisation of pressures of supply. His remarks referred only to the existing undertakings, for the Control Board would doubtless see that all new undertakings were installed in accordance with the standardised system.

The PRESIDENT, in reply to Mr. Swingler, said it was not a question of fixing any standards, such as was the duty of the British Engineering Standards Association; but rather the position was that the Engineering Standards Association, in conjunction with other bodies, had already fixed and legally declared the standard to be adopted. The question now was the putting of that into effect. Their Association, as representing the majority of undertakings, was the biggest body concerned in that, and he thought it would be sufficient if that meeting authorised the Secretary to convey an offer to the Commission, placing the Association's services and organisation at their disposal for any steps they might wish to take. It appeared to him that the Commission were the fathers of electrical progress in the Union to-day and were the people to take the first steps and to call together

any bodies who, in their opinion, should be concerned in it. If they placed their services and organisation at the disposal of the Commission they would be doing all they could do in the matter.

Mr. MORDY LAMBE (East London) agreed with the President because, at the last Convention, at Durban, at the request of the Electricity Commission, they had discussed the matter of standard pressure. The Commission had seen fit to adopt the standards then recommended, and he thought it would be fitting that the Association should offer to co-operate in any possible way, and more particularly be prepared to discuss ways and means to bring about standardisation in existing undertakings.

Mr. SWINGLER (Capetown) pointed out that the Commission could deal with municipalities only through their Provincial Councils, as the Commission advised the Administrator, and not municipalities, on all matters affecting the Municipal Electricity Undertakings.

The Commission seemed to be the best "Union" body to which to offer their services.

Mr. MORDY LAMBE (East London) said he looked to the Commission to advise the respective Provincial authorities as to the attitude they might take up with regard to this matter. He, therefore, moved in the direction suggested by the President, that they (the Association) offer their co-operation to the Commission.

This was unanimously agreed to.

Next Convention.

Mr. POOLE (Durban) said he would like to suggest that at the next Convention they might perhaps arrange to circularise papers well in advance, so that they could start straight away with the discussion. He felt that a great deal more help was gained from discussion of the paper than from the mere reading of it. Papers might be read in the abstract.

Mr. MORDY LAMBE (East London) agreed with the suggestion made by Mr. Poole, but, of course, whether this could be done would largely depend upon the contributors of papers letting him have their drafts in time.

Councillor PATON (Kroonstad) said there was one point he would like to bring to the notice of the meeting—that was, in arranging for the Convention next year, he would like them, as far as possible, to get away from April. This month, councillors were elected, on the 1st April—Fools Day. (Laughter.)

The week after that they were going into the Estimates, and it was rather awkward for councillors in the Free State to get away to the Convention. He suggested the Committee take this into consideration when arranging the next Convention.

Mr. BROWN (Middelburg, Transvaal) said that he thought the majority of the Transvaal Engineers would like, if possible, to have the next Convention after the stormy season was over.

Councillor LOW (Capetown) said he would consider himself remiss if he, as one of the delegates, did not thank the Association for the cordiality of the reception which they had had at their hands. They sincerely thanked them for the lavishness of the hospitality they had bestowed on them.

The PRESIDENT said he would like to thank all members and councillor delegates for their attendance there that week. It had been a great pleasure to him to see what a very large number had attended. When one set out to make the organisation and preparations that were necessary for one of those weeks, one always felt a little bit anxious as to whether their preparations would be followed by a good attendance. He might say, so far as records went, that appeared to be the best attended Convention they had yet had, and he sincerely hoped they would beat the present record when they went to East London next year. He might also say it had been a great pleasure to him to take part in those proceedings that week, and he hoped that, when they finished that night, they would feel they had had a strenuous and an instructive week, and that the social side had not been altogether forgotten. He did not want them to think it had been all social side. He believed they would agree they had had some quite hard work and had been able to obtain some useful and interesting information.

He would now conclude by just thanking them very much for their attendance, and he looked forward with pleasure to meeting all of them again at East London. He did not know whether the Vice-President was able to give them any indication as to the possible time of the year for the next Convention.

Mr. MORDY LAMBE (East London) replied he would rather not do that at the moment, because he wanted to give regard to the representations made by the Free State and Transvaal members of the Association. What he would do was to intimate to the Association as early as possible what date he proposed.

Luncheon.

The members and delegates were then conveyed by motor car to the Automobile Club, where they had lunch, being the guests of Mr. H. Reynolds, the President of the Club.

VISIT.

In the afternoon, a visit was paid to the Rosher-ville Power Station, of the Victoria Falls and Transvaal Power Co., Ltd.

At the conclusion of the inspection, and whilst members and Delegates were being served with refreshments,

Mr. BERNARD PRICE, O.B.E. (Power Supply Manager and Chief Engineer, V.F. & T.P. Co., Ltd.), gave the following address:—

Mr. President and Gentlemen,—It is with much pleasure that I extend a very hearty welcome to the Association of Municipal Electrical Engineers, on its second visit to Rosherville. I think I am right in saying that your first visit was in 1915, the first year of your Association's history. Much has happened since then. We first had to cope with the problems of the war period followed by the no less difficult problems of the post-war period, which led up to the strike and revolution of 1922. That revolution, as you probably all know, entirely altered the position on the Rand and the economic position of the industry on which this Company directly depends. Whereas, immediately prior to the strike, everyone was pessimistic as to the future of the industry, we found that immediately the revolution was over we were faced with heavy demands for additional power. Mines which had been working at a loss and anticipating a very short life were able to contemplate extensions and look forward to a considerable period of prosperity.

We, as a Power Company, therefore, found it necessary to consider extensions of our system, and we decided to go forward with the Witbank scheme. At that time the Electricity Act had recently been passed and this led to the establishment of the Electricity Supply Commission. Negotiations took place and ultimately we came to an agreement with the Commission which enabled us to go forward.

The station is being built by our Company, but is being purchased, as it is being built, by the Commission, and it will be owned by the Commission.

We shall operate the station for a period, at any rate, and we have undertaken to purchase the entire output of the station, other than the small portion which the Commission will itself require for supplying its consumers in the Witbank area.

As a result of the growth in the Power Company's business and the improvements which are continually being effected, including the inherent benefits of the Witbank scheme, we were able some little while ago to revise and renew our agreements, not only with the Mining Groups, but with all our other consumers, and, in doing this, we found it possible to grant, amongst others, two very important and valuable concessions. In the first place we have reduced our prices right through the business by no less than 15 per cent., as from the beginning of 1923, and we have promised a further cut of $2\frac{1}{2}$ per cent., as from the date when the Witbank Station is fully running, thus bringing the total discount up to the striking figure of $17\frac{1}{2}$ per cent. This is a permanent and definite reduction in all our tariffs, and I can assure you the pleasure we have experienced in being able to grant this reduction has been no less sincere than the pleasure which I know our consumers have experienced in receiving it.

In the second place, we have agreed that each individual consumer (excepting the very small ones whose accounts are less than £60 per annum) shall participate *pro rata* with his consumption of energy in a half-share of any surplus revenue we may earn over and above that necessary for meeting our production costs and for providing a fair return on the capital invested in the business. This means that our consumers, whether mining groups, industrial undertakings or municipalities, are equally interested with ourselves in every benefit which may accrue, whether due to expansion of output or improvements of any kind. When we agreed to give the permanent reduction of $17\frac{1}{2}$ per cent. in our prices, we estimated that the cut would absorb all surplus revenue and leave no appreciable balance for division with our consumers, but I am glad to be able to state that already an annual balance is beginning to accumulate, and that unless the mining industry suffers another set-back we can look with confidence to a further small, but nevertheless acceptable reduction, in the net cost of energy to our consumers.

Now, the delay of more than a year occasioned by all these negotiations and arrangements resulted in our having to face a very critical period. We estimated that for about nine months we should have to run without any spare plant. In the end we decided on the somewhat bold policy of rushing into service a new machine to ease over that period of stress. This was the English Electric Company's 3,000 r.p.m. machine which you have seen to-day installed between the large and small compressors at this station. Not very long after getting that machine into service, we experienced the serious accident at Vereeniging which resulted in our losing our most precious spare machine. The installation of the E.E.C. machine saved the situation for us, but the accident left us to carry on for four or five months without spare of any kind. I think you will agree that it reflects the very greatest credit on the departments concerned that we have so far been able to run through since Christmas without any spare whatever and without reducing the supply to our consumers. It says a very great deal not only for our plant but also for those who look after it. (Hear, hear.) It means that we are calling on fourteen large and eight small machines, or twenty-two in all, to be regularly available for service during five to six hours each day of the week, excepting Sundays.

It may interest you to know that when Witbank is running the system will comprise five generating stations with 400,000 h.p. of plant installed, feeding about 100 sub-stations. The load is characteristically one of high load factor—well over 70 per cent. The air supply is quite unique. On the peak 500 tons per hour of compressed air are distributed, and 5,000 tons are distributed at a pressure of 110 to 120 lbs. during each day of 24 hours.

Including the supply of air, our total units sold are well over 1,000,000,000 per annum, and the maximum demand of the system is more than 200,000 k.w. The scheme is the largest of its kind in the British Empire. The mining groups receive power at a price which, after Witbank is running, will be just under .45d. per unit, and you will agree that this is a very low price.

It may be of interest to you if I add a few remarks with regard to bulk supplies to municipalities. I might say that in our business such supplies are very small in relative size. Mining takes over 96 per cent., industries a little under 3 per cent. and bulk supplies

to municipalities about $\frac{3}{4}$ per cent. of our total output; nevertheless, we appreciate that these bulk supplies are of special importance. In the aggregate they represent a load of about 3,000 k.w. and a consumption of about eight million units per annum.

With one important, though regrettable exception (it is, indeed, in some ways a pathetic exception) we furnish a supply in bulk to all the eight municipalities in the Witwatersrand district, and in the near future a similar supply will be given to the Municipality of Heidelberg. In the case of Germiston, which is second only to Johannesburg in size and importance, we distribute the energy to the individual consumer at prices which compare very favourably with those obtaining elsewhere in the Union. The domestic lighting consumer in Germiston has for some years obtained his energy at 4d. per unit, and the tariffs offered for heating and cooking, and for power, enable the consumer to obtain energy for 1½d. per unit after an initial fixed minimum quantity has been taken. For the larger and exceptional supplies the rates are, of course, still lower.

In regard to the other seven municipalities, all of whom themselves distribute the bulk supply to their consumers, I should like to take this opportunity of congratulating the several municipal councils and their technical officials upon the enterprising manner in which they are developing the use of electricity within their areas and the very satisfactory progress they are making. We follow with interest the growth of loading in these municipal areas, and the reductions which the municipalities are able to make from time to time in the rates of charge to their consumers.

You will realise that as these various municipal areas fall within the Power Company's area of supply, we (in terms of the Electricity Act) remain under compulsion to supply (when called upon to do so) any consumer within such municipal areas who requires 50 k.w. or over. It is not, however, our desire to compete with the municipalities within their areas, and a general understanding exists with each municipal council that the Power Company will give the council every opportunity of coming to terms with the consumer before negotiations take place between the consumer and the Power Company. Having in view the low rates at which energy is being supplied by the various municipalities, it becomes increasingly

unlikely that any consumer situated within touch of the municipal mains would benefit by approaching the Power Company for a direct supply.

In conclusion, allow me to congratulate you upon the growth of your Association and the good work it has achieved. All of us, whether we happen to be in the employ of public undertakings or of private enterprise, have, as engineers, one common ideal, namely, to serve the public to the best of our ability. As engineers, we eschew politics, and although your Association may not at all times be able to entirely forget that it represents public enterprise, I feel sure it will keep in view the primary object which we, as engineers, have at heart, and which is to supply the electrical needs of the country in the cheapest and most efficient manner.

We thank you, Mr. President and gentlemen, for honouring us with your presence here to-day, and we trust you will have found the visit both interesting and instructive.

The President, and also some of the Councillor delegates, thanked Mr. Price and his staff for their kindness in arranging the inspection and showing them over the Power Station, and also for their hospitality.

ASSOCIATION OF
Municipal Electrical Engineers
(UNION OF SOUTH AFRICA AND RHODESIA.)

**MEMBERSHIP LIST AS AT APRIL
16th, 1926.**

MEMBERS:

- ASHLEY, T. P., Queenstown.
BICKELL, L. F., Port Elizabeth (*Member of Council*).
BLATCHFORD, W. H., Greytown.
BROWN, G. C., Middelburg (Transvaal).
CHALMERS, A. S., George.
COULTHARD, R. D., Oudtshoorn.
DAVISON, J. G., Mafeking.
DADSWELL, P. W., Cradoek.
DOD, T. C. WOLLEY, Pretoria (*Member of Council*).
DOUGLAS, W., Ermelo.
EASTMAN, H. A., Capetown.
FLETCHER, R. W., Krugersdorp.
HAMLIN, E. J., Stellenbosch.
HORRELL, L. L., Pretoria.
JAGGER, T., Ladysmith.
KERSTEN, P. G., Windhoek.
LARTER, R. D., Standerton.
LAMBE, J. MORDY, East London (*Vice-President*).
MACAULAY, R., Bloemfontein.
MAIL, W. M., Kokstad.
MANN, F. C. D., Worcester.
MARCHAND, B., Paarl.
McCOMB, C. W., Springs.
McDONOUGH, M., Bethlehem.
MILLAR, T., Harrismith (*Member of Council*).
MORRIS, R., Roodepoort.
MULLER, H. M. S., Beaufort West.

MUNRO, A. S., Pietermaritzburg.
NEWCOMBE, P. H., Indwe.
POOLE, E., Durban (*Member of Council*).
PREVOST, H. A., Somerset East.
RALSTON, L., Dundee.
ROBERTS, J., Durban (*Past President*).
RODWELL, A. T., Johannesburg.
ROSS, W. D., Potchefstroom.
ROYLE, R., Rustenburg.
SANKEY, B., Johannesburg (*President*).
SIEBERT, T. F., Uitenhage.
SMITH, J. T., Durban.
SPARKS, L. B., Pietersburg.
STOKER, R. A., Kroonstad.
STOKES, F. T., Johannesburg.
SUTCLIFFE, T., Benoni.
SWINGLER, G. H., Capetown (*Past President*).
TURNER, C. K., Kimberley.
VOWLES, J., Kingwilliamstown.
YOUNGER, J., Vryheid.

ASSOCIATE MEMBERS:

CASTLE, F., Capetown.
DOBSON, J. H., Johannesburg.
HODGE, W. A., Standerton.
PRICE, E. T., Johannesburg.
PROCTOR, L. B., Johannesburg.
SARGENT, B. H., Vryheid.
STEWART, G. A., Johannesburg.

HON. SECRETARY AND TREASURER:

R. G. TRESISE, P.O. Box 699, Johannesburg.

