PROCEEDINGS

of the

Ninth Convention

of the

Association of Municipal Electrical Engineers

(Union of South Africa and Rhodesia).

HELD AT BLOEMFONTEIN

From Monday, November 11th to Friday, November 15th,

1929.

Price Five Shillings.

Hayne & Gibson, Printers, Durban.

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Association of Municipal Electrical Engineers.

(Union of South Africa and Rhodesia)

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ASSOCIATION OF

Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA).
Founded 1915.

EXECUTIVE COUNCIL, 1929.

President :

R. MACAULAY (Bloemfontein).

Vice-President :

L. L. HORRELL (Pretoria).

Past Presidents :

JOHN ROBERTS (Durban).
B. SANKEY (Johannesburg).

Other Members :

L. F. BICKELL (Port Elizabeth).
T. MILLAR (Harrismith).
F. C. D. MANN (Worcester).
G. H. SWINGLER (Cape Town).

Hon. Secretary and Treasurer :

E. POOLE, Assistant Borough Electrical Engineer,
Box 147,
Durban.

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 who 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 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 of 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 readings 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 Hororary Treasurer shall be responsible for the funds of the Association, and shall present a Balance Sheet at the Annual Congress.

NINTH CONVENTION

BLOEMFONTEIN.

PROGRAMME OF PROCEEDINGS.

Monday 11th November, 1929.

9.0 a.m.—Council Meeting in Wesleyan Church Hall, Charles Street.

10.0 a.m.—Registration, issue of Programmes, etc.,

10.30 a.m.—Opening of Convention in Wesleyan Church Hall by His Worship the Mayor of Bloemfontein (Councillor Sol. Harris, Esq.)

10.45 a.m.—Annual General Meeting. (Municipal Delegates may attend this Meeting, but only Members are entitled to vote).

Agenda.

1. Annual Report of Hororary Secretary and Treasurer.
2. Election of President.
3. Valedictory Address by the Retiring President.
4. Election of Hororary Secretary and Treasurer and Officers.

   The following are the retiring Officers and Council, who are eligible for re-election by nomination and ballot to hold office until the next Convention.

   President : J. Mordy Lambe (East London).
   Vice-President : R. Macauley (Bloemfontein).
   Past-Presidents : John Roberts (Durban), B. Sankey (Johannesburg).
   Other Members : L. F. Bickell (Port Elizabeth), T. Millar (Harrismith), E. Poole (Durban). (*Vacant*)
   Acting Honorary Secretary and Treasurer :E. Poole (Durban).
5. Place of Meeting of next Convention.
6. 11 a.m. Armistice Celebration at Cenetoph.
7. 11.15 a.m. Reassemble Wesleyan Church Hall.
8. Presidential Address.

Tuesday, 12th November, 1929.

9.0 a.m.—Council Meeting, Wesleyan Church Hall.

10.0 a.m.—Paper by Dr. van der Bijl (Electricity Supply Commission) on **"Suggestions for a South African Development Association."**

Discussion on Dr. van der Bijl's paper.

11.0 a.m.—Paper by Mr. John Roberts (Durban), on **"Statistics of Durban's Domestic Development."**

Discussion on Mr. J. Robert's paper.

1.15 a.m.—Civic Luncheon, Polley's Hotel.

2.45 p.m.—Official photograph at Municipal Power Station.

3.0 p.m.—Inspection of Power Station.

Delegates will be conveyed to the Power Station by special buses leaving Polley's Hotel at the conclusion of the Luncheon.

8.0 p.m.—Visit to the "Lamont-Hussey" Michigan University, U.S.A., Observatory, by kind permission of Prof. R. A. Rossiter.

Delegates will be conveyed to the Observatory by special buses leaving headquarters Hotel at 7.45 p.m.

Wednesday, 13th November, 1929.

10.0 a.m.—Paper by Messrs. Sankey and Horrell (Johannesburg and Pretoria) on—

"Some Notes on Supply Tariffs and Metering Problems."

Discussion on Messrs. Sankey and Horrell's paper.

8.0 p.m.—Swimming Gala and Gymkhana at Municipal Baths, given by the "Otter's" Swimming Club.

Delegates will be conveyed to the Swimming Baths by special buses leaving headquarters Hotel at 7.45 p.m.

Thursday, 14th November, 1929.

10.0 a.m.—Paper by Mr. J. T. Smith (Durban) on **"Boilers."**
Discussion on Mr. Smith's Paper.

2.0 p.m.—Visit to Mazelspoort Waterworks and inspection of Harvard University, U.S.A., Observatory, by kind permission of Dr. J. S. Paraskevopoulos.
Short address on **"Progress of Astronomy,"** by Dr. J. S. Paraskevopoulos.
Delegates will be conveyed to Mazelspoort by special buses leaving headquarters Hotel promptly at 2 p.m.

Friday, 15th November, 1929.

10.0 a.m.—Paper by Mr. G. A. Swingler (Capetown), on **"Meter Service Equipment."**
Discussion on Mr. Swingler's paper.
Miscellaneous. Conclusion of Business.

2.30 p.m.—Motor Tour of Bloemfontein and District, concluding with visit to Zoological Gardens.
Delegates will be conveyed by special buses leaving headquarters Hotel at 2.30 p.m.

Programme subject to modification.

HONORARY MEMBERSHIPS.

The President and Members of the Bloemfontein and Ramblers Clubs extend to Delegates attending the Convention all privileges of Membership during their stay at Bloemfontein.

PROCEEDINGS

OF THE

NINTH CONVENTION

MONDAY, 11th NOVEMBER, 1929.

INTRODUCTORY.

The Ninth Annual Convention of the Association of Municipal Electrical Engineers (Union of South Africa and Rhodesia) was opened in the Wesleyan Church Hall, Charles Street, Bloemfontein, at 10.30 a.m. on Monday, 11th November, 1929.

In the absence of the retiring President, Mr. R. Macauley, (President Elect, Bloemfontein) was in the chair. There were also present His Worship the Mayor of Bloemfontein, Sol. Harris, Esq., and the undermentioned :—

Members :— T. P. Ashley (Queenstown), W. H. Blatchford (Greytown), G. C. Brown (Vrede), L. F. Bickell (Port Elizabeth), R. D. Coulthard (Oudtshoorn), P. W. Dadswell (Cradock), W. H. Eastman (Cape Town), R. W. Fletcher (Krugersdorp), A. Hadfield (Gwelo), A. Q. Harvey (Middleburg, -Cape), L. L. Horrell (Pretoria), J. Hooper (Robertson), J. Iverach (Grahamstown) S. Lewis (Aliwal North), H. A. Morris (Kimberley), F. C. D. Mann (Worcester), W. M. Mail (Kokstad), T. Millar (Harrismith), P. H. Newcombe (Alice). E. Poole (Durban), L. Ralston (Dundee), J. H. Rogers (Fort Beaufort), T. Sutcliffe (Benoni), F. Simpson (Colesburg), L. B. Sparks (Pietersburg).

Associate Member :— F. Castle (Cape Town).

Councillor Delegates :— W. C. Adcock (Port Elizabeth), J. Blaker (J. H. Burg),, A. L. Clark (Durban), T. Ericsen (Kimberley), P. R. O'Hallorn (Krugersdorp), P. de K. van Heerden (Cradock), A. Withinshaw (Cape Town).

Visitors :— I. J. Allen (Petrus Steyn), T. C. Bezuidenhout (S.A.R.: Bloemfontein), J. S. Butchart (S.A.R.: J. H. Burg), J. B. Bullock ("S.A. Engineer" J. H. Burg), J. Hogg (S.A.R.: Bloemfontein), H. A. Mellor (Elec. Dept. Bloemfontein), E. T. Oates (Elec. Dept.: J. H. Burg), E. V. Perrow (I.E.E. : J. H. Burg).

CIVIC WELCOME.

His Worship the Mayor of Bloemfontein, (Councillor Sol Harris) : It is a very great pleasure to me to open your conference to-day, because it is the first time I have been honoured by being allowed to be present at a conference of such men of mystery, as most of us consider Electrical Engineers to be.

I do not propose to start telling you about K.V.A's M.L.A's., Macaulays, or any other mysterious signs connected with electricity, because I might give you that shock, which it is the aim of electrical engineers to avoid. It is indeed a relief for me to find that you are all apparently ordinary human beings, as one would rather expect, after seeing the weird things that you do with that intangible, elusive and unknown quantity which you call "juice,"— that you would be garbed in the three-cornered hat and long falling robes of the wizard.

One obtains a further sense of pleasure at opening a conference of electrical engineers, because we are all pleased to be associated with success, and I cannot remember having as yet heard of any electric lighting scheme that was not a success, both from a practical and financial point of view. Of course, the varying opinion that all electric lighting schemes are satisfactory beyond criticism may be due to the fact that the humble ratepayer, and, still more, the humble town councillor, is not in a position to criticise highly scientific men like yourselves, in the way they can criticise a roads engineer or a sanitary inspector, if his eyes and nostrils are functioning satisfactorily.

I must say that, judging from Bloemfontein's experience, electrical engineers are to be envied, because their departments seem never to stop expanding.

Ever since electric energy was safely harnessed, it has been the handmaiden of industry, and, to-day, it is more and more becoming the handmaiden of the housewife. We shall all see to-night, the amazing uses to which electricity can be put and the advertiser of electrical appliances has little difficulty in increasing his sales to-day, for the goods practically sell themselves.

Whilst, it is not altogether easy to visualise a world of glass houses, to which I referred at the recent Builders' Conference here, it is quite easy to visualise a world of electrically-served houses, in which every form of menial work and domestic service is met by electricity. The day is not far distant, I am sure, when the housewife, instead of grumbling that women's work is never done, will be able to say that women's work is too quickly done. The appeal for the use of electricity in the home is general, and I have no doubt that this conference, and the exhibition of appliances which accompanies it, will be followed with keener interest by the housewife of the town, than by anybody else. You have only to state your case simply to find a sympathetic audience. You must, of course, be careful how you put your case to the housewife, and not follow the example of an enthusiastic suction cleaner dealer, who, in urging the housewife to go in for his very effective form of electrical equipment, advertisers - "Don't kill your wives; let us do your dirty work."

I believe we have the last word in generating plant, and it is, therefore, no pious wish when I say that your deliberations will be fruitful of much advancement in South African electrical practice, and your visit to Bloemfontein will not only be a happy one from the social point of view, but also an educative one.

May I again say that it gives me, on behalf of the Town Council and citizens of Bloemfontein, very great pleasure in welcoming you here to-day. I now have pleasure in declaring the conference open.

Mr. L. L. Horrell (Pretoria) : Mr. Mayor and members of the Bloemfontein Town Council, on behalf of the Association of Municipal Electrical Engineers, I have very great pleasure in thanking you for your cordial welcome.

We are well aware that it is impossible for us to perform our duties efficiently and satisfactorily unless we enjoy the full confidence of our respective councils and our thanks are due to them for allowing us to attend this conference.

We hear that even to-day there are some Town Councils who object to their engineers attending these meetings. I feel sure that if they sent a Councillor delegate to see for themselves the useful work that is done and the advantages gained by engineers and Councillors alike discussing their differences together, not only in the Council Chamber but outside, they would welcome the opportunity of sending both a Councillor delegate and Engineer each year.

Mr. A. L. Clark (Deputy-Mayor of Durban) : Mr. Chairman, Mr. Mayor, and Gentlemen, as a Town Council delegate and, I may say as a representative of the premier electrical city of the Union (hear hear) I have very great pleasure in welcoming you, Mr. Mayor, and the other Town Councillors of Bloemfontein and elsewhere, to our convention and to thank you and the Bloemfontein Council for the welcome to us to your City. At the same time, I am sorry to see so few members of Town Councils here. I don't know why the Councils do not send more of their representatives to these Conventions. They could help us very considerably by doing so and would, themselves, receive much benefit. I sincerely hope that, in future, we will see very many more representatives of the Municipalities from all parts of the Country present at these Conventions.

I would like to say, Sir, how delighted I am to see Bloemfontein again, and how pleased I am to see the progress the City has made. I was here some time ago and, now, on my return, I am greatly suprised at the improvements and developments on all sides. Fine buildings have gone up and the whole town has a very neat and attractive appearance. Bloemfontein is, indeed, a very fine, up-to-date, and clean town, and I must congratulate the City and Town Council on the very excellent improvement.

ANNUAL GENERAL MEETING.

The Mayor having retired, the Convention proceeded to the business of the Annual General Meeting.

Confirmation of Minutes.

The Minutes of the proceedings of the last Annual General Meeting held at East London, on September 12th. 1927, were taken as read, and confirmed by the Chairman.

Apologies-:

The Chairman said he had received apologies from the undermentioned members and delegates who were, unfortunately, not able to attend :— Messrs. C. Baskerville (Salisbury), A. S. Chalmers (Vryheid), A. Clark (Mech. Engineer, S.A.R.), W. Dance (Humansdorp), G. Dekenah (Senekal), J. G. Davison (Beaufort West), H. L. Groom (Roodepoort-Maraisburg), J. Mordy Lambe (East London), W. C. Lindeman (Asst. Inspector of Machinery, O.F.S.), T. M. Mocke (Dordrecht), I. J. Nicholas (Umtata), J. O. Pentz (Frankfort), A. T. Rodwell (Johannesburg), B. Sankey (Johannesburg), J. T. Smith (Durban), T. F. Siebert (Uitenhage), T. Stanton (Inspector of Machinery, O.F.S.), G. A. Stewart (Johannesburg), F. E. Syers (Umtali), the Mayor of Harrismith and Chairman of the Electricity Committee, and the President of the S.A.I.E.E. who was being re-

presented by Mr. Vivian Perrow instead. Mr. John Roberts (Durban) and Dr. H. G. van der Byl had intimated that they would arrive later during the day.

Votes of Condolence :

The Chairman : It is with much regret that I have to state that since your last meeting, three of our members have passed away, namely—

Mr. W. Douglas of Ermelo,
Mr. M. McDonough of Bethlehem, and
Mr. R. A. Young of Bulawayo. Mr. Young was also a member of the Council.

Votes of condolence were passed to the relatives of the deceased, the members and visitors present standing up in silence, at the request of the Chairman, as a mark of respect.

Mr. T. Millar (Harrismith) : Mr. Chairman, on behalf of the Association, I extend to you our sincere sympathy in your recent sad bereavement, in the loss of your wife.

All present again stood in silence, and were thanked by the Chairman for their expression of sympathy.

New Members :

The Chairman announced that, since the last Convention the Council had elected the following new members, under the Rules of the Association :—

G. Dekenah (Senekal)
J. H. Gyles (Durban).
A. W. K. Hadfield (Gwelo).
J. Hooper (Robertson).
W. Houreld (Randfontein).
A. R. Metelerkamp (Uitenhage).
T. M. Mocke (Dordrecht).
J. H. Rogers (Fort Beaufort).
E. F. Smith (Mossel Bay)

The Chairman : I extend to those of you who are present here a very sincere welcome to the Convention and am pleased to give you the benefit of voting as members of the Association.

REPORT AND BALANCE SHEET OF -THE ACTING HONORARY SECRETARY AND TREASURER.

Mr. E. Poole (Acting Honorary Secretary and Treasurer) then read the following report and submitted the balance sheet for consideration by the members.

Mr. President and Gentlemen,

In submitting the usual report and balance sheet of this Association, I would first of all state that owing to the resignation in August last of the Honorary Secretary and Treasurer you elected at East London (Mr. P. Adkins) I offered to to take over those duties on the invitation of your Council and so carry on the work of the Association and make arrangements for this already overdue Convention.

I have pleasure in stating that the membership of our Association since we last met at East London in 1927 is as follows : —

Members	..	57
Associate Members	..	7
Honorary Members	..	1
		65

During the period under review our Council has lost one of its members through the death of Mr. R. A. Young, of Bulawayo, but no steps were taken to fill this vacancy owing to the impending election of a new Council at this Convention.

Our membership has also been depleted through the death of Mr. McDonough, of Bethlehem, (a foundation member of this Association), and also Mr. W. Douglas, of Ermelo, and through the retirement from Municipal Service of Mr. Wooley Dod, of Pretoria, while Messrs. Clemo (Alice) and Spang (Brandfort) have resigned and so must, I presume, has Mr. Younger (Vryheid), in addition to which the following Associate Members have resigned, i.e., Messrs B. A. Sargent and R. J. Morris.

No new members have been added during the period, but certain applications will come forward for consideration at this Convention by which it is hoped the losses will be made good.

The Balance Sheet shews the financial position of the Association to be in a very satisfactory position with an accumulated fund to our credit of £159 17s. 2d., or an advance of £22 5s. 4d. since our last Convention.

It will be observed that there is no revenue from advertisements, which were apparently overlooked and very little from the sales of proceedings. The printing of our Proceedings is our heaviest item of expenditure and I feel I must stress the point of the lack of sales in the hope that members will endeavour to encourage the purchase of copies by their respective Councils, as the information contained therein is of great interest to those public bodies responsible for their Electrical undertakings.

There are five subscriptions outstanding amounting to £8 8s. 0d. which arrears it will be necessary to consider, one subscription being due by a deceased member and no response has been received from two other members and one Associate Member, and one other Associate Member has long since resigned.

I take this opportunity of acknowledging my appreciation of the honour of being asked to take over the reins of office for the brief period referred to and to note with pleasure the growth of the Association since I last held office.

I am, Mr. President and Gentlemen,

Your faithfully,

E. POOLE,

Acting Honorary Secretary and Treasurer.

REVENUE AND EXPENDITURE ACCOUNT FOR THE PERIOD 20th AUGUST, 1927, TO 10th OCTOBER, 1929.

Expenditure.	£	s.	d.	Revenue.	£	s.	d.
To Printing of Proceedings ..	60	11	3	By Subcriptions	142	12	3
„ Photographs	27	11	10	„ Fees for Statistical Tables ..	42	0	3
„ Stationery & Printing ..	13	7	0	„ Sales :—			
„ Reporting Proceedings ..	7	1	0	„ Photographs .. 24 3 6			
„ Clerical assistance	12	1	6	„ Proceedings .. 4 2 6			
„ Honorarium to Secretary ..	15	15	6	„ I.M.E.A. Reports 5 8 0			
„ I.M.E.A. Reports	5	19	7	„ „ Proceedings 9 0			
„ Railage	2	0	0		34	3	0
„ Bank Charges	2	12	9	„ Donations	2	2	0
„ Statistical Tables	20	0	0	„ Sundries		14	9
„ Postage and Petty Cash ..	32	6	6				
	£199	6	11				
„ Balance being excess of Revenue over Expenditure	22	5	4				
	£221	12	3		£221	12	3

BALANCE SHEET AS AT 10th OCTOBER, 1929.

Liabilities.	£ s. d.	£ s. d.	Assets.	£ s. d.
Sundry Creditors ..		9 10 10	Standard Bank	160 2 0
Accumulated Fund at 19th Aug., 1927	137 11 10		Sundry Debtors	9 6 0
Excess Revenue (current period)	22 5 4			
		159 17 2		
		£169 8 0		£169 8 0

I have examined the books of the Association as regards the latter portion of this period, together with the audited account covering the earlier portion of the period, and I 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 and audited statement.

(Signed) A. GRAHAM COOK,
Chartered Accountant (S.A.)
Honorary Auditor.

21st October, 1929.

Sale of Proceedings of Conventions :

Mr. E. Poole, (Durban) : In connection with my report, just read, there is one matter I would like to bring up. Our funds, as you are aware, are entirely dependent on subscriptions. Although, as you will see from the balance sheet, we are making a profit - £16 a year - we're not getting very fat on it. I think we all feel that we must augment our funds as far as we can, and one way is by the sale of proceedings. They are a great help to members, as well as to the Town Councils, and, by being purchased our own finances would be greatly benefited, and very naturally, I think, it would be a means of giving excellent publicity to our Association and show those, who don't know, just what we are doing. I would very much like members to assist the Association as much as possible, in this way.

Mr. R. W. Fletcher (Krugersdorp) : Mr. Chairman, the question is, could we not obtain the reports a little earlier. Last time I believe it was a matter of 18 months after the date of the Convention, before we received our copies.

The Secretary explained the difficulties in the past with changes in the position of secretaryships and assured the members that he would do his best to have the reports issued as early as possible on this occasion.

Mr. L. L. Horrell (Pretoria) : I would like to make the suggestion that, even before the proceedings are printed, we all make arrangements to order our copies, so that they can be sent out straightaway, when issued.

Councillor W. C. Adcock (Port Elizabeth) : Mr. Chairman, I notice on the agenda that only members of the Association are allowed to vote at the Convention, but I take it, that does not mean that others may not speak and submit suggestions. If this is so, I, as a representative of the Port Elizabeth Municipal Electrical Committee would like to add the suggestion to that of Mr. Horrell, that all Town Councils should see that the members of their Electrical Committees are

supplied with copies of the proceedings. It would be a great help and I intend to do what I can on my return, to see that each member of my Committee obtains one.

The Chairman : Mr. Adcock, I agree with you entirely that we should do our best to see that each Town Council obtains say a dozen of the reports. That's a matter of 5/- per copy and won't hurt any Municipality.

Arrear Subscriptions :

The Chairman : In connection with the Honorary Secretary's report, I am sorry to say that some members are in arrear with their subscriptions, and have not even troubled to reply to the Secretary's letters to them. I think they should be dropped from the Association altogether, if they show such a lack of interest. With your consent, the arrears will, of course also have to be written off.

Agreed *nem. con.*

Adoption of Honorary Secretary's Report and Balance Sheet :

On the motion of Mr. T. Sutcliffe (Benoni), seconded by Mr. W. H. Blatchford (Greytown) the Acting Hororary Secretary and Treasurer's Report and Balance Sheet was adopted, and a vote of thanks, moved by Mr. G. Chase Brown, accorded to the Secretary, Mr. E. Poole, for his work on the report.

Honorary Auditor :

On the motion of the Chairman, seconded by Mr. T. Sutcliffe (Benoni), a vote of thanks was passed to Mr. A. Graham Cook of Durban, who had audited the accounts and also to Mr. C. S. Freake, East London.

Gratuity to Typists : and the retired Secretary :

The Chairman stated that the Council had recommended the payment of honorariums of £5 5s. 0d. to Mr. Prescott Adkins, who had acted

as secretary up to three months ago, and of £2. 2s. each to the Durban and Bloemfontein typists respectively, for work done in connection with the Bloemfontein convention.

Approved.

Thanks to Ex-Secretary :

On the motion of the Chairman, seconded by Mr. W. H. Blatchford (Greytown), a vote of thanks was accorded to Mr. Prescott Adkins for his duties in connection with the secretaryship, which he had carried out until his resignation in August, 1929.

Election of President :

On the motion of Mr. L. F. Bickell (Port Elizabeth), seconded by Mr. T. Millar (Harrismith), Mr. R. Macaulay of Bloemfontein was unanimously elected President of the Association, there being no other nominations for the vacancy.

Mr. Macaulay (Bloemfontein) : Gentlemen, I certainly thank you for the honour. It is a job not at all in my line, but I'll do my utmost to please you all and to further the aims of the Association. I hope you will have a very successful session whilst in Bloemfontein, and, also, a very pleasant time in this City.

Mr. E. Vivian Perrow (S.A.I.E.E., Johannesburg) : Mr. President, I would like to take the opportunity, on behalf of the President of the S.A.I.E.E., who is unfortunately unable to attend this Conference, to extend his greetings and welcome, and also those of the S.A.I.E.E. to you, as the new President of the Municipal Engineers.

The President : Mr. Perrow, I thank you very much.

Armistice Celebration :

Gentlemen, before we proceed with any further business, I have been asked by the Town Clerk to state that, as this is Armistice Day, the Town Council are meeting at the Cenotaph for the usual two minutes' pause, at 11 o'clock. They

have asked whether we would join them in the ceremony. We won't be absent more than a quarter of an hour, or so.

The Convention then adjourned and the members proceeded to the Cenotaph on President Hoffman Square, where they joined the members of the Town Council in the Armistice Day ceremony.

The President laid a wreath at the foot of the Cenotaph on behalf of the Association.

On the Congress resuming after the ceremony,

Mr. T. Millar (Harrismith) read the following address in the absence of the Retiring President, Mr. J. Mordy Lambe :—

RETIRING PRESIDENT'S ADDRESS.

By **Mr. J. Mordy Lambe,** City Electrical Engineer & Tramways Manager, East London.

In relinquishing and handing over to my successor, Mr. R. Macaulay, the office of President of the Association, I do so with the sincere wish that under the Presidency of Mr. Macaulay the Association may prosper and increase its sphere of influence and usefulness, and so make up, as far as possible, for the effect of the sins of ommission which have been only too numerous since I took office at the last Convention of the Association held in East London in September 1927; sins of ommission which have been largely due to causes beyond my control, but for which nevertheless I must and do accept full responsibility.

It is also with feelings of real regret that, again due to causes beyond my control, I will be unable to personally hand over the reins of office to my successor to the Presidential Chair.

With very deep feelings of regret you will have learned of the death of Mr. R. A. Young, late Municipal Engineer of Bulawayo, and a Member of the Council of the Association, he having been elected thereto, as representing Rhodesia, at the East London Convention. I know that Mr. Young was looking forward very keenly to attending the forthcoming ninth Convention of the Association to be held at Bloemfontein on the 11th instant.

We also have to deplore the loss, through death, of a foundation member of the Association, Mr. M. McDonough of Bethleham, whose cheery presence at the Conventions of the Association will be very much missed by all.

In August 1929 the Honorary Secretary and Treasurer elected at the East London Convention, Mr. Prescott Adkins, found himself unable to continue in office and tendered to the Council his resignation, which was accepted. At the request of the Council, Mr. E. Poole, of Durban, very kindy undertook to carry out the duties of Honorary Secretary and Treasurer until the Convention to be held in Bloemfontein. Mr. Poole, who had previously held the combined offices for a number of years, has at all times done such sterling work for the Association that I feel sure every Member of the Association will fully realise the debt of gratitude which the Association owes to him for having undertaken to fill the gap at what bid fair to prove a critical juncture in the affairs of the Association.

At the East London Convention one of the most important subjects which came under discussion was that of Railway Rates for the carriage of coal for local use. Since the Convention a deputation representing municipalities and other firms and bodies being large consumers of coal, has waited upon the Minister of Railways, and very ably put the case for a reduction of the charges made by the Railways Administration for the carriage of coal for use within the Union and in connection with the representations made by the deputation the Association is greatly indebted to Mr. George Swingler of Cape Town.

I regret to say that the reply of the Administration, since received, is in terms which have now become almost stereotyped, viz :—"that the financial position of the Railways will not permit "of any substantial reductions being made."

It is understood, however, that the Government has recently appointed a Commission to examine and report upon Railway Freights, and this would appear to offer a good opportunity for the Association to again make representations in regard to the charges made for the carriage of coal.

Another important subject which has received the attention of the Association at every Convention held, is that of the Standardisation of Municipal Electricity Accounts, and it is with very great satisfaction that a substantial step forward can now be recorded.

As the result of the efforts of the Electricity Commission, a consultation has been held between the Commission and the four Provincial Authorities within the Union, the outcome of which was the adoption by the Commission and the several Provincial Authorities of a Standard Form of Accounts for Municipal Electricity Undertakings. The Form of Accounts approved has already been Gazetted in so far as the Cape Province is concerned, and compulsorily takes effect from the 1st January 1930. In recording this satisfactory culmination of the Association's prolonged efforts in this matter, I feel that it is only fair to mention the large amount of good work put in by Mr. E. Poole in this particular matter.

The preparation of the usual Statistical Tables for inclusion in the Official South African Municipal Year Book has, as for a number of years past, been undertaken by the Association. The extent to which these very valuable Tables are appreciated and made use of is becoming increasingly evident.

The matter of the Standardisation of Statistical Returns called for from time to time by the different Government Departments, etc., has also been under consideration, and it is hoped that a satisfactory conclusion in regard thereto will be reached at a comparatively early date.

The objects of the Association, in the words of the Constitution "are to promote the interests of Municipal Electrical Undertakings", and therefore all matters which tend to affect the welfare of such Undertakings, whether for weal or for woe, legitimately come within the purview of the Association. In this connection one cannot but note with considerable misgivings the number of cases in which, during the past two years, the treatment meted out to Municipal Electrical Engineers has been far from being conductive to the welfare of, or likely to promote the interests of, the Undertakings of which these Engineers have been or are still in charge.

As matters stand at present it does not appear to me that the Association has any locus standi in such matters, but having regard to the future welfare of the electricity supply industry, the subject is one of which the Association should take cognisance.

In conclusion may I express to the Vice-President, the Members of the Council and the Members of the Association my deep appreciation of the kindness and extreme consideration extended to me during my term of office.

The Honorary Secretary : Mr. President, I would like to move a vote of thanks to Mr. Mordy Lambe, for his retiring Presidential Address. I am sure we are all very sorry he is not able to be with us here to-day, but we can, I feel certain, be assured of continued support and assistance from him, as in the past. (Hear hear).

ELECTION OF VICE-PRESIDENT.

On the motion of Mr. T. Millar (Harrismith), seconded by Mr. L. F. Bickell (Port Elizabeth), Mr. L. L. Horrell of Pretoria was unanimously

elected to the vacancy of Vice-President of the Association, until the next Convention, there being no other nominations for the vacancy.

The President : Mr. Horrell, I have very great pleasure in congratulating you on your election to the seat of Vice-President of this Association. I hope we shall work well together and that you will give me a lot of assistance, as, I can assure you, I shall need it.

Mr. L. L. Horrell (Pretoria) : Mr. President and Gentlemen, I thank you for the honour you have done me in electing me Vice-President of this Association. Although I am one of the foundation members, I feel that as I have only recently been appointed Electrical Engineer to the Pretoria Municipality, I am of the younger set and that the cloak should have been placed on other shoulders.

I can assure you I much appreciate the confidence you have placed in me and I will do my best to live up to it.

I believe it is usual at this stage for the Chairman of my Committee to extend an invitation to the members to hold the next conference in the home town of the Vice-President; unfortunately Mr. Duxbury, the Chairman of the Electricity Committee, is unable to be present until the end of the week. I, however, feel very confident that when he arrives he will have great pleasure in asking you to come to Pretoria next year.

ELECTION OF COUNCIL.

The President : We are waiting for a telegram from Mr. Mordy Lambe to see whether he will accept nomination on the Council. A reply has not yet come and, if you'll agree, I think we can leave over the matter of the election of the remaining members of the Council until the morning.

Agreed.

ELECTION OF HONORARY SECRETARY AND TREASURER.

The President : The Council are of the opinion that it will cause too much trouble and inconvenience to appoint another secretary and the feeling is that a permanent one should be elected. Mr. Poole has very kindly come forward and offered his services, for which it is not necessary to say we are all very grateful, and I think we might ask him to continue in that office.

On the motion of Mr. T. Sutcliffe (Benoni), seconded by Mr. T. Millar (Harrismith), Mr. E. Poole of Durban was then unanimously elected Honorary Secretary and Treasurer of the Association.

The President : I take it for granted that you will all agree to Mr. Poole having some clerical assistance to relieve him when necessary.

Mr. L. L. Horrell (Pretoria) : I would like to support that suggestion. I think Mr. Poole a very fine fellow to come forward like this and help us out again. I think our grateful thanks are due to him.

Mr. E. Poole (Durban) : Mr. President and Gentlemen, I thank you for the honour and shall do my best to please you.

PRESIDENTIAL ADDRESS.

By **Mr. R. Macaulay**, City Electrical Engineer, Bloemfontein.

Gentlemen,

I thank you for the honour you have conferred upon me in electing me President of our Association, and whilst appreciating the honour I also fully appreciate the responsibilities attached to the office, and trust that your confidence in me may not be misplaced.

As Municipal Electrical Engineers, we are entrusted with the custody of one of the most essential services in modern towns, as electric energy is utilised by every section of the community, and it is our duty to see that this public service is given when and as required at the lowest possible cost to the user of electricity.

This ideal can only be attained by taking advantage of every method which will reduce generating and distributing costs, and it was with this aim in view that this Association was formed to convey to each other the benefit of our experience in generation and distribution.

My own experience of our Conventions has given me food for thought, and I have come away better fitted to handle the problems which continually confront the Electrical Engineer, feeling that I am not the only one with worries, and if I might say, do not stand alone in my shortcomings.

The uses to which electric energy is put today calls for a practically uninterrupted supply, as a complete shut down of the Power Station plant means the disorganisation of all industries in the town, and it is greatly to the credit of the manufacturers of steam raising, steam using, electrical generating and distributing plant, also in no small measure to the credit of those in the more immediate charge of that plant, that the public can rely upon the service to the extent they do.

Accidents do occur, interruptions do take place, but when looking back some 20 to 25 years, our present failures are very infrequent compared with the old pioneer days, and I have no doubt that many of the senior members of our profession, including myself, could relate without exaggeration, many large and frequent, "hair-raising" experiences of break-downs on the old systems.

Apart from reliability, the efficiency has been improved to such an extent that Stations with only a medium output can sell current at the price which makes the use of electricity for practically any purpose a feasible proposition.

With the lowering of generation costs and subsequent reduced charges to consumer, the consumption of current specially for domestic purposes soon increases, and the chief problem then becomes distribution.

As a general rule, Power Stations can be extended without any great difficulty, but on the distribution side, Sub-stations placed close enough for the lighting loads which existed when first installed and adequate for a number of years afterwards, are unfortunately found to-day to be altogether unsuitably placed even with greatly increased size of mains, to give within reasonable limits the declared pressure at the consumers' terminals.

From Bloemfontein's experience one penny per unit would appear to be about the highest charge whch can be made if the domestic load is to be increased beyond the usual lighting, electric iron, and kettle load. Our domestic tariff was originally on the Norwich System when a number of units varying with the valuation of the house were charged at 10d. per unit, double that number at 2½d. per unit, and the balance at 1¼d. per unit with a minimum of 5/- per month.

From records it was found that the bulk of consumers always reached the 1¼d. rate, so that the higher tariffs really constituted a fixed charge, and in formulating our present tariff, this

was taken as a basis, reduced amout 10%, and made a fixed charge for which no current is given, and all current used charged at ¾d. per unit. The standing or fixed charges on all classes of consumers amount to almost exactly our interest and redemption charges on our capital expenditure. Our domestic tariff, as tabulated in the annexure was introduced about two years ago, and although, after the most careful study of actual payments on the old tariff, allowing for the same consumption on the new tariff, our revenue should have been £1,500 less. It was actually much higher the first year, and is still increasing, and altogether out of proportion with the cost of generating and distributing the additional demand.

This tariff may be considered by some as inequitable, but it will be appreciated that no tariff attains the ideal from every consumer's point of view, and it was considered by the Council that, irrespective of what current a consumer used, he should bear a fair share of the overhead charges —the charge being based on the Municipal valuation of the consumer's house in relation to the capital expenditure to give the service, this being the usual procedure adopted for all public services.

As regards cooking, all admit that ¾d. per unit is reasonable and compares favourably with the coal stove, but most people maintain that they cannot afford to heat water at that rate unless they do with very much less than they have been accustomed to. We offer current at 30/- per month per k.w. installed, provided the load is continuous, but owing to the great variation in our Summer and Winter temperatures, a heater suitable for Summer months is totally inadequate for Winter months. If suitable for Winter months it is too large for the Summer months, and apart from that, the general opinion is that even at .5 pence per unit, water heating is expensive.

The price cannot at present be lowered , and the only remedy that I can see would be to heat all water required for the day between the hours of 11 p.m. and 7 a.m.

I quite believe that in the near future some method of controlling the switching of apparatus of this description from the generating system will be available, eliminating time switches, which are expensive, and are at present about the only means of attaining this end with any degree of accuracy and reliability.

If this method could be arranged water heating could be accomplished at a charge slightly over generating cost and would be cheaper to run than a coal fire installation, and free from the dust and dirt raising propensities of the latter.

This address is not given with the idea of inducing discussion, as we have before us a number of papers and other matters which could take up more time than we have at our disposal, and I am very pleased to note the majority deal with the subject of furthering the interests and development of electric service, being most opportune and coinciding with our first Municipal Electrical Exhibition. The Exhibition was proposed some twelve months ago, but the Town Council agreed to postpone the event until our Convention was being held.

As regards the development of Bloemfontein, electrically, the following figures taken over a period of the last eight years may be of some interest :—

Yearly Nett Units put into Mains and Percentage Increase during the period 1920-21 to 1928-29.

Year Ending	Units put into Mains.	% Increase on previous year
31-3-21	3,833,347	—
31-3-22	4,256,462	11.3
31-3-23	4,806,491	12.9
31-3-24	5,544,808	15.3
31-3-25	6,237,505	12.4
31-3-26	6,954,443	11.4
31-3-27	7,231,485	3.9
31-3-28	8,011,030	10.7
31-3-29	9,755,718	21.7

Nett Units for year ending 31-3-29 are 154.4% over nett units for year ending 31-3-21.

During this period a new Power Station was put into commission in 1926 at a cost of over £200,000, some doubts being entertained as to the wisdom of making it as large as it is, and many people reckoned that we were the small town with the large Power Station. I admit on the first year's working I began to wonder if it was not so as the increase in output was only 3.9% as shown previously. However, last year returns show an increase of 21.7%, and basing our calculations on the workings of the present year I anticipate an increase of 25% or 26%, and I often speculate whether this state of affairs is more satisfactory than alarming.

The Station was originally intended to accommodate 7,000 K.W. of plant, but before completion it was decided to put in 9,000 K.W. and within the next five years further extensions will be necessary, as we have not touched the fringe of the domestic load, and at the moment are proceeding to electrify the Municipal Waterworks at Mazelspoort, which many members will no doubt be interested to visit before the conclusion of our Convention.

During the eight years given, the cost per unit put into mains has fallen from 1.148 pence to .430 pence for year ending 31st March, 1929, and the average price received per unit sold has fallen from 3.02 pence to 2.31 pence, whilst the annual contributions to the General Rate Fund has risen from £2,500 to £14,000.

In conclusion, I hope that all members attending this Conference will participate in the discussions on the most interesting papers we have before us, thereby granting to each other an exchange of views on the subject, and thus furthering the cause of our Association in the interests of ourselves and the public service which is under our administration.

R. MACAULAY.

President.

7th November, 1929.

SCHEDULE "A".

COMBINED LIGHT AND POWER FOR DOMESTIC PURPOSES FOR PRIVATE DWELLING HOUSES ONLY.

"Private Dwelling House" shall mean premises which are used solely for residential purposes by the occupier and his family, and not more than three boarders or lodgers.

(a) Standing Charge.

All householders shall be debited with a monthly standing charge based on the rateable value of the building, in accordance with the following scale :—

House Valuation.	Standing Charge.
£400	4/– per month
£500	5/– „
£600	7/– „
£700	8/– „
£900	10/– „
£1,100	11/– „
£1,300	12/– „
£1,500	13/– „
£1,700	14/– „
£1,900	15/– „
£2,100	16/– „
£2,300	17/– „
£2,500	18/– „
For all private residential properties valued at over £2,500	18/– „

Separate standing charges shall be payable on separately assessed premises.

Where premises are unoccupied for any period, the amount due for the standing charge on such premises shall be payable by the owner or owners thereof, unless premises have been disconnected by the Department when a reconnection fee shall be payable in terms of Section 23 of these Regulations.

(b) Current.

Householders shall be charged at a flat rate of ¾d. per unit for all current consumed for domestic lighting, heating and power for motors of not more than 1 horse power.

(c) Continuous Connection Load.

A continuous connected load of 100% load factor shall be supplied for the full 24 hours to all householders desiring such for the purpose of heating water.

The cost of installation of the necessary connections for this current shall be borne by the householder. The current shall be supplied at the rate of 30/- per kilowatt per month.

TARIFF 2.
FOR BUSINESS PURPOSES.

For hotels, shops, offices, boarding houses, warehouses & workshops, mills, breweries, factories and businesses or factories of a like nature.

(a) For Ordinary Lighting Purposes.

Current shall be charged at the rate of :—

8d. per unit for the first 100 units
7d. „ „ second 100 „
5d. „ „ thereafter.

Monthly minimum 5/- for which eight units will be allowed.

(b) Current for Advertising Purposes.

Current for this purpose shall be supplied through separate meters and shall be used for the sole purpose of advertising wares in such manner that in the discretion of the Council such lighting is in the form of an illumination to a street.

Current under this heading shall be supplied at a flat rate of 2d. per unit.

Minimum 5/–

(c) Heating.

When installation equals :—

5	amps	24	units	@	2½d.	Balance	@ 1¼d.
10	„	48	„	@	2½d.	„	@ 1¼d.
15	„	72	„	@	2½d.	„	@ 1¼d.
20	„	96	„	@	2½d.	„	@ 1¼d.
25	„	120	„	@	2½d.	„	@ 1¼d.

Minimum 5/–

(d) Power.

A consumer of current supplied for power purposes shall pay therefor at the rate of 1d. per unit consumed in addition to a standing charge of 5/- per month per horse power installed up to 20 h.p., and thereafter 2/6d. per h.p. installed up to 50 h.p., provided that the standing charge shall be applicable to each separately assessed premises.

Discussion on Valedictory and Presidential Addresses.

Mr. L. B. Sparks (Pietersburg) : In connection with the past President's address, Mr. Mordy Lambe states that, so far as he can see, the Association does not appear to have any locus standi, regarding the treatment meted out to Municipal Electrical Engineers. In the Transvaal, I understand the Town Clerk is protected, and the Town Engineer is protected. The Municipality can't dismiss either of these officials before submitting their recommendations to the Administrator for his approval or otherwise. Even the Sanitary Inspectors are also protected. But, the Electrical Engineers, so far as I can make out, have no protection at all. I think this Association should take the matter up and see what can be done. The Municipal Engineer very often has to bump up against his Council in certain matters connected with his work and, I think, the best thing this Association can do is to have him put on the same status as the Town Clerk, the Town Engineer, and others.

Mr. H. A. Eastman (Capetown) : In regard to the subject of railage rates on coal mentioned in Mr. Mordy-Lambe's address it will no doubt be of interest to Members and Delegates to know that this matter was on the agenda for the Publicity Conference which was held in Capetown last week. The Electricity Department gave as much assistance as possible to the mover in the matter but, unfortunately, without result.

Mr. L. L. Horrell (Pretoria) : Mr. President, you raised a very interesting point with regard to water heating. I am sure it is a matter of great interest to all present, as it is a problem which practically every Municipal Engineer has to face, during the course of his duties.

We all know how well Durban and Cape Town have done in connection with the building up of a large domestic load, and undoubtedly, in connection with this particular service, these two towns must be regarded as the most progressive in the Union.

The flat rate of 3/- per month per 100 watts for water heating does not find favour in Pretoria and in nearly every instance the householder prefers to get his supply through the house meter, the heater being controlled by a thermostat or by a three way switch.

We have just started supplying current for heating water at ¾d. per unit during the off peak period. This tariff has not been in vogue for a sufficiently long period to enable me to place results before you.

The initial high cost of installation is, of course, a drawback, and I look to Mr. Eastman of Cape Town for further information on this point.

Householders are inclined to blame the installation, when there is not sufficient hot water for bathroom requirements, often forgetting that the house boy has been making full use of the supply in the kitchen. The system of installing two heaters, which, I am of opinion, gives every satisfaction, does not find favour, because of the extra initial cost.

Mr. H. A. Eastman (Cape Town) : In reply to Mr. Horrell I would say that I intended bringing this matter up, as we are doing everything we can to develop the use of electric energy for continuous water heating. I brought certain figures with me from Capetown but, not anticipating that this matter would crop up to-day, I unfortunately, have'nt them with me now.

Mr. W. Mortimer Mail (Kokstad)-: What Mr. Sparks, said about protecting the Electrical Engineers is, I think, very necessary. I have had a lot of trouble in this respect due to changes of

Councils. Its a very difficult matter for some of us in the smaller towns, under the conditions such as we have. In Kokstad, for instance, the Town Council has changed twice within the year; we have had two new Mayors and even now there are three vacancies. Each one comes in with new ideas and a different policy and we have no protection at all. I think the Association should take some action in regard to Mr. Spark's suggestion, as it is essential that we should be safeguarded in some way.

Proceeding, Mr. Mail referred to the amounts allocated by his Council from the Electricity Department, to the relief of rates generally and referred to the difficulties he had experienced owing to the shortage of staff and reductions in salary of his assistants.

Mr. S. V. R. Lewis (Aliwal North) : Mr. President, I'm sure we are all very grateful to Mr. Mordy Lambe and yourself for your interesting addresses. The question Mr. Mordy Lambe raises about the locus standi, even in his own case, is thoroughly proved. We have just heard what Mr. Mortimer Mail has said about the conditions in Kokstad, and it struck me while listening, that the position is, I think, due in some measure to our own fault. What do our Town Councils know about our Association? Mr. Poole raised a useful point about the sale of proceedings and the various papers placed before the Convention, and I think it is one that we should all support.

There is the question of the Standardisation of Municipal Electricity Accounts to which Mr. Mordy Lambe refers in his address. It is a matter being considered by some Municipalities at present and yet, does'nt the suggestion, in the first instance, come from this Association? Statistical Tables - who knows about them? The Electrical Engineers and the Municipal Year Book people - not our Councils. So, Mr. President, I think we are to blame in not bringing more to the notice of our Councils what we do and the negotiations undertaken by this Association. When the question of the Standardisation of Statistical Returns

was discussed some years ago, I think many of us came up against our Town Councils. It takes a little bit of wangling sometimes to urge upon them what we want. We are not supposed to understand that side of the business, or to know much about accounts. I must say, however, that I have been rather lucky in getting them embodied.

Mr. L. Ralston (Dundee) : Supported Mr. Mail regarding the attitude adopted by the Town Councils of some of the smaller Municipalities emphasising that, in the smaller towns, the electrical engineers were expected to act as town engineers and attend to numerous other duties, which correctly speaking, were outside the scope of the electrical department.

Mr. G. Chace Brown (Vrede) : Listening to the recent discussion, I would like to say that I must have a fairly model Council compared with those of some others. Regarding the treatment, I think its every engineer's duty to do all he can in the interests of his town and not expect to do Electrical engineer's work only. If he's competent to give other services to his Council, whether in the building line or not, he should be prepared to do it, and will, himself, benefit as it is all good experience.

Councillor W. C. Adcock (Port Elizabeth) : If it is not out of place for me to speak Mr. President, I would like to refer to a recent experience we had in Port Elizabeth when a rat got into the generator and caused an interruption in the supply. It was very comforting thing to know that every man was at his post in the emergency. The public were put to practically no inconvenience, which would not have been the case had the staff not had the confidence of their Council. We arrange to work in harmony with the Municipal staff, and I must say we have found it very satisfactory. It is also reassuring to the layman to know that they can be relied on in an emergency. I sometimes think, after that little experience, that it would be a good thing for other Municipalities to have an unexpected interruption in their

supply such as we had, as it shows what can be done. But then, perhaps you can't all look to a rat for assistance in this direction. (Laughter)

Mr. F. C. D. Mann (Worcester) : Mr. President, the Retiring President, in his address, suggests that now that the Government has appointed a Commission to report on Railway freights it would be a good opportunity for the Association to make representations again in regard to the charges for the carriage of coal. I sincerely hope this meeting will not terminate before some understanding has been arrived at in the matter. The smaller municipalities of the Cape are finding it very difficult to operate on the existing coal tariff. If it is possible for the Association to pass a resolution to approach the authorities for relief for the smaller towns, it would be of great assistance. We pay the same rate as that paid in Cape Town. The actual cost of coal is only 1/3 and we pay 20/2 for railage. If, therefore, the Railway could give us some rebate, or if they could reduce the rate, it would be the saving of many of the smaller towns.

Mr. G. Chace Brown (Vrede) : Could not this Convention give an opening for the question to be discussed at the next congress of the O.F.S. Municipal Association to be held shortly? If we as a body, were to send a letter to the Municipal Association, they could deal with it and perhaps we could get some assistance in that way.

Mr. S. V. R. Lewis (Aliwal North) : In April of next year, the Cape Municipal Congress meets at Aliwal North and, if we can get a resolution from this Convention, I will undertake to see that my Council will take the matter up with them.

Mr. J. Bernard Bullock (Representing the "S. A. Engineer") : Mr. President, I notice from your address that you have made very substantial contributions from the Electricity Department to the General Rates Fund in Bloemfontein. In view of your very moderate tariffs, the contributions you have been able to make are, in fact, sur-

prisingly large. The first duty of an electricity undertaking is to give supply at the lowest possible cost and in performing this duty, the undertaking which is called upon to make substantial contributions in relief of rates is unduly hampered. It seems to me that this Association should endeavour to tackle this question, for I think we all agree that the first aim of the undertaking is electrical service and that general relief of rates through its profits should come a long way behind. I think it would be of great service to electrical development in this country if this system of taking electricity profits for other services were discontinued.

The President : Regarding the points raised by the various speakers in connection with Mr. Lambe's address and my own, I don't think there is much to say.

Water Heating—This matter, I think, can be left over until later as it comes under two different papers to be read to us during the next few days.

Difficulties in Smaller Municipalities— The bulk of this Association consists of members of the smaller municipalities, and I've often felt they have many difficulties which we can't quite seem to overcome just at present. The Councils expect their electrical engineers to do any and everything and make bricks in their spare time (laughter). As regards appreciation for ones efforts, I find my Council very good indeed. The idea I always have when I leave the council chamber after having received support to some proposal or suggestion of mine, is - Couldn't I have done it a little cheaper, seeing they have such tremendous faith in me?

Interruptions to Supply— This I feel is not only a Bloemfontein or South African matter - but, a National one.

Coal Freights— Candidly, I don't think we'll get nearer an issue by discussing this question, as the freight charges are still under consideration by the Government. The matter was brought up

at East London, with the idea of introducing a flat rate, but the Government have not agreed to what we had hoped for.

Contribution to Relief of Town Rates—This is really a sore point, but unfortunately, we do not run the public services. The Councils have to administer them. It's, of course, very hard on us.

Gentlemen, I thank you for the kind way in which you have received my address and that of Mr. Mordy Lambe, on whose behalf I thank you.

Councillor T. Ericsen (Kimberley) : Mr. President, seeing there has been so little criticism of the addresses I think it is a very great compliment to you. I must congratulate you for the very able address and would like to take this opportunity, on behalf of the Kimberley Town Council, to compliment you on your election as President, and to congratulate the members of the Association for the very hearty way in which they have elected you. I hope you will have a very successful year of office. (Applause)

Transfer of Banking Account.

At the suggestion of the Secretary, it was agreed to transfer the banking account from East London to Durban, the following resolution being adopted in regard thereto, moved by the Secretary and seconded by Mr. Horrell (Pretoria) :—

> "That The Standard Bank of South Africa, "Durban Branch be requested to open an "account to be called 'Association of Municipal "Electrical Engineers (S. A. and Rhodesia)' "and until written notice to the contrary be "received by the Bank to debit such account "with all cheques purporting to be drawn "thereon provided that they are signed by "the Hon. Sec. and Treas. and any one member "of the Council and that all cheques paid into "the Credit of the Association be endorsed "by the Hon. Sec. and Treas. — That a list "of the names and specimen signatures of "the persons at present authorised to sign

"under this Resolution be furnished to the "said Branch Bank, and that they be advised "in writing of all changes which may take "place in the same from time to time.
"That a copy of this Resolution be furnished "to the said Branch Bank and remain in force "until receipt by the said Branch Bank of a "copy of Resolution by the Association."

Representative on Committee of the British Engineering Standards Association (South African Branch).

On the motion of Mr. E. Poole (Durban), seconded by Mr. T. Millar (Harrismith), Mr. B. Sankey of Johannesburg, was re-appointed as the Association's representative on the Committee of the British Engineering Standards Association (South African Branch).

Mr. L. L. Horrell (Pretoria) : Mr. President, I would like to mention how sorry we all are that Mr. Sankey is not with us to-day. He has been one of the keenest members of our Association and has done a great deal for us. He is seriously ill at present and unfortunately, cannot attend.

The President : Mr. Horrell, we all agree with you and express our sympathy with Mr. Sankey in his illness. He has certainly done a lot for us and got us out of a mess once, as you all know.

Representative on the Sub-Committee of the World's Power Conference.

On the motion of Mr. T. Millar (Harrismith), seconded by Mr. W. H. Blatchford (Greytown), Mr. L. L. Horrell of Pretoria, was appointed as the Association's representative on the Sub-Committee of the World's Power Conference.

Visits.

The Convention adjourned at this stage and, in the afternoon, the members inspected the printing works of "The Friend" Newspapers, Ltd. In the evening they paid a visit to the Electrical Exhibition held in the Market Hall, which was opened by His Worship, the Mayor, Councillor Sol Harris, at 8.0 o'clock.

TUESDAY, 12th NOVEMBER, 1929.

The Convention resumed its proceedings at 10 a.m., with the President (Mr. R. Macaulay) in the Chair, there being also present :—

Honorary Member — Dr. H. G. van der Bijl, (Electricity Supply Commission).

Members — T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), W. H. Blatchford (Greytown), G. Chace Brown (Vrede), R. D. Coulthard (Oudtshoorn), P. W. Dadswell (Cradock), H. A. Eastman (Cape Town), R. W. Fletcher (Krugersdorp), A. Hadfield (Gwelo, S. Rhodesia), A. Q. Harvey (Middelburg, Cape), J. Hooper (Robertson), L. L. Horrell (Pretoria), J. Iverach (Grahamstown), S. V. R. Lewis (Aliwal North), W. Mortimer Mail (Kokstad), F. C. D. Mann (Worcester), T. Millar (Harrismith), H. A. Morris (Kimberley), H. M. S. Muller (Upington), P. H. Newcombe (Alice), L. Ralston (Dundee), John Roberts (Durban), J. H. Rogers (Fort Beaufort), J. H. Simpson (Colesberg), L. B. Sparks (Pietersburg), T. Sutcliffe (Benoni), J. Vowles (Kingwilliamstown) ;

Associate Member — T. Castle (Cape Town).

Delegates — Councillors W. C. Adcock (Port Elizabeth), J. Blaker (Johannesburg), A. L. Clark (Durban), T. Ericsen (Kimberley), D. A. Thomson (Bloemfontein), A. Withinshaw (Cape Town), Mr. O'Halloran (Krugersdorp) and P. de K. van Heerden (Cradock) ;

Visitors—Mrs. W. C. Adcock (Port Elizabeth), I. J. Allen (Petrus Steyn), J. S. Butchart (S.A.R. J. H. Burg), J. Bernard Bullock (Johannesburg) O. Feldman (A. E. G. Co., Johannesburg), E. Grinther (Springfontein), John Hogg (Bloemfontein), A. M. Jacobs (Electricity Supply Commission, Johannesburg), H. A. Mellor (Bloemfontein), E. T. Oates (Johannesburg), E. Perrow

(S.A.I.E.E., Johannesburg), W. D. Phelp (B. G. E. Co, J. H. Burg), R. T. Riley (B.G.E.C., J. H. Burg) A. N. Rishton (Bloemfontein), Mrs. J. Roberts (Durban), F. C. Stephens (Public Works Department, Pretoria), Mrs. M. Storey (Bloemfontein), V. van Dalsen (Electricity Supply Commission, Johannesburg), A. J. C. W. Vermeul (Johannesburg), E. G. Weyhausen (Siemens [S.A.] Ltd. Johannesburg) ;

Honorary Secretary and Treasurer — E. Poole (Durban).

Welcome to Visitors :

The Chairman : Gentlemen, before commencing our business for the day, I wish to welcome Dr. van der Bijl, Chairman of the Electricity Supply Commission, also Mr. Jacobs and Mr. van Dalsen. Then we also have with us Mr. Weyhausen and Mr. T. W. H. McEwen members of the S.A. Cable Manufacturer's Association.

Election of Members of Council.

The President : The next business is the election of members of the Council. The retiring Council have recommended Messrs. Swingler (Cape Town), Millar (Harrismith), Blatchford (Greytown) and Rodwell (Johannesburg), but it is however open for other nominations to be made.

There being no other nominations, the President declared the various members as being elected.

Disapproval being later expressed at the procedure of the election of the Council, fresh nominations and a ballot was taken resulting in other members being elected. (See Friday's proceedings).

The President : I'll now ask Dr. van der Bijl to read us his paper.

SUGGESTIONS FOR A SOUTH AFRICAN ELECTRICAL DEVELOPMENT ASSOCIATION.

By **Dr. H. J. van der Bijl,** Chairman of the Electricity Supply Commission.

Dr. H. J. van der Bijl : Mr. President and Gentlemen, it gives me great pleasure to be able to attend one of your Conventions at last. I feel really delinquent about not having attended in the past, but each time something has cropped up to prevent me from doing so.

This proposal to form an Electrical Development Association is something in which our Municipalities will be very largely interested and I have therefore chosen this Convention at which to make the suggestion for the establishment of such a Development Association. In most of our Municipalities there are still a large number of householders who need to be told the value of electricity and who should be encouraged to use electricity in their houses.

I do not, however, want to convey the impression that the purpose of the proposed Electrical Development Association would be only to sell more current and more electrical appliances, our main purpose should be to say to the public "Electricity is your greatest servant, let us show you how to use it." It follows of course that with a more extensive use of electricity more current and more electrical appliances would be sold and although this is incidental it is also important because since we should also try and interest manufacturers and merchants and dealers in electrical appliances, it stands to reason that they would expect a reasonable monetary return for the contribution that they would be asked to make to the Electrical Development Association.

Dr. van der Bijl then proceeded to read his paper as follows :—

Electricity supply in South Africa to-day may justly be said to have passed the problem stage. We have, generally speaking, won through those stages of development so full of interest to the engineer, the laying down of new undertakings, the enlargement or complete remodelling of existing ones, in which engineering bulks so largely. Although this kind of work will continue to demand our attention to keep pace with the development of the country, I feel the time has come when we should go one step further than the mere provision and consider the utilisation, to the utmost, of the supply provided. I need scarcely remind the engineers in my audience that our livelihoods are all bound up in electrical development. The object of this paper is to make concrete suggestions as to how we can actively and practically forward such dvelopment, and the solution I have to offer is the formation of a South African Electrical Development Association.

There are two obvious questions : First, how is it to be done? and second, what is it to do? Let us first consider what such an Association could do.

Let me first point out, with all due deference to the good work which several members of this Association have done, that there is a distinct vagueness, and in many cases very definite ignorance on the part of the general public, male and female, as to the possibilities of electrical service as touching themselves. To begin with, take lighting. The easiest and best understood service, you will say, but should we not ask ourselves by how much the eyesight of our consumers is being weakened and impaired by present slap-dash methods, resulting in harmful glare. The supplier of electricity should surely feel some direct responsibility for the damage that is undoubtedly being done, and he will also consult his own interests in trying to remedy matters, knowing that the general effect of improved lighting will be greater consumption of electricity.

In the realm of electric heating, there is undoubtedly a fairly strong prejudice for something on which the master of the house can use a poker.

This prejudice is strengthened by the fact that as a rule, hitherto, electric heaters have been given small loadings, so that they do not adequately warm the whole room, but are more suitable to individual application. In addition, in most cases, the architect has failed to provide outlets of adequate capacity, so that a big upset becomes necessary before a fire with adequate loading can be installed. Even with such a fire, ventilation is generally much more "free" than necessary with a heating medium which consumes no air, and undue convection losses tend to make electric heating seem inadequate.

An Electrical Development Association could make suggestions to both architects and houseowners, of such weight as to compel attention, concerning its views on both lighting and heating, thereby ensuring a higher general appreciation of these electric services throughout the community. The public should be made to feel that the houses of the present and future should be arranged as all-electric homes, and the Association's aim is to advise how it shall secure the best compromise between service and outlay.

Except in a few areas of supply, the cooking load is still utterly in its infancy, and even where it has been pushed and developed it is still far from the saturation point. South African coal is comparatively cheap in first cost, and, although it is also dirty, there is much to be done before the housewife appreciates the overall economy of the electrical method. The initial outlay, moreover, is still a bugbear, which an Association would help very largely to reduce, with suggestions to to suit various purses.

It might also influence the wider adoption of hire purchase methods, assisted wiring schemes and the like.

As regards domestic water heating, electrical engineers have generally been somewhat conservative, but the public should be told the exact position in each supply area and encouraged as far as possible to complete their home electrification

when the hot water position is mutually economical to both consumer and supplier. Presently, no doubt, the supply of energy for this purpose will be placed in the hands of the power station staff, by means of high-frequency control, when it will be possible to give every consumer a definite number of units during the twenty-four hours for water heating, with full benefit to the load curve. While this system is being perfected, let us by all means cultivate the water-heating load as far as we can, with an eye to the future.

Industrially there is also a certain amount to be done in pushing electricity, and one is not without hope that presently it will be possible to develop a farming load in the vicinity of large centres, where intensive methods are desirable and payable.

The basic idea of an E.D.A. is to make the proper and adequate use of electricity a national, as distinct from a local cause. The selling efforts of even a large undertaking can be materially furthered by a scheme of national electrical propaganda. As to the smaller undertakings, they will undoubtedly have work done for them which they could not expect to be able to do at their own expense.

Let us see what form propaganda can take. First, there is judicious national advertising in the press. This would be directed to arousing the interest of the public in electrical matters of all kinds and giving them a habit of thinking electrically. It could be supplemented where necessary by local advertising, and the Association's executive would help the local work by preparing attractive and topical layouts for the purpose.

The circulation of booklets or leaflets dealing with electrical applications is a valuable means of developing the use of electricity in the home, in business and in industry. The Association would prepare high-class literature for distribution by its members, and could produce it at prices much less than those which would obtain if each undertaking attempted to produce a limited number for itself.

Posters are another strong publicity agent, and most undertakings can secure space for their display either at no cost or at very low rates, and could probably arrange to illuminate them at small cost, thereby greatly adding to their pulling power. The Association would be responsible for producing suitable designs, and would distribute these to members at cost.

A lecture service is another very useful branch of activity. Two methods can be applied: one, the circulation of standard lectures to all who can be inspanned for such work; people who attend Rotary Clubs, political, social and religious societies, Chambers of Commerce, Ratepayers' Associations, Literary and Debating Societies, any body whereby people can be got together and induced to listen to a short talk. The executives of the various undertakings themselves would doubtless be willing to do their bit, even if unaccustomed to public speaking, if so far helped by having the material placed in their hands. The other method is for the Association to maintain an official lecturer, whose services would be provided free to members who could undertake to secure suitable audiences.

Suitable lantern slides would be prepared to accompany the lectures, and, in addition, members could secure a regular service of advertising slides for use in cinema advertising. The cinema itself could also doubtless be utilised in an educative rather than an advertising way. as there are many interesting short films already in existence and procurable for such application.

Another important branch of publicity is, of course, shop-window dressing. We are familiar with the average shop window of the retailer in this country, and know that it is capable of very great improvement. Part of the Association's work would be to prepare standard seasonal window dressings, to produce and sell to members the necessary trimmings outside of the actual apparatus, and to recommend suitable lighting effects.

Exhibitions can help greatly to promote sales. Some exhibitions could be arranged and financed by the Association, for example, at big agricultural shows or on occasions when any big function draws the public to a particular centre. Other local exhibitions can be helped by advice, by official encouragement of exhibitors and, in some cases, by financial assistance.

Press advertising will also secure the inclusion of much more editorial reference to electricity, and such matter, when specially prepared by experts, will do a great deal of good. Articles would be available to members who are able to secure their insertion in local publications.

Other possibilities are the consideration of new markets for electricity and of new electrical developments, and also the study of salesmanship among distributors and contractors.

Other possible fields of useful activity may occur to you, and in this connection I should emphasise that the policy and work of an Association would be settled by consultation and not arbitrarily Suggestions in line with the national aspect of its work would be encouraged and, where feasible, acted upon.

I hope that the outline I have given will convince you of the possible usefulness of an E.D.A. in Southern Africa. I might, however, epitomise the scheme by saying that its aim is to arouse the interest of the community in electricity on the broadest possible lines and to educate it up to a point such that the prospect comes to the undertaking, fairly well posted at the outset, instead of the undertaking having to seek out its prospects and do all the education itself.

I would suggest to this Convention that if the idea commends itself to members, as it does to myself as representing the Electricity Supply Commission, we have here the foundations of the proposed Association and success in our grasp. The various supply undertakings are not, of

course, by any means the only prospective beneficiaries. The Association must include manufacturers of plant and apparatus or their local representatives, retailers and contractors. I suggest however, that if we can start with unanimity among the supply undertakings, we can carry the rest with us. It is necessary, however, to look to members of this Association of Municipal Electrical Engineers not only for direct support, but also for assistance in the work of organisation. This assistance will take the form of securing supporters among the interests mentioned in the area of each undertaking, and particularly from your local contractors and retailers. If each undertaking supports the scheme whole-heartedly, I consider it is bound to bring in with it all those businesses which depend upon it for their work and their livelihood. Moreover, in view of the distances involved, it would not be practicable or economical for a central body to canvass the whole country.

A suitable way of assesing the annual contribution of supply undertakings could be worked out. We might, e.g.. consider basing them on the annual revenue of the undertakings, say 0.2 per cent. of the revenue with a minimum of £10 per annum and a maximum of £500. Statistics are not yet available for 1928, so that it is not possible to give the total revenue which would accrue if general support were accorded on the above basis, but I estimate that we might expect between five and six thousand pounds in the first year.

A suitable scale of assessment could also be worked out for big manufacturing corporations, their representatives, specialist firms, contractors, retailers, etc. The amount of support given by such concerns would be influenced by the unanimity, or otherwise, shown by the suppy undertakings, and if you present a united front, I consider that in many instances we can rely upon very substantial contributions. If by means of support from all those outside the supply undertakings themselves we can increase the Association's revenue to, say, £9,000 per annum, we

should have a development fund sufficient for an adequate campaign, which will produce decisive results.

The Association would be registered as a corporate body formed for purposes other than the making of profits, and would be controlled by a Council. In order to put this latter matter on a concrete basis for discussion, I would suggest that the following organisations or groups be included in the make-up of this body .—

Association of Municipal Electrical Engineers,
S.A. Institute of Electrical Engineers,
Manufacturer's representatives and wholesalers,
Retailers and Contractors,
Electricity Supply Commission.
Victoria Falls and Transvaal Power Co.,
Local Committees, Cape, O.F.S., Natal, Transvaal and Rhodesia.

The existence of local committees would, I think, be desirable to furnish means of representing local points of view, and to act as a focus for putting forward suggestions to the management and, reciprocally, for assisting the latter in carrying out its programme in each area.

From the above, an executive committee of about five to seven should be chosen of your Association, while the executive could meet quarterly or at such more frequent intervals as might be found desirable.

The Council itself might suitably meet annually on the occasion of the convention of your Association, while the executive could meet quarterly or at such more frequent intervals as might be found desirable.

The work of the Association would be placed in the hands of a managing director, who, as you will appreciate, should be, among other things, an electrical engineer. It should be possible, with due allowances for local conditions, to base our proposed organisation to a considerable extent upon that of the British E.D.A., which has done outstanding work in Britain during the last four or five years, and which is directed by Lieut-Col. W. A. Vignoles, D.S.O., M.I.E.E.

I suggest that the natural headquarters for the Association should be Johanesburg, but that it will probably be found useful and desirable to have a local branch office in the Cape Province, the Free State, Natal and Rhodesia. At the outset it might be practicable and economical to link these local offices with the chief undertakings of the respective areas, e.g., Capetown, Bloemfontein, Durban and Bulawayo or Salisbury.

Our aim should be that the Association should be prominently housed, not only in Johannesburg but also in the main branch offices, in or near the shopping area, and that provision should be made for a permanent show-room, a rest room for ladies, a lecture centre and a place where a certain amount of exhibition work can be done.

The municipalities of the towns where these offices will be situated might reasonably be asked to assist by contributing to the rent.

My conceptions of the scheme, of the annual income and the potential personnel may strike members, at first blush, as somewhat grandoise, but I think you will agree on due consideration that the field we propose to till is a very fertile one, and that we must not, if we are to succeed in our appeal, think and act on narrow lines. Moreover, I think it should be considered whether, in starting this organisation, we should not endeavour to ensure its existance and vigorous activity for a period of at least five years. It will take an appreciable time to organise the undertaking and secure decisive results, but I think you will agree that if the Association is broadly founded, given adequate means and effectively run, it is bound to produce such results.

I shall be glad if you will discuss and criticise these suggestions fully, and, as you only meet once a year, if the general feeling is in favour of the scheme, you should, I think, endeavour to take steps on this occasion provisionally to found an E.D.A. for South Africa.

We shall, in due course, look for mandates from your respective Councils in favour of such a body and for financial participation, either on the lines I have sugested or on any modifications of them which this Convention may choose to adopt.

The President : I think we are all very much indebted to Dr. van der Bijl for his excellent paper. To me it seems to raise two issues - the desirability of the scheme, and the other, which is the main question - finding the money. The paper is now open for discussion and, I think, appeals as much to the Councillor delegates as to the Engineers.

Mr. A. M. Jacobs (Electricity Supply Commission) : Mr. President and Gentlemen, before beginning to speak on the paper by Dr. van der Bijl, I would like to express my extreme gratitude for the invitation issued by yourself and the Council to me to attend this Conference, and to say how glad I am to be able once again to meet the Councillors and Engineers together at a Convention like this.

In support of the proposal put forward by my chief, the Chairman of the Electricity Supply Commission, I must say I am convinced that the formation of the Association will be of inestimable benefit in the development of the electrical work of this Country and will lead to a still further increase of the applications of electricity and an extension of the experience of the last few years. I have no prepared contribution on the subject, but will give you a few remarks and hope they will encourage others of you to express your views on the matter.

I would like to say that there has been no collusion between the Chairman of the Commission and myself in this question. During my recent visit to England, I was invited by Colonel Vignoles to the headquarters of the British Electrical Development Association and spent a most interesting

forenoon there, when Colonel Vignoles showed me the various advertisements and posters used by them and explained something of the Association's activities.

Gentlemen, we are, or I hope we are, all business men, and the question is - "Are you going to get adequate return for the money expended on the formation of such an Association?" Colonel Vignoles was most emphatic on the point that, in England, the Association was obtaining a very adequate financial return for moneys invested in it.

In January, 1927, Dr. Lulofs, of Amsterdam, Holland, gave me some interesting data bearing on the encouragement of the use of domestic appliances, heaters, etc. He had felt that great developments were possible in his city in that direction and be proceeded to investigate. Speaking from memory I believe that in the summer of 1926 something like 6,000 fans were sold in Amsterdam and, in the winter, upwards of 9,000 heaters were distributed.

The Association would, I think, be a means of great benefit to the power stations, the public, manufacturers and retailers, and all those referred to in the address, which my Chief has given you.

If the Development Association is formed, we will have the very fortunate co-operation of a new body being established in this Country shortly, namely, the Electric Lamp Manufacturers' Association. Dr. van der Bijl has referred to others in his paper, but this Association, I believe, are about to move very rapidly and powerfully in the direction of electric lighting, the opening up of showrooms, the organisation of lectures and the general dissemination of information and education of the public in general to the use of electric light. We will be helped from the outset by the presence of this powerful body of experts.

There is one important thing I would like to emphasise and that is the responsibility of suppliers to give the public not only reliable, but also safe electrical appiances for use in their homes. Nothing discourages the public more than risky appliances or things needing continual repair. I would urge that, when the Association is formed, they see to it that the manufacturers use every endeavour to place only the best appliances they can on the market.

A great deal will, of course, fall on the power stations in the way of revisions of tariffs to meet the demands. Then, if the experiences of all the constituents of this Association were to be pooled, we might, through discussion, arrive at tariffs which would be remunerative to both the suppliers and the consumers of current.

In conclusion, Mr. President, I would like to add that I hope the Development Association will not only be formed and get an enthusiastic send off from the beginning, but, what is more, that afterwards there will be no lagging. That would be the death knell to it, which would be most unfortunate.

Mr. John Roberts (Durban) : When I read Dr. van der Bijl's paper, I was naturally very interested and thought the question so important that I could not leave it to the very inadequate remarks I would be able to make in an impromptu speech and so I have written my contribution to the discussion which, with your approval Mr. President, I would now like to read :—

Our Association of Municipal Electrical Engineers is indebted to Dr. van der Bijl for bringing this matter of the formation of a South African Electrical Development Association before us, and it is to be hoped that the scheme will be brought into being without delay. I think that as a body Municipal Electrical Engineers throughout the country can be said to be fairly live men who have worked hard to develop the use of

electricity in their respective spheres. Dr. van der Bijl's scheme is to centralise and co-ordinate these efforts to get the advantage of specialised and concentrated effort.

Now I think the first thing we have to emphasise is, that we are not starting this movement as a mere business stunt to increase our sales and revenue so as to make bigger jobs for ourselves. We embark on it feeling that the problems with which our country is faced — the extension of transport, industries and agriculture — can only be solved by the co-ordinated efforts of engineers, especially Electrical Engineers. The President of the Chamber of Mines in his speech at the recent Annual Dinner of the South African Institution of Electrical Engineers, truly said that the great magnitude of the gold mining industry on the Rand is due to the application of Electricity to mining problems, and it is a fact that mining and electrical engineering are so closely related on those fields that we can scarcely imagine what the gold mining industry would even look like to-day without electricity. The out-put would certainly not be half what it is and probably not a quarter.

What electricity has done for mining in the Union it can do for railways, factories, agriculture and the house. Compare the appearance of the filthy driver of a steam locomotive and of the same smart looking man after his transfer to an electric unit on the Natal main line. The difference is as striking as that between the poor household drudge sweating over her coal stove and the same contented lady after she is given an electric kitchen. These references may provoke a smile, but they have a profound significance for they mean that we have an agency at our hand to do the work of the world, quicker, more efficiently and cheaper than ever before.

We are fortunately well placed in South Africa to pursue the country's wide development of the use of electricity. Pretty nearly every town and village has its electric plant. The last five years have seen the establishment of the Electric-

ity Supply Commission on the initiative of that progressive railway pioneer, Sir William Hoy. The Commission under the energetic leadership of Dr. van der Bijl has made great strides in that short period and the Commission is not only supplying current to two important sections of Railways, but delivering current to 20 towns and villages who are in most cases getting it at a price far less than they could have produced it for themselves. At Cape Town and Durban the co-operation of the Commission with the municipalities has been an important factor in spreading -the electric systems outside the town areas and has given the suburban dweller the same blessings of electric service as are enjoyed by the citizen.

We must start with the law-makers and governors, national and municipal, to think electrically. Lenin, the first great man to rise out of the bloody shambles of the Russian Revolution, determined upon the establishment of a vast electric supply system as the first step towards putting his country on the road to peace and prosperity. Our own country, too, cries out for electric service and wherever there is a river or a stream, the farmer must have an electric pump to irrigate his lands. The sugar lands of Natal and Zululand would have their annual production increased at least 50% with electric irrigation. We have to educate our municipal fathers to the electrical idea and to their duty to provide electric service at such a price that it is available for all its uses in every home, and we have to bring before the prospective user of current himself to realise that whatever he has to do, he can do it better and cheaper if he does it electrically.

Let us take up Dr. van der Bijl's proposal and pursue it energetically. As a first step let us go back to our own tasks, determined each one to make our own towns the centre of an electric activity, spreading outwards till each will join up together in one network, which will embrace all South Africa in its usefulness.

Mr. O. Feldmann (Managing Director of the A.E.G., Johannesburg) : Mr. President and Gentlemen, I wish to thank you for giving me, a visitor, the opportunity of making a few remarks in support of Dr. van der Bijl's suggestions for a South African Electrical Development Association.

When coming to this country about three years ago to re-establish the A.E.G. business in South Africa, I was very much disheartened by the attitude taken up by private people in some of the smaller townships. I was often told by house owners that, what was good enough for their grandfathers, was also good enough for them. They were not keen on having even electric light. I was also informed that electricity was something very wonderful, but that it was still in its infancy. I could not help thinking that I must be very much younger than I really am, because I have being in touch with this infant for at least forty years, and I have never had the idea that I was nursing a baby. Expressions of this kind were very disheartening, particularly, in view of the difficulty of a single undertaking to enlighten the public on the advantages electricity offers. The cost of propaganda of this kind to one single firm acting alone is quite out of proportion to the advantages it may gain. An expenditure of £100 in this direction would mean that sales to the value of more than £2,000 would have to be made. My friendly competitors will admit that a considerable effort is required to produce this result. An individual undertaking cannot tackle this huge task of waking up the public to the use of electrical energy, and the combined effort of an Association as proposed, is necessary to advance our cause.

Those who will undoubtedly benefit by the Development Association are—

(1) the consumers, i.e. the general public,

(2) all producers of electrical energy, and lastly, the producers and importers of electrical material.

I feel sure that the benefits will be considerable and the Development Association may be well described as a Benevolent Association.

To educate the present and prospective consumers on what can be done with electricity, is by no means easy, particularly when dealing with people who have not had the privilege of visiting Europe or the United States to see what is being done there at the present moment. There is a large amount of work to be done to improve methods of lighting. Improved lighting does not necessarily mean greater consumption of electrical energy. I have no authority to say what the S. A. Lamp Association will do in connection with this scheme, but I think, it should be asked to join and to assist this general movement by placing its lighting propaganda organisation at the disposal of the Development Association. The same applies to the Cable Manufacturers' Association.

Collaboration with architects and builders seems essential. I have often wondered why architects do not generally introduce the practice of allowing the future owners of houses to put in their own lighting fittings and switches. A house built on speculation should be completed without the switches and fittings. In many cases, the price of the electric installation of houses is kept as low as possible by the builders at the expense of efficiency, quality and taste. This competition among wiring contractors does not lead to improved workmanship and quality of material employed, and I think builders and architects should be educated to be able to judge whether the electrical work which they sub let, meets certain minimum standards. The Development Association should not, I think, assume authority on the question of design of electrical material. There are sufficient bodies in existance whose duty is to uphold standards. Do not let me be misunderstood on the question of competition; in my opinion, sound competition is a help to development. I should like to state here, that in coming to South Africa again the A.E.G. believes in a traditional right to a seat in the sunshine of this Country. They rendered very considerable assistance in

establishing the industry both for producing and for consuming electrical energy on the Rand. Development, improvement and progress is again our policy since re-starting three years ago.

On the question of heating, which is the next subject referred to in the paper by Dr. van der Bijl, as open for improvement, I think it is a mistake to try to imitate a coal fire with electrical energy. It is up to us to show that a cosy room can be obtained without the emission of smoke and sulphur and without concentration of heat rays. In the proximity of large power stations in Europe and the United States, the method of supplying steam or hot water for heating purposes is being introduced more and more, but in a country like this, with fairly warm winters, heat from electrical energy is perhaps the most hygienic and best way of obtaining a warm house. Chimneys, emitting volumes of dark smoke and fumes, are not only an eye sore; they demonstrate waste of common property, namely coal, a national resource. From my present home in Johannesburg, I overlook a populated valley and, every evening after 5 o'clock, dense volumes of smoke rise from thousands of chimneys, poisoning the refreshing evening air and obliterating the beautiful scenery in the distance. A condition of that kind is a crime, and should be stopped by law, when other more hygienic forms of energy for heating purposes are available.

One of the most important uses of electrical energy is for small power purposes. Consumers must be shown what can be done with a small motor, and I think a special effort should be made in this direction, because the peak of the motor load occurs during the day time, when no energy is used for lighting. The same remark applies to the use of domestic appliances. In this connection, it may be of interest to note that, in 1928, it was estimated that 14.5 millions of electric flat irons were used in the United States; over 19 million households were supplied with services from public utility companies. Compared with conditions in the Union, with less than 2 million white inhabitants, it would mean that about 200,000 electric

flat irons should be in use. I wonder whether the total present number reaches even a quarter of this estimate.

Another title for the Association - I have already mentioned 'Benevolent Association' - would be "Electrical Propaganda Association." After all, this is its essential feature. Propaganda spells enthusiasm, and with enthusiasm we shall get over the difficulties that are sure to be met. This brings me to the attitude the producers of electrical energy may be inclined to adopt. If we tell consumers to use more electrical energy, to use it differently, if we tell them when and how to use it, the answer will be - "We shall be able to do all this, if you reduce your tariff." This is a problem which producers in the large centres are not confronted with as much as those controlling small power stations, with plant capacities of 50, 100, or 200 K.W. I find that often tariffs are not reduced owing to lack of courage to take the step. The experience of producers in Germany is that the extraordinary rise in consumption and revenue makes them wonder why the change was not made earlier. Consumers should be told that the more energy they use, the cheaper they can get it. But even a small reduction in the tariff leads to a rise in consumption with the corresponding increase in revenue. This is, however, not the main point only. Producers in the smaller centres should be made to realise the advantages of a day load. I know that the engineer and the councillor in charge are generally fully alive to the necessities of their undertakings, but they have councils to deal with and are confronted with problems such as the distribution of revenue, and the raising of capital for extensions. It is up to authorities like the Electric Supply Commission and the Provincial Administration to help to remove this kind of obstacle to development.

An uninterrupted supply and a steady voltage will help development, because then, consumers will not have cause for complaint. Birds, rats and mice and even lightning should not be allowed to stop the supply of electrical energy for any length of time.

It should require no very lengthy arguments to convince you that the proposed Association would also finally benefit the manufacturers and importers of electrical material. We are discussing a business proposition, and a proposal that means progress, advancement, movement, must of necessity, be of benefit to those of us who are interested in the sale of material. Speaking, therefore, as a manufacturer's representative, I repeat that the Association will have our fullest support. (Applause)

Councillor D. A. Thomson (Bloemfontein) : My friend, Mr. Millar, has mentioned to me that he thought this a matter more for Councillor delegates than for the engineers, and while I agree with him, to a certain extent, I don't think that he is altogether correct in that surmise. The Town Councils cannot carry on without the assistants of their officials . I am not going to trouble you with much in the way of details for the reason that, not knowing much about the subject, I fear it will be a case of "fools rush in where angels—" you know the old saying. But, I do think the subject is one on which the Council delegates can express their opinions. From what I've heard of the paper, a certain amount of the financial responsibility in an undertaking like this would be involved, and the Municipal Councils, no doubt, would have to assist in "footing the bill." I can see no objection to the scheme, providing it can be made a payable proposition and judging from the arguments put forward, it seems as though it can be made to pay. If that is so, I can see no reason why there should be any objection against the scheme from the Town Councils. In the first place it would mean cheaper current for the consumer - the Counicl never objects to that, and, certainly, the consumer never objects. Then, secondly, if the Council can provide current which satisfies both sections, it will mean the use of more current. The only fear that I have, if this Association develops, is that we, in Bloemfontein, ought have put in a 10,000 K.W. generator in the Power Station instead of the 3,000 K.W. one we have.

From the point of view of the man in the street, I don't think you need have any fear that the Association will be unpopular. They will support any sound scheme.

I do hope other municipal delegates will give us the benefit of their opinions, and if the matter comes up before my Council, I assure you I shall give it every support. We owe a debt of gratitude to Dr. van der Bijl for his suggestion. I was very pleased to hear that the establishment of showrooms was suggested as that would give opportunities for demonstrations that are much needed and serve a very useful purpose.

Mr. W. B. Phelp, (Chairman of the South African Electric Lamp Manufacturers' Association, Johannesburg).

Mr. President,

I would like to thank you and your Association for the opportunity which has been given me to attend this Conference.

Speaking as a manufacturer's representative I feel sure that the papers which are to be read at this Conference and the discussions which follow will be of the greatest interest and will help to bring us more closely in touch with the problems of the Municipal Electrical Engineer, which more often than not are identical with those of the Manufacturer. I would therefore like to suggest that more manufacturers' representatives are invited to attend these Conferences in future, and this I think would be to the mutual benefit of all parties.

I would like to congratulate Dr. van der Bijl on his very able paper on the South African Electric Development Association, to which I have listened with the greatest of interest. An Association such as this is in every way most desirable from all points of view, and I am therefore quite confident that the proposals will have the hearty support of the Manufacturers.

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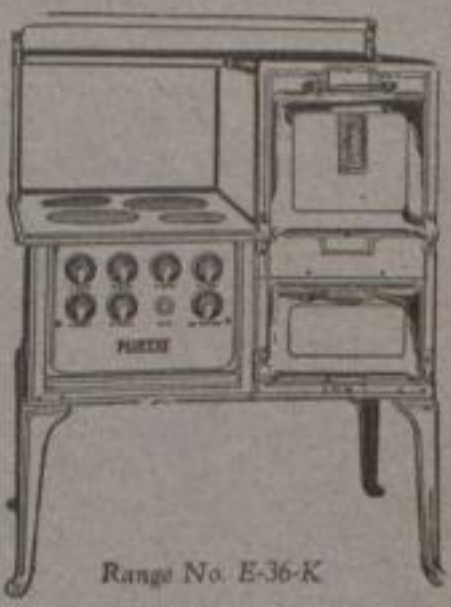

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Mr. Jacobs in his remarks referred to the South African Electric Lamp Manufacturers Association, and I would like to state briefly what it stands for. The South African Electric Lamp Association is a Branch of an International Association consisting of the principal Lamp Manufacturers of the World; this Association was formed some years ago for the purpose of collaboration in connection with Research Work, Patents, Testing and Standardisation, the main object being to stabilise the industry and to ensure that at the finish the user will get a first class article at a reasonable price.

As only one instance of how such collaboration is to the benefit of all parties, a special range of 5 Lamps has been standardised from 15 up to 100 W. internally Frosted, and which meant the elimination of no less than 65 different types of Lamps, the benefits of this to the Manufacturer, the Trader and the user are obvious.

One of the most important functions of the Association is to spread propaganda for More and Better Lighting. In this connection the Association has established Lighting Service Bureaux throughout America and the Continent of Europe, the object being to demonstrate to the consumer the proper methods of using Electric Light.

The South African Electric Lamp Association is very shortly going to open Lighting Service Bureaux of this nature in South Africa, and it is hoped that early next year the first of these will be inaugurated in Johannesburg. The advantages of such Bureaux will I am sure be obvious to all the Municipal Electrical Engineers.

Councillor T. Ericsen (Kimberley) : Mr. President and Gentlemen, we are very deeply indebted to Dr. van der Bijl for his paper and to those who have contributed to the discussion. As far as Kimberley is concerned, our whole Council and the Engineers are very much alive to electricity. We have in the last few years, doubled the sale of electric current, and we have even experienced a time when we have had to put the

brake on, because our wives were spending too much in the way of electrical apparatus not as in Councillor Thomson's case.

I hope all of you will go back to your Councils and push this proposal. As far as Kimberley is concerned, I can assure you there will be strong support of the Association from Mr. Morris and myself. One point worries me, however. What are we to tell our Councils about the contributions to the establishment of the association? Seeing they are the producers of the main electric supply to-day, there may be a difficulty. If Dr. van der Bijl can guide us in any way it would be useful.

Mr. Bernard Bullock (Editor "S. A. Engineer") : I am personally gratified with the reception you have given to Dr. van der Bijl's paper for this matter of electrical development is one in which I am deeply interested. It is nearly three years since I made the first suggestion regarding an organisation in the "SOUTH AFRICAN ENGINEER" and the present paper is, I may say, a direct outcome of suggestions made therein two months ago.

Councillor Ericsen is anxious forthwith to have definite financial proposals to lay before his Council. I do not think the present paper carries us as far as this. It's intention is rather to sound the feelings of engineers and councillor delegates here present. The reception given to the paper suggests that when concrete proposals are made to be laid before all Councils operating electricity undertakings there should be no difficulty in securing their allegiance to the proposed Association. One can also point to the support similar bodies have received in other parts of the world and the success which has attended their work.

I would like to emphasise that the majority of our undertakings are small and that these proposals touch them as nearly as they do the few large undertakings. There are many difficulties in the way of bringing wider electrical service to consumers served by the small plants. The Association would devote particular attention to helping on extensions in plant and courageous

tariff policies which will give the greatest possible encouragement to consumers in the smaller towns, in addition to exhorting the consumers themselves to use more electricity. There are still numbers of small undertakings unable to supply current at less than 6d. per unit. This position to me, is an indication of tremendous room for improvement, in which an Association can render vital assistance.

Councillor A. L. Clark (Durban) : Mr. President, I think, Sir, there are three points in the forming of an organisation, such as has been suggested. We look to Dr. van der Bijl and the Commission for a lead in a matter of this nature, as the very aim, the very idea, is to boom the development of electricity in this Country, so as to be able to supply current at the cheapest rates to the poorest and the meanest of the Country's population - that is current for heat and light - and not for getting increased supplies for power users.

I think that this is a point that should come home to the manufacturers. It is their business to boom and to give a very real assistance to an organisation of this kind. Business depends on getting orders and you can't expect much unless you advertise and make your goods known.

Then again, there are the municipalities, who also try to sell the electric "juice" they produce in order to try and make profits. So far as we in Durban - which is, as I said yesterday, the premier electrical city of the Union - are affected, we have not yet needed to boom our supplies. We have a chief there, Mr. John Roberts, who has done all that is necessary in booming, and I, during the last few years, have done what I could to the best of my ability. During the last year, we put 1,399 electric stoves in, which I think you will agree, is commendable. Herein hangs the tale - When we started, the suppliers of electric apparatus didn't like it; they thought we were going to kill their business. Eventually, we got together and held a meeting and explained that we were out to make matters better for them. Where they were selling 10 stoves, we wanted them to sell 100. What was the result? We paid as much as £7,000 to one man in one month for stoves supplied.

I am very glad Dr. van der Bijl has advocated the establishment of an organisation like this and hope it will be a great success. There seems to be no reason why it should not be - if we all get together, all pool our strength, I have no doubt but that it will give the proposal a very great impetus.

The President : I am afraid, Gentlemen, that I cannot ask for any more discussion on this matter, as its unfair on Mr. Roberts, who has still his paper to read. The question is too big a one for this Convention to handle. Would someone suggest appointing a committee to go into the business further.

Dr. van der Bijl-: May I suggest that we appoint an organising committee as it is not a matter that can be settled by this Convention now. I would like to make it clear that, as soon as we have some definite proposals, you will have to approach your respective councils for their support. I feel it would be hardly fair to bother them now, until we have more concrete suggestions. The best way, I think, would be for a provisional committee to be approved by this Association. It need not necessarily represent different bodies all over the country for the present, and I would suggest the following gentlemen to serve on it :—

Messrs. J. Bernard Bullock, L. L. Horrell, A. M. Jacobs, H. B. Lane, H. M. Missing, W. B. Phelp, Major Rendall, John Roberts, B. Sankey and E. Weyhausen.

May I suggest that, Mr. Bullock be made Convenor of the organising committee. He was largely instrumental in getting me to start this movement, he has made a close study of the subject and has been a considerable help to me in putting forward his proposal to-day. The committee should comprise members who can easily get together for discussion and for drawing up a Constitution. Mr. Horrell lives in Pretoria and could therefore easily attend meetings of the Committee, Mr. Jacobs is in Johannesburg and I would be glad to have a representative of the

Electricity Supply Commission on the committee. I would appreciate it if Mr. John Roberts could serve on the committee, although he lives far away, for he has done so much in fostering the use of electricity for heating and other domestic purposes (hear hear). Major Rendall would be, I think, President of the Institute of Electrical Engineers next year, and the other members suggested reside in or near Johannesburg and would I believe all be of great assistance in framing a constitution.

When the committee is formed and has gone into the question, they would submit their suggestions and recommendations to the municipalities and other bodies.

Mr. G. Chace Brown (Vrede) : May I suggest a representative from one of the smaller municipalities. I would like to propose Mr. Mann of Worcester. He has done a lot in the way of encouraging the use of electricity for heating purposes.

Mr. John Roberts (Durban) : I too would very much like to see more representatives of the smaller municipalities on the committee, although I must admit their difficulty is to get away, as it cannot always be arranged. I appreciate Dr. van der Bijl having suggested my name, but I think it will be very difficult for me to attend the meetings and give any assistance. The matter will need a great deal of preliminary spade work. and I think we should have on the committee more of the engineers of the smaller municipalities, who are the people we have to look to for support and, without whose co-operation, we would not be able to make much headway. I think it will be a real practical way of making the scheme a sucess if we could find someone from the smaller towns to serve on the committee.

Dr. H. J. van der Bijl : Mr. President, may I explain that the sub-committee is not intended to be a permanent one, but only temporary, being only an organising committee. Their recommendations will be submitted to the municipalities and

manufacturers' associations and other bodies, after which a permanent and representative committee would have to be appointed.

We should have to approach the members of the other organisations to find out whether they would be willing to serve on the committee. The proposed organising committee would not be a committee of the Municipal Electrical Engineers' Association only.

Mr. E. Vivian Perrow (S.A.I.E.E. Johannesburg) : Mr. President, the paper read by Dr. van der Bijl is a very interesting one, and I am sure the movement will receive all the support it deserves. As far as the S.A.I.E.E., is concerned, we would welcome a copy to be read at one of our Meetings.

Dr. H. J. van der Bijl : What Mr. Perrow has just suggested will come afterwards. It is not necessary to have a permanent representative committee at present, but a committee that will have to formulate a scheme and draw up a constitution for submission to the bodies that may be interested and thereafter a permanent body will be established, that will be representative of the interested bodies.

Approval of suggested Committee :

On the motion of Mr. Ericsen (Kimberley), seconded by Mr. Millar (Harrismith), the Committee suggested by Dr. van der Bijl was unanimously approved.

The President : The thanks of the Association are due to Dr. van der Bijl for his help in this matter. We appreciate his advice and assistance very much indeed.

Dr. H. J. van der Bijl : Mr. President and Gentlemen, it is a great pleasure to me that you've received my suggestions so well. It has been in my mind for some time and I am very glad to have had the opportunity of bringing it before the Association.

DOMESTIC USE OF ELECTRICITY.

By **Mr. John Roberts, M.I.E.E.**, Borough Electrical Engineer, Durban and Member of the Council.

I have been asked to contribute a paper to this Convention on the "Domestic use of Electricity". It is a many-sided subject, and the request came altogether too late to give me time to deal with it in anything but a scrappy fashion.

The headings under which a complete paper might be divided are as follows :—

(1) The economic price at which current can be supplied.

(2) The economic price that the consumer can afford to pay to completely electrify his home.

(3) The effect of the universal use of electricity on supply systems :—(a) Output, and (b) Maximum demand.

(4) The distribution problem.

(5) Type of domestic appliances.

I do not propose to deal with the subject systematically under these heads. Each of them is worthy of a paper to itself, but I will try to cover the ground in a general way, giving some figures relating to the Durban system, from which current is taken pretty freely by domestic users, perhaps more so in proportion to its size than in any other station which depends on coal for its source of power, for it must be confessed that, leaving out a few systems with power generated from water, the fringe of the domestic electrical problem has scarcely as yet been touched. In Canada, in the systems of the Winnipeg Commission and the Ontario Commission, both of which generate their electricity from water power,

electrification has made great strides. In Switzerland this is also the case to a very large extent, but in those countries where current is produced from steam power, the Gas industry practically holds the field; even among Electrical Engineers there are many who say electricity cannot compete with it, and so well is gas entrenched as a means of domestic and industrial heating, that the electrical undertakings have for the next few years a very uphill fight before them, to prove to the public that electrical domestic heating is a commercial proposition. There are signs, however, that the apathy which characterised undertakings all over the world on the domestic side of our business is disappearing. It is now beginning to be realised that the field which has been almost completely overlooked or neglected, has greater possibilities of expansion than any other, and that the average domestic home which might consume from 200 to 300 units per annum at present for lighting is a potential consumer of as much as that per month when the home is completely electrified, or in other words, that the domestic users' demand can be increased over tenfold. This, of course, will have a most profound effect upon public electricity undertakings, both from the engineering and the economic point of view. The use of electricity will, of course, also greatly extend for industrial heating as well as industrial power, and it is very difficult to forecast closely what will be the effect on the economic side of the business.

It is many years ago since I first directed my efforts here in Durban towards the extension of the use of electricity for domestic purposes. It is over 30 years ago that the Durban Town Council, on the advice of their Borough Engineer, refused the application of a Gas Company to establish a privately-owned and operated undertaking in this town. The applicants were informed that as the Town Council had decided to embark on a Municipal electricity scheme they had decided to depend upon electricity for heating as well as light, and

that they would, therefore, not establish two rival systems in competition with one another for economic reasons. I am afraid that had their adviser been an Electrical Engineer he would not have been so enterprising, for there were not many in the Electrical engineering profession in those days who could have been found to give such far-sighted advice.

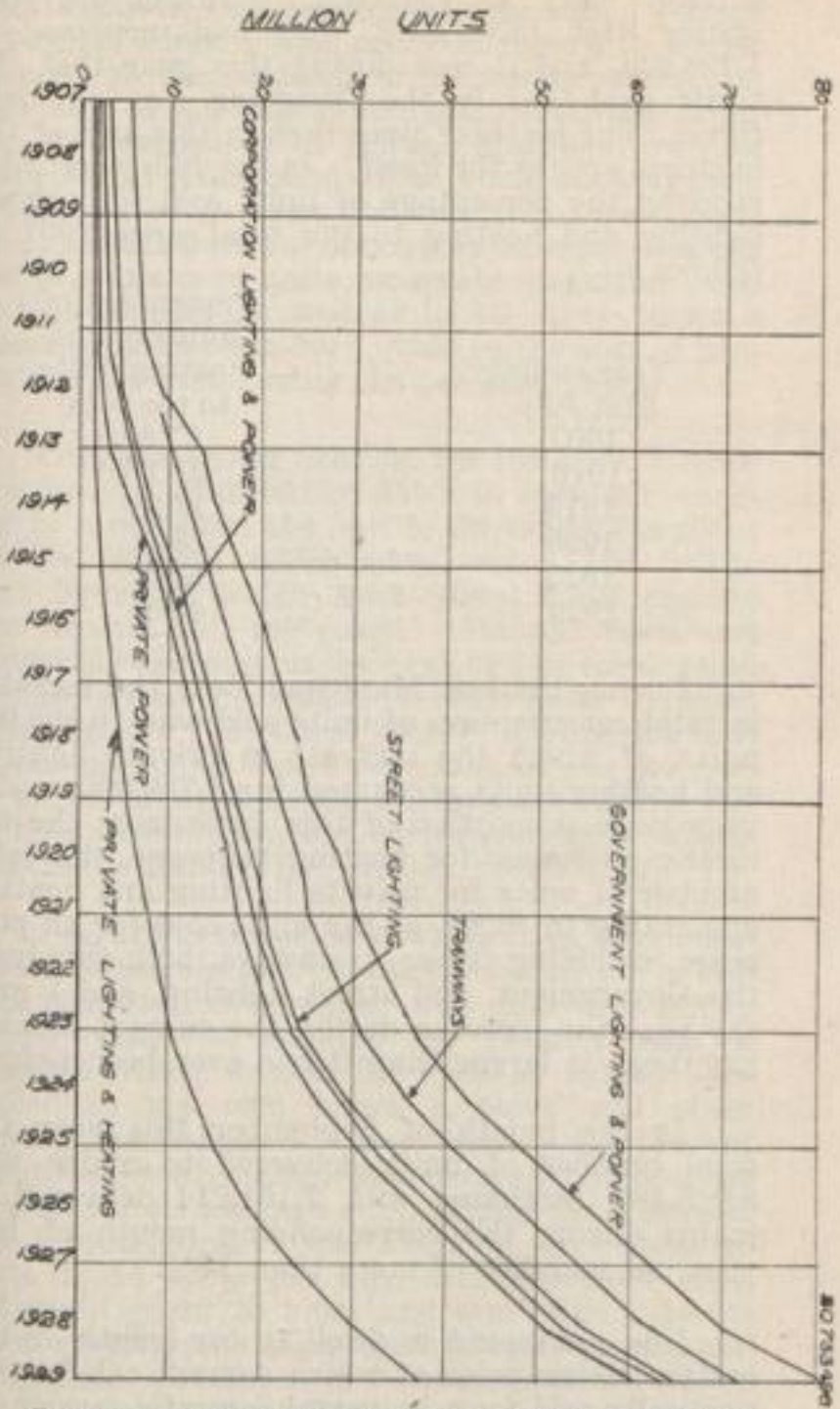
It was about the year 1905, when the Municipal electrical undertaking had been in existence for about seven years, that I began to make efforts to introduce electricity among domestic users for heating purposes. The great "bugbear" of which all Electrical Engineers were afraid was the high evening peak with corresponding poor load factor, which frightened us from going all out for domestic heating, and in Durban we started in a somewhat half-hearted way by offering a low price of 1½d. per unit for current used off the peak, the peak being reckoned as from about 4.30 p.m. to 7.30 p.m. Naturally such a restriction as this practically damned the business from the start. In many households the most important meal of the day was the one taken in the evening, and consumers were, therefore, not interested in our proposals.

In the year 1912 it was decided that all restrictions on the use of current had to be dropped and electricity put at the service of the consumer when and as he wanted it in the same way as other commodities are supplied, and the question of the best form of tariff to adopt was carefully considered. About that time there had been introduced in the town of Norwich, England, a method of charging which had the merits of simplicity and equity. Under that system a consumer guaranteed a minimum revenue by taking a certain number of units at the ordinary lighting rates (6d. or there abouts) and further consumption was offered at such a price as would enable him to use electricity for domestic purposes freely. It is known in England today as the rateable

value system of charging. The actual minimum amount guaranteed depends on the rental value of the property. It is not a scientific system, because it cannot be taken for granted that a consumer's use of current can be measured by the rental he pays, but it has one outstanding merit, i.e., that the rental value does to a great extent depend on the consumer's ability to pay, which is a very important practical consideration. This system was, therefore, chosen for Durban and adopted by the Town Council with the modification that instead of rental value the capital value of the house was taken as the basis of the minimum charge, for the reason that it is upon the capital value that rates are assessed in Durban and not, as in England, upon the rental value.

The method did not extend rapidly even in the country where it was introduced, but it is now beginning to be recognised as a fair and business-like proposition for both the supplier and the consumer, and only the other day I noticed that in Manchester the system was under consideration by the Municipal Electricity Supply Department. I am not aware that the system has been adopted in any other town in this country, though a similar system has been introduced whereby the minimum sum depends on the number of rooms per house. I do not propose to go into the comparative merits of the two, except to say that I think the Durban system is preferable. It is interesting, however, to note that from statistics published in the "Electrical Times" there are at present 105 British undertakings which have adopted the Rateable Value system and 31 which have adopted the basis of a minimum consumption per room. In some of these a room over 25 square yards (15 feet by 15 feet) is reckoned as two rooms. It should be particularly noted that the basis of the Durban minimum charge is, as stated, the VALUE of the house and not of the land as well.

There is given in Appendix 1 particulars of this tariff showing the minimum charges with the corresponding rate on the value of the house.



QUEBEC CORPORATION ELECTRICAL DEPT.

CHART NO 1 SHOWING ANALYSIS OF TOTAL UNITS SOLD EACH YEAR 1907

I call attention now to Appendix 2 and Chart No. 1, which show the number of units sold yearly for various classes of service since the year 1907. It will be seen that in this year, ending 31st July, 1907, the units sold for private lighting were 1,547,524, and in the year 1911 the units sold were

actually less, i.e., 1,468,692. During the year ending 31st July, 1912, they had increased to 1,725,944, and it was during this year that the tariff explained in the foregoing was put into force. The increase since then in this side of the business speaks for itself. In the following table is given the percentage of units sold for private lighting and heating to the total since 1907 as follows :—

Year ending 31st July	Percentage of lighting and heating units to the total
1907	27.4%
1910	21.1%
1915	16.8%
1920	23.3%
1925	32.4%
1929	46.8%

During the last Municipal Year the increase in total consumption of units sold was 10,900,000 units, of which the increase in private lighting and heating units accounted for 7,700,000, and a very large proportion of this came from the domestic consumer for heating purposes, the total number of units for private lighting and heating amounting to 46.8% of the units sold for all purposes, including power, tramways, bulk supply to the Government, and street lighting, and I may say that the increase during the current Municipay Year is larger than it has ever been before.

In the month of September this year the total number of units delivered to mains was 8,385,186, compared with 7,161,214 delivered to mains during the corresponding month of last year, an increase of more than 17%.

I do not intend to dwell at any length on the matter of the price at which current can be economically sold for a universal domestic service including lighting, heating, cooking, etc. It is a subject which would require the most exhaustive treatment, but for my own satisfaction I intend to pursue this matter, though not in time for this Convention. But there is one thing I would

like to say in this connection, i.e., that I believe it pays to adopt a bold policy in regard to prices, because all the tendency of electricity production today (with one notable exception) is in the direction of cheapening of prices. Stations are now operating at efficiencies which would scarcely have been believed to have been possible a few years ago, and this does not only apply to super-stations but to stations of quite moderate magnitude, and in this country as well as in all other places a tremendous cut has been made in the cost of production per unit during the past ten years.

Congella Power Station, for instance, though it is by no means settled down to economic working, is turning out the unit to the mains for about 1.4 lbs. of coal, which costs under .12d. (The best figure at which Alice Street could operate was around .2d. for coal). Present costs will materially decrease in the next two or three years as the output increases. I observe in a recent article in the "Electrical World" of America that it was estimated that a reduction of one per cent in prices brought about an increase of two per cent in consumption and correspondingly (within reasonable limits) for greater reductions.

In regard to the price at which it pays a householder to use electricity entirely for all his household purposes, this matter was gone into pretty closely when we adopted our present scale of charges, which was as far back as 1912. I installed in my own house a stove and other utensils, including a water heater, to discover about how much current was necessary in practice to cook for an average sized family for a month, and I found that it was likely to vary from 10 units to 15 units per day with moderate care, but could go to 20 units and over with a lavish use of current and large cooking requirements, and under these circumstnces an average family would have to spend around 30/- pér month for lighting and cooking if a fairly good watch out was kept to prevent wastage. I found that this was slightly more than the average family was paying for light and coal, but that the advantages of electric heating would be so much appreciated that the small

amount extra would be no obstacle whatever. This is proved to have been a fairly good forecast, and I have taken out the consumption of various classes of consumers where cooking is pretty extensively used, and when I say extensively used I mean that it is used to the exclusion of all other forms of heating, and there are given in Appendix 3 to this paper the figures in this connection. In No. 1 district, which is a newly settled area consisting of good class houses probably costing from £1,500 to £3,000 out of a total possible of 94 consumers 88 are using electric cooking exclusively. The average consumption per month of these cooking consumers is 347 units. In No. 3 district, which is also a new district, there are 111 electric cooking consumers out of a possible 120. These houses are occupied by a poorer class than in No. 1 and it will be seen that the average is 298 units. The last four classes are consumers in Flats, the highest being No. 6, where the average consumption reaches as high a figure as 524 units. The month from September to October, 1929, is taken in all cases.

It is likely that this information will be of interest to those who have not yet had much experience of the use of electricity to a large extent by domestic customers.

I may say that we have found that our best customers, that is those among whom electricity is taken up most freely for cooking purposes, are among the poorer sections of the community rather than among the wealthy, and the reason is not far to seek. In the former case the housewife spends a good deal of her own time in the kitchen and is willing to dispense with a certain amount of domestic help if she can undertake her household duties herself provided the work is not too arduous. In the better class household where the lady of the house spends little or no time in the kitchen, and where economy has not to be studied to the same extent, things are apt to be allowed to remain as they are, partly from a feeling that native servants will not give the same care and attention to electric appliances and from an inclination to let what is apparently well alone.

Up to the year 1923 electric stoves were being installed steadily by consumers, but quite slowly, and our records show that there were 110 stoves installed in consumers' premises during the year ending 31st July, 1923.

It was in 1924 that the Electrical Department determined to make a serious attack on the domestic problem. Members will remember that at the end of that year our Annual Convention was held in Durban and an Electrical Exhibition similar to the one now going on in Bloemfontein was held in our Town Hall, lasting for three days. In April of the following year (1925) we got our easy payment scheme through and this gave a decided impetus to the business, as will be seen from Appendix 4, which shows the number of stoves installed for every year ending 31st July. 1928 was our peak year, although there is not much sign of a serious diminution, the number of stoves sold last month (September, 1929) being 117. The main outline of this scheme may be of interest to members.

The Town Council does not purchase or stock stoves themselves. The consumer may buy whatever make of stove he pleases from a number available locally, all of which, however, must obtain approval of the Department, and a certificate by the Department is given before a stove can be sold under the scheme. There are now 13 different makes of stoves available, being chiefly of English and Canadian manufacture, but one locally made stove is included in the list. The Corporation pays the supplier outright for the stove as soon as it is installed. A supplier is permitted to make up to 25% profit above landed cost, £2 being allowed above this landed cost as expenses for assembly, delivery, etc., so that a stove which he can land for £18 is taken as costing £20 sold, and he is allowed to charge £25 for it. He must produce supporting documents to the Town Treasurer in regard to his costs. The purchaser then makes payment to the Town Treasurer in monthly instalments over from one to three years on the first of every month, and the agreement stipulates that if he is behind in his pay-

ments for his stove the Council have the right to cut off current. This proviso, together with the fact that two sureties must be provided for the due fulfilment of the contract, (and these must be registered male property owners) has prevented any loss to the Town Council, though the total amount advanced since the beginning of the scheme exceeds £90,000. The amount at present outstanding is under £30,000, and this amount is more or less stationary, expiring contracts just about counterbalancing new contracts being entered into. The Corporation charges 6% interest on outstandings, and as our loans are at 5% the difference of 1% is available to cover clerical expenses.

In regard to service connections and wiring the Department increases the size of the Service wires when a stove is installed without charge to consumers, but it is necessary for the consumer to increase the size of his mains, and the cost of this work is usually fairly heavy, varying from £8 to £15, and the consumer is allowed to pay this in instalments also if he is a property owner. The minimum cost of the stove available under the scheme is £6.

Members will be interested in the water heating question. Appendix 4 shows also the number of water heaters installed each year since 1923, but this is by no means the full number, as a large number were installed previous to that year, in much greater numbers, in fact, than electric stoves.

We calculate that we have considerably more than 4,000 water heaters and about 6,000 stoves on our circuits.

When a universal heating service was first suggested, most supply Engineers expressed grave doubts as to whether this could be done commercially, fears being expressed that the peak would be so heavy that the annual load factor would fall so seriously that the service could not be given at a reasonable price. I give in Appendix 5 the the annual load factor in Durban since 1922, during which year it may be taken that there were only about 200 stoves on the circuit and they could

not have been seriously affecting the peak. It will be observed that for the last three years the load factor has remained steady at 38%, though this is, of course, somewhat lower than it was in 1922, the figure for the year being 45%.

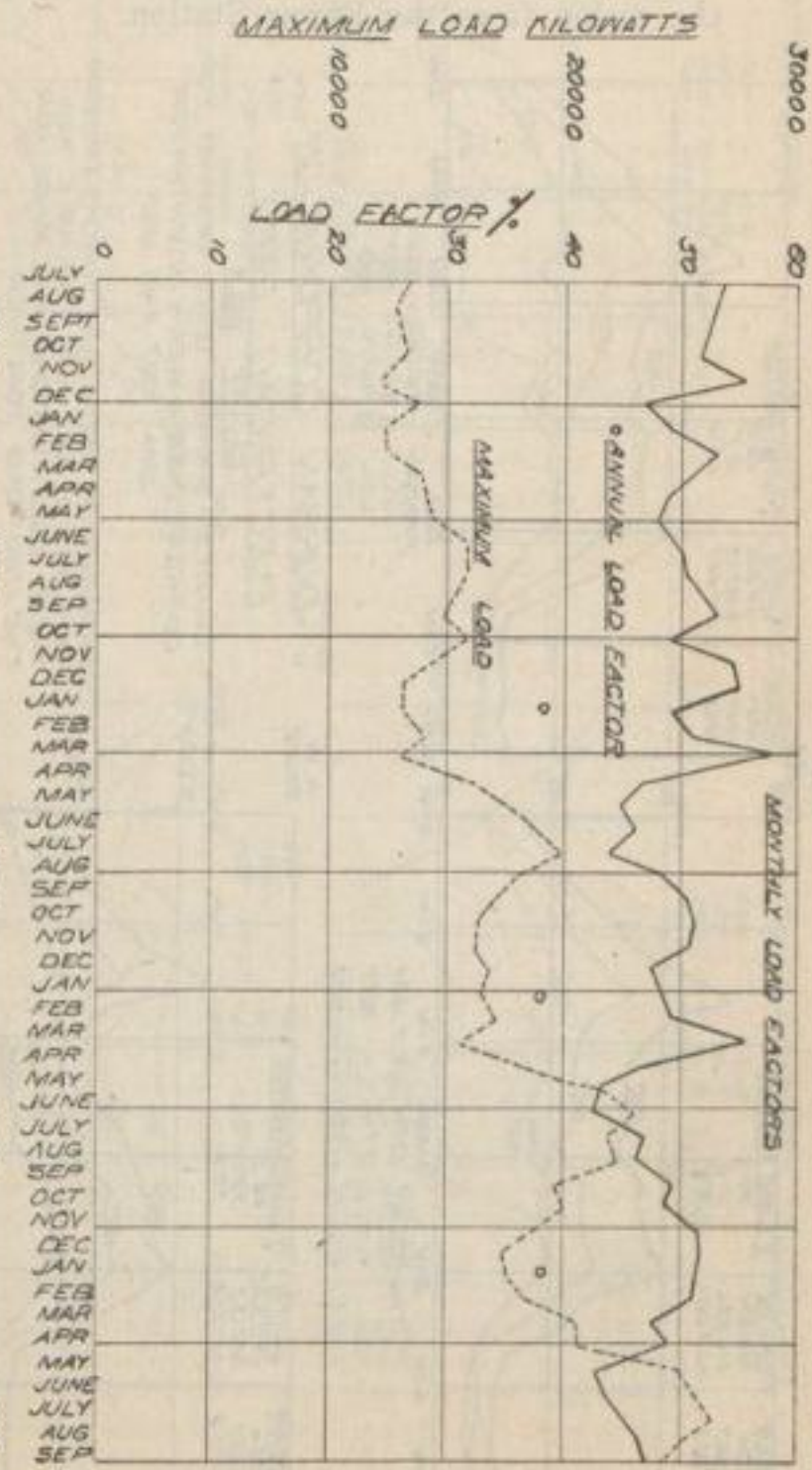
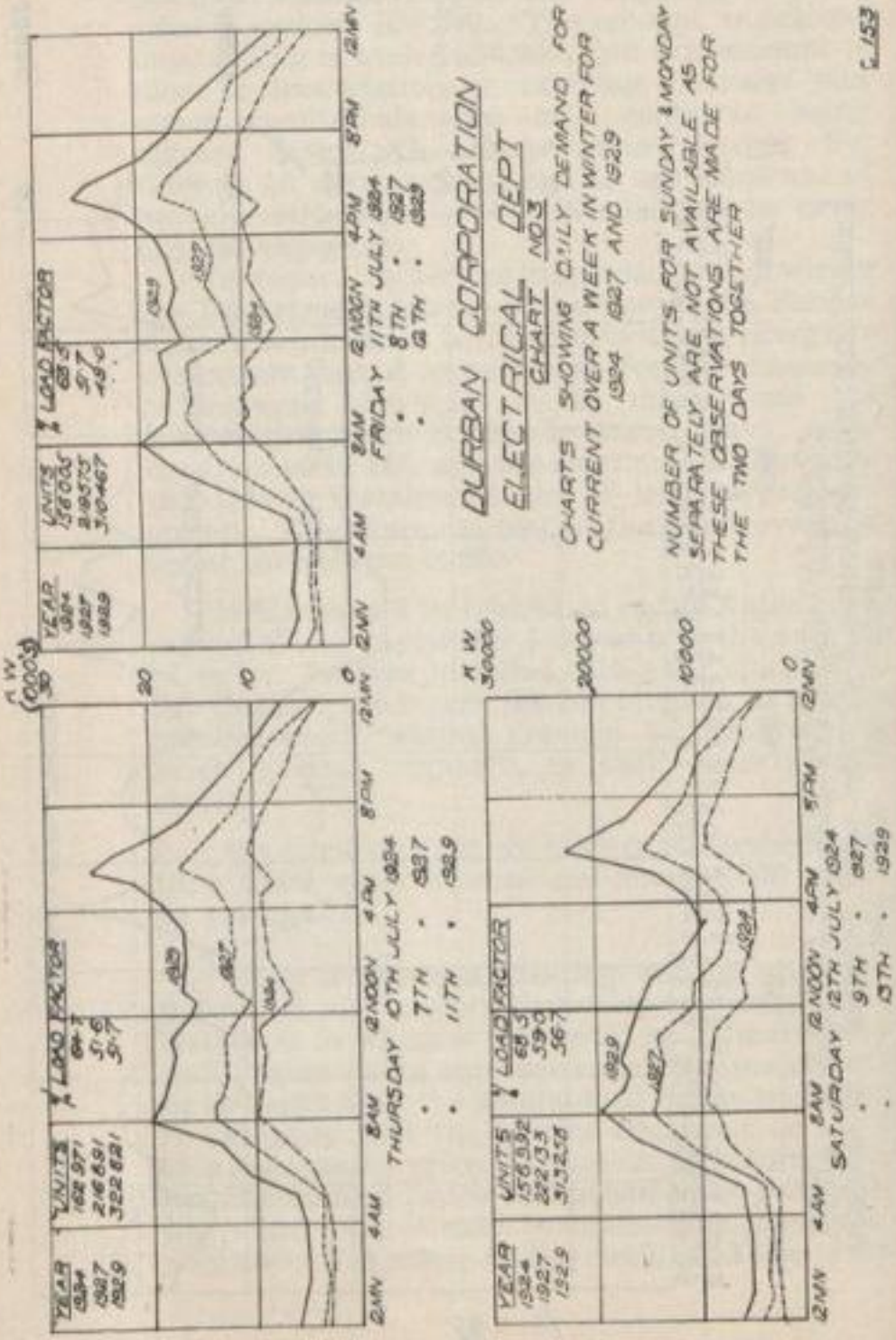


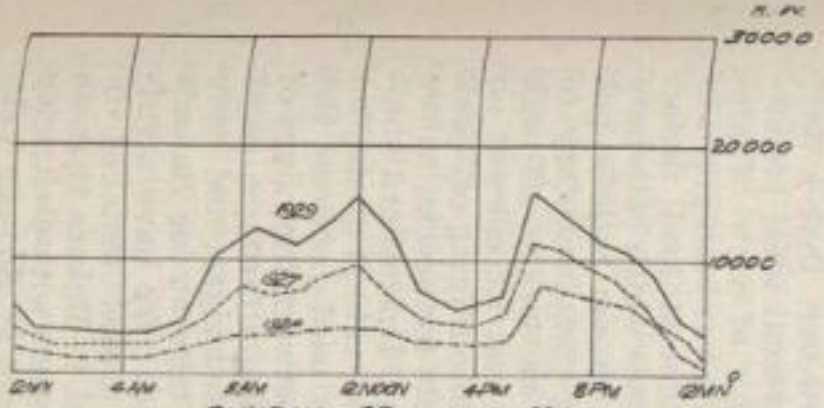
CHART NO. 8 SHOWING MONTHLY & ANNUAL LOAD FACTORS AND MAXIMUM LOADS FROM JULY 1925

LOAD FACTORS BASED ON TOTAL UNITS DELIVERED TO MAINS

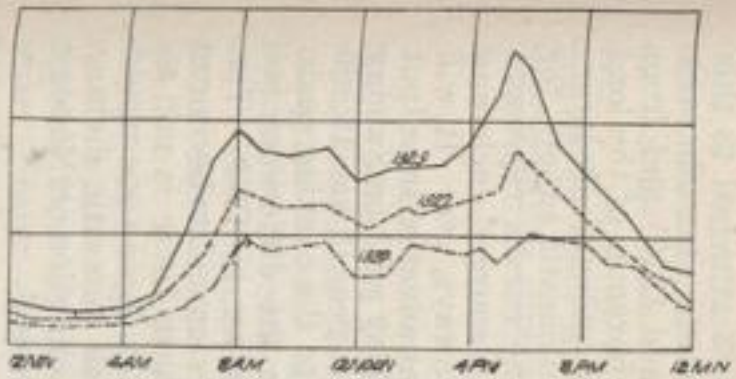
DURBAN CORPORATION ELECTRICAL DEPT.

I give on Chart No. 2 a curve showing the increase in the maximum load monthly since July, 1925, also the monthly load factor and the annual load factor. It will be noticed that the monthly load factor varies from 43% to 57.6%. These load factors are reckoned on units delivered to the mains from the Power Station.

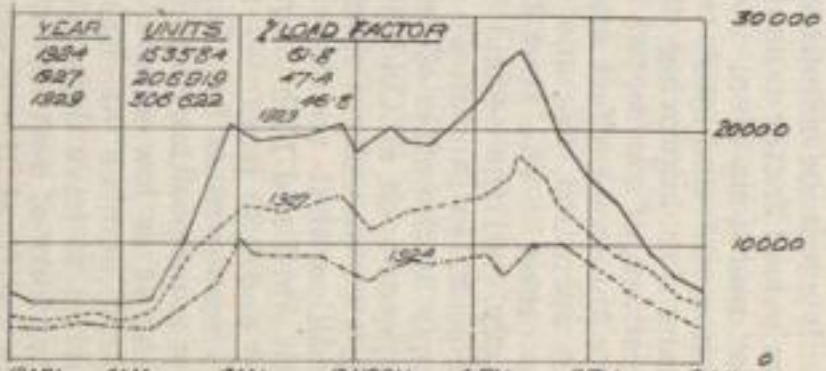




SUNDAY 6TH JULY 1924
" 3RD " 1927
" 7TH " 1929

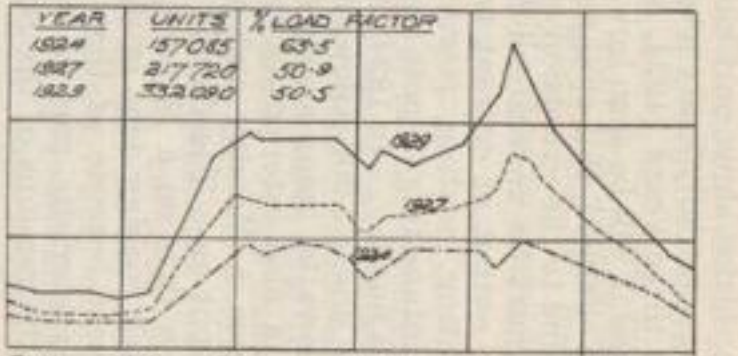


MONDAY 7TH JULY 1924
" 4TH " 1927
" 8TH " 1929



YEAR	UNITS	% LOAD FACTOR
1924	153584	61·8
1927	206919	47·4
1929	306622	46·5

TUESDAY 8TH JULY 1924
" 5TH " 1927
" 9TH " 1929



YEAR	UNITS	% LOAD FACTOR
1924	157065	63·5
1927	217720	50·9
1929	332090	50·5

WEDNESDAY 9TH JULY 1924
" 6TH " 1927
" 10TH " 1929

DURBAN CORPORATION ELECTRICAL DEPT

CHART NO 3 CONTINUED

I also show on Chart No. 3 attached to this paper the daily load curves in winter over one week for three years (1924, 1927, and 1929) and from these it will be seen how the character of the load has changed, this change being undoubtedly largely due to the extension of the domestic supply, for it must be understood that the curves represent the output of current from all sources, including lighting, heating, power, tramways, etc. It will be interesting to note the great advance in output on a Sunday. In 1924 the midday peak on Sunday was under 5,000 Kilowatts; this year it was 15,500 Kilowatts, being nearly equal to the evening peak. It is also interesting to note the difference between a Monday and a Tuesday in 1929. The output on a Tuesday is always considerably more than it is on a Monday, because there is not so much cooking done in the latter day as one would expect because of that British domestic dietary characteristic, namely the consumption on Monday of the remains of the Sunday joint.

It must be admitted, however, that a 38% yearly load factor cannot represent ideal production conditions from the point of view of production cost, and much thought has been given to means for improving this annual load factor. There are, of course, two methods which both have have the same effect and which can both be put into operation, the one being complementary to the other. The first is to encourage off-peak supply, and the second is to restrict current on the peak. In Durban we are encouraging off-peak supply by the offer of contracts for special power purposes such as Cold Storage, Irrigation Pumping, etc., whereby a special low rate is quoted on condition that no current is used between the 15th April and 15th August between the hours of 4.30 and 7.30 p.m. We are also offering current at cheaper rates for illuminated signs, and have now a proposition to supply current for Baker's ovens at as low a rate as .4d. We have a sufficient number of Baker's ovens installed in Durban to have demonstrated to Bakers that no other form of heating can compare with electricity The tariff at the present time is .6d. per unit, but the cost of current is so much in excess of coal

that it is very difficult to persuade the larger bakers that the advantages of electricity will make up for the extra cost. At the lower rate, however, I feel quite confident that it will only be a matter of time when all other forms of bread baking will be superseded in Durban by electricity.

In regard to restriction of the use of current on the peak, the Department has often considered what means can be taken to reduce domestic consumption at peak times. It is obvious that it is impossible to restrict the hours of ordinary cooking. The consumer naturally wants his cooking to suit himself, and not at times to suit the Power Station. I think it is possible, however, that some means might be taken to restrict the use of water heaters to off-peak times. This can be done in two ways, i.e., firstly by controlling the water heater circuits with a time switch, or secondly, by so connecting the stove with the water heater that both cannot be used together. Unfortunately there are so many of these appliances in use now in Durban that it would be a very great expense to make an alteration now, though the plan is still under consideration. A reliable electrically-wound time-switch is available at a cost of about £4 and it would cost about another £2 to instal and connect it up, making a total of £6 ready for service. It would thus cost us, say, £25,000 to so fit all the water heaters in Durban, at an annual charge, allowing 10% interest and depreciation, of £2,500 per annum. It would probably cost at least £1,000 per annum to inspect, maintain, and repair these time-switches, making the total cost £3,500 per annum. It is difficult to say to what extent the maximum load would be reduced if every one of these time-switches were switched off on the peak and because we have no means of knowing how many are on circuit at peak load therefore somewhat difficult to estimate what saving in the Station's standing charges on generating plant would result, but as I stated, the position is being investigated, and even so large a capital expenditure as £25,000 might possibly pay.

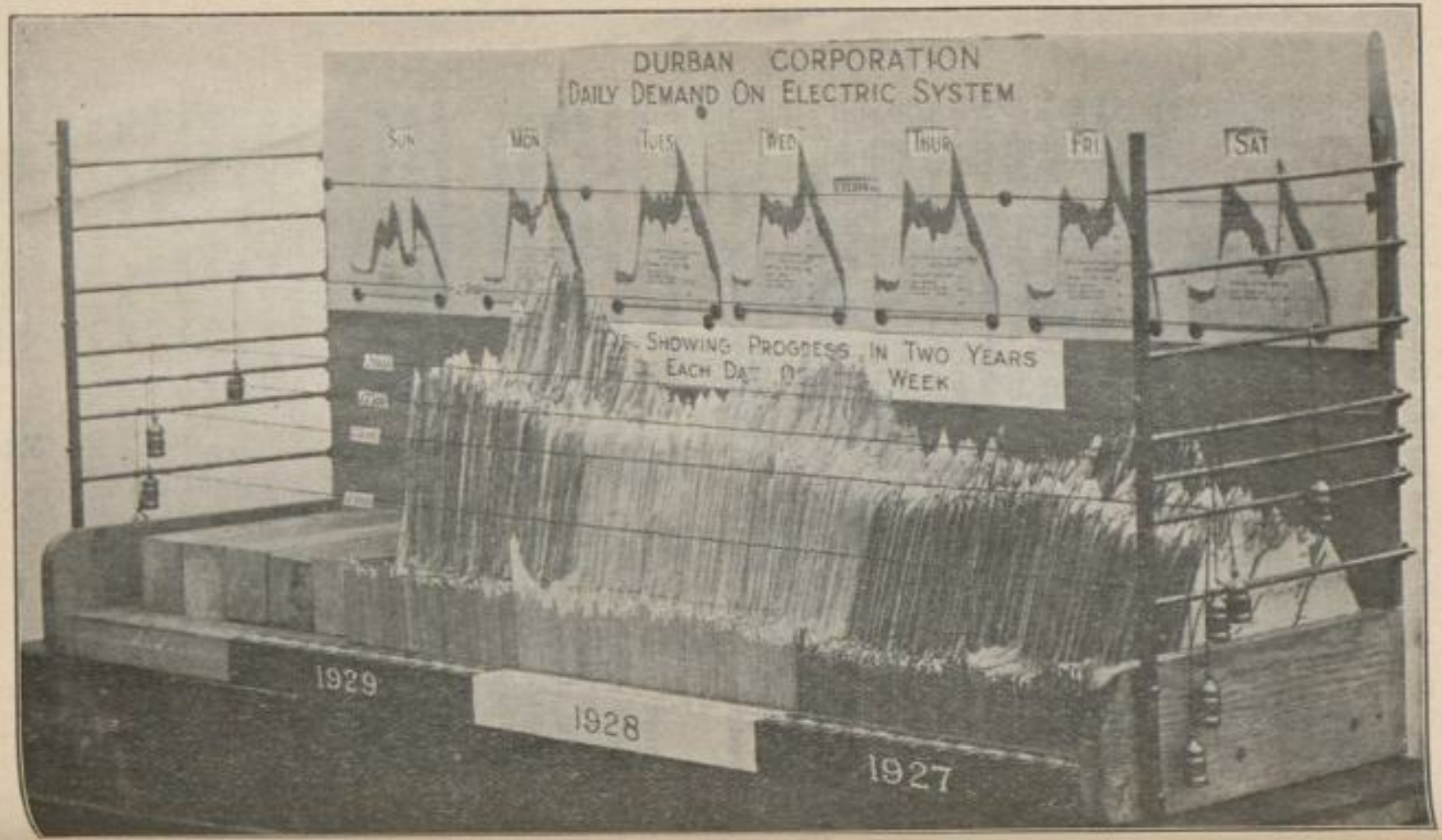
Another method of achieving the same result and probably at a lower capital expenditure, would be to instal a two-way switch so that when the stove is switched on the water heater is automatically switched off. This method has been frequently suggested by others studying the problem during the last year or two, and the idea is one well worthy of consideration. There is one doubtful factor, however, i.e., whether, in households where the use of the stove for cooking is extended over several hours a day, a consumer would obtain the amount of hot water he requires during the hours while the stove is not in use. It is our intention in Durban to very carefully study the problem and make up our minds whether the disadvantages of a fairly high capital expenditure to the Department and the possible inconvenience to the consumer would be worth the saving which would be made by the reduction of the peak. I will say, however, that if we were beginning afresh I think it is extremely likely that one or other of the suggestions I have made would be adopted, and this expression of opinion may be of interest to those who are in the early stages of their domestic work.

There is no doubt that it pays all suppliers to do their utmost to improve load factor provided they bear in mind that serious inconvenience to customers must be avoided, for the first object to be aimed at is to serve the community and not to get a good load factor. If one can do both, so much the better. The Durban peak is unfortunately a very sharp one (I refer, of course, to the winter peak, which is the only one of importance, lasting not more than a quarter of an hour or so). It must be remembered that this peak occurs not only on the Station but on the distribution mains, and while Power Station machinery can be overloaded for short periods safely one cannot avoid pressure drop on mains, and this is objectionable, even if it lasts only for a short time. One must, therefore, not only consider the point of view of the Power Station when improvement of load factor is being studied, but the distribution and transmission system as well.

Durban, of the larger towns in the country happens to have the worst condition in regard to its winter peak. It is furthest east, and the meridian which fixes the time for the Union passes almost exactly through Durban, so that in Durban our time is true according to the sun. Johannesburg is about 3 degrees west and has the advantage in evening hours of daylight of about 12 minutes over Durban. Capetown is about 13 degrees west and has the advantage of 52 minutes. I reckon that if Durban lay on the Johannesburg meridian and all other conditions remained the same, our winter peak would be at least 2,000 Kilowatts lower. Our peak time is exactly at 5.35 each evening during June and July. This is at the time when offices & shops are still burning a certain amount of light, when a few power consumers are still working, and when the tramways are busiest. At all other times of the year, of course, we get the advantage of shorter evenings, darkness falling every day sooner than in more westerly parts of the Union according to the clock, but we could, perhaps, afford to lose a quarter of an hour of daylight every day of the year for the sake of a saving on the peak in winter.

I attach to this paper a photograph of a block chart made up of cardboard sheets assembled together, each sheet being cut out to the shape of the daily demand for current on the system. This chart is of great use to us in watching the growth of the load and its varying characteristics. It will probably be also of interest to members.

I must apologise for the brevity and scrappiness of this paper, but it will probably arouse some discussion and on this account will prove of some value.


DURBAN CORPORATION
DAILY DEMAND ON ELECTRIC SYSTEM
SUN
MON
TUES
WED
THUR
FRI
SAT
SHOWING PROGRESS IN TWO YEARS
EACH DAY OF WEEK
1929
1928
1927

APPENDIX 1.

"Scale 5" Figures. (Rateable Value Tariff).

Valuation of Buildings	Minimum No. of Units	Minimum Monthly charge £ s. d.
200	9	3 9
300	12	5 0
400	15	6 3
500	18	7 6
600	21	8 9
700	23	9 7
800	24	10 0
900	26	10 10
1,000	28	11 8
1,100	29	12 1
1,200	30	12 6
1,400	33	13 9
1,600	35	14 7
1,800	36	15 0
2,000	37	15 5
2,200	38	15 10
2,400	40	16 8
2,600	42	17 6
2,800	43	17 11
3,000	44	18 4
3,200	45	18 9
3,400	46	19 2
3,600	47	19 7
3,800	48	1 0 0
4,000	50	1 0 10
4,200	51	1 1 3
4,400	52	1 1 8
4,600	53	1 2 1
4,800 and above	54	1 2 6

APPENDIX 2.

Analysis of Total Units sold, from 1907. (See Chart No. 1).

YEAR	Private Lighting & Heating	Private Power	Municipal Lighting & Power	Street Lighting	Tramways	Govt. Lighting & Power	Total
1907	1,547,524	499,722	670,915	657,000	2,266,317	—	5,641,478
1908	1,382,799	517,794	981,605	675,160	2,459,502	—	6,016,860
1909	1,383,046	636,956	1,128,441	700,000	2,614,367	—	6,462,810
1910	1,417,089	712,719	1,098,888	710,554	2,773,378	—	6,716,628
1911	1,468,692	809,350	1,140,949	728,010	3,249,623	—	7,396,624
1912	1,725,944	1,457,324	1,163,370	733,836	3,389,712	553,513	9,023,699
1913	2,085,208	2,522,764	1,153,881	719,205	3,704,540	3,567,386	13,752,984
1914	2,570,941	3,583,717	1,051,855	915,566	3,909,710	3,394,889	15,426,678
1915	2,971,184	5,680,174	1,054,592	901,165	3,744,880	3,307,927	17,659,922
1916	3,495,841	7,092,749	1,073,299	887,545	3,769,109	3,707,363	20,025,006
1917	4,207,186	7,623,612	1,240,463	944,548	4,138,455	3,843,617	21,997,881
1918	5,042,634	8,346,525	1,254,885	946,598	4,452,086	3,843,942	23,886,670
1919	5,700,761	9,505,797	1,285,819	935,053	4,658,483	3,811,295	25,897,208
1920	6,661,162	10,005,665	1,328,804	937,463	5,425,607	4,235,068	28,593,769
1921	7,815,068	9,876,927	1,396,179	1,057,979	4,874,018	5,081,120	30,101,109
1922	8,926,201	10,861,145	1,418,894	1,075,993	5,667,370	5,420,548	33,370,151
1923	10,388,115	11,372,520	1,811,019	1,103,825	6,071,758	5,741,609	36,488,846
1924	12,799,174	13,035,901	2,024,385	1,223,530	6,293,950	6,494,982	41,871,922
1925	15,602,988	15,033,213	2,272,237	1,306,536	6,847,411	7,090,860	48,153,245
1926	19,082,888	17,844,953	2,348,871	1,613,660	7,218,928	7,734,866	55,844,166
1927	24,455,344	19,212,392	2,512,041	1,909,479	6,651,064	7,957,631	62,697,951
1928	30,177,558	20,494,727	2,050,958	2,048,459	6,596,431	8,490,496	69,858,629
1929	37,843,976	22,780,940	2,032,126	2,371,720	6,652,799	9,051,935	80,733,496

APPENDIX 3.

Return of Consumer's average consumption in various districts per month, in September-October, 1929.

No.	District	Total Consumers	Total cooking consumers	Total Units	Average per consumer	Average per cooking consumer
1	Evans Road & Nicolson Road	94	88	20,956	329	347
2	Cowey Rd. Housing Scheme	77	63	20,458	265	314
3	Stella Park Estate	120	111	33,743	281	298
4	Windermere Flats, Marine Parade	20	18	5,641	282	307
5	Beach Mansions	37	28	7,683	208	260
6	Springfield Mansions, Musgrave Road	14	14	7,338	524	524
7	Musgrave Mansions Musgrave Road	20	19	5,972	298	314

APPENDIX 4.

Number of electric stoves and water heaters installed every year since 1923.

Year ending 31st July	Stoves	Water Heaters
1923	110	292
1924	228	324
1925	307	372
1926	646	521
1927	1,304	711
1928	1,404	791
1929	1,399	710

APPENDIX 5.

Annual Load Factor and Maximum Load, since 1922.

Year	Annual Load Factor %	Maximum Load Kilowatts
1922	45	8,815
1923	44	10,150
1924	47	11,150
1925	42	14,155
1926	44	16,100
1927	38	20,150
1928	38	23,428
1929	38	26,680

Mr. John Roberts (Durban) : Mr. Poole has drawn my attention to the fact that I was booked to say something about the electrical exhibition. I don't know why I was chosen to do that and the only thing I can say, Sir, is that you Mr. President. are to be congratulated on the success of yours last night. Unfortunately, I could not get round in the crush to see much, but later, I hope to pay the exhibition another visit and devote more attention to it.

Mr. President : I thank you, Mr. Roberts, for your very interesting paper, but I don't see why you should need to apologise in your concluding paragraph. Although the paper may be brief, it is one that is very interesting and takes a lot of digesting. It is now open for discussion, Gentlemen.

Mr. L. L. Horrell (Pretoria) : Mr. President, Gentlemen, I think Mr. Roberts, the pioneer of electric cooking in this country, deserves the congratulations of us all. Undoubtedly he has done more towards increasing this type of load than any other engineers in South Africa.

We have now over 900 electric stoves in Pretoria and the average account amounts to 29/7 for cooking and lighting and 39/10 for lighting, cooking and water heating. At this figure the electrical installation compares favourably with the coal stove, and householders are thereby induced to install the electric type. Despite our loan system, we find that the initial cost of installation is the chief obstacle.

I sometimes think that contractors should assist Councils more by giving better service. It is essential that complaints from householders should receive prompt attention and a skilled workman dispatched to remedy the fault immediately. Unless contractors are prepared to give this matter more attention, I am of opinion that Municipalities should seriously consider the question of establishing their own service station, with a highly efficient staff to attend rapidly and effectively to faults on all types of household electrical appliances.

Mr. H. A. Eastman (Capetown) : Mr. Roberts has presumably not intended to set out the principal points for consideration in developing the Domestic Use of Electricity in the order of their importance. If this had been intended he would no doubt have given an earlier place in the list to "the distribution problem." The first essential for any development scheme is so to plan the distribution system - and if necessary to reconstruct it - that it is, or can readily be extended to be - suitable for meeting the increased demands and consumption produced by future reduced charges and facilities which might be granted for the installation of electric appliances.

As an example of the results of disregarding this requirement I might mention the case of the Wynberg Municipality which for many years before unification with Capetown placed practically the whole of the profits of its electricity undertakings to the relief of general rates and spent only a negligible amount on the maintenance and extension of its distribution system. At the time of unification the distribution system was unable to supply even the normal increase in requirements of electric energy, and in order to maintain a supply at all the Capetown Corporation had to spend £50,000 on reconstruction work during the first year and was compelled to maintain the tariffs at a higher average price while this work was in progress than in the remainder of the Unified Municipal Area so as to keep a check on the growth of the load until the system had been put into reasonable order for meeting the demand. A further £50,000 was spent on the Undertaking in the following year on reconstruction work to make it suitable for the anticipated increase in demands when the tariffs were made uniformly the same as in other parts of the Municipality. The tariff rates and the cost of appliances installed are the main considerations to a consumer in adopting the use of electricity. The price per unit however need not be reduced to uneconomic levels merely to encourage the use of electricity on unprofitable services. The tariff should rather be determined by what the service is worth and what the consumer may reasonably

be expected to pay for it. If at that price a profit is made, this should go to meeting the loss on other services which are being encouraged to the ultimate benefit of the undertaking and its consumers, any balance being contributed to interest charges to the reserve funds for the replacement and extension of plant and equipment.

As an illustration of the influence of the tariff on the consumption I would draw your attention to figures in a recent report by the Hydro Electric Power Commission of Ontario where it is stated that of all units used by Municipalities in their area of supply for domestic purposes 86.2% was sold at 1.9 cents or less; 12.4% at from 2 to 3.9 cents; 1.3% at from 4.0 to 6.9 cents; and only 0.1% at 7 cents or more per unit.

We have taken out figures in Capetown that show conclusively that the lower the price the greater is the rate of growth of consumption. In 1922 the consumption at lighting, heating and cooking rates was 5.8 millions per annum with an average price paid of 7¼d. per unit. This had increased to 9.3 million units per annum in 1925 with an average price of 4¼d. per unit, but upon making further reductions in the charges the consumption increased far more rapidly and was 18.4 million in 1928 when the average price was 3¼d. per unit. That is to say, the consumption for lighting, heating and cooking increased nearly four fold when the average price was halved and a further analysis shows that the consumption for heating and cooking purposes only, while remaining almost steady at an average price of 13/4d. per unit increased eight fold in five years when the average price fell to 0.9d. per unit.

I understand that the figure of average consumption for Durban of 347 units per month for an "all electric" home includes also the provision of hot water. If so the figure shows very clearly the effect on the consumption of electricity of climatic conditions and geographical position. The average consumption of an all electric house in Capetown for lighting, heating and cooking is 350 units per month while a hot water supply system would use at least another 300 to 350 units.

In Capetown rapid strides have been taken in the use of electricity for water heating on the continuous thermal storage system at at a tariff of 30/- per K.W. per month. Very little trouble is met with due to the variation in inlet temperature of the water in summer and winter which is much less than for instance in Johannesburg and Pretoria. "Booster" heaters are however used in some cases in conjunction with "continuous" heaters in order to speed up the supply of hot water if necessary and these can be used to compensate for the variation in summer and winter inlet temperatures. For ordinary domestic purposes in the average house of five rooms we find that a 30 gallon continuous water heater with a 500 watt element gives entirely satisfactory results and this method of obtaining hot water is being more or less standardised in 30 gallon (500 to 600 watts) and 60 gallon (750 to 1,000 watt) sizes.

Booster heaters where used are supplied with electric energy at the ordinary tariff rate of, at present, 1d. per unit.

Having in mind the possibility of quoting a lower rate than the present day equivalent of ½d. per unit for continuous water heating if the water heating load can be "kept off the peak" we have for some time been collecting information as to the practical results obtained in other undertakings of carrying out switching operations at a distance by superimposed high frequency currents (400 to 800 cycles per second) on the distribution network by means of which tuned relays would be used to control the local water heating supplies, but we have not carried out experiments in this connection ourselves as yet. The best arrangement is obviously that by which such switching operations are controlled at the Power Station and although this control can readily be obtained by means of auxiliary wires run on the existing distribution system it is thought that this system would be more expensive than that which we are looking into.

In Capetown we find that hire purchase facilities are granted by the electrical dealers on reasonable terms and so far the Council has not inaugurated facilities of this nature for domestic appliances though it has done so for some years in respect of electric motors.

Congress then adjourned at 12.50 p.m.

Mayoral Lunchoen held in Polley's Hotel.

The delegates were entertained to luncheon at Polley's Hotel by the Mayor (Councillor Sol. Harris) and the Town Council.

Visits :

During the afternoon the delegates inspected the Municipal Power Station, where an official photograph was taken, and in the evening they visited the Lamont-Hussey Observatory on Naval Hill, being shown around by Professor Rossiter and his staff.

WEDNESDAY, 13th NOVEMBER, 1929.

The Convention resumed its proceedings at 10 a. m. with the President (Mr. R. Macaulay) in the Chair, there being present :—

Members— Messrs. T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), W. H. Blatchford (Greytown), G. Chace Brown (Vrede), R. D. Coulthard (Oudtshoorn), P. W. Dadswell (Cradock), H. A. Eastman (Cape Town), R. W. Fletcher (Krugersdorp), A. Hadfield (Gwelo, S. R.), A. Q. Harvey (Middleburg, Cape), J. Hooper (Robertson), L. L. Horrell (Pretoria), J. Iverach (Grahamstown), S. V. R. Lewis (Aliwal North), W. Mortimer Mail (Kokstad), F. C. D. Mann (Worcester), T. Millar (Harrismith), H. A. Morris (Kimberley), H. M. S. Muller (Upington), P. H. Newcombe (Alice), L. Ralston (Dundee), John Roberts (Durban), J. H. Rogers (Fort Beaufort), H. G. Simpson (Colesberg), L. B. Sparks (Pietersburg), T. Sutcliffe(Benoni), J. Vowles (King-williamstown) ;

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Associate Member— F. Castle (Cape Town) ;

Delegates— Councillors W. C. Adcock (Port Elizabeth), J. Blaker (Johannesburg), A. L. Clark (Durban), J. B. Dersley (Bloemfontein), T. Ericsen (Kimberley), D. A. Thomson (Bloemfontein), and A. Withinshaw (Cape Town) P. R. O'Halloran (Krugersdorp), and P. de K. van Heerden (Cradock) ;

Visitors— Messrs. I. J. Allen (Petrus Steyn), H. S. Bell (Rouxville), J. Bernard Bullock (Johannesburg), John Hogg (Bloemfontein), H. A. Mellor (Bloemfontein), E. T. Oates (Johannesburg), E. Vivian Perrow (S.A.I.E.E., Johannesburg), W. P. Phelp (Johannesburg), Mrs. H. D. Phelp (Johannesburg), R. F. Riley (B. G. E. C., Johannesburg), A. N. Rishton (Bloemfontein), J. S. Butchart (S.A.R., Johannesburg), F. C. Stephens (Public Works Department, (Pretoria).

Honorary Secretary and Treasurer— Mr. E. Poole (Durban).

ANNOUNCEMENTS :

New Members : The President announced that the Council had elected Mr. T. Maddren (Assistant Electrical Engineer, Pretoria) as a member and the transfer of Mr. J. G. Clark to the class of Associate Member.

Electric Cable and Bare Copper Conductors : Yesterday morning, the Council met representatives of the Cable Manufacturers' Association, who suggested the inclusion of certain clauses in the standard specifications for cables, as follows :—

"The tender price covered by this specification is to be based on Electrolytic Copper Wire Bars and English Lead per ton of 2,240 lbs., as taken from the London Metal Report, appearing in the daily Press in South Africa, the basis price to be nominated by municipalities inviting the tender and the figure to be named by them to be closely approximate to the current value prevailing.

"Adjustments in price according to the price of metals ruling on the day following that on which the Council's acceptance of the tender is received by contractor to be the basis for adjustment, and this to be determined as follows :—

"The actual weight of metal contained in the cables and/or copper to be calculated from the tables appearing in the British Standard Specification No. 7, 1926, which, if necessary, will be supported by a certified letter from the manufacturer, and the adjustment will represent the actual difference in value of the metals specified due to the variations in the prices of same."

On the suggested clauses being put to the Meeting they were adopted unanimously and it was decided to circularise all members, asking them to recommend to their Councils the inclusion of the clauses.

Papers for next Convention : I shall be glad of offers of papers for the next convention, and I hope that some of the Engineers of the smaller towns will come forward.

The President : The discussion left over from yesterday is much the same as will take place to-day on Messrs. Sankey and Horrell's paper, and I think we could take both discussions together, and I will therefore call on Mr. Horrell to read the paper now.

SOME NOTES ON SUPPLY TARIFFS AND METERING PROBLEMS.

By **R. Sankey**, General Manager Electricity Department, Johannesburg and
L. L. Horrell, City Electrical Engineer, Pretoria.

Few subjects of commercial interest to those responsible for public supplies of electricity have been more discussed than the basis and practice of framing tariffs and charges.

The basic object of all tariffs is, or at any rate should be to encourage the further use of electricity by making the average cost per unit less and less as the consumption increases; hence the present policy of what are known as two-part tariffs for lighting, heating and cooking, and sliding scale tariffs for motive power and industrial uses.

One of the first difficulties encountered by the framer of electricity tariffs arises from the fact that whilst the ordinary domestic, industrial or business tariff will meet the case of the very large percentage of ordinary users coming within the scope of the tariff, there invariably seem to be a few consumers who do not fit into any tariff. In some towns, endeavours are made to overcome this difficulty by a multiplication of tariffs, which the writers contend is wrong in principle and leads to confusion and trouble. The present notes are intended to deal, not with the large majority of consumers to whom the ordinary system of tariffs can be easily and simply applied, but to the few who offer difficulties either in the application of the tariff or in the metering and recording of the consumer's supply, or both.

As electricity must be supplied at a rate which compares favourably with other commodities such as gas, steam, etc., and as before mentioned, all tariffs and tariff reductions should have in view the encouragement of the use of electricity for all purposes, it follows that a flat rate for all

consumers is out of the question, and where in use, is a serious bar to progress. In framing tariffs, the Engineer must bear in mind that there are two distinct charges to be met, viz., the fixed and the running charges. The fixed charge is that portion of the cost of the supply to the consumer involved in being ready to supply, i.e., maintaining the pressure at all times at his terminals. This cost is, to a large extent, independent of the number of units consumed, but bears a close relation to the maximum demand, or, in other words, the maximum extent to which the consumer can draw from the mains, and comprises, principally, capital, overhead and distribution charges. The running charges consist essentially of the cost of producing the units used by the consumer and the transmission cost involved in transmitting and delivering them to his premises.

By analysing the cost of supply to a consumer in this manner, it will be seen that a large demand with a comparatively few units will involve a high average cost per unit but that if a means can be found whereby the consumer can increase his consumption with advantage to himself, then the additional cost involved to the supplier is very small indeed and the general average cost per unit to the consumer falls rapidly as his consumption increases, provided that at the same time he does not increase his maximum demand or pull on the mains. It is to meet these conditions that the two-part tariffs come into use. Undoubtedly the best two-part tariff from the supplier's point of view and, therefore, also from the consumer's point of view is the two-part tariff whereby the fixed charges are payable by the consumer at a fixed sum per month, constituting practically a minimum charge. By this means, the supplier is definitely covered for his fixed charges and can, therefore, supply at the lowest possible rate per unit by meter. Unfortunately comparatively few towns will accept such a tariff, owing to the fact that a considerable number of consumers do not use enough electricity to cover their proper proportion of fixed charges, and the opposition from this class of consumer is such as to prevent such a tariff being imposed.

The next best tariff, is, therefore, in more common use, viz., a high rate per unit for a certain number of units, after the consumption of which the low rate comes into force. The use of this tariff entails a higher secondary rate per unit in order to make good the loss incurred by consumers who do not use their quota of high rate units and consequently are supplied at a loss.

The most general systems in vogue in South Africa for assessing the quantity of high rate units consist of assessing a certain number of units supplied, (a) on the number of living rooms, (b) on the valuation of the property, or (c), on the floor space, and charging for this number of units at the high rate, and when this quantity has been consumed, then the lower rate comes into force. Of these systems, in the writers opinion, the room basis system is by far the most suitable and flexible, and in this respect, offers considerable advantages over the valuation basis. In both Johannesburg and Pretoria this domestic supply tariff has been extended from its original object, which included only private houses, to cover the following :—

(1) Private Houses.
(2) Boarding Houses.
(3) Private Hotels.
(4) Flats or Blocks of Flats.
(5) Hostels.
(6) Homes run by Charitable Institutions.
(7) Buildings or separate sections of Buildings separately metered and exclusively used for residential purposes.
(8) Nursing Homes and Hospitals.

Business Premises.

One of the most difficult classes of consumers to deal with, both as regards tariffs and metering, is offices and shops. Offices seldom require any lighting during the daytime and in this country, are usually closed before dark; hence their demand during the greater part of the year is nil. In Johannesburg, however, during the three winter months great use is made of electric radiators whic create enormous heating loads usually of

short duration. In addition, a dark winters' day may add a considerable amount of lighting load also. Under these conditions, it may be imagined that even at 6d. per unit or more, this class of supply is a very unsatisfactory one, involving heavy outlay in plant and distribution and giving a return over a small period of the year only. Shop lighting also, though more constant throughout the year, is of short duration, involving heavy loads on the top of other loads, thus creating heavy peaks. The most usual way of metering shop premises is by means of two-rate meters, whereby the evening lighting load is charged for at the high rate and current used during the daytime at the low rate. For lighting purposes only, this is fairly satisfactory, except for the trouble and expenses involved in supplying and maintaining the electric timeswitch and two-rate meter. Difficulties begin, however, immediately the consumer wants to use current for heating or cooking purposes on his premises. This is solved in many towns by providing a separate meter and another tariff, which again means separate wiring. It is difficult to argue as to the logic of charging the shopkeeper 6d. per unit for his lighting on one meter and, say, 1d. per unit for his heating and cooking requirements at the same time of the day. Also, with two separate wiring systems on the premises, is is difficult to prevent the inadvertent use of the cheap heating circuit for lighting purposes.

It is obvious that some more satisfactory one meter method is required for supplying this class of consumer. Investigations are now proceeding in Johannesburg to ascertain whether it cannot be further extended to cover business premises of various classes by taking an area of 30 square yards as the equivalent of one room and assessing such premises as Hotels, Restaurants, Tea Rooms, Eating Houses, Stores and Offices on this basis. It is doubtful whether it will be possible to fit in such a tariff to every one of this class, but if some, at any rate, can be transferred to the room basis tariff, it will greatly simplify matters.

Shop Window Lighting.

In the ordinary way, shop window lighting is most unsatisfactory, for it only occurs during the peak load and in the majority of cases, the windows are only lit up one or two evenings a week.

No other class of supply is so restricted and no other class of supply costs more to deliver, the only point in its favour is that it certainly helps to light the streets. If however, a tariff could be devised which would encourage the lighting up, of the windows **every evening,** Sundays being optional, it would be both profitable to the consumer and to the supplier.

In all cases, the consumer should pay his quota of the capital charges and if, therefore, these payments are spread over six days a week instead of one or two, these charges would be met and it would be a benefit to the Supply Undertaking.

The system of paying so many units per running yard of window front at a high rate and the balance per month at a lower rate is not favoured by commercial houses.

A scheme has been adopted in Pretoria for this service which has increased the revenue in three years from £300 to 3,000 and is as follows :

The consumer makes a contract with the Municipality to take a supply for three, four or five hours per evening for every day in the year, Sunday being optional, and by doing so gets the current at reduced rates; the rates depending on the hours of demand.

An automatic time switch, governing the window lighting, is installed in the shop and is controlled and maintained by the Municipality. This automatic time switch is set to switch the lights on or off at predetermined times.

The consumer enters into a yearly contract for the supply of current for three or more hours per night for 313 days in the year on the following terms :—

(1) The Council provides, controls and maintains an automatic switch, which switch remains the property of the Council.

(2) The consumer pays a monthly rental of 5/– for the use of the time switch.

(3) The current is supplied at the following rates :—

First hours's consumption per night at 5d. per unit. Second hour's consumption per night at 3d. per unit. Third and subsequent hour's consumption per night at 1d. per unit.

On this basis, the average cost of consumption would be :—

3	hours	per	day	3d. per unit
4	„	„	„	2½d. „ „
5	„	„	„	2¼d. „ „
6	„	„	„	2d. „ „

The consumer is given the benefit of changing his time and hours of supply on the 15th March and 15th September in each year, providing the hours of supply are not less than three hours per night.

The advantages are shared by both consumer and Supply Undertaking; the Supply Undertaking because it obtains a constant load of at least three hours per night and the benefit derived therefrom for lighting streets, and the consumer because he gets his supply at such reduced rates.

Tariffs for Blocks of Flats :

As in most of the larger towns in South Africa, the building of large blocks of Flats, often combined with shops on the ground floor, has become the rage in Pretoria, and in order to give the occupants the advantage of the domestic rate and at the same time avoid complicated metering arrangements, the following scheme has been adopted with regard to the Flats.

The Municipality installs the main meter or meters at the point of entry of the service and charges the owner with the full account for current consumed in the buildings, at the rate of 5 units per room at 5d. per unit, an equal number of units at 2d. per unit, a further equal number at 1d. and the balance at ¾d. per unit per month.

The following is an example of how this tariff can be applied to a three roomed flat which, say, consumes 100 units per month :—

Amount paid for current through prepayment meter 100 units @ $\frac{3}{4}$d.		6	3
Monthly account collected by the landlord through the rent,—			
15 units @ $4\frac{3}{4}$d.	5 $3\frac{3}{4}$		
15 „ @ $1\frac{1}{4}$d. ..	1 $6\frac{3}{4}$		
15 „ @ $\frac{1}{4}$d. ..	$3\frac{3}{4}$		
		7	$2\frac{1}{2}$
		13	$5\frac{1}{2}$

With regard to the installation, maintenance and reading of the sub-meters, two methods are in use in Pretoria. In each case the landlord only is responsible for the payments to the Department.

("A") The first method is a flat rate one. A Master Meter being installed through which the whole of the supply to the building is passed and registered. This is the account sent to the landlord.

The meters for each of the individual flats are assembled on a main board in the main switch board room.

No rent is charged for the Master Meter, but each sub-meter is charged for at 1/6 d. per month. These sub-meters are read by the Department and a statement is rendered to the landlord showing the amount due for each flat, which amount plus the meter rent he recovers from the various tenants.

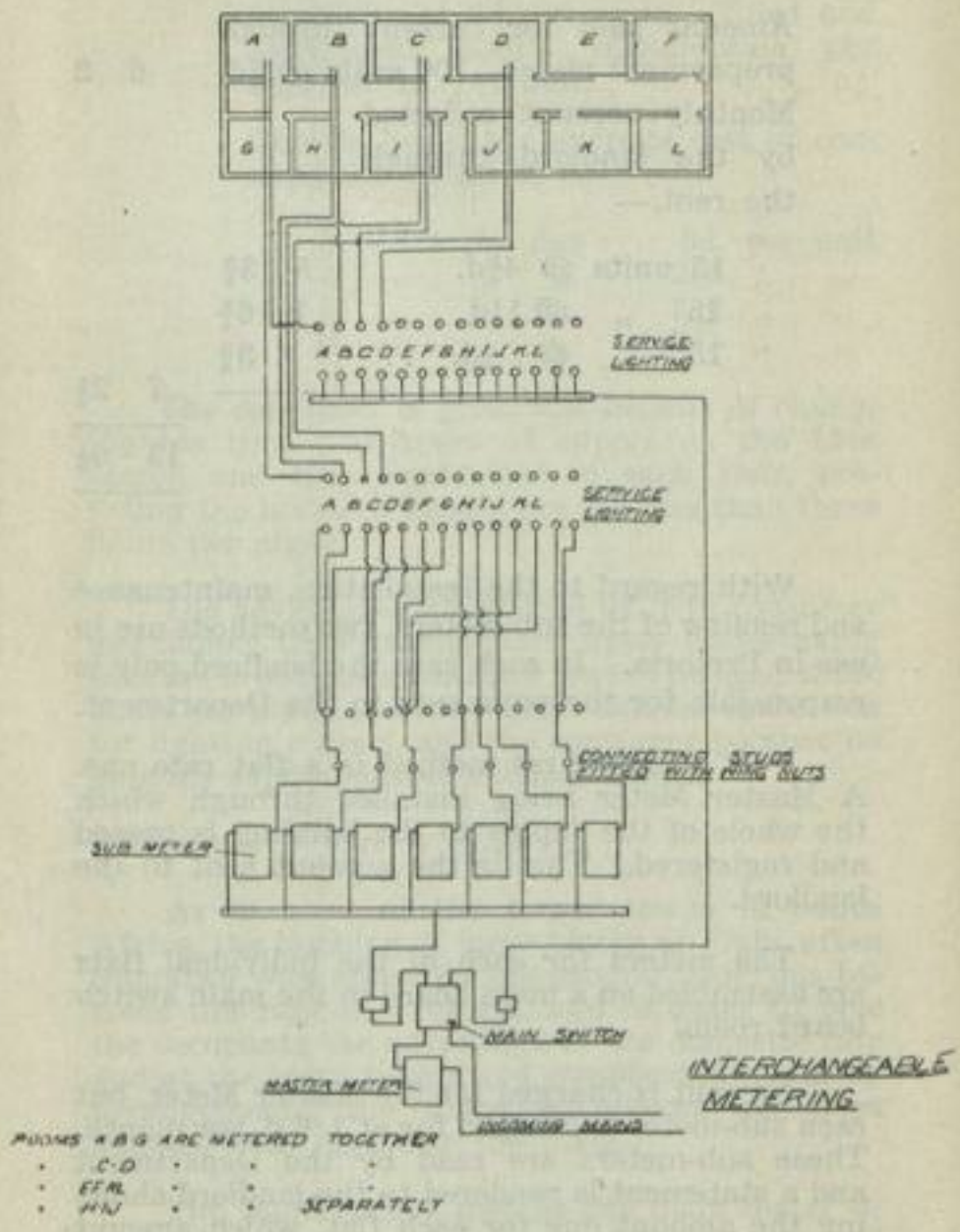
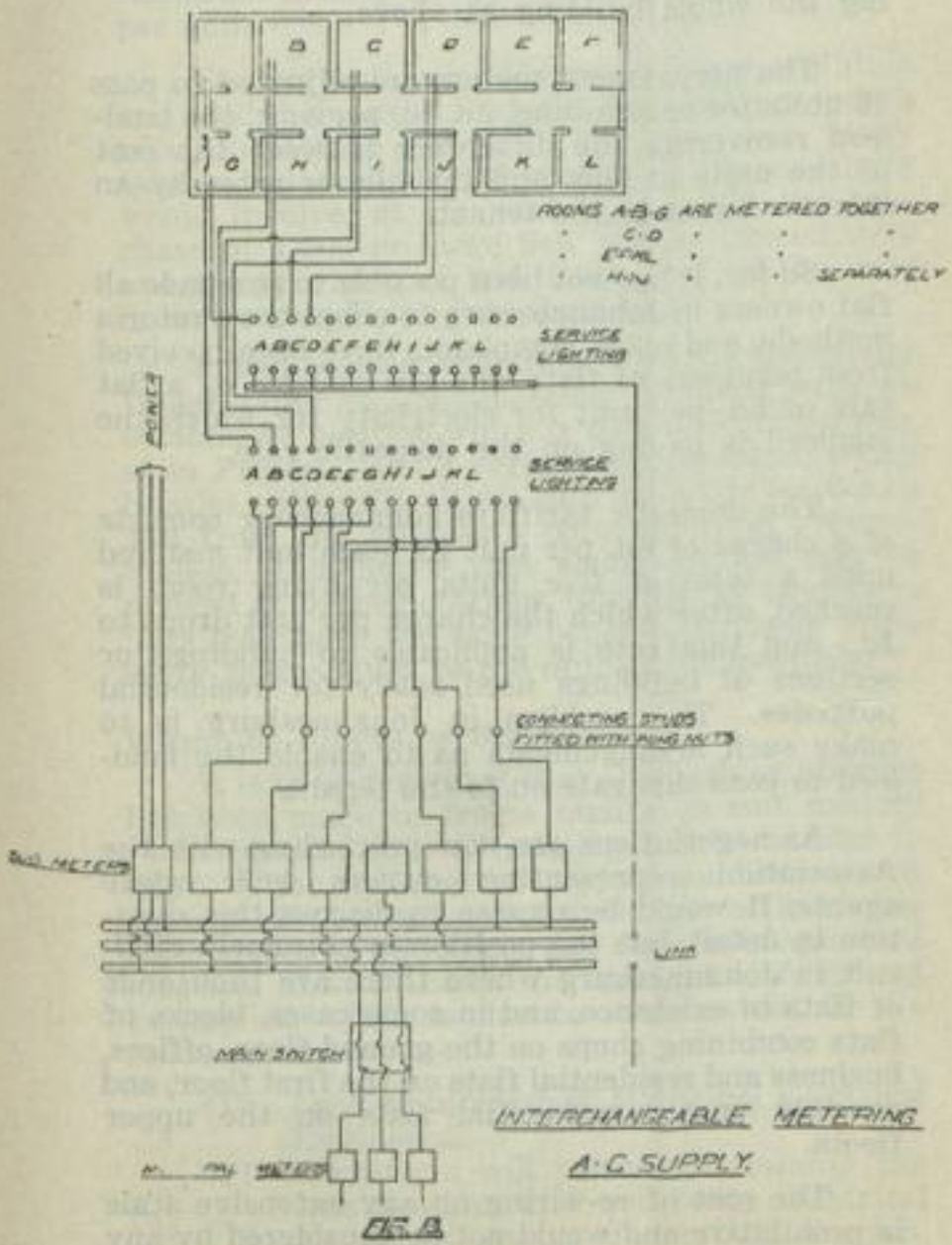

A B C D E F
G H I J K L
A B C D E F G H I J K L
SERVICE LIGHTING
A B C D E F G H I J K L
SERVICE LIGHTING
CONNECTING STUDS FITTED WITH RING NUTS
SUB METERS
MAIN SWITCH
MASTER METER
INTERCHANGEABLE METERING
ROOMS A B G ARE METERED TOGETHER
C·D
E F H L
H N J
SEPARATELY

FIG A.

The tariff under this method is a basic charge of 12 units per flat, plus 5 units per living room, i.e. the charge for, say, a 3 room flat will be 12 plus

15=17	units	@	5d. and
27	„	@	2d.
27	„	@	1d.
any excess		@	¼d.

All service lighting being charged for at 5d.



("B) The second method of charging is by prepayment meters. A suitable meter being installed in each flat and maintained by the Department at rental of 3/- per month.

The usual Master Meter is installed at the main distribution board of the building, all energy registered on this board being charged for on the basis of 12 units plus 5 units per living room taking the whole building as above.

The prepayment meters are adjusted to pass 16 units for one shilling, i.e. ¾d. per unit, the landlord recovering the difference between the cost of the units at this and the higher rates by an increased rent to the tenant.

So far, it has not been possible to persuade all flat owners in Johannesburg to adopt the Pretoria methods, and many complaints have been received from occupiers of flats who are charged on a flat rate of 6d. per unit for electricity for which the landlord is paying on the domestic rate.

The domestic tariff in Johanesburg consists of a charge of 6d. per unit for each unit metered until a total of five units per living room is reached, after which the charge per unit drops to 1d., and this rate is applicable to buildings or sections of buildings used solely for residential purposes. The problem in Johannesburg is to make such arrangements as to enable the landlord to pass this rate on to the tenant.

As negotiations are now proceeding with the Association representing owners and estate agents, it would be unwise to discuss this question in detail, but the position is extremely difficult in Johannesburg where there are thousands of flats in existance, and in some cases, blocks of flats combining shops on the ground floor, offices, business and residential flats on the first floor, and possibly purely residential flats on the upper floors.

The cost of re-wiring on any extensive scale is prohibitive and would not be considered by any landlord. The crux of the difficulty appears to

be the question of metering. Landlords are somewhat jealous of anything approaching interference between themselves and their tenants. Landlord's meters, as far as can be ascertained in some cases ,operate far from correctly, and cases have been found where the units recorded by 6d. per unit slot meters fail to provide sufficient revenue to cover the units registered by the main meter, at approximately half the cost per unit.

The suggestion to take over meters, maintain and read them, as at Pretoria, for 1/6d. per month was objected to strongly. To take over, maintain and read all the sub-meters in Johannesburg would involve, at the outset, probably the purchase of 1,000 or more new meters immediately and the provision of additional men, as the total in meters would run into thousands.

It will be seen, therefore, that the Electricity Undertaking in Johannesburg is faced with an established position which is not of recent growth, as in Pretoria, and a very thorny problem, which bristles with difficulties, both from the landlord's and from the supplier's point of view. Nevertheless, it is hoped that some solution may be arrived at by negiotations whereby all tenants in flats may have the same benefits of cheap electricity as are given to the ordinary householder.

Wiring of Blocks of Buildings :

It is to be regretted that although an attempt has been made to frame tariffs to suit modern requirements, little or nothing has been done to improve the methods of wiring buildings which consist of numerous rooms let for offices, consulting rooms, workshops and residential quarters etc., and in many cases the special tariffs cannot be applied. This is due to some extent to the following causes :—

(1) Lack of interest of Municipal Electrical Engineers.
(2) Architects will persist in framing the specification, and not being Electrical Engineers. do not understand the job.
(3) The lowest tender is invariably accepted.

It has been the custom in the past for electric current used for lighting purposes to be included in the office rent. This was quite satisfactory when the current was used for lighting only, but to-day, when electricity is used for heating, cooking and power, the owner would be faced with a large account for current and have no means of recovering the cost of same from his tenants.

One can understand that if a building of this kind is supplied with current at lighting rates, through one meter, it is difficult for the owner to include the cost of electricity in the rent which will be fair and equable to all concerned. To overcome this difficulty, the current must be either supplied at such low figure so that is is possible for the owner of the property to be able to make satisfactory arrangements with his tenants for the supply of current for all purposes, or he must get the supply authorities to assist him in separately metering each room or set of rooms as required.

If the landlord obtained an all round rate, say of 3d. a unit (and this is very unlikely) and retailed it to his tenants at that price, it would be acceptable for those who were using it for lighting purposes, but on the other hand the people who were using the current for heating and cooking would be dissatisfied.

It is an easy matter to meter any set of rooms, providing they are wired as a separate installation, but the trouble arises when these sets of rooms are split up into different sequences. The place must then be entirely re-wired which, in modern buildings, is not possible unless it is done on the surface, because all the tubing is embedded in concrete.

A scheme has been adopted and is in use in Pretoria which overcomes the difficulty. Each room is wired back with a pair of mains to a central distribution board and fed through a separate pair of fuses placed in two distinct rows on the distribution board. The top set of fuses on this

distribution board are all joined together with a common bus-bar and connected to the neutral fuse. The fuses in the bottom row are independent of each other and to each of them is coupled a short piece of insulated wire which is used to connect the circuit to the meter. It is, therefore, possible to bunch these wires together and meter any room or suite of rooms and also without expense to re-arrange the sequence and meter any other set of rooms.

The above arrangements have also the advantage from the landlord's point of view that they prevent any interference or tampering with the meter by the tenant. They are applicable however, only to the ordinary meter and would not be suitable for slot meter supply. The design of meter terminal boxes, especially for the metering of current in flats, leaves much to be desired as the meter leads are generally exposed. Where the meters are fixed inside flats and the leads to the meter are exposed, then it is not a difficult matter to tamper with the meter reading. Cases have been cited where tenants in Johannesburg flats, incensed at the flat rate charge of 6d. per unit imposed by certain landlords, have arranged that their meter shall record a suitable number of units, so that their month's account shall not exceed what they would have to pay at the domestic rate if they were occupying their own house

INDUSTRIAL SUPPLIES :

Where application is made for supplies of power involving a demand on the system of 50 kilowatts or upwards, it is obvious that such supplies cannot be economically given by a low tension overhead or underground network, and in such cases it is customary to take the high tension mains into the consumer's premises and provide a transformer sub-station thereon. This may sound very simple, but the whole question of high tension and low tension supplies bristles with difficulties. It not infrequently happens that an industry starts with 25 H.P. The Municipality is called upon, at considerable expense, to extend its mains and give supply from its low tension

system. If the industry is a failure, the industrialist goes bankrupt, usually owing the Municipality for his current, and the Municipality may or may not be covered for the expenditure incurred in extending the mains. If, however, the industry is a success, the demand increases, another 25 H.P. Motor is required—making a total of 50, and later on—still a third 25 H.P. Motor, and at this juncture the supplier begins to consider how much longer he can continue to suppiy through his low tension network, and if, on the other hand, he requires to change the method of supply over to high tension supply with the necessary sub-station, who is to bear the cost of this second outlay?

The Johannesburg Municipality introduced in 1926 the following special high tension bulk supply tariff :—

For the first	2,500	units	per month	1½d.	per unit
„ next	5,000	„	„	1d.	„
„ „	10,000	„	„	¾d.	„
„ „	balance of units		per month	½d.	„

(Metered on H.T. Side)

This represented a very material reduction in power cost, leaving the charge for low tension current practically unaltered. This tariff has been extremely successful and has very nearly eliminated the difficulties arising from the growth of industrial consumers coupled to the low tension mains, but has now lead to another difficulty. In certain areas, groups of factories have sprung up, each factory supplied through its own high tension sub-station, whereas in some cases one central sub-station close adjacent to four or five surround factories would be a more economic proposition, both for the supplier anr the consumer. The question now arises as to what relation the low tension tariff should bear to the high tension tariff, so that the supply may be given either in the form of high tension or low tension current.

One solution of the problem is to meter all supplies, whether high or low tension, on the low tension side, which means that the Municipality

must then bear the transformer losses and no incentive is given to the consumer to cut out his large transformers after his factory is closed down. This latter is an important point, as a number of banks of large transformers running idly in an industrial area have a serious effect on the power factor of the adjacent network, and make the maintenance of a suitable supply pressure dificult during peak lighting hours. This class of supply to large industrial consumers is usually treated as a bulk supply, that is to say, the consumer is free to use same for any purpose, whether lighting, heating or motive power. In a general municipal supply, one is sooner or later confronted by the consumer whose requirements for lighting over the peak load may be equal to or greater than his motive power requirements, or he wants to include a row of houses on the same property. In some towns, the restriction is made that the units consumed for lighting purposes shall not exceed 20% of the total requirements, but, beyond this, it is not usual to exercise any serious check on the purpose for which such bulk supplies are used.

SPECIAL TARIFFS :

Water Heating.

It is customary in some Undertakings to devise special tariffs for special classes of supply, such as cinematograph converters, water heaters, irrigation pumps, etc. Generally speaking, such tariffs are, in the authors opinion, not always sound in principle, but undoubtedly serve for a time to promote business and add to the revenue. The weakness of such tariffs is that their value is usually of short duration, as the special conditions to which they apply are usually of a transitory nature.

In the case of water heaters, for instance, this problem has been attacked in several directions, viz., by charging a fixed price per month for a constant current heater in which a small current is taken day and night. This method of charging, whilst it obviates the expense of a meter or time-

switch, has the objection from the supplier's point of view that for every kilowatt added to the night load an equal amount is added to the peak load, and it is a question whether at the very low rates per unit usually associated with this system a proper proportion of capital charges involved in such peak load supply is provided for.

The next development was the offer of a special low rate between the hours of 10 and 11 at night and 7 in the morning, with the object of filling up the gap in the load curve during the night time and materially improving the plant load factor from the supplier's point of view. Except for the fact that the cost of the necessary meter and timeswitch is a very heavy item this system seems to be ideal, but if this arrangement is to be a success it is the writers opinion that in order to obtain this low rate, the installation must be installed to Municipal specification and that such specification should include a storage tank of not less than 60 gallons capacity, that the whole of the storage space which it is required to maintain under temperature must be efficiently lagged in such a manner that the loss of temperature does not exceed one degree per hour and that the heating element for such an installation should not be of less capacity than one kilowatt and be controlled by a thermostat. It is also an additional convenience if a second element can be included which can be connected to the ordinary house circuit, in case of a shortage of hot water occurring during the restricted hours. A third system is a restricted hour tariff for water heating, which cuts out the circuit between sunset and 10 p.m. only. Under this system, it is essential to have automatic thermostatic controls and it seems probable that the bulk of the water heating would take place during the night time, supplemented to some extent during the day time by the thermostatic control should the consumption of water exceed normal requirements. This would ensure that the consumer had a full cistern of hot water to carry him over the peak load.

ELECTRIC COOKING :

In the case of shops and business premises, such as Restaurants and the like, which are usually supplied on the two-rate system at a comparatively low rate during the daytime and a much higher rate over the lighting peak, a difficulty arises at once when the consumer applies for a large electric cooking load. So far, no universal one-meter tariff appears to have been devised to meet this position, and it is customary in most town to offer supply by special meter at about the same price per unit as a secondary rate applicable to the domestic tariff. This enables business premises to obtain current for electric cooking at the same rate per unit as the private householder, but as this supply is usually given in the form of a flat rate, it is advisable to insist upon a minimum charge per month to justify the installation, maintenance, etc., of a separate supply and supply meter.

ELECTRIC HEATING :

Electric supply for electric heating in a place with the climate of Johannesburg is a most unpayable proposition and one which the supplier would gladly be without. It is met with during approximately the three winter months only of the year and then it is very intermittent. Cold snaps may involve an increase of load at about 8.30 in the morning ranging from 1,500 to 2,000 kilowatts, due to people in offices, shops, etc., turning on radiators. When the sun gets up by about 10 o'clock the whole of this load is gone, or in the case of a very cold day, it may continue more or less throughout the day. To maintain adequate distribution pressure on the system under these conditions is almost impossible. The load factor is extremely bad and the revenue obtained comparatively small. This problem is probably peculiar to Johannesburg. If such supplies were encouraged and extended throughout the suburbs, the maintenance of adequate distribution pressures during cold snaps would be

utterly impossible. In other towns where winter conditions are not so severe the position is probably not so serious. It is, however, questionable whether electric heating of rooms and buildings is worth encouraging in any town.

CONCLUSION :

In conclusion, the authors wish to emphasise that the notes and remarks in this paper are intended to apply to cases out of the ordinary such as are met with in almost every supply Undertaking, and they hope that the experiences cited will result in contributions from other towns as to the difficulties encountered elsewhere and the methods which have been developed to overcome them.

The President : The papers are now open for discussion.

Mr. H. A. Eastman (Cape Town) : With regard to the difficulty mentioned by Messrs. Sankey and Horrell in their paper providing for loads of upwards of 50 K.W. I would submit that the solution is largely one of distribution planning, tariffs and arrangements with the Consumer.

In Capetown we find no difficulty in giving 380 volt three phase supplies up to 300 K.W. per consumer. These supplies are usually given at bulk supply rates by cables laid direct to the consumer from the nearest substation. The cables are usually short and are paid for by the consumer. Where a substation does not happen to be conveniently situated for a large industrial supply, as for instance may occur in a newly developing industrial area, we find no difficulty in coming to an arrangement with a consumer to allow of a substation being built on his property and which can be used to give supplies to other consumers.

Mr. Ralston (Dundee) : Mr. Chairman, I would like to pass a compliment to Mr. Roberts on his very able paper, and with your permission I would like to read the following contribution to the discussion which I have prepared :—

The much discussed question known as tariffs is one which I think gives more worry to Councils and Engineers than any other branch connected with Municipal Service. A Council having an electric supply always is out to make a particular point on supplying its consumers with cheap electrical energy, such a supply being based in most cases in competition with coal.

In South Africa coal is comparatively a cheap article, also Native labour. The development of electric supply must be put forward at such a figure per unit that householders must feel that they are not paying too much for this commodity, and also that they are getting value for their money. Apart from the lighting of a house, which, in truth is the founder of the supply comes the question of domestic apparatus. In considering same must be taken its utility, reliability, price and standardization. The difficulty in small towns presents itself from the consumers point of view as the competitive price paid in large centres for electricity for general use. We in Natal have the competition of cheap coal both for power and domestic use. Most of the small towns in Natal are within reach of the Commission's Electricity Supply Mains, and fast the small towns are being linked to the supply, this being brought about **mainly** through the consideration of expanding on their existing plant or replacement of worn out, low voltage, old age, and badly **designed plants.** The question of change to A.C. with a bulk supply is no doubt the correct thing to do where possible, but, what about the tariff? When talking of cheap electricity for domestic and industrial purposes the K.V.A. charge of 30 minutes maximum demand does not seem conducive to favour consideration. I know that the diversity factor will be put forward, but this does not agree in many cases. The peak load on small power stations is reached between the hours of 6.30 and 9.30 if

K.V.A. charge is fixed, and for some reason such as a motor being started, small pumps being operated, bioscopes, stoves, public functions, the extra K.V.A. above stipulated demand, is to be charged for the whole year.

If one has fixed a low domestic tariff it is most likely to come out on the wrong side if the above condition occurs several times during the year. Take a similar position when operating a small power station when this load comes on there is little or no difference made to the cost of generation, in fact, it comes down per unit. Take window lighting; if one is purchasing on a K.V.A. charge, window lighting would not be encouraged mainly because of putting up the extra K.V.A., although the window lighting in a sense helps to pull down the price per unit generated.

Tariff of charges from bulk supplies must be based on conditions the same as one has to frame tariffs for ones own supply, in other words the small power stations are to the bulk suppliers as the consumers are to the Municipalities. Tariffs cannot cover all conditions especially when it comes to shutting down a power station to take a bulk supply. When Municipalities apply to the suppliers for service the question asked is what is the maximum K.V.A., and how many units, and why cannot the supply be given at a flat rate without K.V.A.? Municipalities cannot go off the mains like a consumer may, they are there for all times, and their growth can be watched the same as the small power stations have to watch the growth of the town, and make provision for extra plant out of profits, new loans, etc. The sliding scale would encourage sale of units, as buying the increased demand it automatically brings down the price, but with a K.V.A. one is inclined to keep down the peak. Take improvement of street lighting as an instance; street lighting if extended would cost too much on a fixed K.V.A. charge. Small towns have a very bad load factor, and it is difficult to improve this on account of conditions over which we have no control. Bulk suppliers have installed large plant, why not then load them up?

From observation it has been found that very often at peak the load has been increased by Tea Rooms, Restaurants, various shops in the Winter using radiators.

When a low tariff has been charged for this service it is a question as to whether the current costs more than the purchase price. If a double tariff is put forward to the consumer the question is asked "where is your cheap electricity, what advantage have you now given us by taking a bulk supply?" What the Public object to is that they are to be told how and when to use the supply, and the answer in many instances is "I can use my stove when I have coal without stipulated conditions," the power likewise answers "I can steam when I like." What is wanted is an electric supply at all times at a cheap rate, the Public do not want to know about peak loads, power factors and load factors, they want cheap electricity.

Mr. Sparks (Pietersburg) : Mr. President, I would like at this point to thank Mr. Roberts, Mr. Horrell and Mr. Sankey for the papers they've given, and would like them to understand how deeply grateful we are. In coming to these Conventions, I feel you have sympathy with the smaller municipalities and, while that continues, I think we will have their support and will increase our membership. I'm sorry Mr. Sankey is not here to-day. He has always been the father of the Engineers of the smaller municipalities and has done his best in the encouragement of these.

When we started the conference, and I listened to the remarks of some members, it seemed to be that there is a good deal of friction between some of the councils and their electrical engineers and, I can't help feeling that the fact of many of us being here at our municipality's expense, to-day, shows strongly that we have our Council's support and confidence.

Regarding the point made as to the cost of connections, these should be made as cheap as possible even though the initial cost is not covered.

In one department we reduced our connection fees to a mere nominal figure of 10/- and as a result the consumers increased 30% that year. Replacement of fuses is done free of charge, our tariff is already high and we prefer to give free service rather than unnecessarily irritate our consumers with what may be termed "pin pricks." The motto of every Electrical Engineer should be "Service."

Concerning the K.V.A. charge I am inclined to think this is higher than it need be for one must take into consideration that there is such a thing as diversity factor and it is possible that if all the K.V.A. charges were totalled up on a system it would be found to cover more than the cost of the interest charge on the plant of the supply authority.

Mr. Fletcher (Krugersdorp) : I see that, in some towns, there is a difficulty of multiplicity of tariffs.

It seems to me, that in a smaller town, we are able to get at it very much easier. In Krugersdorp, we took the average on business properties and shops and made them the basis of the high charge and the others at the low rate. At present, it is 2d. We don't have to put in a time switch, and so encourage the load. We have also discussed the difficulty of metering the larger buildings. It seems the difficulty is that the municipalities won't take over the responsibility of the large consumers. If they have a row of houses, they have to take them over - why not so with large buildings, also? In all we had, I've done it so that the meters are at one point. It makes it easier to read meters at one point than in a row of houses.

As regards power, I think it can be got over by allowing them a certain amount of power. At present, we are getting a lot of refrigerating machines and want power rates. The only way, so far as I can see is to meet it by a separate meter or supplying at the 2d. rate for business, but that seems to be fairly substantial.

Mr. L. L. Horrell (Pretoria) : The whole idea of installing time switches, which are under the sole control of the electricity department, is to be assured of a steady load of 3, 4 or 5 hours for every night of the year, less Sundays if desired. Mr. Eastman's suggestion of halving the ordinary flat high rate for this service is not, to my mind, satisfactory, for one could not possibly guarantee that the lights would be switched on for three or more hours for every day of the year.

Councillor Clark (Durban) : Mr. President, I would like to say something on the terms used by writers of papers. It has been said that it is the duty of age and experience to warn and instruct youth, one of the earlier professors of electricity, Farady, I think, asked by a young professor what he should take for granted when addressing students, replied - "Take nothing - experience is everything." This conference is for the discussions of the electrical engineer's own problems, but there are also councillor delegates who don't know, maybe, or who are perhaps attending for the first time, and know very little of the terms used by electricians - K.V.A., for instance - one of the bugbears - what the devil does it mean? K.W., perhaps we have a knowledge of what that is. Then there are amps, three phase, alternating current, time switches - the average councillor does not know very much about these things, unless he has been able to make himself "au fait" with them. If he is to take back an intelligent report to his council, he should have an intelligent idea of these terms. The great thing is to be able to explain properly and simply what you want. Take Mr. Roberts' paper, for example, as an exposition of simplicity, but we can't say the same of all of the papers. I realise, perhaps, the difficulty is bringing things down from the technical point of view to the average speech of the everyday man, but it would serve a good purpose, if technical names and phrases could be put into speech understood by councillors and others, to understand and grasp, and in that respect, the meeting would be more interesting and useful, and more pleasant to them.

Mr. President : Thank you, Mr. Clark. We will do that to the best of our ability, but, I'm afraid, the explanation of some of the terms would require as much time and length as the papers themselves.

Councillor Adcock (Port Elizabeth) : I must say if we could do that it would not be a bad practice. Might I go a little further than my friend Mr. Clark, when he referred to the Professor having said - "Take nothing for granted," in London, they say - "Ask a policeman," so I would like to ask the men here concerned in the selling of electrical things which do not come under the purview of the council. When we get down to the facts - (there is nothing personal in what I say) - it seems there is such a thing as a ring on prices which does not serve the public well, in that it takes away competition and is inclined to make people a little diffident. I am not argueing against rings or otherwise, where there is some form of protection, but I do feel that if you want to encourage the use of electricity, it must be at a reasonable price. One customer can possibly get a 33⅓% discount, but the man in "ordinary business" cannot unless he happens to be an electrician. I tell you straight in this way you're killing your sales. If you give the trade discount to electricians then give some encouragement to those who want to pay cash. Don't rub it in. Take the modern buildings, I think if one could adopt some arrangement for the people to be instructed through the architects on all natures of wiring to be built into the walls during construction of the building, it would help a great deal.

Then again for encouraging the use of electricity one must have advertising in the first instance.

One thing I would like to ask the Cape Town representative and those from Durban, that is if they could give us some idea of the reading of meters and issuing of accounts. It comes under municipal business and as the town grows the system seems to become more and more difficult.

At least that is our experience. I'm looking for something useful in this way to take back, to see if we can't get a better system in Port Elizabeth for reading our meters and rendering our accounts - something concise and quick. (hear, hear).

Mr. Nicholas (Umtata) communicated— As regards water heating in Umtata we have restricted the load to a maximum of 600 Watts, the heater being controlled by a two-way switch so that when the kitchen light is required the switch automatically switches off the water heater; and we have also reserved the right to instal a time-switch at any time. I have heard of other means of meeting the winter peak load difficulty by the introduction of regulators. When no lights are required a maximum heating is applied to the water heater, but as each light is switched on in the house, so it reduces the load to the water heater, so that between the lighting and the water heating you always have a constant load at 100% load factor, and the water heater does not effect the Peak Load very much.

Councillor Withinshaw (Cape Town) : Replying to my Councillor friend, re reading of meters, the position in Cape Town is that there are approximately 33,000 meters read a month by 9 readers. Each ras his area carefully mapped out to enable him to pass from house to house by the shortest route. Readings are sent into the Treasury and the accounts sent out from there daily.

If the meter is read, say, on the 10th of the month the consumer is allowed until the 10th of the following month to pay the account if he wishes to avail himself of the nett rates. This system works well from the Treasury point of view, as there is no rush at the end of the month of people who will delay paying to the last minute.

From the consumers point of view this system is not quite so satisfactory especially if he has to see to the paying of a number of Municipal accounts (in Cape Town water accounts are dealt with in the same way on a quarterly basis). I

myself some months have to pay about 40 accounts for various services and these arrive and are due at odd dates. It will be realized that it would be much easier to attend to all accounts at once and make one payment to cover the lot.

Our readers here have an immense area to cover, from Camps Bay 7 miles from Cape Town in one direction to Simonstown 25 miles in the other. The system works well and I think it is the one best suited to our area.

Mr. J. Bernard Bullock (Editor "S. A. Engineer") : I cannot help feeling that Mr. Roberts' paper is a landmark in the annals of this Association. We are all anxious to develop on similar lines. It is significant to note that Mr. Roberts finds his best customers among the less well-to-do. In larger installations salesmen and contractors should keep one aspect prominently in mind if they are not to do harm to the movement towards general home electrification. The customer is probably both able and willing to pay for the best but care should be taken to see that the apparatus installed is not on the large side. It will probably be chiefly handled by natives and my experience is that the larger the range, for example, the greater the consumption for a given service. The bill at the end of the month assumes alarming proportions and electrification is liable to be prejudiced on the score of extravagence. It is in the contractor's own interests to see that the minimum size of stove, capable of giving the service required, be installed rather than the largest he can persuade his customer to purchase.

In the field of electrical hot water, Mr. Roberts gives us two alternative methods of control, the time switch and the two-way switch in conjunction with the range. It will be agreed, I think, that on the scores of simplicity and cheapness the two-way switch is preferable. The ultimate development, however, seems to be supervising control by superimposed high-frequency currents from the power station. This will give maximum benefit to the daily load curve and justify very low rates. One is really selling hot water

to the consumer and as long as he gets this to his satisfaction, he need not concern himself as to the hours during which heating is carried out, the solution being adequate storage. One of the delegates has pointed out that in Johannesburg gas is a competitor, as though this precludes the development of water heating by electrical methods. I feel sure no electrical engineer is going to sit down and say "let gas do it." This sort of competition is a healthy stimulus to us.

The question of charges for service connections is a contentious one, in Johannesburg and elsewhere. I suggest that electricity is a commodity on a par with bread or groceries. The latter are delivered to the consumer without extra charge, whether he live next door to the shop or several miles away. In the same way electricity should be delivered at the supplier's charge to the point of use. The capital charges involved should be taken care of in the tariff and the consumer should not be required to pay directly for cable connections any more than he is called upon directly to help buy the groceries cart or motor van.

Mr. Lewis (Aliwal North) : I would like to add another comment of gratefulness for the papers -read by Messrs. Roberts, Horrell and Sankey.

One point Mr. Horrell referred to, viz., the wiring of blocks of buildings and the lack of interest of contractors and architects. From my experience, I think it is the architects who are at fault. They draw up plans and all they are concerned about is the building. Later when it is wanted by the owner, he finds he's one light in a room and perhaps no plugs where they are wanted. The houses change hands and succeeding tenants may require these fittings.

Another thing in Mr. Horrell's paper is that of the irritating charges of a meter rental. In our Municipality, we have hidden it in the tariff. In the case of shops, we put in a time switch.

The Port Elizabeth delegate referred to the method of sending out accounts. Some municipalities, I understand, have adopted a practice, where the meter-reader renders the account at the same time of reading, and collects the amount. I don't think this an advisable system as it puts the responsibility for collecting money on the employees. The discussion on this question is, however, better fitted for the Town Council delegates.

Mr. Ralston (Dundee) : In regard to the system of placing profits to the relief of rates, I noticed in my returns that the Town Clerk had put in a certain amount for "Pole Rights" instead of the relief of rates. This, I suppose, is the same thing in the long run, but if they would only leave it to us, we could make improvements out of profits. In many instances it is not the consumer who is the supporter of the power station who benefits, but the others who do not use electricity.

Architects and wiring - I can't see why a body like this of electrical engineers can allow the position to continue. The electrical engineers should certainly have the opportunity of collaboratng with the architects in drawing up the plans. We ought to, take it up.

There have been many compliments paid to the electrical engineers, but I think some of it should be passed to the town councillors, as 50% of our success is due to them and we know we can do little without their aid.

Mr. Vowles (Kingwilliamstown) : Mr. President, I wish to add my quota of appreciation of the splendid pioneer work of Mr. Roberts and also of his Council in so ably backing his efforts. The costs of installation of cooking ranges in Durban are alarming and I am afraid that little development would take plce in the small towns with such high costs. After nearly three years' experience with the installation of about 100 cooking ranges in Kingwilliamstown, I may state that the average cost of installation is fifty shillings and for water heaters £1. We import direct

and with the system adopted of three years' hire purchase a range sufficient for the needs of three of four people can be obtained for 8/6 per month with full ownership at the end of the three years. All our all-electric cooking consumers have only one tale to tell and that is, We would not go back. The average monthly consumption is 430 Units costing 27/-. The load obtained has enabled us to make substantial reductions in the domestic tariffs, our cooking tariff being three farthings per unit and we expect a surplus of £2,000 this year.

The Secretary : I would like to mention that, although the figures given are very interesting, it would be interesting to know what the K.W. demand is per consumer in other towns. In Durban, we find it is over 3 K.W. per consumer. That gives some idea of what to expect with a fully developed domestic load.

In Messrs. Horrell and Sankey's paper they say it is questionable whether electrical heating is worth encouraging in any town. To my idea it is not for us to select. What the supply should give is not our concern; we should give what is wanted. We can't simply pick out the eyes of the supply and give what we want.

Mr. W. D. Phelp (Chairman of the S. A. Electric Lamp Manufacturers' Association, Johannesburg) : Firstly, Mr. Chairman, I would like to add my quota of praise to the very excellent papers which have been read.

I have been greatly interested to hear the remarks of some of the speakers in reference to the service or rather lack of service in connection with the wiring of Buildings; there is no doubt at all that a very large proportion of Electrical Installations whether for Lighting or for Domestic Appliances are hopelessly inadequate. This is where an Electrical Development Association such as has been proposed would come in, for by educating not only the user but the Architects and Contractors the general standard of lighting would be improved and the general use of Domestic Appliances would be gradually extended.

The President : I don't know whether I have very much to say on the papers.
Tariffs— Our system in Bloemfontein may not be simple but works very well. On the back page of my address there are a few remarks about it. On our new tariff, the consumers pay 5/- on low current. A few did complain, but 98% gained, and, after a new tariff came in, the output has been nearly doubled. According to our calculations, the revenue ought to have been £2,000 less this year than it was last year, but, as things are going, it will be about that above.

Contributions to Rates— Our Treasury Department use the electrical department to make them pay for anything. If works fail, it goes out of the light department. But, after all said and done, we are only the Council's expert officials. The Councils can do as they want; we can't

Water heating— I must admit that it is not popular and we will never make much headway with this in Bloemfontein. We make no restrictions as far as the use is concerned.

Development generally— I think the foundation stone is local activity (hear! hear!).

Architects and wiring—I do think it is high time for something to be done in regard to wiring of big buildings by architects. Even in the private houses it would help considerably if the installation was done correctly in the beginning. Mr. Roberts, I must thank you personally for your valuable paper. We regard you as a pioneer in this line, and one of the very few who is able to give the benefit of experience to the younger engineers. I also wish to thank you, Mr. Horrell, and Mr. Sankey, for your useful paper.

Reply by Mr. Roberts (Durban) : Thank you very much, Mr. President and gentlemen, for the very encouraging remarks you have made about our work in Durban.

In all our country places, stretching out to Hillcrest on the main line, we are supplying service so that everyone can get electricity for cooking purposes, and all our mains and transformers are designed on that basis. I am sure that, if I had not the co-operation of Mr. Poole and the rest of my staff, we should not have had such good results.

Regarding cost of connections for stoves, the Corporation undertakes the work of increasing the size of the service without charge to the consumer and our standard service is of 7/16 s.w.g. The Corporation's responsibility terminates at the roof, and from that point the consumer must instal his own mains to the main distribution board and onwards to the stove. Where these mains have been installed large enough only for lighting we find the Contractor's charges for increasing the size of these mains to make them large enough to supply an ordinary stove varies from £8 to £15 depending on the size of the house, etc.

Regarding supply of stoves by the Corporation, which I understand from the Kingwilliamstown engineer is the practice in his town, I would say that we are not allowed to undertake this business in Durban.

Regarding the contributions from Electric Supply Departments to the Borough Fund, I must say that I consider the contributions made in some of the larger towns to be too high, and there is a danger that these heavy burdens will militate against the development of Municipal electrical work as it is obvious that without the necessity for such contributions prices for current could be materially reduced. In England recent legislation provides that any contributions from an electricity undertaking must not exceed 1½% of the loan debt.

In regard to high tension supply, we give no high tension supply within our Municipal area. Our standard pressures are 100 volts and 200 volts single-phase, 500/550 Direct Current and 500/550 volts three-phase. In those cases where the supply is too heavy to be taken from the distribution

·mains then we ask the consumer to provide us ·room for a transformer, lead in a high tension cable, and we meter his supply on the low tension side of the transformer.
This is a common practice of ours in the supply to blocks of flats where every flat has its own electric stove. It is usual for each flat occupier to become a separate consumer and we charge the same connection fee as if he were connected to low tension distribution mains outside the building.

In regard to current for illuminated signs. we charge a special rate, but current must be taken off the peak, that is after 6.30 p.m. in the winter months.

For many years past our system of rendering accounts has been that the Meter Reader leaves the account at the consumer's premises at the same time as he reads the meter and it has proved to be very satisfactory, especially in country districts where addresses are very vague and where there is no postal delivery.

The Corporation does not undertake such work as the servicing of stoves. Our easy payment scheme provides that the Contractor shall keep every stove in repair free of charge for a period of twelve months and I think that on the whole consumers must be getting very good service from their stoves because I get practically no complaints whatever now, whereas ten years ago complaints of the expense of keeping electric stoves in repair were very frequent.

Reply by Mr. Horrell (Pretoria) : Mr. President, Gentlemen, I thank you for the manner in which you have received the paper and for the criticism given - criticism which I am sure will be of great assistance to many. We naturally have to investigate our difficulties from the point of view of the requirements of our individual towns. It was mentioned with reference to our tariffs that we are trying to multiply them. I assume you that this is not the idea; the whole of the tariffs are based on the Norwich system, i.e. the two-part tariff.

Metering of blocks of buildings. The method adopted by Mr. Roberts in Durban, in entering into an agreement with the tenant of flats for the supply of current, may be better than the system in Pretoria; on the other hand our arrangement works very well and both the landlord and tenant are satisfied.

Is not the criticism, with regard to the lack of interest by some Electrical Contractors, justified? How often do they or their staffs interest themselves in connection with the installation of wiring in buildings to see that it is so arranged that consumers can obtain the best tariff? To a great extent the archtects are also to blame, for rarely do they engage expert advice to draw up their specifications. In nearly every case the "specification" is only a schedule of points and lights.

The method adopted in Cape Town of forwarding the specification, together with the building plans, to the Engineer's office for the City Engineer's and Electrical Engineer's approval before being passed by the Council, is undoubtedly wise. It also compels the architects and contractors to pay more attention to the matter.

Water Heating. I do not altogether agree with the last paragraph of the paper. We supply current in Pretoria off peak periods for water heating at ⅜d. per unit. (Hear! Hear!).

Contribution to Rates. Pretoria last year contributed over £21,000 to the relief of the rates, and this year it is hoped the revenue over expenditure will exceed £30,000. I have heard that it is possible that the relief in the rates from the profits of the Electricity Department in Johannesburg will exceed £100,000 this year.

Mr. H. A. Eastman (Capetown) In regard to Mr. Horrell's suggestion that plans for buildings should be subject to scrutiny by the Electricity Department, I would say that some time ago we endeavoured to get the Council to embody in its Building Regulations a stipulation that adequate

provision to the approval of the City Electrical Engineer should be made for housing the metering equipment. This however was rejected by the Council.

We sometimes experience a little difficulty in this connection, particularly in the case of large blocks of flats, offices, etc., because the Building Regulations do not specifically call for the provision of a metering chamber, but almost invariably after discussion of the matter with the owner and consulting engineer, if any, an amicable arrangement is come to, to the satisfaction of all concerned.

The President : I'm afraid we must adjourn, Gentlemen. I propose a hearty vote of thanks to Messrs. Roberts, Horrell and Sankey. (Applause).

In the evening, the delegates were entertained at the Swimming Gala and Gymkhana given at the Municipal Swimming Baths, by the "Otter's" Swimming Club.

THURSDAY, 14th NOVEMBER, 1929.

The Convention resumed its proceedings at 10 a.m., with the President (Mr. R. Macaulay) in the Chair, there being also present :—

Members— Messrs. T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), W. H. Blatchford (Greytown), G. Chase Brown (Vrede), J. S. Clinton (Brandfort), R. D. Coulthard (Oudtshoorn), P. W. Dadswell (Cradock), H. A. Eastman (Cape Town), R. W. Fletcher (Krugersdorp), A. Hadfield (Gwelo, S. R.), A. Q. Harvey (Middleburg, Cape), J. Hooper (Robertson), L. L. Horrell (Pretoria), J. Iverach (Grahamstown), W. Mortimer Mail (Kokstad), F. C. D. Mann,

(Worcester), T. Millar (Harrismith), H. A. Morris (Kimberley), H. M. S. Muller (Upington), P. H. Newcombe (Alice), L. Ralston (Dundee), John Roberts (Durban), J. H. Rogers (Fort Beaufort), J. H. Simpson (Colesberg), L. B. Sparks (Pietersburg), T. Sutcliffe (Benoni), J. Vowles (Kingwilliamstown)-;

Associate Members— Nil.

Delegates— Councillors W. C. Adcock (Port Elizabeth), J. Blaker (Johannesburg), A. L. Clark (Durban), J. B. Dersley (Bloemfontein), G. S. Duxbury (Pretoria), T. Ericsen (Kimberley), and A. Withinshaw (Cape Town).

Visitors— Messrs. I. J. Allen (Petrus Steyn), J. Bernard Bullock (Johannesburg), S. H. Barnett (Johannesburg), J. Clinton (Brandfort), John Hogg (Bloemfontein), H. A. Mellor (Bloemfontein), E. T. Oates (Johannesburg), E. Perrow (S.A.I.E.E., Johannesburg), G. M. Pirie (Bloemfontein), F. C. Stephens P.W.D. (Pretoria) ;

Honorary Secretary and Treasurer— Mr. E. Poole (Durban).

VENUE OF NEXT CONVENTION.

The President : Gentlemen, my first duty this morning is to welcome Mr. Councillor Duxbury of Pretoria, who is an ex-Mayor and the chairman of the committee which looks after matters electrical in that city. Mr. Duxbury, we welcome you here, and if Bloemfontein does not treat you well, just tell me.

Councillor Duxbury (Pretoria) : Mr. President, and Gentlemen, I feel quite overwhelmed. I've just had a long train journey and, on arriving here this morning, have met a good many old friends and hope to meet others before I go. It is a great pleasure to be here as a representative of the Electrical Committee of Pretoria, and I thank you for the invitation. I take a very great interest in the Association and am sorry I was prevented from being here on the opening day.

I have been told a little by Mr. Horrell of what you have been doing and am very glad to hear of the appointment of the committee to encourage the use of electric appliances in homes. I think it is a most excellent idea and do hope it will result in carrying electricity into all the homes in South Africa. I think, therefore, that you should have a women's representative on the committee, by association with whom, if one could be included in some way, the committee would have a great deal of help in the work to be done. It will also be necessary to see that the town councils help in the proper way.

Mr. President, I extend a hearty invitation to the Convention, on behalf of the Town Council of Pretoria, to hold the next gathering in that City.

Mr. Sparks (Pietersburg) : I would like to ask, Mr. President, when it is intended to hold the next conference. We are now at the end of 1929 and a year hence will bring us into the summer of 1930. That is an inconvenient time for a lot of the electrical engineers and I think it would be advisable to hold it about eighteen months from now.

The President : It has been suggested to be around March 1931, if possible, if that is convenient to Pretoria.

Councillor Duxbury (Pretoria) : I think it would suit Pretoria very well. The only thing is, if you have it at this time of the year you would see Pretoria at its best. Otherwise, held in March or thereabouts, it will coincide with the Johannesburg Easter Show, and that is, of course, a very interesting time.

Mr. Roberts (Durban) : There is one point to be remembered in fixing the date of the Convention, and that is that some of us here have some difficulty in persuading our councils to let us get away, and, in the past, it has been the custom not to hold them strictly annually. We could then tell them we do not hold them so fre-

quently. We thought it would be very undesirable to wait two years for the next and that is why we decided on March. It would be a good time so far as the work of the electrical engineers are concerned and coinciding, as it does at that time, with the Johannesburg Show, I think the date would be very suitable.

Resolved unanimously, that the next Convention be held at Pretoria, in March 1931.

BILL FOR LICENSING OF ELECTRICIANS :

The President : I will ask the Secretary to read a letter dealing with this subject.

The Secretary : The following letter has been received from the General Secretary to the National Federation of Building Trade Employers in South Africa :—

> "I have to advise you that at the Annual "Congress of my Federation just concluded "at Bloemfontein, the question of the Bill for "the Licensing of Electricians was brought "forward and the following resolution un- "animously passed—
>
> 'That Congress supports the principles 'of the draft Bill for the Licensing of 'Working Electricians and the registrat- 'ion of electrical contractors, and re- 'commends the Executive Committee to 'take whatever steps possible to have 'same placed on the Statute Book at an 'early date' "

Mr. H. A. Eastman (Capetown) : The letter which has been read deals with a subject which has been under consideration by our Association for some time and is of particular importance to Undertakings where Licensing of Electrician's Regulations are now enforced due to the variation in essential qualifications required of applicants for licenses and procedure by the Examining Boards in the different Municipalities.

These differences may lead to difficulties in the way of a license of one Municipality satisfying the Examining Board in another Municipality as to his qualifications and has actually led on more than one occasion to an applicant failing to obtain a Capetown License - although he held a license issued by another large Municipality - on the grounds that he had not had the necessary practical experience prescribed in the Capetown Regulations to permit of the Examining Board considering his application. This is not the fault of the Board which itself must work to the Regulations but it shows how the difference in the existing regulations is productive of hardship in certain circumstances.

It will be remembered that at the last Johannesburg Convention Messrs. Wolley Dod and Sankey presented a Draft Bill for the Licensing of Electricians - which I understand was accepted by the Association in principle - as a means of securing uniformity if and when it should be passed as an Act of Parliament. After the Convention it was sent to all Municipalities for suggested amendments.

The Capetown Examining Board went to some trouble to improve the draft in the light of its experience and after approval by the City Council it was forwarded to the Hon. Secretary at the time.

The Examining Board in Capetown is very anxious to know what has transpired further since it considers the question of standardising the regulations to be a very important one.

It realises the practical difficulty in getting the Bill before the House of Assembly and it seems to me that the offer of assistance contained in the letter of the National Federation of Building Trades Employers in South Africa will help to set the ball rolling.

This body is the parent body of what is known as the Master Builders Association which is represented on the National Industrial Council, the latter being an advisory body to the Department of Labour.

Thus I think we have a very useful opportunity of working in conjunction with a body in close touch with the Government and to get something done.

Papers for next Convention :

I have received an offer of a paper for the next convention from Mr. Muller of Upington. (Applause). Any others who wish to give papers are asked to notify us as soon as possible.

Engineering Monthly Notes :

If all members would only send any small items of news or interest to the Secretary it would be very useful. Such notes would be sent on to the "S. A. Engineer" our official magazine and thus all members to whom copies are sent are kept well posted of others members doings and progress.

Associate Member :

I am sorry to say Mr. Pentz of Frankfort has tendered his resignation as a Member of our Association on his leaving Municipal employ.

Election of Council.

Mr. President : I understand that there is a feeling that we were rather in a hurry in electing the new Council. It was done in good faith and with an eye to expediting the business, and the matter is open for review.

Resolved that the resolution in electing the Council on Tuesday, November 12th, be rescinded and that the Council be elected to-morrow Friday.

The President : The next item is a paper on Boilers, by Mr. J. T. Smith (Durban), who is unfortunately not present owing to indisposition, but Mr. Morris, (Kimberley), has consented to read the paper.

BOILERS.

By **J. T. Smith**, (Durban).

It is proposed in this paper to deal with the advances made in steam generation during recent years in the quest for larger and more economical units, and to discuss the more common forms of boiler troubles and methods of overcoming them. Many notable achievements have been made in general and in detail to the design of boilers and their accessories, in fact, such developments have been so numerous and so varied in character, that it is impossible to touch more than briefly on the more outstanding features.

Boiler development has been necessary to keep pace with turbine outputs and is all in the direction of larger capacities, higher pressures, large radiant heat surfaces, pulverised fuel and automatic control of steam pressure and combustion, to maintain the highest efficiencies.

With the rapid growth in the use of electricity it is only to be expected that the greatest advances have been made at electricity generating stations.

Types.

Dependant on the angle of the tubes, water tube boilers are divided into roughly two classes, vertical and horizontal tube. Advantages are claimed for both types, but usually it is a matter of individual preference.

The prevailing fashion in this country appears to be in favour of the horizontal type such as B. & W., & Vickers Spearing. In America on the other hand, the vertical tube boiler is to be found in many of the largest power stations. It is possible that this may be accounted for by the fact that in America very high ratings are common practice, and the advantage of the vertical tube boiler in having each tube delivering into the drum giving the full tube area for circulation, as against a number of horizontal tubes being

connected into a common header with a consequent partial baffling, together with consideration of easy cleaning, have been the deciding factors in choosing the type of boiler installed.

CAPACITIES.

Boiler capacities are a function of the total load on the station, and the load factor, and while it is not wise to depend upon too few boilers the number should be cut down to a minimum compatible with reliability so that the largest possible units may be installed. The normal and overload capacities are governed by the expected duration and extent of the peak loads.

The systems with the greatest total loads must have the largest boilers, in fact the trend appears to be toward one boiler to each turbine, so naturally we look to America for these units. We find there, commonly used in the Power production service, units evaporating from 150,000 lbs to 300,000 lbs water per hour. In England, where outputs are not too large 80,000 to 180,000 lbs steam per hour are to be found in the largest stations, while in this country large boilers are considered to be from 40,000 to 80,000 lbs evaporation.

The largest of its kind is always of interest so that the gigantic boiler at the Ford works, made by the Ladd Boiler Co., of the vertical tube type fired with pulverised fuel and evaporating normally 400,000 lbs of water per hour, and having an overload up to 500,000 lbs steam per hour should be mentioned. This boiler when installed evaporated 350,000 lbs per hour, but owing to greatly increased requirements it was remodelled and the furnace lined with water tubes, giving the extra capacity.

One of the problems especially in a growing country like this, is to design a boiler to fit into existing buildings and to give two or three times the output of the displaced unit. It is in cases like these that the great improvements are most noticeable, especially when, as is usually the case,

the layout has to be cramped and conditions are far from ideal. Particularly is this to be observed in restricted furnace volumes and consequent reduced furnace efficiency.

STEAM PRESSURES AND TEMPERATURES.

Increased pressures and temperatures are now required, principally to obtain greater efficiency from the turbines. The question of materials represents the limiting factor, and the main difficulty restricting the advancement of pressure and temperatures.

Great strides have been made in construction and materials, and temperatures of 800° F are now being successfully carried, the steel being generally of the Nickel Chromium variety.

Professor Lea had shown the importance of temperature control, by giving the following example :— "An increase of 25% in the working stress at 750° F will only diminish the factor of safety from 2.33 to 1.93, whereas a similar increase in temperature, while keeping the pressure constant, diminishes the factor of safety from 2.33 to less than unity."

About 1912 a pressure of 200 lbs. per square inch was considered high while at the present time 350 lbs is in use in this country, and in England, America and Europe, a number of boilers are working at 1,200 to 1,500 lbs per square inch.

A boiler at the critical pressure 3,200 lbs is now being experimented with.

The first difficulty encountered in making these extra high pressure boilers was in the construction of the drums. Rivetted joints were not a success and solid forged drums were constructed which, although satisfactory from the operating point of view are very costly, and the chief object of the critical pressure boiler is to eliminate this very expensive item. A cheaper method of construction which it is claimed is suitable for the highest pressure, is by lapwelding. With watergas it is possible to weld up to 3½" plates.

The water level in the drums presented another difficulty, and various means have been tried, including a cylinder of metal connected by flexible pipes to, and level with the centre of the drum, this is balanced when the water in the drum is half and is connected to a pointer. Any alteration in the water level alters the amount of water in the cylinder and the pointer indicates the water level.

This has the advantage of not bursting or becoming discoloured, but gives no actual visible indication.

Various gauge glasses have also been tried, the most successful being of Pyrex glass. Experiments are being made with ordinary glass lined with Mica, but these do not give such a clear indication as the unlined Pyrex glass.

Joints are usually made with a serrated steel disc between faced flanges, all the bolts being fitted and reamered in position. No detailed information is to hand concerning construction and tightness of safety valves and other fittings, at these very high pressures.

Extra high pressures have been used in some of the older generating stations to increase their efficiency, the steam being generated at say 1,200 lbs per square inch to drive a turbine at that pressure, the turbine exhausting direct or through a reheater into the existing lower pressure mains.

FUEL BURNING.

The outstanding development in coal burning during recent years is the introduction of pulverised fuel.

This is undoubtedly the current manner in which coal should be burnt and while stokers may be able to equal pulverised fuel on a short test, the ease with which test efficiencies can be maintained with the powdered fuel and the low banking losses make a considerable difference in yearly efficiencies in its favour.

Great strides have been made with both Chain Grate and Underfeed stoker designs. Chain grates are to be found in practically all the power stations in this country, using mechanical firing. Recent advances in this type of stoker are in their increasing lengths and widths.

The difficulty of even distribution of coal and air over long grates has been overcome by the introduction of the compartment type stoker, in which air can be controlled to any portion and at the same time the fuel bed can be maintained under balanced draught either with or without heated air. With a suspended arch any width of grate can be made.

Air Preheaters and Economisers.

The regenerative cycle of feed heating (in some cases up to practically boiler temperature) has done away with the necessity for an economiser, and in order that the heat in the escaping flue gasses should be recovered, air heaters were introduced into power stations.

Considerable controversy exists on the question of Economisers versus Air-heaters, each having their advantages and disadvantages. The air-heater lacks the hot water storage of the economiser, and additional surface has to be put into the boiler to absorb the heat recovered in the air-heater; in addition, if the furnace is brick lined, trouble may be experienced owing to the high temperatures. With Chain Grate stokers of present construction 300-350° F, appears to be the maximum air temperatures at which makers will guarantee their stokers, so that further increase in heating surface will need to be put into the boiler to reduce the flue gas temperature without high chimney losses. In this respect pulverised fuel has a distinct advantage in that, air of any temperature may be used, there being no grate troubles to consider. Steel economisers on the other hand have their corrosion troubles and their efficiency varies inversely with regenerative feed heating from the turbines, being zero when bleeder heating is carried up to boiler temperature.

It would seem that a very careful study would be necessary in each individual case to determine the most economical and the most efficient apparatus or possible combination, such as say, limited feed heating from the turbine, and a small economiser followed by an air preheater on the boiler.

SUPERHEATERS.

The trend aoward higher temperatures is reflected chiefly in the improvement of the materials and in the altered position of the superheater. As has been stated 800°F is about the maximum normal temperature yet used, and allowance has to be made for a slight variation with output.

It has also been shown that control of temperature at these high temperatures is essential.

Originally the superheater was placed after the boiler, but when higher degrees of temperature were required it was brought nearer the furnace and placed between the first and second passes. In this position it is satisfactory for a temperature of about 550° F to 650° F and although varying somewhat with the output it is of no great moment at these temperatures. When still higher temeperatures were attempted with Superheaters in this position special means had to be employed to control the temperature by the automatic injection of water, etc. As the greatest amount of water is evaporated in the few bottom rows of the tubes it was thought that the placing of the superheater after the first 4 or 5 rows of tubes would give a better arrangement and distribution of the quantity of steam passing through, and the heat, to the superheater. This was found to be the case and this "interlock" position as it is called, gives a practically constant total temperature. Radient superheaters are now being introduced in which the tubes actually form part of the furnace wall, acting also as a protection for the furnace brickwork.

MERCURY BOILERS.

While dealing with modern advancements it is necessary to refer to the Mercury Boiler and turbine.

After many years of experience and experiment with mercury vapour installations on a small scale, this process can be said to have passed its chrysalis stage and a unit of 10,000 K. W. output from the Mercury Turbine at 70 lbs. pressure and giving about the same output from the steam generated in the condenser boiler, is I believe actually in commission. It is not proposed to give a detailed description of this process as it will be familiar to all, the latest type of Mercury Boiler being a group of seven drums about 2′ 6″ diameter each carrying dead ended tubes about 6′ long, and being described as having the appearance of a "huge coarse Brush," The evaporation is given as 1,150,000 lbs. mercury per hour at 70 lbs. pressure and 884° F.

AUXILIARIES.

The extensive use of regenerative feed water heating and the reliability of modern electric motor drives is responsible for the passing of the small auxiliary drives with the exception of the boiler feed pump, for which the turbine drive is still the most favoured.

Electrical drives for boiler feeding purposes will show a higher station thermal efficiency owing to the greater efficiency of the main generating units, which consume at the most 1/3 of the steam required per K. W. by the auxiliary.

Evaporators for boiler feed make-up are now commonly used as these ensure a pure non-scaling boiler water which becomes increasingly essential as the pressure rises.

Another auxiliary which is being installed in increasing numbers is the dust collector. The primary function of this apparatus is of course to reduce as much as possible air pollution. The

Collector in its most common form is a cylinder near the base of the chimney, the flue gasses entering tangentially creating a whirling motion.

The centrifugal force on the dust particles throws them outward while the gases escape from the centre.

A new system has been developed in which the gasses are passed through vertical tubes with a centre rod charged with a very high voltage. The dust is electrified and adheres to either the rod or the walls of the tube. The tubes are periodically tapped and loosened dust falls into a collector. The extraction of the dust by means of water sprays is probably one of the latest and simplest methods, and one which would also appear to possess the advantage of removing the sulphur from the gasses. It may be argued that steam driven auxiliaries need not be highly economical as the heat in the exhaust can be utilised for feed heating purposes. This however is a direct contravention of the principle of the power station, which is the conversion of heat into work and not the transfer of costly produced heat in feed heaters.

Part 2.

Having given a brief account of boiler progress it is now intended to proceed to the operation, and some of the principal attendant troubles.

Boiler operation is of course the most important feature of the power station and while great care may have been taken in the design and construction, efficiency cannot be "built in" as with turbines and a great drop in efficiency will ensure if the operation is bad.

It is generally understood when speaking of a "Boiler" for this term to include grate, furnace, boiler proper, superheater, and economiser or air-heater.

This is not correct. The boiler is that portion which contains and evaporates the water, and this loose term is likely to be confusing when, as is often the case, the items forming the unit are made by different firms.

The unit may be roughly divided into two sections, the heat producing and heat absorbing portions, and will be considered separately, although with the advent of water screens a very close relationship is established between them.

The basic essentials for high operating efficiency are mainly physical, tightness of all parts of the boiler and more especially of the combustion chamber and flues to prevent the inrush of cold air and the cleanliness of the heating surface both inside and outside. High CO_2 and low flue gas temperatures are entirely dependant upon these two items and the difference between the Test efficiency and Yearly efficiency is also largely due to them.

The personal element ranks next in importance, in obtaining efficient running conditions and assuming the boiler fulfils the above essentials ion and the intelligence of the operator have a as to cleanliness and tightness, personal observatgreat effect on the efficiency. The saving due to automatic control is due largely to the fact that the personal element is eliminated, and test conditions can be maintained. During a test the boiler is usually surrounded by experts so that one fireman attending to a number of boilers cannot of course be expected to get the same results.

COAL.

The selection of the best coal involves numerous questions and indeed is of sufficient importance to warrant a separate paper. This question will only be dealt with as far as it affects the operation. The type of stoker must be chosen which gives the best results with the available coal supply. Divided roughly, underfeed stokers

are most successful with coking coal of fairly low ash. This method keeps breaking up the coal bed, and prevents the coal from coking thus allowing a free mixture of air in the coal bed. Travelling Grate stokers are suitable for non-coking coal, high in ash, and generally of low grade, and pulverised firing for any class of coal. In this country travelling grates are most used and therefore will only be considered.

Uniform size is a first consideration. Large coal burns slowly, while too small a size falls through the grate and also requires a greater draught. Mixed sizes are not desirable on account of the smaller coal being burnt out, or carried by the draught leaving holes in the fire bed.

This of course should not be confused with the "Sandwich System" where the coal is fed from a double hopper, in uniform layers. The uniform distribution of coal in the hopper is next in importance. Fixed chutes all have the tendency to allow the larger coal to roll to the outside edges causing uneven fires, this is rectified by chutes fitted on to the opposing screws which cause the chute to travel backwards and forwards across the hopper.

If the ash has a low fusing point, trouble will be experienced with clinkering. Even when the fusing is not so great as to run through the bars there is usually a growth which adheres to the side walls with the result that the grate is swept bare at the sides, in most stations this has to be removed regularly by means of a slice bar with resulting damage to the brickwork. This may be prevented by introducing special hollow bricks along the grate line which admit air to reduce the temperature below the fusing point or a water tube connected in the boiler circuit which has the same effect. "Birdnesting" or "Honeycombing" is caused by the finer particles of the coal, which usually contain a higher percentage of iron and sulphur than the main body of the coal, being drawn up by the draught and adhering to the lower row of tubes.

These high ash and iron portions have a relatively low fusion temperature and form a binder for other light, draught carried particles, eventually forming an agglomerate which effectively chokes the draught.

The extent of the birdnesting depends upon the coal and the draught, but usually the lower tubes become choked long before the remainder of the boiler is dirty, and the possible remedies would be in carefully prepared coal, or the lining of the furnace with water tubes to reduce the temperature of the gasses below the fusing point, before they enter the boiler.

These remedies are costly especially to existing plants, and other means are employed such as soot blowers and holes in the walls for hand cleaning rods, operated at intervals as required, to keep the openings clear.

To remove the soot from the other portions of the boiler, hand lances or soot blowers may be used. These are operated in relation following the draught and it is important that the steam or air used be free from moisture.

External Corrosion is very seldom encountered and is due to the flue gasses being cooled below their dew point and the resulting moisture combining with the sulphur dioxide in the gasses to form Sulphurous acid. This form of corrosion is found in the last pass of the economiser if the feed water is allowed to enter at too low a temperature i.e., below 100° F., or in extreme cases it may occur near an opening in the boiler wall due to the reduction of the temperature by the incoming air.

WATER.

The quality of the boiler feed water plays the largest part in the economical operation of the boilers.

Practically no natural water is directly suitable for the boiler feed. Unsuitable water may cause damage and loss of fuel in many ways,

amongst which may be mentioned, corrosion of tubes, drums etc., overheating causing blisters on tubes, priming and scale formation.

Let us first briefly follow out the cycle taken by the water, assuming of course a surface condenser installation.

Taking the feed pump as the starting point the water is pumped into the boiler in most cases through an economiser or heater.

For reasons of strength boiler tubes are of necessity made of steel, while the economiser may be of steel or cast iron. Cast iron is less susceptible to corrosion than steel and is mainly used for this reason. In the boiler therefore we have the transferrence of heat from the gasses to the water through the steel walls. The pressure and temperature in the tubes accelerate very much any corrosive action and the tubes must be kept clean and free from scale if the maximum efficiency is desired.

Having been converted into steam it passes into the superheater. Corrosion in the superheater if any is usually confined to the inlet and where there is moisture present.

Passing from the superheater it goes to the turbines and finally to the condenser, where its latent heat is extracted by the cooling water. It is then taken by the extraction pump and returned to the feed pumps either direct or from feed tanks. If the whole of the steam leaving the boiler could be passed through the cycle and returned direct to the feed pump, the water would be chemically pure and enert and no boiler troubles would result.

However, leakage in the system is unavoidable, and the raw or treated water has to be added to make up.

Further possible sources of contamination are in the leakage of circulating water into the condenser, and of the air in the open tanks.

The following are the three most important sources of corrosion and scale troubles, and will be considered separately :

(1) The steam piping should be sufficiently lagged to prevent condensation losses through the steam traps, which of course should be maintained tight, in fact every means should be taken to prevent the loss of this valuable and pure water.

At the best however, the make up will be about 3 to 5%.

(2) Contamination from circulating water can be prevented by careful packing of the tubes and the immediate removal or plugging of defective tubes.

(3) The absorption of Oxygen and C.O.2. open feed tanks can be seen at a great number of stations where the condensate splashes merrily into the open hot well. This is the most troublesome and difficult to deal with in older plants.

For the total de-aeration the "Closed" and the "Deaeration" systems are both workable and dependable.

In the closed system the feed is pumped by the extraction pump direct to the feed pump, an open feed tank is connected through an automatic valve to the condenser and the make up is passed through the condenser where it is de-aerated.

With the Degassing method the feed is allowed to enter the open feed tanks and then it is taken through the de-aerator which extracts the air by boiling the water, usually under vacuum. The Closed feed system is better on account of the water being inert at the commencement of the cycle and there will be no corrosion in the piping. It is however more complicated and difficult to apply to a plant already in commission.

INTERNAL CORROSION.

Corrosion troubles are found in varying degrees in most of our plants, as the methods discussed for total prevention are not available.

Boiler and economiser corrosion has been the subject of great study, principally on account of the fact that the behaviour of the water and impurities at various pressures and temperatures is a matter of conjecture and theories have been built up on the analysis of the scale etc.

It is now generally agreed that the cause of corrosion is twofold, firstly due to the dissolved gasses Oxygen and C.O.$_2$ and secondly to acidity and certain salts in the boiler water. In the first case the corrosion usually takes place in the economiser, and in the second in the boiler itself, if therefore boiler corrosion is experienced the treatment of the make up to render it chemically pure should be considered, and if the trouble is in the economiser, which by the way is the most common, every means should be taken to reduce the air in the system. Water softening using lime and soda is generally adopted as the reagents are cheap and the process is easily controlled. Divided roughly, water has its temporary and permanent hardness, the temporary hardness being only objectionable in that it forms a scale which impedes the heat transfer but is non-corrosive, in fact a paper thickness of this scale was often allowed to form, especially in marine practice, to protect against corrosion.

The permanent hardness supplies the corrosive constituents and the result of softening by lime and soda is to remove by precipitation the temporary hardness and to place the corrosive hardness by a non-corrosive one. The quantities of lime and soda required must be determined for each individual case and there must be sufficient storage to allow the solids to precipitate otherwise they will soon fill the boilers with scale. With these softeners it is necessary to agitate the water to insure a through mixing of the chemicals and raw water.

This softened water while its corrosive salts are neutralised is likely to cause economiser corrosion on account of its being saturated with gasses.

Distillation supplies a pure make up and evaporators can be installed using the exhaust from the feed pumps or steam bled from the turbines.

Having now dealt briefly with the prevention of boiler corrosion, I will give a few suggestions as to the lessening of economiser corrosion assuming that the totally closed or de-aerations systems are not practical politics.

In the first instance all splashing should be avoided, pipes delivering condensate or make up into the feed tanks should be "drowned". The covering of the tanks leaving only a vent should be an advantage.

Old tubes may be placed in the tanks forming a dummy economiser as they will be attacked, thus diminishing the corrosion in the feed piping and economisers.

The most effective method tried by the author and one of which has had a marked effect on economiser corrosion is the partially closed system which can be easily and cheaply applied to any existing plant. This arrangement keeps the condensate entirely out of contact with the atmosphere and only the make up contains any dissolved gasses.

A portion of the make up may be de-aerated by passing it through the intercoolers of the air ejectors (Jet condenser type if installed).

From the extraction pump the condensate is pumped direct to the Boiler feed pumps through two feed heaters into which the feed water steam turbine pumps exhaust. Near the feed pumps a pipe is connected to the feed tanks which have a head about 3 feet above the pumps. No circulation whatsoever takes place in the tanks which

merely compensate for variations in evaporation requirements and supply available at the time, and which will supply the make up as required when there is a shortage of condensate. By this arrangement which works exceedingly well, the amount of air in the boilers is cut down to a minimum by a very simple means without complicated piping.

Electrolytic Protection by means of zinc slabs is not now so popular as a few years ago, it being recognised that galvanic action is a very rare occurrence and the corrosion which was formally thought to be due to this action is now agreed as being caused in most cases by the gasses in the feed water.

Furnace and Brickwork. Good Combustion, which is the consuming of all the combustibles in the coal, with as little excess air as possible, requires certain essentials which must be borne in mind. Sufficient air must come into intimate contact with the coal so that it can be completely burnt, the temperature must be high enough to support the combustion, and adequate time must be allowed before the gasses reach the cool boiler surface.

Until recent years furnace volumes have not been sufficiently considered, and in the majority of existing plants there is very often a more or less serious efficiency.

Smoke is the usual visible sign of restricted furnace volume and is the result of the hydrocarbons liberated from the coal being only partly consumed before they come in contact with the relatively cool boiler tubes.

There is an economic limit, however to size of the furnace. Beyond this limit the losses do not warrant the extra expenditure on brickwork etc., and the extra radiation losses.

Plain Firebrick furnace linings are satisfactory if boilers are not worked continuously, above about 5 or 6 lbs evaporation per sq. ft. of heating surface.

Above these figures maintenance of plain walls becomes heavy and special carborundum bricks or air or water cooled walls are necessary. Air cooling is accomplished by building the walls of hollow construction and passing the air through the spaces which has the double effect of cooling the brickwork and preheating the air which is delivered to the furnace. This method is suitable for fairly high combustion rates but has two disadvantages.

(1) It limits the economical use of the regenerative feed water heating as the use of the air preheater is very much curtailed.

(2) It cannot be used at very high capacities as the amount of air required to maintain cool brickwork is greatly in excess of that required for combustion.

The next step, which is a development of the water screen for quenching the ash, was the water cooled walls. This has proved a very great sucess. The walls may be entirely or only partly covered as required. Two types of tubes may be used, one having fins welded on each side of the tube so as to form a continuous metal wall the other being a pair of tubes placed together and welded into one at each end, so as not to weaken the headers. This construction has the possible objection in that it lacks the red hot radiating surface to assist combustion and to overcome this a water cooled brick lined wall has been successfully tried in which refactories of a special shape are clamped on to the tubes. The thickness is such that they become red hot, but the cooling is sufficient to prevent damage.

Ignition arches are necessary with chain grate stokers and especially with the larger spans are a source of trouble and anxiety. They have three functions (1) To ignite the coal. (2) To mix the gasses. (3) To direct the flow of the products of combustion.

To fulfil the first condition they must be of a proper length and height. The ignition is accomplished by radiation from the hot bricks, and the length is governed by the calorific value and percentage of volatile in the coal.

A decrease in the calorific value or volatile matter means a longer arch. An inefficient arch may reduce the capacity of a boiler by its inability to ignite the coal fast enough, but on the other hand it should not be made too long on account of the maintenance.

The gasses under the arch at the front portion of the stoker are deficient in oxygen while at the rear end there is an excess, so that the second requirement is, therefore, that the front and rear gasses should be mixed. A well designed arch will do this but in a few instances a separate mixing arch may be added. The strength of an arch increases with the rise, but on the other hand the combustion efficiency is reduced.

Grooving sometimes occurs at the spring of the arch and is due to the fact that it is close to the fire and is raised to a high temperature causing the brick to fuse and partly wear away. Fusing of the fire bricks is greatly accelerated if much iron is present in the coal, as it acts as a flux lowering the fusing temperature.

Fine ash increases the wear on the arches by its abrasive action. The firebricks should have the following characteristics. (1) Mechanical strength. (2) High fusion temperature. (3) Low coefficient of expansion. (4) Resistance to compressive stresses at high temperatures. (5) Uniform size.

Unfortunately all the above cannot be combined into any one brick (the nearest approach being the expansive Carborundum Brick) and a brick must be selected for each particular job having the most important characteristics required.

Having chosen the brick the laying is equally important . The joints should be as thin as possible and the fireclay of good quality. Numerous patent cements are on the market each being claimed as the most superior. The joint question is considered so great that at least one firm supplies the refactory in plastic form which is hammered into the wall thereby eliminating joints entirely.

Chimney and Draught. While a great deal of time and thought is given to the boiler, stoker and all details at the front end, there is very often too little consideration given to the importance of the back end comprising the chimney and ducts. This defect is most prevalent in older installations where boilers are frequently added to existing chimneys in a most haphazard manner, or as another example an economiser may be added without means of intensifying the draught.

The direct consequence of impaired draught is the lowering of the boiler output and efficiency.

Draught is a difference in pressure and the force supplies the energy necessary to cause a circulation of gasses, and it is this unbalanced pressure which draws the air through the fuel and if, for any reason the quantity of air is limited, the amount of coal burnt and therefore the boiler output must also be limited. Draught may be created in two ways: naturally, by means of a tall chimney, and mechanically by fans which may be further divided into forced and induced draught.

As has been stated the ideal condition is a content, and this is only possible if the C.O. ^{2} draught permits a constant relation of coal burnt and air required at all rates of combustion. Until recent years natural draught was almost exclusively used, and has the advantage of being reliable and requiring practically no upkeep. As however the ratings of boilers have increased, necessitating greater draught, and the greater use made of economisers or air heaters reduces the available temperature for draught production, natural

draught on account of its cost, has given way to some form of mechanical draught, which in addition is very flexible, thereby facilitating quick changes in draught to suit the coal feed.

The size of chimney and draught intensity are subject to a number of variables, e.g. Analysis and amount of coal burnt, temperature of flue gasses, draught losses through fire bed, boiler and connecting ducts, and highest efficiency will be obtained with a gas velocity throughout of about 35 to 40 feet per second. Where a number of boilers are connected into one flue leading to a common chimney, the design and areas should be given careful consideration, as any unnecessary friction means a reduction of furnace draught and boiler output.

Sharp bends should be avoided, as should any sudden alteration to the cross section. Soot should not be allowed to accumulate to such an extent as to impede the draught.

Pulverised Fuel. The firing of coal in a pulverised state has made rapid strides in the last few years especially in America and Germany. It is a method which has great possibilities and as yet has only been studied in the abstract in this country. All eyes are centred on the first plant fired entirely by the pulverised fuel, at the Electricity Commission Power Station at Congella, Durban, and as this subject is of great importance it justifies special mention.

The questions that naturally suggest themselves are (1) What are its advantages and (2) What does it cost.

Dealing with its advantages these may be briefly summarised as follows :—

(1) High combustion efficiency at all loads.

The great surface area of the powdered coal, and the intimate mixing with the air gives a rapid and complete chemical union at all loads with very little excess air.

C.O.$_2$ percentages of 15 to 16% can be carried with a consequent reduction in economiser or air heater surface.

(2) **Smokeless and Clean.** With the perfect combustion possible there should be no smoke, and the cleanliness may be judged by the fact that a power station is being constructed in England without any dividing wall between the boiler and the turbine rooms.

The emission of dust from the chimney is at present causing a great deal of discussion, and it is not proposed to enter into this controversy. Manufacturers appear to be spending considerable time in picking out the faults of other makers in the hope of belittling their own dust troubles and possibly in the hope that residents will become so accustomed to the nuisance or so tired of grumbling that complaints will cease.

(3) **Flexibility and Low Banking Losses.** Where the load on the boilers fluctuates to a great extend, the flexibility of pulverised fuel is most apparent. Stokers require a considerable time to alter the condition of the fuel bed whereas the reducing or even the shutting off or lighting up of some of the burners is only a matter of moments.

In the same way the time taken for the stoker fired boiler to die down, and the fact that coal has to be added regularly to maintain a fire on the stoker when the boiler is taken off the range during the night, compares unfavourably with pulverised firing where all that is necessary is to shut off the burners and close all the dampers, when the heat stored in the boiler will maintain the pressure for many hours, practically eliminating banking losses.

(4) **Efficient burning of low fuels.** Probably the greatest advantage of the pulverised fuel system is its ability to burn any class of coal efficiently. This makes available the large mine dumps of slack which are unsuitable for any other class of firing. To avoid any misapprehension as

to whether this duff is suitable for powdered fuel without pulverisation, it should be mentioned that the difference between duff and pulverised fuel may be likened to the difference between a pumpkin and a pea, and further it can be proved that the power required for pulverising is very little less for duff than say for half inch peas.

Automatic Control. Within the last few years the boiler house has received a great deal more attention than was formally the case. Instruments have been improved to the extent that they are not merely delicate laboratory playthings but are able to stand up to ordinary boiler house conditions. With the reliable and practical instruments now made it is only to be expected that means will be found to adopt these meters to continuously and automatically adjust furnace conditions and thereby prevent the losses they were designed to show. This has been found to be very practical with powdered fuel, owing to the rapidity with which conditions can be changed, and it is claimed that from 2% to 5% can be saved by this means.

Three general functions are essential, firstly the steam pressure must be maintained, secondly air and coal ratios must be maintained at all loads, and thirdly easy change over to hand control must be possible.

With regard to the question of costs, this must be subdivided into three items, Capital, Value of fuel saving and Maintenance. Speaking generally the Capital expenditure is higher and the saving in fuel and maintenance must exceed this extra capital to justify its installation.

Firing. Pulverised fuel firing should be considered in two parts (1) Preparation (2) Combustion and further there are two means of preparation namely the unit and the central systems. The difference between these two means of preparations being in the storage of pulverised fuel in the latter. Both methods have their own spheres of application and should be separately considered for each individual installation.

It is claimed for the unit system, which is of course one or more mills supplying the boiler, pulverising the coal as required, that it is much cheaper than the central system which requires driers, cyclones, storage bins, conveying gear and a separate pulverising house. This reduces the capital cost to a level comparitive with stoker gear. On the other hand it would appear that it has the same drawbacks as the stoker in that the failure of a grinder, due possibly to a hot bearing or some other small fault puts the whole boiler out of action unless spare mills are installed for emergency, or cross connections are made to other boilers, which safeguards however add to the cost.

The provision of driers are a necessity with the central system on account of the conveying and storage of the pulverised coal, although it is not always essential to use them, but they are not used with the unit system unless the coal is very wet. The drying process may be carried out in a number of ways, which include the separately fired inclined rotating tube, down which the coal travels by gravity, the flue gas drier where a portion of the chimney gasses is passed through the wet coal and the steam drier, which is much cheaper and less bulky than the other types. It should be stated that while pulverisers can be made to deal with a high moisture content, the power consumption and wear and tear increase rapidly with the moisture percentage. These methods have all great disadvantages and an improved means is now being used in which heated air or flue gas is admitted to the air circuit of the mill.

This air has of course to be removed again and as it will contain a certain amount of coal dust it cannot be exhausted to atmosphere, and it is customary to draw off this air for primary air. To reduce the coal to the required degree of fineness the storage system employs either tube or roller mills while the unit system usually pulverises by means of beaters.

Tube mills are simply large steel lined cylinders containing steel balls. The tubes revolve at a very slow speed, and in consequence they are cheaper in first and running costs and are very reliable. On the other hand they have to be lagged to try and deaden the noise as much as possible, and cannot handle a high percentage of moisture.

Roller mills are mills in which rollers or balls run around opposite a bull or die ring, the coal being fed in between them preventing any actual contact between the metals.

The running speed is much higher than tube mills, being about 100 to 150 r.p.m.

The other pulveriser mentioned, namely the beater type, is run at a fairly high speed, in most cases about 1,000 r.p.m., and powders by a large number of small blows, which is claimed to be theoretically correct.

With the roller and beater pulverisers magnetic separators must be placed in the circuit to remove any tramp iron. Air separation of the powdered particles is now almost universal for all types.

Pulverised coal can be conveyed by screw conveyor or by air pressure. If conveyed by air pressure, which is the method usually employed for long distances, a cyclone has to be fitted to separate the dust and air at the bins.

From the storage bins or unit pulverisers as the case may be the coal is carried by conveyor and air to the burners whose function is to throughly mix the fuel and air ready for combustion. Having thus supplied the fuel to the furnace the only other essential is to have a sufficiently large chamber to give the time factor, which is very important as has already been discussed. This large combustion chamber is the usual

stumbling block in attempting to fit pulverised fuel to old boilers, in fact this point held up for some time the full development of pulverised fuel firing.

The older method of supplying only sufficient air with the coal to promote combustion and adding the remaining air progressively as the flame travels through the furnace, necessitated a large furnace and a long flame travel, and it is the endevour of the designers to reduce this furnace volume, and incidentally the cost.

This has been partly accomplished by the "short flame" burner and at the same time gives a great turbulence which results in a much shorter flame.

CONCLUSIONS.

It is very difficult to predict future boiler practice owing to the great developments which are taking place every day.

One would be on comparatively safe ground nevertheless in a general forecast. Higher temperatures and pressures will progress with improvements in metals and manufacture. The use of pulverised fuel will increase. This increase will depend to a large extent upon the capital cost, and for small plants there will probably be a greater demand for the unit system. Monthly efficiencies as high as 90% are being carried in some of the American stations, and as a modest estimate I should imagine that the majority of smaller stations in this country could show a saving in coal of at least 20% with pulverised fuel, which at any rate would warrant serious consideration.

The question of low temperature carbonisation, as far as it concerns the power station, is mainly a commercial one, in that the return from the by-products must be such that it supplies the boilers with fuel as cheap if not cheaper than the raw coal.

The President : Gentlemen, I propose a very hearty vote of thanks to Mr. Morris for reading the very lengthy paper. (Applause). As we are now due to pay a further visit to the Electrical Exhibition, the paper will be open for discussion to-morrow.

The Convention then adjourned. After lunch, the delegates were conveyed by municipal buses on a visit to the Mazelspoort Waterworks and an inspection of the Harvard University, U.S.A., Observatory, by kind permission of Dr. J. S. Paraskevopoulos who gave a short address on the "Progress of Astronomy."

FRIDAY, 15th NOVEMBER, 1929.

The Convention resumed its proceedings at 10 a.m. with the President (Mr. R. Macaulay) in the Chair, there being also present :—

Members— Messrs. T. P. Ashley (Queenstown), L. F. Bickell (Port Elizabeth), W. H. Blatchford (Greytown), G. Chase Brown (Vrede), J. S. Clinton (Brandfort), R. D. Coulthard (Oudtshoorn), P. W. Dadswell (Cradock), H. A. Eastman (Cape Town), R. W. Fletcher (Krugersdorp), A. Hadfield (Gwelo, S. R.), A. Q. Harvey (Middleburg, Cape), J. Hooper (Robertson), L. L. Horrell (Pretoria), J. Iverach (Grahamstown), S. Lewis (Aliwal North), W. Mortimer Mail (Kokstad), F. C. D. Mann, (Worcester), T. Millar (Harrismith), H. A. Morris (Kimberley), P. H. Newcombe (Alice), L. Ralston (Dundee), John Roberts (Durban), J. H. Rogers (Fort Beaufort), J. H. Simpson (Colesberg), L. B. Sparks (Pietersburg), T. Sutcliffe (Benoni) ;

Delegates— Councillors W. C. Adcock (Port Elizabeth), J. Blaker (Johannesburg), A. L. Clark (Durban), C. S. Duxbury (Pretoria), T. Ericsen (Kimberley), and D. A. Thomson (Bloemfontein) ;

Visitors— Messrs. I. J. Allen (Petrus Steyn), J. Bernard Bullock (Johannesburg), J. S. Lategen (Boshoff), H. A. Mellor (Bloemfontein), E. T. Oates (Johannesburg), E. Perrow (S.A.I.E.E., Johannesburg), G. M. Pirie (Bloemfontein), F. C. Stephens (P.W.D., Pretoria).

Honorary Secretary and Treasurer— Mr. E. Poole (Durban).

NEW MEMBERS :

The President : Gentlemen, I have pleasure in announcing that the Council has elected Mr. J. S. Clinton of Brandfort as a member of this Association. The next business will be the election of the Council.

MEMBERS OF COUNCIL.

Mr. Bickell (Port Elizabeth) : Could I ask the Secretary to read Rules 8 and 9 of the Constitution?

The rules were then read as follows :—

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

9. "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.

Mr. Bickell (Port Elizabeth) : I understood that one of the immediate past presidents was not elected when the Council members were elected earlier during the proceedings. What is the position?

The Secretary-: I take it that under our Rules that if one past president refuses election, the immediate predecessor should be elected.

Mr. Bickell : The Rules make no such provision.

The President : The position is that the retiring President (Mr. Mordy Lambe) does not seek a seat on the Council, and though I do not think it has been notified to our full meeting, he has telegraphed his unwillingness to stand.

The Secretary : The procedure would have been that Mr. Roberts would have retired and the two past presidents Messrs. Sankey and Mordy-Lambe have been re-elected. As Mr. Lambe decides not to sit, I think we must carry on with the previous two immediate past presidents.

Resolved :
On the **motion** of Mr. Lewis (Aliwal North), **seconded** by Mr. Sparks (Pietersburg) this procedure was adopted, namely that the past presidents of the proceding year be re-elected.

Election of 4 Members of Council. On the question being raised by Mr. Bickell, lengthy discussion took place on the procedure to be followed, it being pointed out that the past practise of each Province having its representative is not laid down in the Constitution and ultimately Mr. Bickell moved that four members be elected by ballot, this was seconded by Mr. Horrell and on being put to the meeting was carried by 15 votes to 1.

The President : I now call for nominations for the four members to be elected.

Nominations were then received as follows :—

Messrs. L. F. Bickell, T. Millar, G. H. Swingler, A. T. Rodwell, W. H. Blatchford and F. C. D. Mann.

The President : There being more nominations than vacancies, we will have to arrange a ballot and only members may vote, each one voting for four and I would ask Mr. Bullock and Mr. Adcock to act as scrutineers.

A ballot was then taken and the result was—

Mr. H. SWINGLER.
Mr. L. F. BICKELL.
Mr. F. C. D. MANN.
Mr. T. MILLAR.

The President : I propose a hearty vote of thanks to the scrutineers. — **Carried.**

BILL FOR THE LICENSING OF ELECTRICIANS AND REGISTRATION OF CONTRACTORS.

The President : The next item for consideration is in regard to the letter we had from the National Federation of Building Trade Employers.

Mr. Roberts (Durban) : Mr. Eastman opened the discussion yesterday and explained the present situation very closely. Members will have been interested to learn of the letter which has been received from the Master Builders supporting the idea of legislation to put this matter of Licensing of Electricians and Registration of Wiring Contractors on a uniform basis throughout the country. Our Association is, I am sure, very glad that the Master Builders are alive to the importance of control over both Contractors and Artizans engaged in wiring and I move the following resolution :

(i) That this Association is in favour of co-operation with the National Federation of Building Trade Employers, in order to put the matter of the licensing of electricians and registration of contractors on a satisfactory footing;

(ii) That the Association authorises the Council to take the necessary steps towards the above end; and

(iii) That, as a preliminary step, Messrs. Eastman and Horrell be asked to prepare the draft bill after consultation with the National Federation of Building Trade Employers, and thereafter, submit it to the remaining members of the Council for their approval."

Note :—*A further resolution was added at a later stage as follows —*

That special conditions be introduced in the proposed legislation to care for the special conditions in the smaller towns.

Councillor Adcock (Port Elizabeth) : Would it be in order my speaking on the matter? It is only with the idea of assisting that I do. We must be guarded to see that all are brought into the fold and no man's living is taken away from him. I remember years ago, the Law Society doing this sort of thing. They took all who had licensed practices. Any action taken, must not be with the idea of getting any small contrartors out of the road.

Others members referred to the effect of the Bill with the smaller municipalities, and feared that it would be unworkable but the President thought the bill would improve matters in that respect.

Mr. H. A. Eastman (Cape Town) : To the best of my knowledge, this draft bill has already been put to the Association and approved in principle. To the best of my recollections, all the difficulties suggested now, were considered at the time, and, if not provided for then, it was up to the members of the Association, after careful consideration, to suggest amendments. All except members elected since that date had an opportunity of going into the matter with the object of improving the draft as seemed desirable. Since then, however, the secretaryship has changed and, unfortunately, in the change, the bill seems to have been lost sight of.

The President-: Mr. Roberts' motion is this. It is evidently impossible for the whole of our Association to consider the matter properly at this stage, and he asks permission for the certain gentlemen named to go into it. I take it they will pay attention to all the points raised and, if any members have suggestions to make, they should be sent to Messrs Eastman and Horrell as early as possible.

Councillor Duxmury (Pretoria) : It is a very important matter to get this through and it might be useful to have these suggestions noted down now.

Mr. Harvey (Middelburg, Cape) : Could not the bill possibly be sent around for the scrutiny of all the members?

Mr. Roberts (Durban) : I am sure that we, of the larger towns, realise the point of view of the Engineer in the small town where it would be very difficult to bring in the same rigid machinery as is necessary in the larger towns. On the other hand I am sure the smaller towns do not wish to stand in the way of control which is absolutely necessary in the large centres, and in order to care for the special circumstances of the smaller towns I move that the following addition be made to the resolution I have already moved :

> "That special conditions be introduced in the proposed legislation to care for the special conditions in the smaller towns."

Mr. Roberts' motion, with the addendum, was then put to the vote and

Carried unanimously.

PAPERS FOR NEXT CONVENTION :

The President : Gentlemen, so far only one paper has been offered. I would be glad to receive more and would like something on matters affecting the smaller towns.

Mr. Ralston (Dundee) : I will try to bring up a paper on the "ADVANTAGES, IF ANY, OF CHANGING OVER TO THE BULK SUPPLY."

Mr. Blatchford (Greytown) : I will endeavour, if possible, to deal with a paper on "MORE EFFICIENT PLANT -AT SMALL STATIONS, MORE ESPECIALLY CONDENSING PLANTS."

Discussion of Mr. Smith's paper on "Boilers."

The President : We will now proceed to the discussion of Mr. Smith's paper.

Mr. Brown (Vrede) : Mr. President, the paper is quite comprehensive as was said in today's newspaper, "Friend" and was supposed to have been written for the benefit of engineers in small power stations - that was the suggestion made at the last convention, so as to enable engineers to know what they could do to overcome their difficulties with their Boiler plants. I am afraid, Mr. Smith, did not touch on that point at all. I, myself, have experienced difficulties with corrosion troubles due to the condition of the water used, and I was looking forward to some advice as to how to treat this trouble. Corrosion had taken place in a Boiler drum in extent about one foot square, which had developed in a period of three months. The rod carrying the water alarm was about half way through and on an analysis being made it was found that the Sulphate of Alumina in conjunction with the Oxygen in the water was the cause of the corrosion. The water used was taken from the town mains which had been treated with Sulphate of Alumina and Lime for purification purposes.

Mr. Bickell (Port Elizabeth) : I would like to mention for the information of the members who seem to be having difficulties that, if they get into trouble, they should write to Mr. Reynolds of Messrs. Reunert and Lenz, Ltd., Johannesburg, he has a paper written I believe by American engineers from which they will get all the information wanted on caustic embrittlement. While on the paper, regarding the reference to water sprays for dust prevention, could we have an idea how much water is used every 24 hours for this purpose at Congella. It would be rather an expensive process over a period of 12 months, I should say.

Mr. Roberts (Durban) : I am not authorised by Mr. Smith formally, but will give any information that will be helpful if it is wanted later.

Mr. L. L. Horrell (Pretoria) : The use of Pulverised fuel is of universal interest. Any information Mr. Roberts is able to supply us, regarding the operation of the Congella plant, will be much appreciated. Pretoria is the only town in the Union, I believe, with a boiler pressure of 350 lbs. per sq. in. Contrary to expectation, no trouble with leaky joints is experienced.

Mr. J. Bernard Bullock (Editor "S. A. Engineer") : I think members will appreciate an account of the steam generator from Mr. Roberts who has recently investigated this new departure in England. The present position of pulverised fuel may, I think, be summarised by saying that so far no boiler, except the steam generator, has been designed specifically to use this system of firing. It has been the custom merely to perch a standard type over a combustion chamber designed to burn powdered coal and to call it a job. Whereas the average evaporation per square foot of heating surface of such boilers is in the neighbourhood of 5 to 6 lbs. per hour, it is recognised that the portion of the tube surface exposed to direct radiation is operating at a much higher rate, possibly approaching 40 lbs., and experience proves that this can be done with safety. In the steam generator practically the whole of the heating surface is exposed to radiant heat and is thus worked at rates as high as 32 lbs. per sq. ft. per hour. This is a purely logical development but one which seems likely to revolutionise boiler practice. It suggests that thousands of square feet of heating surface in a big boiler, working at low rates, is simply wasted.

The small man may feel that this new method of firing only relates to big units and that this discussion has therefore no relation to himself. On the other hand, powdered fuel installations are now being applied to quite small boilers without material alterations and the new method thus has a very definite interest to the small plant, and its engineer. I think we have at last arrived at the correct way of using coal and if objections are raised to the dust problem created by powdered coal, the answer is that all methods produce

dust and that in future every user of boilers, irrespective of the method of firing adopted, will have to tackle the emission problem.

It is interesting to note that the use of welded drums for moderate pressures, is making big strides among Continental boilermakers. English designers are conservative and do not apparently trust a weld sufficiently as yet but the method is attractive, avoiding the problem generally referred to as caustic embrittlement, and in due course, as welded drums prove themselves in service, British makers will probably be encouraged, if not compelled to adopt the idea.

Reply by Mr. Roberts (Durban) : I shall try, Mr. President, to reply to the various points raised but I do not know whether my full views will be in accordance with those of Mr. Smith, who unfortunately, owing to bad health, is not able to be with us.

In regard to the corrosion trouble experienced by those operating small stations, it is probably due to the use of inferior boiler feed water or imperfect purification. I have often expressed my surprise that small station plants are not equipped with condensers on account of coal economy to be derived from their use, and one important incidental advantage of the condenser is that it gives a pure supply of water for the boilers.

My opinion has been asked as to the merits of pulverised fuel firing of boilers in view of the experience we have obtained on the Congella Power Station, Durban. I may say that though we had some initial difficulties to overcome due largely to inexperience of the operating staff, not a single one of whom had had any previous experience of burning coal in pulverised form, we are quite satisfied with the results we are now getting, especially from the point of view of efficiency. The success or otherwise of a pulverised fuel plant depends very greatly on the operating force. They must be prepared to abandon many pre-conceived ideas of coal firing and for this reason I have

heard of excellent results being obtained by operators who have never had any experience of pulverised fuel boilers at all.

I have been asked my opinion on the Wood boiler, the design of which is a great departure from standard practice, and I was fortunate enough to see two boilers of this type in operation at Brighton Power Station, England, and those in charge of their operation expressed the greatest satisfaction at the excellent results they were getting.

In regard to dust, a great deal of trouble has undoubtedly been experienced from the emission of dust from the chimneys of pulverised fired boilers. We have practically eliminated the difficulty at Congella by copious water spraying in the flues and in the base of the chimney.

The President : Mr. Roberts, I think we owe you a very hearty vote of thanks for replying instead of Mr. Smith. The latter will no doubt, in due course, give us some further information.

Reply by Mr. J. T. Smith (Communicated) : I very much regret that I was not able to be present at the Convention in order to answer the questions raised, and wish to thank Mr. Morris for his kindness in reading the paper and to Mr. John Roberts in replying to the queries raised.

I found when writing the paper that it was practically impossible to write in any general way on the troubles that would be likely to occur in small plants owing to the great number of variable conditions peculiar to each plant.

From the very sketchy notes of the discussion, I gather that Pulverised Fuel is very much in the foreground at present, and it is undoubtedly the method of firing of the future.

With regard to the boiler corrosion troubles mentioned, this was one of the points which caused so much difficulty in writing a paper on small plant problems. Each plant has a different

source of water supply, some treated and some untreated, some using condensers and others 100% raw water feed. Under these circumstances only general text book information could have been given which was not, of course, considered satisfactory.

In addition, I think it very unwise for any engineer to attempt any feed water treatment, without a full chemical analysis.

I do not know whether Mr. Brown has painted his boiler drums or not, but if not I would strongly advise painting with Apexior which is in no way a chemical treatment; but an exceptionally good preventative when applied correctly.

SUGGESTIONS FOR THE IMPROVEMENT OF METER SERVICE EQUIPMENT.

By **Mr. Geo. H. Swingler**, M.I.E.E., M.I. Mech. E. City Elec. Eng'r., Cape Town.

At the request of the President, Mr. Eastman (Cape Town) summarised the following paper submitted by Mr. Swingler, who was not able to be present at the Convention :—

It will be remembered that at a previous Convention, some discussion ensued in regard to the possibility of installing service connections and equipment in consumer's premises in such a manner as to eliminate, as far as possible, the unsightliness existing all too frequently at the present time with such apparatus in the case of supplies being given through overhead conductors, and that the Author undertook to go into the matter with a view to offering some suggestions for improvement in this respect for consideration by the Association.

In particular, the discussion centred upon the possibility of making adequate provision in all new premises for the accommodation of the service equipment in as inconspicuous a manner as practicable, as well as providing such protection to the current carrying parts as to make it

difficult—if not impossible—for unauthorised tampering with the connections and illegal abstraction of electric energy to take place.

In the following notes the author has attempted to show how the two conditions referred to above can be obtained by the adaptation and improvement of the apparatus commonly in use in this country. A description is given also of the steel encased meter service equipment used largely in the United States of America which, it is thought, may be of interest, but that particular type of apparatus is, to the best of the Author's knowledge, not used at present in South Africa.

At the present time, the only regulations referring generally to the accommodation of the service equipment are those appearing as a clause in the Wiring Regulations of most Municipal Undertakings which require a specified area in an accessible position and within a certain height to be set aside in dwelling houses for the accommodation of the equipment and those which specify that in blocks of offices, tenements, etc., a special room must be provided for this purpose.

In the case of dwellings, these regulations imply that the service equipment, including the meter, is to be fixed on the surface of a wall and therefore that no special structural arrangements require to be provided for their accommodation. With regard to the accommodation required in blocks of offices, tenements, etc., no serious difficulty is experienced in applying the regulation, always provided the Architect is previously made aware of the requirements, preferably by means of a Clause in the Local Municipal Buildings Regulations, and the following notes may be taken as referring more particularly to the case of the usual type and size of dwellings.

There is no need for me to lay stress on the difficulty which is frequently experienced in arriving at an arrangement mutually satisfactory to the Supply Authority and consumer in the case of dwelling houses where, in most instances,

wall space is difficult to obtain in a position which may be the most suitable from the Authority's point of view.

The Supply Authority's requirements may be summed up as follows :—

(1) The service equipment must be readily accessible to meter readers, inspectors and other officials.

(2) The service connections should be as short as possible.

(3) The equipment must be installed in a dry place, reasonably safe from accidental damage, and protected from the weather.

(4) The design and location of the equipment must give every possible protection against unauthorised cutting off of the supply and against danger by fire or electric shock.

Since in most instances, the supply mains are carried along the streets in the fronts of premises, the above stated requirements are most readily met by installing the service equipment immediately inside the entrance door.

The consumer's requirements are that :—

(5) The equipment occupies a minimum area and depth.

(6) Its design, location and method of fixing does not constitute an eye-sore.

(7) It is not situated in a place likely to be required for any other purpose at a later date.

It would appear, at first sight, that no difficulty need arise in all seven conditions referred to above being met to the satisfaction of both parties,

but, unfortunately, very few houses are built or furnished in the same manner, and in any case, the consumer has every right to consideration in what he may regard as the disfigurement of his walls, so that unless the Supply Authority uses a very considerable amount of tact in exercising its statutory powers in the location of the equipment and takes steps as far as possible to eliminate the possibility of complaints as to its bulk and appearance, one feature of paramount importance at all times to the sucess of the undertaking, namely, the consumer's goodwill, is endangered.

The question of the situation of the equipment is necessarily bound up with that of security of the supply and the length of the service connections themselves, and whether or not the Supply Authority's usual procedure is to instal the whole of the service connections entirely or only partly, free of charge to the consumer, it is clearly to its advantage to make these as short as possible, and as mentioned previously, the result is that the Supply Authority aims, in every instance, at installing a meter in, or near, the main entrance hall, a position to which most consumers cannot be blamed for objecting from a point of view of unsightliness in the case of apparatus as installed at the present time.

One practicable method of overcoming this objection to a great extent in connection with overhead service conductors is to arrange that the whole of the internal service connections, with the exception of the service cut-outs and meter, be provided by the consumer—a method which has been applied with great success in this respect in Capetown during the past twelve months. Under this arrangement, the Corporation supplies and fixes only the outside portion and main cut-outs of the service connections from the supply mains to a point at which internal service connections are led to the service board. The service leads, for a distance of 100 ft. from the pole, are provided by the Corporation free of charge, and the cost of any additional length, in excess of 100 ft. is shared equally by the Corporation and the consumer.

It is unusual in the ordinary villa for this distance to exceed 100 feet, but even should this be exceeded, the proportionate cost of the additional portion paid by the consumer amounts only to a very small sum in the usual type of connection. Thus, although the Corporation requires the metering equipments, etc., to be installed in a place easy of access, no objection on the score of additional expense can be raised by it against the consumer desiring the equipment to be placed in any approved position where the question of unsightliness does not arise to any extent, for any extra cost of the servce connection so caused is small compared with the total cost of the installation and is borne unnoticed by the consumer.

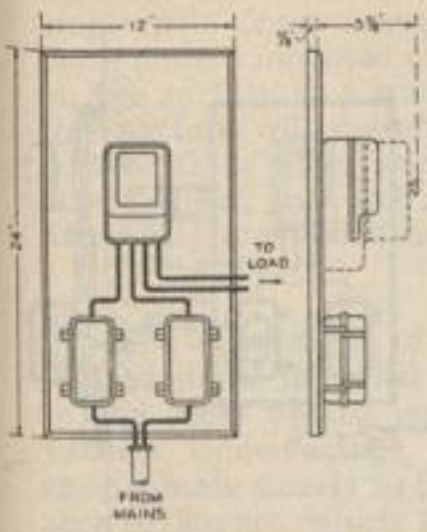
The question of unsightliness is very largely one of degree, and is determined principally by the location of the object with reference to its environment, but it must be admitted that its dimensions and design of the type of service apparatus most generally in use in this country is such as to make it appear to be unnecessarily cumbrous. Occasionally, however, one meets with an instance of a consumer overcoming the question of unsightliness simply by covering up the equipment in such a manner as, not only to make it impossible of access, but also to introduce a very real source of danger by fire under severe fault conditions. One typical instance of this which has recently come to my notice occurred in an installation where the service board was originally installed in a Draper's Shop immediately inside the main entrance, but as a result of subsequent alterations to the building, the service equipment was finally situated inside one of the shop windows. This was then, of course, suitably hidden from view by being covered over with the usual articles exhibited in such windows, and so far from the owner objecting to its presence there, he objected very strongly to paying the cost of its removal to a more accessible position and to one where possible danger by fire would be a minimum.

In passing, it might be of interest to know that, while the Capetown Council's Wiring Regulations follow very closely those recommended for general use by our Association in 1920, no regulation is included definitely permitting the Council to insist upon the removal and re-erection of the apparatus in another place at the cost of the consumer.

Any improvement on the lines referred to above is very largely governed by the question of cost in relationship to the additional amenities thereby gained, and a fundamental requirement in this connection is the standardisation of all service equipments installed in similar types of premises, and it is at this point that the first real difficulty is met with.

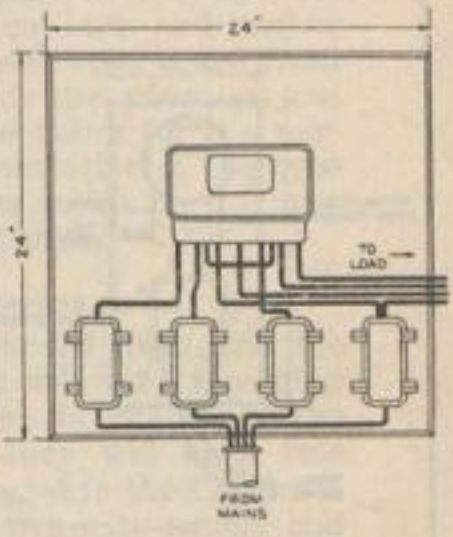
The difficulty is that in most of the older established undertakings, as well as in many of the newer ones, not only is the supply given under more than one system, but similar premises in the same system area may, according to their load demands, be given supplies either by 2, 3, 4 or 5 wires, while the number of meters installed may vary in each of the same systems of supply, according to the tariff of charges applicable to, or adopted in the individual installation.

In view of the large number of possible combinations of meters and cut-outs, it is possible to deal in this paper only with the more general case of a 2-wire supply and to indicate generally the application of the same suggestions to those supplies requiring more than one meter or two wires by simply increasing the dimensions of the apparatus and incidentally the required accommodation to suit.



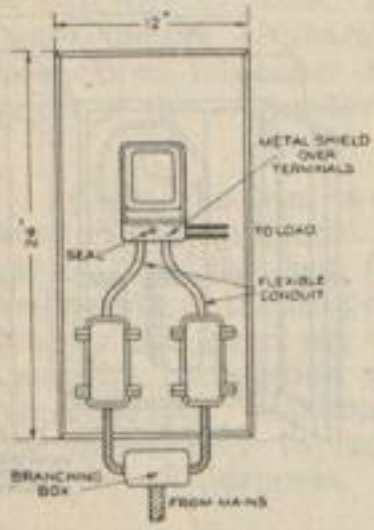
TYPICAL 2 WIRE SERVICE BOARD.

FIG. 1.



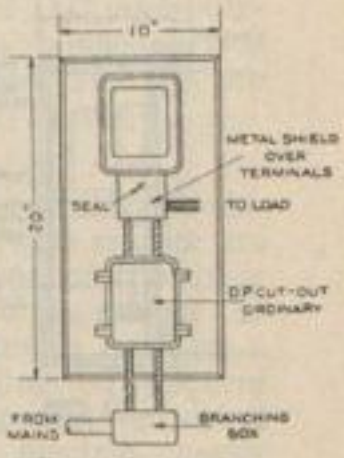
TYPICAL 3 PHASE 4 WIRE SERVICE BOARD.

FIG. 2.



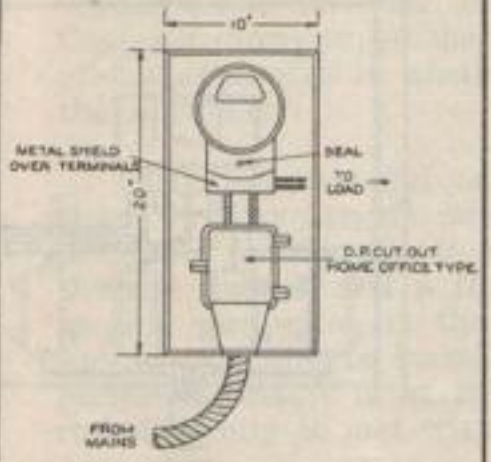
2 WIRE SERVICE BOARD WITH PROTECTED CONNECTIONS.

FIG. 3.



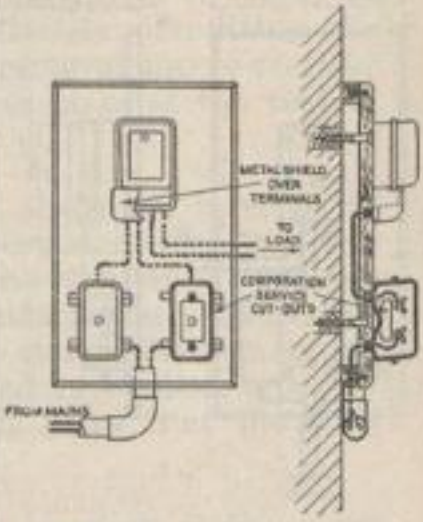
2 WIRE SERVICE BOARD WITH D.P. CUT-OUT & PROTECTED CONNECTIONS

FIG. 4.



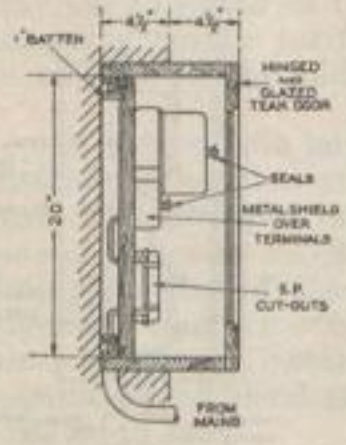
2 WIRE SERVICE BOARD
WITH D.P. CUT-OUT
& PROTECTED CONNECTIONS.

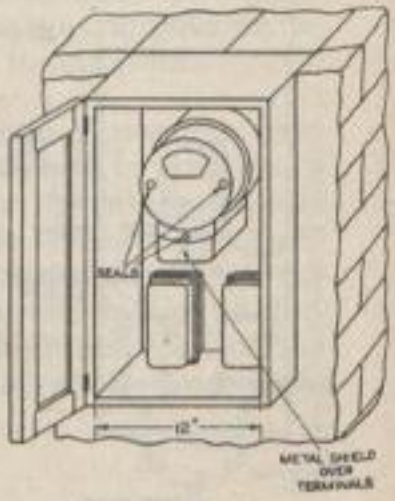
FIG. 5.



SERVICE BOARD
(CONCEALED CONNECTIONS)

FIG. 6.





2 WIRE SERVICE BOARD IN BOX RECESSED INTO 9" WALL.
(CONCEALED CONNECTIONS.)

FIG. 7.

FIG. 8.

The type of service equipment most generally used in this country is similar to that shown in figure 1 and consists essentially of two or more single pole front connected cut-outs and one or more meters mounted on a hard wood board fixed on the surface of a wall inside the premises, and this pattern will therefore be taken for the purpose of these notes as representative of the type of equipment on which improvements on the lines previously mentioned are required.

The dimensions of the board itself and the various items mounted on it will vary according to the ideas of the engineers in charge of the various Undertakings, but they will as a rule approximate closely to those used in the Capetown area of supply, which for a two wire supply and a three phase four wire supply are shown in figures 1 and 2 respectively.

In figure 1 alternative sizes of meters are indicated, namely, those having the least and also those with the greatest depths commonly in use on two wire systems. All types of D.C. and polyphase meters ordinarily used in house service connections moreover do not exceed that of the larger of the two meters shown in Figure 1.

As will be seen the maximum overall dimensions of the equipment for a two wire system are 24" x 12" x 6¼" deep from the end of the cover sealing nut of the deepest meter to the rear of the board. One such set of apparatus is used on a two wire installation not exceeding 20 amperes per conductor maximum loading and requiring one meter only to register the electric energy used for all purposes.

In the event of the adoption of a tariff involving the use of two meters and also for polyphase supplies up to 20 amperes per phase, the width of the board is doubled but the height remains unaltered as shown in Figure 2.

For larger conductor loadings on polyphase supplies the dimensions of the board are still further increased to a maximum of 30" wide by 24" high for ordinary types of services.

Unless other special provision is made to the contrary the fact that the meters and cut-outs are front connected necessarily involves the use of small lengths of exposed conductors between the end of the conduit carrying the service wires and the cut-outs and between the latter and the meter thereby providing easy means for tampering with the connections and illegal abstraction of electric energy.

An improvement in this respect is shown in Figure 3 which shows the same fittings illustrated in Figure 1 erected on the same size of boards, but the interconnecting and leading-in conductors to the cut-outs are protected by flexible steel conduit of the "Sprague" type. This arrangement, however, does little or nothing towards improving the appearance of the equipment, but by the adoption of double pole cut-outs, not only can the overall dimensions of the boards be reduced, but a distinct improvement in appearance is also gained, as is illustrated in Figure 4, where the size of the service board is shown as 20" x 10" as compared with the standard of 24" x 12".

The "Sprague" type of flexible steel conduit has been shown in Figure 3 and 4 as the means of protecting the lead-in and interconnecting conductors against accidental mechanical damage or deliberate interference for as a rule this would undoubtedly be found to be more easily installed than say the ordinary type of rigid tubing, but whichever type of protection is employed unless the meter terminal box is specially constructed for the purpose it will be necessary to fit a special lead-in box and cover at the terminals into which the conduit must enter sufficiently far to allow a back nut or other similar suitable device being fitted to hold it in position. Moreover this cover will require to be sealed.

This difficulty will not obtain as a rule in respect of the conductor outlets of the cut-outs but in the case of all of those described with the exception of that shown in figure 5 where double pole cut-outs of the Home Office type are illustrated which are fitted with a special hood for the purpose, it would be necessary, in order to protect the incoming leads, to fix a branching box on the service conduit near the board whence the conductors are led separately through conduit to the live side of the cut-outs. This box will of course require to be sealed. Unfortunately, however, the greater the number of places requiring sealing the more easily is a broken seal overlooked, and although it appears impossible of attainment with the type of apparatus under consideration the ideal to be aimed at is an arrangement in which the fact that a seal is broken gives conclusive evidence that this has been done for an illegal purpose.

In passing I need scarcely draw your attention also to the large number of different types of meter terminal covers which a Supply Authority may require to provide in order to suit the variety of meters which may be in use in its supply area.

The only other alternatives to those set out above for providing for the mechanical protection of the conductors on the surface board appear to be either to mount the board on battens say 1" deep and to run the wiring in the space so obtained between the board and the wall or to use equipment in which the meter terminals and the cut-outs are all included in a suitable sealed steel case.

For the first alternative the use of back connected apparatus is scarcely practicable and is not recommended on account of the difficulty in making connections, changing and testing meters etc., but it may readily be carried out by leading the conductors through to the front of the board near meter and cut-out terminals and protecting them at these points either by hoods extending from the meter and cut-out covers or

by extending the cases a sufficient distance to allow of the point of exit of the conductors from the board to be included in them.

An arrangement of this description is shown in figure 6 where the cases of the cut-outs shown in figure 1 have been extended to permit direct entry of the conductors through bushes cast in their bases which project a small distance into the face of the board. Similarly the conductors at their points of exit for connection to the meter terminals are protected by an extension of the meter terminal cover and by small bushes entering the face of the board so making it practically impossible for any illegal connection to be made except by breaking the meter and cut-out seals.

A still further improvement in appearance and a slight reduction in the width of the board would be obtained by the use of double pole cut-outs as shown in Figure 4.

The additional cost involved in the provision of meters with such special terminal covers and slightly larger cut-out cases than usual would be small when ordered in quantities and I would suggest for the consideration of this Association that an arrangement of this type might be recommended for general use by all Municipalities.

No further improvement in appearance appears feasible by the use of the type of service apparatus described above except by enclosing it in a suitable box or frame wholly or partly recessed into a wall in the premises.

The universal adoption of any such scheme throughout an area of supply will necessarily involve making provision in the Local Authority's Building Regulations for the construction of the recess during the course of the erection of the building, a matter to which there should not be any serious objection.

It will be evident that the dimensions of the recess should be suitable for accommodating the largest type of board likely to be required for the

size of the installation, taking into account, also, the number of meters and wires through which the supply may be given and which as indicated above would ordinarily be say 12" x 20", or 24" x 20" in the case of a single-phase supply being required to be extended later to a polyphase supply, but it does not follow that the whole of the space available need be taken up in the first instance.

As will be seen from figure 1, the gross overall depths of metering equipment as used in Capetown for ordinary house connections 2-wire system is $6\frac{3}{4}$" or say $7\frac{3}{4}$" in the event of rear wiring being used which, in the case of brick wall, makes it difficult to effect the complete recess of the service equipment into any but walls 14" and upwards thick. As a rule, the selected position for a service board requires that it be fixed on either 9" or $4\frac{1}{2}$" thick walls. In the former case, the maximum depth to which the recess can be made without requiring a projection on the other side of the wall to provide for its support, is 6" provided the meter board itself is supported suitably from the sides of the box or $4\frac{1}{2}$" if secured to plugs driven into the remaining brick work while, in the case of $4\frac{1}{2}$" walls, a large projection to the rear is the only alternative to mounting the whole of the equipment on the surface.

Having regard to the necessity of being able to accommodate in the recess any type of meter ordinarily in use the depth of the box clearly must be made sufficient in every case to take any meter used in the area of supply for such work.

An illustration of this arrangement is given in figure 7 which shows suggested details of the construction and method of fixing a meter in a box recessed $4\frac{1}{2}$" deep into a 9" wall. The meter board is fitted with battens for rear wiring and the whole is closed by a hinged teak glazed door fitted with a hook latch.

The overall depth of the box is shown as 9″ which gives a clearance of ½″ from the inside of the glass front to the outside extremity of the meter cover holding down bolts in the case of that of the maximum depth shown in figure 1 and the outside of the cover projects only 4½″ from the wall. A perspective view of this arrangement is shown in figure 8, from which it will be seen that its appearance, if not everything that could be desired, is, at any rate, a great improvement on the existing method of installing the service connections.

Further refinements of construction could of course be introduced with a view to improving the appearance of this arrangement but they do not appear to be warranted on the score of necessity.

The cost of providing the recess and the meter service box described if carried out during the construction of the building would be insignificant compared with the total contract price and the small amount involved would not be grudged by a consumer who desires his electric equipment to be installed in a first class manner throughout.

Sheet steel encased service equipment containing the cut-outs and meter terminals as well as a control switch are used extensively in America at the present time to serve the same purpose, which besides giving still greater protection against tampering with the connections are still more compact than that described above. This type of apparatus has been developed under the same conditions of overhead distribution practice obtaining at the present time in Capetown, which, as mentioned before, consists in the wiring contractor terminating the load circuits at the service point and extending the service wires to the outside of the building. The consumer is required to purchase the fuse and switch portion of the apparatus, but the meter is supplied and installed by the Electric Utility. The apparatus which is made in a variety of forms by different manufacturers, is subject to the approval

of the Supply Authorities, and is required to conform to their specifications in regard to non-accessibility to live parts, sealing or non-sealing of service cut-outs according to the vogue in the area of supply, provision of load fuses in addition to services fuses, etc.

Although, apparently, no one standard type of equipment has as yet, been adopted by all Supply Authorities, certain of the designs evolved appear to comply very fully with all probable requirements, but these appear to have been developed principally for use where the distribution is carried out mainly at 250/125 V. with a pressure of 125 V. to earth, so that comparatively few of the designs made at the present time purely for meter service work would be suitable for use on all of the different systems of supply commonly in use in South Africa.

Equipment of this general type are manufactured for use as D.C. and polyphase motor control switches up to 600 volts and to which meters can be attached, but their cost is considerably greater than that of the ordinary house service meter-box so that their employment for the latter purpose is not justified unless under exceptional circumstances.

A typical meter service switch of this kind consists essentially of a steel box completely enclosing all conductors which contains a switch and fuses with a locking device whereby the fuses are entirely disconnected from the supply when the switch is out. The fuses may be of either the plug or cartridge type without affecting the overall dimensions, which for a 2-pole service are $19\frac{3}{8}$" x 8" to the outside extremity of the handle, by $7\frac{5}{8}$" wide. The fuses may or may not be left accessible to the consumer according as to whether the hinged cover for the same is left unsealed or sealed respectively, but the main cover over the whole of the apparatus is sealed or otherwise locked.

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The arrangement is such that the cover over the fuses is locked in position by a "U" piece projecting through the outside of the main cover and which cannot be withdrawn unless the switch handle is in the "off" position. In the "off" position of the switch, however, the fuses are disconnected from the supply by a sideways movement. Similarly, the switch cannot be put into the "on" position unless the fuse cover is closed and locked by the insertion of the "U" piece, whereby the switch handle is allowed to pass from the "off" to the "on" position.

Hence although the fuse terminals themselves become accessible upon breaking the seal and opening the cover over them, the very fact that in order to open the cover the switch must be "out" and the fuses with their terminals are disconnected from the supply makes it practically impossible for any connection to be made to "live" parts. Such connection is only possible by breaking the seal and removing the main cover, and so no possible valid excuse can be made by the consumer for doing this, and evidence of the breaking of this seal presumes very strongly that it was done for an illegal purpose. Moreover, disconnection of the fuse in this manner entirely eliminates the possibility of the operator receiving a shock when replacing them. Further, since the fuse cover must be closed before the switch can be inserted minimises to the utmost reasonable extent the possibility of danger due to fire being caused by the switch being closed under serious fault conditions.

These switches may be mounted either on a wooden or metal panels and metal adaptors can be supplied for entirely covering over and sealing the conductors leading from the service switch to practically any known type of meter commonly in use. Numerous twist-outs and knock-outs of various standard sizes are provided in the sides and bottoms of the boxes to allow of the fixing of the lead-in and lead-out conduits and it may readily be built up in blocks for branch distribution. The cost of apparatus of this type varies

about £2. 10s. upwards for 30 amp. 250 volts. though for quantities this price would no doubt be very considerably reduced.

Testing facilities are also provided in certain makes of these switches to permit of the meter being tested against another without disconnecting the supply to the consumer.

The President : Our thanks are due to Mr. Swingler for his excellent paper. I must admit that here in Bloemfontein, our service is no ornament and anyone, who can bring forward suggestions for improvement would be doing something very useful.

Mr. Ralston (Dundee) : I see by the paper that, in Johannesburg they had the experience of being called upon to replace fuses in consumer's premises when it was not the Council's but the consumer's fuses that had blown. I was wondering whether some apparatus could not be installed to detect whether a blown fuse is theirs and not the Council's, so that they may call in a contractor.

Discussion was entered into on the question of charging for the replacement of main fuses. Some towns charged from 5/- upwards depending upon the distance, while some gave a gratuitous service to avoid "pin-pricks" and others while being empowered to charge did not act on it strictly, and Members were generally of opinion that the Municipality should give a certain amount of gratuitous service in this direction, so long as the Department was not imposed upon.

There being no further discussion, Mr. Swingler was accorded a hearty vote of thanks for his Paper.

Vote of Thanks.

Mr. E. Vivian Perrow (S.A.I.E.E., Johannesburg) : Before this convention closes, I should like to avail myself of this opportunity of support-

ing the vote of thanks to the Mayor and Town Council of Bloemfontein for the kind hospitality and welcome that has been extended to the delegates. I should also like to congratulate you Mr. President on the very successful convention you have had, and to express the hope that your term of office will be equally successful.

As the next convention is to be held at Pretoria, I think the scheme adopted at the one held in Johannesburg some years ago, might be followed, by arranging a meeting of the South African Institute of Electrical Engineers to be held during the period of your Convention. I feel sure that such a meeting could be arranged, and this would give those members of the S.A.I.E.E. and others attending your Convention, the opportunity of meeting some of the Electrical Engineers engaged in spheres of activity other than Municipal ones. The Institute would endeavour to have a paper read at that meeting which would be of interest to the members of your Association, and the discussion would naturally be open to all those attending.

I cannot help feeling that the question mentioned at some of your meetings, of the larger membership you would like from the Municipal Engineers in charge of the small stations, is a particularly important one. During the last year or two, I have had the opportunity of meeting a number of Engineers engaged by small Municipalities, and they say - "What can you do on £20 or £25 a month?" In many cases I do not think the fault is as much that of the Municipal Council employing these men, as of the Consulting Engineer employed to draw up the original scheme. One finds the Consultants, in order to make their scheme appear attractive, frequently grade the position of Electrical Engineer at a salary of from £250 to £300 a year. The Municipal Councils are thus placed under a misapprehension right from the start of the scheme, in being led to think that a fully qualified man can be obtained at such a salary. They invariably get one, but usually only for a sufficient period to gain Municipal experience necessary to enable them to obtain more remunerative positions in larger towns.

Regarding the proposed Electrical Development Association, I feel sure it will meet with wholehearted approval by all those associated with the Electrical Industry.

Mr. President I again congratulate you and hope that before the end of the year, the membership, and thereby the usefulness of your Association, will have increased considerably.

The President : I thank you, Mr. Perrow, for you presence here and for the suggestion you have made for a combined meeting with your Institute at our next convention in Pretoria.

Gentlemen, before we disperse, I think we should pass a vote of condolence with Mr. Sankey and hope he will soon recover to attend many more conventions. (hear! hear!).

Councillor Adcock (Port Elizabeth) : It has been a great pleasure to attend this Convention, but I think we've had a very soft time of it. Too much time has been devoted to entertainment. It is difficult for some of the delegates of the smaller municipalities to attend the conventions and remain away from their posts for so long a time. I think in future, we should leave the pleasure part out of it and get through with the business at the commencement and then, at the end of the Convention, spend some time in pleasure. That would also ensure better work. In Port Elizabeth I've had appeals made to me by the delegates to various conferences to eliminate some of the entertainments - where, you must admit, we do give a good deal of it - and I therefore make this appeal to you.

Councillor Thomson (Bloemfontein) : I do'nt want to bring in a controversy at this time, but I find I can't agree with the views of the last speaker.

Gentlemen, we appreciate your presence here, but more than that, we appreciate the great honour you have conferred on our electrical engineer in choosing him for the presidential chair.

I have been on the council for many years and have always felt that in Mr. Macaulay we have a very conscientious man and an excellent one in his electrical work. I am not surprised seeing he underwent his training with Mr. Roberts (hear! hear!). There is one thing though, about Mr. Macaulay; he always mesmerises his Committee. When he wants something, he starts telling them about K.V.A.'s or some other technical thing and the result is, he gets what he wants. I recently saw in a newspaper, the description of a man keen on reform, who said, "I want political reform, industrial reform, religious reform. I want educational reform," and someone interjected "You want chloroform!" Of course I don't want to insinuate that any of you want that. On the contrary, I've found the Convention most instructive and interesting. I knew about as much of electricity as the young man who said, when asked what the difference between electricity and lightning was replied, "You don't have to pay for lightning."

The Town Council of Bloemfontein have looked forward to your visit and will look forward to the next convention when held in Bloemfontein. I, myself, hope that wherever the next is held, the Council will decide that I am to be the one to represent them. I hope you will carry back with you pleasant recollections of your visit and that you will all reach your homes safely.

Councillor Ericsen (Kimberley) : I wish to pass a vote of thanks to the President and to the members of his staff for the excellent arrangements they made for this Convention. There is always a considerable amount of worry and work on these conferences and, on the result of this one, I congratulate you, Mr. President. I also wish to thank His Worship the Mayor and Town Council for their welcome and especially Councillors Dersley and Thomson for attending the meetings and their personel interest taken in us. What I regret is that no more councillor delegates are present and I feel that those present can do a lot to encourage others, by writing a few articles

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to the paper - "The Electrical Engineer," and telling other Councillors, who are apathetic about attending, what they can do here and how important these meetings are. I also feel that the Government is not recognising us as it should. The industrial development of this country is in the hands of the electrical engineers. I wish also, Mr. President and members, that you will bear in mind that there is such a place as Kimberley and that you will have this as the seat of your next convention after Pretoria.

Mr. L. L. Horrell (Pretoria) : Before we conclude. I would like to express a hearty vote of thanks to Councillors who have attended this Convention. As I have stated before, we are wholly dependant on our respective councils and it would be of material assistance if we were accompanied by members of these bodies. Town Councillors should be members of the Association as is the case in England.

The next Convention is to be known as the "Small Power Station Engineers' Convention" and I therefore trust that it will be an incentive to all members to attend.

I cannot agree with Mr. Adcock's suggestion of hurrying through the proceedings, as I am of opinion that as much good is done by informal discussions outside this room as by the actual papers read.

I have pleasure in moving a hearty vote of thanks to the visiting Councillor delegates. (Applause!).

Councillor Clark (Durban) : Mr. President, I think I ought to respond on behalf of the Council delegates and have great pleasure in doing so. I am sure every one will agree that we have had a very good time and that the arrangements made for the delegates have been excellent. I shall do my best to inspire my Council and to impress on them that councillor delegates, ought to be here, and hope that, at the next Convention, there will be a greater assembly of them. At the same time, one must always remember that

the town councils are there to protect the rights of the citizens and take care of the rates and there is criticism from them of what is considered to be giving "joy-rides" to councillors. I am glad to say that at present the Electrical Department has to bear the expense of this show. I know some councils look upon these as "joy-rides," but if they were to attend they would change their minds, and give greater heed to sending their representatives.

I should like to associate myself with Councillor Thomson in this. I was rather sceptical when the Electricity Committee suggested that I should be their delegate. When I told my wife, she said, "What do you know about electricity?" I said, "Nothing." I now realise what one can learn here and am greatly surprised at the amount of information collected, information which I am sure will be of use to the councillor when he gets back to his Committee. This is not the first conference of this sort that I have been asked to attend, and I am looking forward to more.

Mr. Roberts (Durban) : I would like to add something to the remarks of Mr. Perrow and the Councillor delegates, about you personally, Mr. President. I am sure that the colleagues of your convention would not like to be behind in seeing a vote of thanks passed to you. You have conducted this convention in a way that is a credit to you, and a dignity to the profession. I wish you a successful year of office. (Applause!).

The President : I thank you, Mr. Roberts, for your personal remarks and also the Councillor Delegates for their appreciation of our efforts in connection with this Convention. I looked with fear and trepidation at the approaching convetion, but it has been a pleasure instead, as I hold the success of the convention is not due to me - Our thanks are largely due to my assistants, particularly, Mr. Mellor, Mr. Skinner, Mr. Pirie, and Mr. Merry. I also wish to record votes of thanks to The Wesleyan Church, for the use of the hall, and particularly the Rev. and Mrs. Roth for their kindness and help.

Professor Rossiter, and Dr. Paraskevopoulos for permitting the delegates to visit the Observatories,

Mr. Ollemans for permission to visit the "Friend" Newspaper Printing Works,

The Oranje Bowling Club, and the Bloemfontein and Ramblers Clubs,

The Exhibitors who supported the Electrical Exhibition and the Press,

The City Engineer for entertaining us at the Waterworks.

Votes of thanks were carried with applause.

Donation for use of Wesleyan Hall.

The Convention voted the sum of £5. 5s. 0d. as a donation to the Wesleyan Church for the use of the hall.

Mr. Millar (Harrismith) : On behalf of the Association I wish to accord a hearty vote of thanks to you and the staff members, whose names have been mentioned before, not forgetting the Trams Superintendent, Mr. Merry.

The President : Thank you, Mr. Millar, and I would also thank Mr. Stephens of the Public Works Department and Mr. Perrow who is representing the Electrical Institute of Engineers for their attendance and assistance.

Mr. Stephens (Bloemfontein) : Mr. President, I thank you very much for the opportunity you have given me. These conferences are always refreshing, and I am sure we will all go away mentally and bodily refreshed.

Mr. Roberts (Durban) : One name has not been mentioned and that is the name of our Secretary. (Hear! Hear!) Mr. Poole is my assistant and perhaps someone else should have brought the matter up. I know the tremendous amount of work he has had to put into this. After bearing the heat and burden of the Convention for many years, he has again stepped into the breach and, after burning much night oil, has done things

without a hitch. It would be ungrateful of us to go away without expressing our appreciation of it. (hear! hear!).

The President : I wish to associate myself with those remarks, Mr. Roberts, and had intended mentioning Mr. Poole before you spoke. I have a big task in front of me and am relying on Mr. Poole for a great deal of assistance.

The Secretary : I can only very briefly say I thank you very much Mr. President and gentlemen, and assure you nothing pleases me better than to know I am doing service for my fellow collegues.

The proceedings of the Convention terminated after three cheers had been given for the President.

In the afternoon the delegates were taken on a motor tour of Bloemfontein, concluding with a visit to the Zoological Gardens.

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Municipal Electrical Engineers

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