PROCEEDINGS

of the

Tenth Convention

of the

Association of Municipal Electrical Engineers

(Union of South Africa and Rhodesia).

HELD AT PRETORIA

From Monday, March 23rd to Saturday, March 28th,

1931.

Price Five Shillings.

HAYNE & GIBSON, Printers, Durban.

L. L. HORRELL, PRESIDENT.
(City Electrical Engineer, Pretoria).

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ASSOCIATION OF

Municipal Electrical Engineers

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

EXECUTIVE COUNCIL, 1931.

President :

L. L. HORRELL (Pretoria).

Vice-President :

L. F. BICKELL (Port Elizabeth).

Past-Presidents :

R. MACAULAY (Bloemfontein).
JOHN ROBERTS (Durban).

Other Members :

G. H. SWINGLER (Cape Town).
F. C. D. MANN (Worcester).
A. RODWELL (Johannesburg).
T. MILLAR (Harrismith).

Hon. Secretary and Treasurer :

E. POOLE, Asst. Boro. Electrical Eng. (Durban).

Association of Municipal Electrical Engineers.

(Union of South Africa and Rhodesia)

Members, Councillor Delegates and Visitors at Pretoria (10th) Convention,. March 23rd to 28th, 1931.

Top Row—W. G. Miller (Heilbron), L. B. Sparks (Pietersburg), T. P. Ashley (Queenstown), R. D. Coulthard (Oudtshoorn), F. R. Taylor (Bulawayo), A. R. Metelerkamp (Salisbury), J. B. Robb (Hercules), Cr. F. G. Burgess (Hercules), J. W. Webb (Bloemfontein), T. M. Mocke (Dordrecht), H. M. S. Muller (Upington), Cr. H. R. R. Mance (Innesdale).

Second Row—G. G. Ewer (Pietermaritzburg), A. Q. Harvey (Middelburg, Cape), I. J. Nicholas (Umtata), G. Dekenah (Frankfort, O.F.S.), Cr. J. J. Nepgen (Umtata), R. Torr (Indwe), D. B. Marchand (Witbank), A. J. Verryn (Middelburg, Tr.), W. E. Geerling (Pretoria), W. F. Bower (Innesdale), F. C. Wegerle (Innesdale), W. Horrell (Pretoria).

Third Row—J. Hooper (Robertson), Cr. R. A. Jansen (Glencoe), P. G. Kersten (Windhoek), Cr. M. F. de Kock (Cradock), P. W. Dadswell (Cradock), Cr. A. Withinshaw (Cape Town), W. Mortimer Mail (Kokstad), H. A. Morris (Kimberley), Cr. F. J. Farrelly (Kimberley), J. Vowles (King-williamstown), J. A. West (E.S.C., Colenso), Cr. P. A. Morkel (Middelburg, Tr), G. R. E. Wright (Benoni).

Fourth Row—A. S. Chalmers (Vryheid), H. T. Turner (Glencoe), E. S. Evans (Johannesburg), Cr. R. Phillips (Salisbury), Cr. J. B. Dersley (Bloemfontein), Cr. W. C. Adcock (Port Elizabeth), Cr. C. J. Hookham (Johannesburg), H. G. Simpson (Colesberg), J. J. Wud (Swellendam), S. V. R. Lewis (Aliwal North), J. Iverach (Grahamstown), L. B. Proctor (Johannesburg), E. Gunther (Springfontein), C. R. Tee (Reitz), G. Chase Brown (Volksrust),

Bottom Row—D. W. Ritson (Stellenbosch), Cr. J. T. Halse (Krugersdorp), J. Younger (Krugersdorp), Cr. W. S. Duxbury (Pretoria), T. Millar (Harrismith),—Memb. of Council, John Roberts (Durban)—Past President, L. F. Bickell (Port Elizabeth)—Vice President, L. L. Horrell (Pretoria)—President, R. Macaulay (Bloemfontein)—Past President, G. H. Swingler (Cape Town)—Member of Council, A. T. Rodwell (Johannesburg)—Memb. of Council, E. Poole (Durban)—Hon. Sec. & Treas., Cr. A. L. Clark (Durban), W. Houreld (Randfontein), L. Ralston (Dundee).

ASSOCIATION OF

Municipal Electrical Engineers

PAST OFFICERS AND MEMBERS OF COUNCIL.

	Past Presidents.		Hon. Sec. & Trea.
1915-17	J. H. DOBSON	J. H. Burg.	F. T. Stokes : E. T. Price.
1917-19	J. ROBERTS	Durban.	E. Poole.
1919-20	B. SANKEY	Port Elizabeth.	E. Poole.
1920-22	T. C. W. DOD	Pretoria.	L. L. Horrell.
1922-24	G. H. SWINGLER	Cape Town.	H. A. Eastman
1924-26	J. ROBERTS	Durban.	E. Poole.
1926-27	B. SANKEY	J. H. Burg.	R. G. Tresise.
1927-29	J. M. LAMBE	East London.	P. Adkins.
1929-31	R. MACAULAY	Bloemfontein.	E. Poole.

Past Ordinary Members of Council :

1915-17 J. Roberts: W. Bellad Ellis : B. Sanky.
1917-19 W. Bellad Ellis: G. Stewart: T. C. W. Dod: T. Jagger.
1919-20 W. Bellad Ellis: G. Stewart : E. T. Price: A. S. Munro
1920-22 L. F. Bickell: T. Millar: L. B. Proctor: E. Poole.
1922-24 L. F. Bickell: T. Millar: R. W. Fletcher: J. Roberts.
1924-26 T. Jagger: A. S. Munro: T. Millar: L. F. Bickell.
1926-27 L. F. Bickell: T. C. W. Dod: T. Millar: E. Poole.
1927-29 L. F. Bickell: R. A. Young: T. Millar: E. Poole.
1929-30 L. F. Bickell: T. Millar: F. C. D. Mann: G. H. Swingler: A. Rodwell.

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. The Council shall have power to elect as an Associate Member any person in the employ of the Victoria Falls Power Co. or the Electricity Supply Commission who may be engaged in the public supply of electricity to Municipal bodies.

6. CONTRIBUTIONS. — The membership subscription for Chief Engineers and their Chief Assistants shall be based on the Units sold by the undertaking as shown in the following scale :—

Up to 5 million Units	£2	2	0
Over 5 million & up to 10 million Units	3	3	0
„ 10 „ „ „ „ 20 „	4	4	0
„ 20 „	5	5	0

For other members and associate members £1 1s. 0d. 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 Councol 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 Honorary Treasurer shall be responsible for the funds of the Association, and shall present a Balance Sheet at the Annual Congress.

TENTH CONVENTION

PRETORIA.

PROGRAMME OF PROCEEDINGS.

Monday, 23rd March, 1931.

9.0 a.m.—Meeting of Council, Polley's Hotel.

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

10.30 a.m.—Opening of Convention in St. Andrews Hall, Schoeman Street, by His Worship the Mayor of Pretoria (Councillor Frank Dey).

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

Agenda.

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

   The following are the retiring officers and Council; the Council being eligible for re-election by nomination and ballot to hold office until the next Convention :—
   President : R. Macaulay, Bloemfontein.
   Vice-President :L. L. Horrell, Pretoria.
   Past Presidents : John Roberts, Durban, G. H. Swingler, Capetown, (vice late B. Sankey.)
   Members :L. F. Bickell, Port Elizabeth; F. C. D. Mann, Worcester; T. Millar, Harrismith; A. T. Rodwell, Johannesburg; (vice-G. H. Swingler).
5. Place of meeting of next Convention.
6. Presidential Address.
7. Discussions arising.

1.45 p.m.—Visit to Mint proceeding to the Zoological Gardens for tea.

2.0 p.m.—Combined meeting of Council and Master Builders' Federation, Polley's Hotel.

8.0 p.m.—Official opening of Electrical Exhibition by his Worship the Mayor of Pretoria, Councillor Frank Dey.

Tuesday, 24th March, 1931.

8.30—9.30 a.m.—Meeting of Council, Polley's Hotel.

9.30 a.m.—Official Photograph. To be taken at the side of Old Government Buildings, Parliament Street.

10.0 a.m.—Paper by Mr. J. Vowles (King Williamstown), on **"Development of a Domestic Load in a small inland Town."**

11.0 a.m.—Paper by Mr. L. Ralston (Dundee), on **"The advantages of Electrical Bulk Supplies compared with Municipal."**

2.0 p.m.—Picnic at Hartebeestpoort Dam.

7.30 p.m.—Civic Dinner at the Kiosk, Fountains Valley.
Delegates will be conveyed to the Kiosk by a special bus leaving headquarters Hotel at 7.15 p.m.

10.30 p.m.—Visit to Premier Diamond Mine to view the midnight blast.

Wednesday, 25th March, 1931.

9.0 a.m.—Meeting of Council, Polley's Hotel.

10.0 a.m.—Replies by Messrs Vowles and Ralston to discussion.

11.0 a.m.—Report on the organisation of the Electrical Development Association of Southern Africa by the Chairman, Commander J. Burnard Bullock.
Address by Mr. A. M. Jacobs (Commissioner, Electricity Supply Commission) on the movement.

2.0 p.m.—Visit Power Station and Substations.
Tea at Power Station.

Thursday, 26th March, 1931.

9.0 a.m.—Meeting of Council, Polley's Hotel.

9.30 a.m.—Paper by Mr. Nils B. Eckbo (Government Timber Investigation Officer, Pretoria), on **"Preservation of Poles for Electric Supply and Telephone Lines."**

11.30 a.m.—Proceed to Johannesburg by Motor Cars.

1.0 p.m.—Guests of the South African Lamp Association to Luncheon.

2.30 p.m.—Lecture and Demonstration by Mr. E. S. Evans of the S.A. Lamp Service Bureau.

4.0 p.m.—Visit to Johannesburg Power Station.

6.45 p.m.—Guests of the President and Members of the S.A. Institute of Electrical Engineers to Dinner.

8.0 p.m.—Attend Monthly General Meeting of S.A. Institute of Electrical Engineers.
Paper for the Evening. **"Road Passenger Transport Systems with Special Reference to Electric Trolley Omnibuses & Overhead Equipment,"** by Mr. A. Rodwell (Johannesburg).

Friday, 27th March, 1931.

9.0 a.m.—Meeting of Council, Polley's Hotel.
10.0 a.m.—Discussion on Elect. Development Association (Contd.) and on House Service Wires.
11.0 a.m.—Discussion of Council's Report with reference to the Licensing of Electricians and the Registration of Electrical Contractors.
11.30 a.m.—Paper by Mr. D. J. Hugo (Pretoria), on **"Alternating Current Distribution in Residential Areas."**
12.0 a.m.—Paper by Mr. A. R. Metelerkamp (Salisbury), on **"Difficulties of Developing a Municipal Electrical Scheme with Gas Engines as Prime Movers."**
2.0 p.m.—Visit to Railway Workshops, proceeding to Fountains Valley for Tea.
4.30 p.m.—Motor Trip round Klapper Kop, Waterkloof and Union Buildings.
7.50 p.m.—Guests of the Town Council of Pretoria to a performance at the New Plaza Kinema.

Saturday, 28th March, 1931.

10.0 a.m.—Discussion of Papers
General Business.

HONORARY MEMBERSHIPS.

The President and members of the Pretoria Club and of the British League Club extend to the Delegates attending the Conference all privileges of membership during their stay in Pretoria.

ASSOCIATION OF

Municipal Electrical Engineers

MEMBERS & DELEGATES ATTENDING THE CONVENTION

Aliwal North	S. V. R. Lewis.
Bloemfontein	R. Macaulay: Clr. Dersley.
Benoni	G. R. E. Wright: Clr. Kermack.
Bulawayo	F. R. Taylor.
Cape Town	G. H. Swingler : Clr. Withinshaw.
Colesburg	H. G. Simpson.
Cradock	P. Dadswell: Clr. Dekock.
Colenso	J. A. West.
Durban	J. Roberts: E. Poole: Clr. Clark.
Dordrecht	T. M. Mocke.
Dundee	L. Ralston.
Frankfort	G. Dekenah: Clr. Hawkins.
Grahamstown	J. Iverach.
Glencoe	Clr. Jansen: H. Turner: Elec. Engineer.
Hercules.	Clr. Burgess: J. B. Robb.
Heilbron.	W. G. Miller, Elect. Engineer.
Heidleburg	L. Wildner, Elect. Engr.
Harrismith	T. Millar.
Indwe	R. Torr.
Innesdale	W. E. Bower: Clr. Mance: F. C. Wegerle (Town Clerk)
J. H. Burg	A. Rodwell: Clr. Hookham.
Kimberley	H. A. Morris: Clr. Farrelly.
Krugersdorp	J. Younger: Clr. Halse : J. W. Davis (Town Clerk)
K. W. Town	J. Vowles.
Kokstad	W. Mail.
Middleburg C.	A. Q. Harvey.
Middleburg T.	A. J. Verryn: Clr. Morke.
Oudtshoorn	R. D. Coulthard.
Pretoria	L. L. Horrell. Clr. Dey (Mayor) Clr. Duxbury.
Port Elizabeth	L. F. Bickell: Clr. Adcock.
P. M. Burg.	G. G. Ewer.
Pietersburg	L. B. Sparks.
Queenstown	T. P. Ashley.
Randfontein	W. Houreld: Clr. Hopkinson
Reitz	C. R. Tee.
Robertson	J. Hooper.
Springfontein	E. Gunther.
Salisbury	A. R. Metelerkamp: Clr. Phillips.
Stellenbosch	D. W. Ritson.
Swellendam	J. J. Wud.
Umtata	I. J. Nicholas: Clr. Nepgen.
Upington	H. M. S. Muller.
Vryheid	A. S. Chalmers.
Volksrust	G. C. Brown.
Windhoek	P. G. Kersten.

ASSOCIATE MEMBERS.

T. C. W. Dod : B. Marchand : L. B. Proctor: T. Sutcliffe.

VISITORS.

Miss Bisset (Women's Elec. Assoc., England): J. B. Bullock (E.D.A.) P. Cowie: C. M. Cox: J. Clinton: H. L. Dawe, (S.A. Cables Assn.): C. Deithelm: W. de Vries: J. L. de Vries: E. S. Evans (S.A.E.L.A.): N. B. Eckbo (Timber Investigations Officer): O. Feldham: P. Fraser: S. Garnett: W. E. Gerling: D. J. Hugo: W. Horrell: A. M. Jacobs (Elect. Supply Com.): A. Keller: H. B. Lane: J. S. Mc Murray: F. Mc Kowen: T. H. MacKenzie: E. V. Perrow: H. Reynolds: Major Rendall (V.F.P.): H. L. Shermer: E. R. Smith:(S.A. Cable Assc.): G. P. Sole: F. Stephens: H. A. Tinson: J. W. Webb.

PROCEEDINGS

OF THE

TENTH CONVENTION

MONDAY 23rd MARCH, 1931.

INTRODUCTORY.

The Tenth Convention of the Association of Municipal Electrical Engineers (Union of South Africa and Rhodesia) was opened in the St. Andrew's Presbyterian Church Hall, Pretoria at 10.30 a.m. on Monday March, 23rd, 1931.

Mr. R. Macaulay, City Electrical Engineer, Bloemfontein and Retiring President of the Association was in the chair and introduced his Worship the Mayor of Pretoria (Mr. F. Dey) who had kindly consented to open the Convention, which was attended by 46 Members, 20 Councillor Delegates and 13 Visitors.

CIVIC WELCOME.

His Worship the Mayor of Pretoria **(Councillor F. Dey).** In opening the Convention, on behalf of Pretoria, I would first of all bid you sincere welcome to our City. The Pretoria City Council members are aware of the value of a congress such as this, and do not propose offering a mere lip service. You are heartily welcomed to this city, not only by the Council, but by the Pretoria Community. I will not say anything at the moment about Pretoria's achievements in electrification except that in 1904 we had 900 consumers and in 1930, 8,985. The units consumed in 1904 were 162,000 and to-day the annual consumption is approximately 40,000,000 units. You will do doubt see many of the beauty spots of the wonderful city during your stay and, I hope, be able to carry away pleasant memories.

Touching upon the responsibilities of engineers in general at this time in the history of South Africa, and of Pretoria in particular, I may say that Dr. V. D. Bijl, who is in charge of the Electricity Supply Commission, has made a wonderful success of a great undertaking.

The Electricity Commission is doing much to help the various Electrical Undertakings of the Union and is also doing great work in acquainting South Africa with all the most up-to-date methods in the science of Electrical Engineering. It is reasonable to say that Pretorians are looking forward to the day when great Generators will be manufactured on the Pretoria Industrial Sites and when the importation of machinery of this nature will be a thing of the past. There is nothing impossible in the thought, and it is up to you in your capacity as engineers, to guide public opinion in this direction.

Our boys and girls must be provided with opportunities in their proper spheres. Your help, energy and brain power are the real assets in this direction and coupled with optimism you will make for the future wellbeing of South Africa. We know that you electrical engineers here to-day are the pioneers of perhaps the greatest future power producing country in the world and that you will grow under your responsibilities steadily and surely. I wish you the heartist success in your deliberations and may all your contributions reflect the greatest credit on your profession as pioneers of energy and forcefulness in the meeting of the many requirements of South Africa."

The Chairman **Mr. Macaulay** (Bloemfontein): On behalf of the Association, I desire to thank you for the very hearty welcome you have accorded our Association. Judging from the programme put before us we are sure of an enjoyable time, and we take it as a very great compliment that you would not have done so much for us if you had not appreciated us.

Cr. A. L. Clark (Durban) : Mr. President, on behalf of the visiting Town Councillors, I would like to associate myself with you in extending to His Worship the Mayor our thanks for the welcome he has accorded us at this Convention this morning. I notice, Mr. President, that the Mayor is a "brither Scot" I notice that by his tongue, Sir, and I feel that the Town Council and the town of Pretoria is to be congratulated in having a man like Mr. F. Dey for the head of this very fine city of Pretoria. The Mayor has asked us to go away as his missioners to boom Pretoria and its amenities and all the things that make for good, so far as Pretoria in concerned. We are all missioners for our own towns, and I think we should never forget the amenities and beauties of our towns. I notice that a very fine little bulletin has been issued to us and I congratulate Pretoria and Mr. Horrell. We are all for publicity and especially as regards the question of domestic electricity and I am glad to see a lady visitor here who is out on a world's tour on this question. When she comes to Durban we shall give her a very happy welcome and show her what we have been doing as regards electricity in that town. I have again to thank you on behalf of the Councillor delegates for the hearty and cordial welcome you have given us this morning.

ANNUAL GENERAL MEETING.

Confirmation of Minutes.

The Minutes of the previous Annual General Meeting, which had been circulated, were taken as read and **Agreed to**, on the proposal of Mr. L. L. Horrell, (Pretoria), seconded by Mr. A. T. Rodwell (Johannesburg).

Apologies.

Apologies for non-attendance were received from Dr. van der Bijl, wishing the Convention suc-

cess; Mr. Jacobs, regretting not being present at opening (but will be present later); Messrs. Castle (Capetown), J. T. Smith (Durban), W. M. Wade (Inspector of Machinery), F. C. D. Mann (Worcester), P. H. Newcombe (Alice), Electrical Enginner (Mossel Bay) J. G. Davison (Beaufort West), T. Jagger (Ladysmith), C. H. Baskerville (Salisbury) and W. D. Ross (Potchefstroom).

REPORT AND BALANCE SHEET OF THE HONORARY SECRETARY AND TREASURER.

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

Mr. President and Gentlemen,

I have much pleasure in submitting the tenth report and Balance Sheet of this Association, the Membership of which stood at 65 as at the last report and now comprises the following :—

Honorary Member	1
Members	56
Association Members	11
TOTAL	68

It is with very much regret that we have to deplore the death of Mr. B. Sankey one of our Foundation Members, Past President and a Member of the Council since the inception in 1915, and his experience in connection with the affairs of the Home Incorporated Municipal Electrical Engineer's Association, with whom we are affiliated, proved him to be one of our most useful Members.

The vacancy thus caused through the loss of our Past President was filled by the Council transferring Mr. Swingler from ordinary Member of Council, his place in turn being filled by the appointment of Mr. A. T. Rodwell of Johannesburg.

We have unfortunately lost other Members through the death of Mr. Fletcher of Krugersdorp and the resignation, through their retirement on reaching the pensionable age, of Messrs Stoker, Sutcliffe and Blatchford and also by the vacating of their appointments of Messrs Clinton and Royle, while one other Member elected at the last Convention did not complete his obligations, and he has not been included in the present list of Members. I much regret also that Mr. Mordy Lambe has seen fit to withdraw his name from our list of Members.

While it is to be regretted that our losses total nine it is pleasing to note that twelve new Members have since been elected giving us a net gain of three. It is to be hoped that additional Members will be found by the inclusion of the Electrical Engineers of those towns not now represented, and at this Convention amendments to our Rules and Constitution may be brought about to increase our Membership.

The Balance Sheet shows the financial position of the Association to be in a very satisfactory position with an accumulated fund to our credit of £234 11s. 2d. or an advance of £74 14s. 0d. since the last report. It is particularly pleasing to record that the point I stressed in my last report, in regard to the lack of sales of our Proceedings, has borne such good fruit, as by the ready response through our Members our sales have during the period under review reached a record and with the inclusion of advertisements in the Proceedings (which in the previous issue were omitted) our funds have been placed in a much more highly satisfactory position, and for the first time in our history sales and advertisements alone have more than paid for the printing of our Proceedings.

I am also pleased to state there are no outstanding subscriptions.

During the period under review the sub-committee dealing with the question of Licensing of

Electricians have been engaged on drafting regulations in regard thereto, which will come up for consideration at the Convention.

A questionaire which has been circulated amongst the various Electrical Engineers of the Country dealing with the question of working on live mains, which emanated from the South African Association of Municipal Employees was considered by your Council who agreed that the matter was one for concerted action and it was decided that the matter be dealt with at the forthcoming Convention.

This report brings my period of office to a close and I take this opportunity of thanking the President and Members of Council for their kind assistance rendered to me in connection with the affairs of the Association.

I am, Mr. President and Gentlemen,
Yours faithfully,
E. POOLE,
Honorary Secretary and Treasurer.

DURBAN,
March 4th, 1931.

REVENUE AND EXPENDITURE ACCOUNT FOR THE PERIOD 10th OCTOBER, 1929, TO MARCH 4th 1931.

Expenditure

	£	s.	d.
To Printing of Proceedings	81	6	10
„ Expenses at Bloemfontein	32	0	6
„ Stationery	12	15	6
„ Statistical Tables	10	0	0
„ Honorariums	7	7	6
„ Wreaths	3	4	0
„ Bank charges	1	17	3
„ Secretarial expenses :—			
Stamps	11	7	0
Telegrams	3	10	4
Sundry	1	4	10
Rail and boat charges		10	0
I.M.E.A.	4	10	1
	£169	13	10
Balance being excess of Revenue over expenditure	74	14	0
	£244	7	10

Revenue.

	£	s.	d.
By Subscriptions to 23/3/1931 after writing off £8 8s. 0d. outstanding Subscriptions at 10/10/29 which proved uncollectable	128	2	0
„ Sale of Proceedings	70	13	7
„ Statistical Tables	20	5	0
„ Advertisements	17	4	0
„ I.M.E.A. Reports	8	3	3
	£244	7	10

BALANCE SHEET AS AT MARCH 4th, 1931.

Liabilities.	£	s.	d.	Assets.	£	s.	d.
Accumulated Fund at 10th October, 1929	159	17	2	Standard Bank	234	11	2
Excess Revenue (Current period)	74	14	0				
	£234	11	2		£234	11	2

I have examined the books of the Association 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 shewn by the books and Audited statement.

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

9th March 1931.

Mr. J. Roberts (Durban) : It would be fitting for the meeting to record its grief at the loss of the two deceased members, particularly two such honoured members as Mr. Sankey and Mr. Fletcher.

(The Convention rose in silence).

(Mr. Roberts, continuing). I do not know that there is any member among us more deeply beloved than was Mr. Sankey, and I do not know that everyone is aware that by stepping into the breach on one occasion he saved the Association from dying altogether."

Adoption of Report and Balance Sheet.

Mr. J. Roberts (Durban) : I have much pleasure in moving the adoption of the report. **Mr. Horrell** (Pretoria) : I beg to second. **Agreed to.**

Honorary Auditor.

The Chairman : Our thanks are due to Mr. Graham Cook of Durban for auditing our accounts, and I think a vote of thanks should be accorded to him.

Gratuities.

Mr. Horrell (Pretoria) : I have much pleasure in proposing a vote of thanks and honorarium of Two guineas to Mr. Graham Cook. **Mr Vowles** (K.W. Town) : I beg to second. **Agreed to.**

The Chairman : There is the matter of a gratuity to the typist in Durban who has done a deal of work for the Association. I propose an amount of Five guineas be paid. **Mr. Coulthard** (Oudtshoorn) : I have much pleasure in seconding that. **Agreed to.**

Election of President.

The Chairman : The next item is the election of a President for the ensuing term. I call for nominations for my successor."

Mr. L. F. Bickell (Port Elizabeth) : I beg to propose that Mr. L. L. Horrell be President. Mr. **Coulthard** (Oudtshoorn) : I beg to second. There being no further nominations Mr. Horrell was declared elected.

The Chairman in welcoming Mr. Horrell as President, declared that the Association would be in good hands and Mr. Horrell, in thanking Mr. Macaulay, expressed his thanks for the honour accorded to him and took the Chair which Mr. Macaulay vacated and called upon him to read his Valedictory Address.

RETIRING PRESIDENT'S ADDRESS.

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

In reviewing the period between last Convention and this one, during which I have had the honour of being your President my thoughts naturally turn to those who were but are no longer with us, and it is with great regret that I have to mention the death of two of our most highly respected and esteemed members. Messrs. B. Sankey, of Johannesburg, and R. W. Fletcher, of Krugersdorp. Our Association is much the poorer by the removal of two members of whom we cannot speak too highly—they were indeed all that Engineers should be.

Naturally, averse to being in the limelight, I found it an extremely difficult proposition to formulate a Presidential Address, but to-day I find it much more difficult to give a retiring address. In the former case, I was at least full of good intentions - to-day, I am afraid it would have to be a case of apologising for things undone, but I have fully appreciated the honour of having been your President for the last sixteen months, and the loyalty and co-operation of every member during that period.

I need not enlarge on the general condition of our Association as it will be seen from the Honorary Secretary and Treasurer's report that as regards membership and finance it is in good standing.

As regards the Electrical industry, generally, it can hardly be said that any great or revolutionary development has taken place during the period under review, but it has been a period of great and steady expansion of large schemes already started or about to start at that time, and also in older undertakings in the utilisation of electric energy, both on the industrial and domestic sides. The cost of production is being reduced by the installation of larger units both on the steam raising and using sides to cope with ever increasing loads rather than by any departure from methods familiar to all Engineers, with perhaps the exception of the "Mercury" boiler and "Mercury" Vapour Turbine. It says a lot for the manufacturers that units of the capacity that are being installed in some parts of the world today, are feasible propositions. Imagine a unit of 120,000 K.W. capacity (sufficient to meet the maximum demand of all the towns in the Union of South Africa) suddenly refusing to function, quite a probable contingency, the disorganisation resulting no matter how the station in which it is installed is interconnected to other stations, must be tremendous, so that reliability and freedom from frequent or even occasional breakdowns must be the outstanding feature of these electrical giants. Higher and higher efficiencies are continually being attained, but are not always reflected in a corresponding reduction in the price of the unit at the consumers' terminals, so that one is apt to think that sometimes the cost of extremely high efficiency is out of proportion to the benefits which do actually arise therefrom. What appeals to me more than the results obtained by large stations, are the results obtained in quite a number of small stations in our own country where, in spite of a small output (in many cases less than the house service requirements of a large station) plant which cannot be called "modern"

and high fuel costs, they can still supply current at a reasonable rate. This can only be obtained by sheer hard work and the most rigid economy on the part of those in charge of the undertakings concerned. Much as I respect large undertakings and those in charge of them, I have a greater respect for the man who can make a success of a small undertaking.

Gentlemen, in this my retiring address or "Swan Song" I may be incoherent and I may have wandered, but they are the ruminations of an Engineer who has spent the best part of his life, and given of his best, in Municipal Service, of one who has had high ideals but, who, unfortunately, never managed to attain them. Whilst on the matter of municipal service, I would like, in this my last opportunity of expressing my sentiments before retiring, to express my appreciation of the Municipalities I have served. Municipalities, like Limited Liability Companies, are generally thought of as something with neither a body to kick nor a soul to dam, but after thirty years service with them I can honestly refute the accusation, as I have always found them to be on the whole a just and sympathetic body of men. I have had all the hard work, all the pleasure, all the heartbreaks, all the sport, made as many mistakes and have been excused as many times as any human being can expect, all in municipal service.

Now that I am retiring, it is my duty to instruct those who follow me in the matter of conducting the affairs of our Association, and I have only one suggestion to make.

At the East London Convention, the Councillor delegate who accompanied me had a grievance, and that was, that we took these Conventions too seriously and that there ought to be more humour in them (he was Scotch, so we must be bad in that respect). Being Scotch myself, it was excusable that this could not be carried out in Bloemfontein, but I think we are entitled to it in Pretoria where the President is not Scotch.

During the period of my Presidency, 21st anniversary of the founding of the South African Institute of Electrical Engineers took place, and on your behalf, a congratulatory message was sent them. I was also honoured with an invitation to the Banquet but owing to circumstances, could not attend. Our Association was, however, ably represented there by the Vice-President Mr. Horrell, who kindly acted as deputy on that occasion.

Other matters which have arisen have mostly been of such a nature that they could be left over for discussion at this Convention.

In conclusion, I would like to have placed on record, the services of our Hon. Secretary & Treasurer, Mr. Poole of Durban, who has been the one to really look after the affairs of our Association during the last two years. No matter how much work is asked of him, he has seen to it, and seen to it in his usually thorough manner. Apart from the thanks of this Association for his services, I desire to thank him personally for the wonderful help and assistance he has been to me as President.

To our new President I wish all success, and to our Association continued success.

ELECTION OF VICE-PRESIDENT.

Mr. Vowles (K.W. Town): I beg to propose that Mr. L. F. Bickell (Port Elizabeth) be Vice-President, Mr. Ashley (Queenstown): I have pleasure in seconding. **Agreed to.**

ELECTION OF FOUR COUNCIL MEMBERS.

Messrs. F. C. D. Mann, (Worcester); G. H. Swingler, (Cape town); T. Millar (Harrismith); and A. T. Rodwell (J.H. Burg.) were nominated by Messrs. Hooper, Marchand, Macaulay and Bickell respectively. There being no further nominations, Messrs. Mann, Swingler, Millar and Rodwell were declared duly elected.

ELECTION OF HONORARY SECRETARY AND TREASURER.

Mr. Swingler (Cape Town) : I beg to propose Mr. Poole for this post; Mr. Rodwell (J.H. Burg) : I have much pleasure in seconding. There being no other nomination Mr. Poole was declared duly elected.

DELEGATES FOR (a) WORLD'S POWER CONFERENCE, and (b) BRITISH ENGINEERING STANDARD ASSOCIATION. (S.A. Branch).

Mr. Swingler (Cape Town) : I have much pleasure in proposing the President for (a). Mr. Macaulay (Bloemfontein) : I beg to second. Mr. Roberts (Durban) : I beg to propose Mr. Rodwell (J.H. Burg) for (b). Mr. Ralston (Dundee) : I have pleasure in seconding. **Agreed to.**

Membership Transfer.

The President : I have to announce that the Council had decided on transferring Mr. J. Younger from the class of Associate Member to that of Member.

VENUE OF NEXT CONVENTION.

Cr. Adcock (Port Elizabeth) : I have very much pleasure, on behalf of the Mayor and Town Council of Port Elizabeth, to extend to you a very hearty welcome to hold your next convention in Port Elizabeth. When I put the matter before the Council they were very enthusiastic about it and you may be sure of a very hearty welcome. I do not know when you will hold your next Convention, but at Easter our Bowling club will be 50 years old when celebrations will be held, but of course, I leave the date to you. We shall do all we can for you.

The President : On behalf of the Association I thank you very much, Mr. Adcock, for your invitation to hold our next Convention in Port Elizabeth. The Council has discussed the probable date and suggest September, 1932, as twelve months from now is considered too early. We shall of course notify you in due course.

Mr. Houreld, (Randfontein) : I beg to propose that the next Convention be held at Port Elizabeth. Mr. Mail (Kokstad) : I beg to second. **Agreed to.**

PRESIDENTIAL ADDRESS.

By L. L. HORRELL, Municpal Electrical Engineer, Pretoria.

I must express a keen appreciation of the honour in being elected President at this, our tenth Convention. I am conscious that distinguished engineers have preceded me in this office, and can but hope that the high place our Association has already taken in the country will be maintained, and even enhanced during the ensuing twelve months. I am emboldened in this hope by the spirit of enthusiasm and friendly co-operation which pervades our membership.

It is encouraging to see the finances of the Association are so satisfactory, and, as mentioned by the Retiring President, our thanks are due to Mr. Poole for the excellent work he has done on behalf of the Association. You will remember that last year members were asked that on their return from the Conference they should immediately get in touch with their Councils to purchase copies of the Proceedings, and this presumably was done with excellent results. It is hoped the same procedure will be adopted this year. The time has arrived when the Association may have to provide funds for meeting the expenses of mem-

bers of the Council to attend special meetings, for occasional matters of vital importance have to be dealt with without delay. The only method at present available is to correspond either by letter, telegraph or telephone, which when the matter is urgent, is cumbersome and unsatisfactory. Such a case of importance arose recently, when the amendment to the Factory Act was before the House, and had it not been for the good services of Mr. Swingler, the alteration to the Bill would have gone through without any opposition.

The value of these Conventions has been so thoroughly proved that I hope it will be decided that they shall be held annually. This will ensure contact between members, so essential if we are usefully to share our experiences. We represent a community of interests and the results gained from any one municipal undertaking is of value to all. With a view to making the Association still more representative of the electrical undertakings in the country, it has been thought opportune to propose an alteration to our Constitution so as to include Councillor-Delegates as members. This proposal, together with other suggested amendments to the Rules and Constitution will be considered by your Council, and most probably will be brought before this Conference.

Though a young country, we have the advantages of enthusiasm and ambition, and, as electrical engineers it has been our ideal, steadily to raise the standard of our profession and to bring it into line with that already obtaining in older countries. Already, our municipal services offer an important, if not necessary, training for University graduates who have decided to enter the profession. We are very anxious to keep in close touch with the academic life, and to this end I suggest that it would be eminently useful for each of the larger Municipal Electrical Departments who are in close touch with a University, to offer a 2 - years Apprenticeship every year to young graduates. By the institution of such post-graduate courses, I feel sure our Municipal work would become still more an integral part of the life of the country.

The valuable paper by Mr. Roberts at our last Convention on the "Domestic uses of Electricity" has born fruit in the development that has since taken place. Both Johannesburg and Cape Town have had notable increases to their load. Pretoria, like Durban, has the advantage of having no rival in gas to contend with, and the advantages of electrical cooking are being increasingly appreciated. Over 1,000 cookers are now on the mains, but much more, of course, remains to be done. In this connection, we may remember how Councillor Weir at our East London Convention in 1927 emphasised the value of advertising, and that it was the duty of every electrical department to educate the public in regard to the uses of electricity. In this respect, our thanks are due to Dr. van der Bijl for the illuminating address he gave at the last Conference with regard to the Electrical Development Association, and we are also most grateful to Messrs. Bernard Bullock and Evans for the tour they made all over the Union on behalf of that Association. We are, I feel sure, pleased to see that that subject has been placed upon the Agenda, and it is hoped that the Conference will approve of the scheme that will be definitely launched this year. The advice of Mr. Weir has also borne fruit in the Electrical Exhibitions that have been held in Johannesburg, and now this week in Pretoria.

I have received a communication from the President of the South African Institute of Electrical Engineers on the subject of Lightning Investigation. A Sub-Committee has been formed by the Institute to collect and to disseminate information, and the President asks for the co-operation of our Association. I am sure that our members will do all in their power to assist the deliberations of the Sub-Committee.

I have had the honour to have been on the Local Committee of the World-Power Conference, and this has emphasised to me the value of regarding our work in an international spirit. The great development of the Grid system in England, whereby Power-Stations are inter-connected, is

a hint that we too must have an eye to the future. The advantage of linking large undertakings, and so avoid the installation of large stand-by plant cannot be over estimated.

We shall be considering a proposed draft Bill for the "Licensing of Electrical Wiremen and the Registration of Electrical Contractors," and we have invited a deputation from the Masters Builders' Association to attend a Round Table Conference on this matter.

In connection with the papers that are read at our Conferences, I suggest that some encouragement might be offered in the shape of a Premium, of say £10, for the best paper delivered.

In conclusion, let me say how pleased we are to see so many Councillor delegates and visitors present, and on behalf of the Association, I extend to them a hearty welcome. They will, I am sure, forgive us if the members take up the major portion of the time devoted to discussion, but we trust nevertheless, that there may be some occasions when they will assist us in our deliberations.

In addition to the invitations forwarded to our members and their Councils, invitations were sent to the Town Clerk of every town with an established Electricity Undertaking, but whose Engineer is not a member of the Association, for their Electrical Engineer and a Councillor Delegate to attend.

I am glad to say that a very ready response was received and I have great pleasure in welcoming also the representatives of these Electricity Undertakings and sincerely trust that next time we shall have the pleasure of their company as members of the Association.

Mr. Rodwell (Johannesburg).

In congratulating the President on his excellent address, dealing as it does with a number of very important subjects to Municipal Engineers, I desire to comment on a few of the very interesting points raised.

The President has referred to the very real necessity for the Council to meet more frequently than has been the case in the past. This has been recently exemplified by the proposal to amend the Factories Act which it was felt would be detrimental to the progress of Municipal Electricity Supply Undertakings. I, together with the Chairman of the Tramway and Lighting Committee, joined the deputation to interview the Minister at Cape Town, and it is hoped the proposed amendment with which most of you are no doubt familiar will not be incorporated in the Union of South Africa laws.

In these important matters, it is essential that the members of this Association should act for the respective Councils as quickly as possible, and it is regretted that many large undertakings were not represented on the deputation.

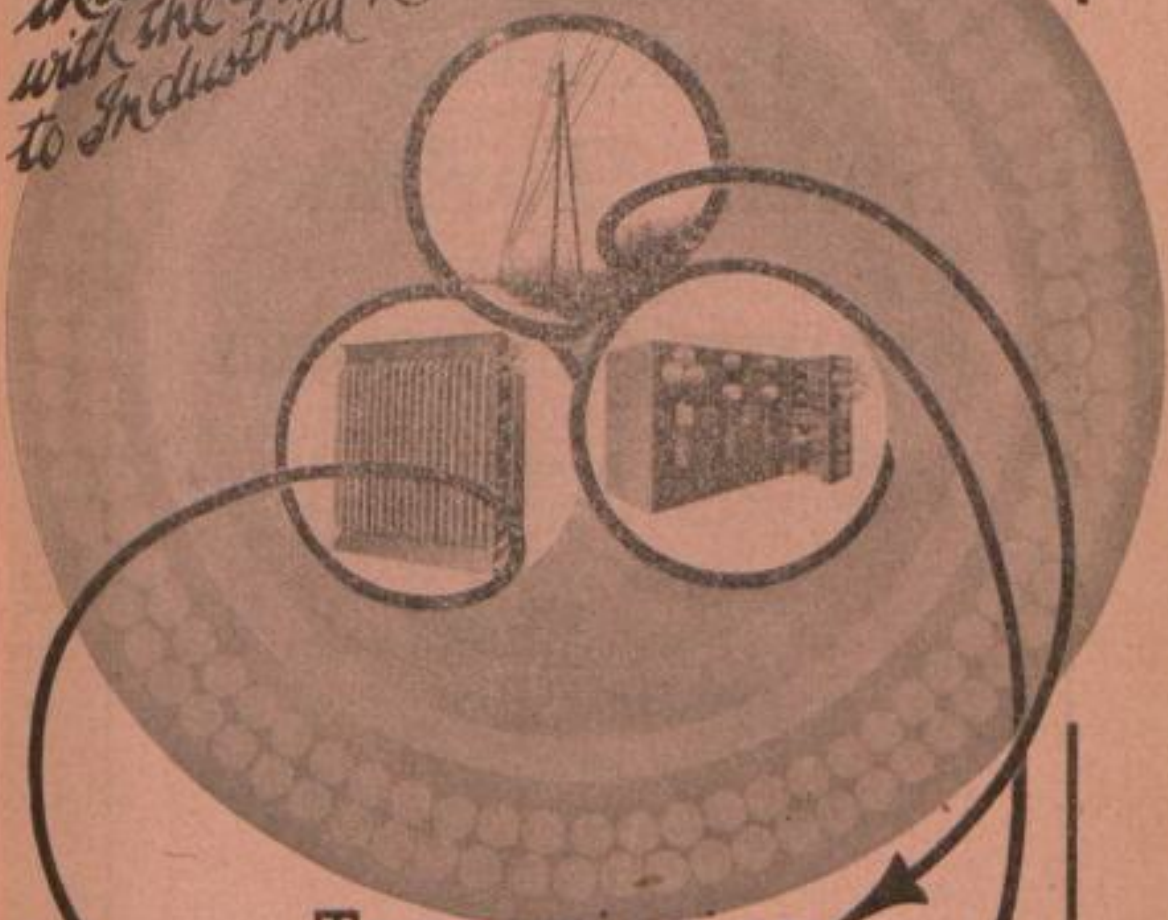
The President referred to the possibility of two years apprenticeships. It is doubtful if this suggestion is possible. Apprenticeships are controlled by the Apprenticeship Act under the Minister of Labour, and the conditions of apprenticeship are laid down.

I am in agreement with the President on this question if it is feasible under the Act. It is unfortunately true that the young technically trained Engineer has not the opportunities to obtain practical experience which obtain in older and more highly industralised countries.

It is pointed out that benefits would accrue by reason of one electrical undertaking becoming interlinked with other electrical undertakings. Whilst this is an undoubted fact from a purely engineering point of view, there are, unfortunately, many factors to be taken into account. In any case, so far as I can judge, there is no other undertaking with which this City of Pretoria can interconnect and, therefore, other factors and problems do not present themselves in this instance.

I congratulate the President on his valuable and interesting Presidential address.

Our immediate interest and concern with the application of Electricity to Industrial needs is 3 phase



Transmission

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Mr. Swingler (Cape Town) : In thanking the the President for his address, I would take this opportunity to refer to the amendment of the Factory Act. The proposal to transfer power stations to the Department of the Labour would mean that electricity undertakings would come under the Chief Inspector of Factories and the Inspector of Machinery and Regulations generally in turn under local Inspectors of Factories. This transfer from the control of the Mines Department is, in my opinion, detrimental to the interests of the Industry and is likely to bring electricity supply undertakings into conflict with labour and other troubles extraneous with that of electricity supply.

One of the reasons given by the Railways for the necessity of the Electricity Supply Commission was that electricity undertakings should be kept as far apart as possible from labour troubles. If the proposal becomes law our respective undertakings would be considered from the factory point of view and not that of an essential service industry.

It is proposed that undertakings not used exclusively for mining purposes are to be under the same body, therefore, the V.F.P. and the Electricity Supply Commission will find themselves in the same position as Municipal Undertakings, and in this matter I am in complete accord for I don't see why the Government should discriminate between the V.F.P., E.S.C. or Municipal Undertakings. The Minister may send the Bill to Select Committee or he may accept an amendment to exclude us, which I understand Sir Robert Kotze has ready to propose, but in any case I would suggest that all members present will lose no time in getting in touch with their respective Councils and present to them the bigger issue; it is not just the inspection of Boilers that matter. This work has been carried out for the last 30 years by the Mines and Works Department and has proved quite satisfactory and in case of disputes there was always some redress; you first had to appeal to the Chief Inspector of Machinery

and then to the Government Mining Engineer. Under the proposed amendment to the Factories Act the Chief Inspector of Factories has been described by the responsible Minister as an administrative officer and that there was no necessity for a technical man to hold the post, so if this bill becomes law we shall be left to the tender mercies of our respective local inspectors of Factories whose opinion will be the first and last word, and as no man holds the same views on every question, I am afraid we shall have one Inspector in one area requiring quite a different thing to another Inspector in another area, and altogether, having regard to all the circumstances, I cannot see for the life of me why the prposed change should be made. If it were on economical grounds then there is no reason why the Inspector of Factories qualified to inspect Machinery in a certain area could not do so on behalf of the Government Mining Engineer, just as has been the case during the last few months, for although the Inspectors of Machinery have been seconded to the Labour Department, in actual fact they are still working under the Mines and Works Regulations when they inspect our Boilers and Machinery.

As regards the training of engineers, in Capetown years ago it was the Council's policy to give free tuition to the boy who came first in his class in engineering at the South African College. Now the best graduate can have a post graduate course if he likes, but I may say very few take advantage of it, for whilst it is beneficial to the man who wants to specialise in the power production side of the art, it reduces the field for his operations, as we are considerably handicapped in our training by virtue of the fact that little or no engineering plant is manufactured in Capetown. I hold the opinion that boys are all the better for going abroad after obtaining their degree.

Amendment to Constitution.

In connection with the proposed amendment of the constitution of the Association, the Council had discussed this and decided to leave well alone. In so far as subscriptions were concerned, I sug-

gest that they be raised in relation to the units actually sold by the undertaking. I therefore propose that an engineer in charge selling up to 5 million units should pay £2 2s. 0d., up to 10 million £3 3s. 3d., up to 20 million £4 4s. 0d. and 20 million and over £5 5s. 0d. The Chief Assistant's subscription to remain at £2 2s. 0d. Mr. Macaulay (Bloemfontein) : I beg to second. This was then put and carried with one dissent.

VISITS.

In the afternoon the party were shown over the Royal Mint, afte r which they visited the Zoological Gardens.

ELECTRICAL EXHIBITION.

In the evening the party were present at the opening of an Electrical Exhibition in the Town Hall, by His Worship the Mayor.

TUESDAY 24th MARCH, 1931.

The Convention resumed its proceedings at 10 a.m. with the President (Mr. L. L. Horrell) in the Chair, there being present 45 members, 16 Councillor Delegates and 15 Visitors.

APOLOGIES.

Apologies for non-attendance were read from Dr. van der Bijl, Mr. Davidson (Beaufort West) and Mr. G. Stewart (Johannesburg).

DEVELOPMENT OF A DOMESTIC LOAD IN A SMALL INLAND TOWN.

By J. Vowles—Municipal Electrical Engineer —Kingwilliamstown.

The approach of the saturation point, in a town, which, for one reason or another, does not grow, may well be viewed with apprehension by the Engineer-Manager of its Electricity Undertaking, and any means are justified in the effort to expand the uses of Electrical apparatus, thus staving off actual stagnation.

In many of the older towns of the Union there is a very decided tendency towards thrift on the part of their inhabitants which the mistaken tariffs of the past have helped to accentuate and the Engineer Manager of a small Cape Province Undertaking may be forgiven for envying his confrere in some of the Northern towns where the question most often asked amongst the members of a family is not, Have you switched off the light? Many of those present could doubtless, amuse this Convention with tales like the following,—A consumer invariably wrote in great wrath whenever a certain street lamp failed because he had then to use his own bedroom light. Enough has been said on that spirit of thrift, which (while an excellent subject for Politicians to debate and Economists to write about) is the greatest deterrent to building up a satisfactory load in a town with a stationary population, where the family ramifications are apt to be very extensive, and where the primary consideration is not so much the cleanliness, convenience and many other advantages of Electric cooking, as its runnning cost compared with wood fuel burned in a furnace in the kitchen.

In using the expression, any means are justified, the author, in advocating the exercise of full trading powers by an Electricity Undertaking, is aware of the possibility of raising controversy. Nothing, however, that could be brought forward

in support of the argument for full trading powers is more significant than the fact that practically all the large Undertakings in the United Kingdom have, during the last few years, adopted full or partial trading in Electricity consuming apparatus, and are spending large sums on showrooms and other means calculated to develop the uses of Electricity, and this in the face of the organised opposition of influential Electrical Traders' Associations. To the author this universal trend suggests nothing less than an acknowledgement of the failure of the Electrical Contractor to meet the requirements of both consumer and Undertaking.

Now, in the author's opinion, the whole question is bound up in the matter of service. The average electrical contractor in a small town, as a rule, has neither an experienced nor adequate staff to carry out this so-essential service to the consumer, even if the Undertaking finances a deferred payment system for his benefit, as is done in some of our large towns.

The importance of this matter of service in building up a domestic load, cannot be over-stated and this is where the Undertaking should be in the best position to render such service.

It will, probably be generally agreed that the best advertising means are the consumers themselves and a complaint not attended to in time to prevent a spoiled dinner will do much to retard the installation of cookers in the homes of that consumer's friends. In this matter of service, the author would stress the advisability of sending men of experience, not first year apprentices, to attend to even, what may sound over the telephone, a trivial complaint. Infinite patience and much tact are factors in gaining cooking consumers. A personal call by the Engineer within a few days of the installation of a cooker in order to inquire if there are any points upon which enlightenment are needed is usually appreciated. This, of course, only applies to the very early stages of developing a cooking load.

Assisted Purchase. It is an unfortunate fact that the cost of reliable electrical cooking apparatus is still relatively high and the number of those able to afford the initial cash outlay on cookers, is strictly limited, while the number of those who would be only too glad to become all-electric cooking consumers where deferred payment terms available, is relatively large. By direct import and sale either for cash or on hire-purchase, at prices just sufficient to cover all expenses, it is possible to reach a class of consumer impossible by other means.

Guarantees. It is necessary, in the early stages of development of a cooking load to establish confidence and the guarantee period of free maintenance should be as long as possible. While no hard and fast rule can be laid down, it may be mentioned that a three year period has been found satisfactory and justified by r e s u l t s in Kingwilliamstown.

Types of Cooker. The number of different makes of cooker should be kept to a minimum, for the all-important question of holding an adequate stock of spare parts must be taken into consideration. In this connection, it is pertinent to ask; how many of us would care to have several makes and types of boiler in our stations. We in K. W. Town deal in only one make of cooker. It may be said that the policy of standardizing on only one make of cooker is carrying things too far, but with such guarantee and service, it would be unwise, in the author's opinion to multiply the types.

An objection frequently raised by would-be all-electric cooking consumers, and one which it is not easy to meet, is the wide spread belief that electric cooking ranges cannot with safety be put in the hands of Native servants, and in a town where it is universal practice to leave everything to the Native, this difficulty can best be overcome by frequent lectures and demonstrations.

Unrestricted Supply. An important point in building up a domestic load is the advisability of giving an unrestricted supply, and meter rents,

which, in the author's opinion have never at any time been justified (except on the score of expediency) should be abolished, for they are undoubtedly a source of irritation to the average consumer. The tariff question, which for many years had invariably the prefix "vexed" attached to it, is now, one might say, virtually settled and variations of the two part tariff having been adopted by the very great majority of the Undertakings, there only remains this question of restricted hours of use.

It will be found very difficult to explain to the average consumer, who simply believes the generating station to be a reservoir, just why he may only use certain apparatus at certain times, as difficult, in fact, as trying to explain Power Factor. Satisfactory development can only be obtained if restrictions are cut to the minimum or eliminated altogether.

Water Heating. In those towns subject to cold Winters, there is much scope in the way of obtaining a remunerative night load. Like the cooker, however, the initial cost of a water heater is a formidable matter to the majority. The ideal water heater, in the author's opinion, has yet to be evolved. Leaving out of consideration those expensive heaters of the pressure type with large storage tanks in the roof, which are quite beyond the means of the class of consumer dealt with by the majority of the members attending this Convention, where is one to look for a water heater at reasonable cost which will fill the conditions that three, or four or more persons following one another, may each obtain an equally hot bath without any waiting? We have endeavoured to solve the problem, and the water heaters now installed in K.W. Town in sufficient numbers and length of time to warrant proof that they are popular and fulfill the conditions outlined, are an example of the old saying that "an ounce of practice is worth a ton of theory". We have had no failures and the load is obtained when it is most needed, that is to say, during the night hours and not super-

imposed upon the daily peak as in those systems where a sealed 24 hour supply is given at special rates.

Refrigerators, while essential to the all-electric home are not an economic proposition when considered from a Municipal hire-purchase point of view, the revenue derived being too small in relation to the capital outlay. The author does not recommend the inclusion of refrigerators in a deferred system of payment for the small town.

The Cost of Installation of cookers and water heaters should be made as low as possible, and here again the Undertaking is often in a better position to carry out the work than the local Contractor. In support of this contention, the author would instance the difference in installation costs between a large town with Contractor installed cookers and K. W. Town where the work is carried out on a 10% on cost basis. In a paper read at our last Convention, the costs in one large town were given as from £8 to £15, while in K.W. Town they average £2 10s 0d., yet wages and material are practically the same in both towns with a slight advantage in favour of the large town.

No consumer ever in practice, switches on the whole of his heating equipment at full heat at one time, and there is no need to compel him to run mains sufficient, on the thousand amps per square inch standard, to carry the full heat load of his cooker. The average demand in a group of cookers we have found to be of the order of 2 K.W. and we have not found it necessary to run more than one phase into any residential domestic service with consequent economy to both consumer and Undertaking.

D.C. Supply. Of the seventy one Undertakings listed in the yearly statistics which our Association contributes to the S.A. Municipal Year Book, as generating for themselves, more than half are D.C. and it has been said that a domestic cooking load cannot be developed to any extent on a D.C. Supply. The wonderful development at

Worcester may be cited as forming the greatest encouragement to those in charge of small D.C. Undertakings.

Public Lighting. In the author's view street lighting should be regarded as a form of advertisement for the Undertaking. Public lighting should be on a generous, even lavish scale, and the charge made as low as possible. The best way of making a consumer realise that the lighting of his home by means of 20 and 30 watt lamps is inadequate, is to light the street so well that he finds comparative darkness on entering his house.

All Night Schedule. Judging by recent inquiries received from both large and small towns, the midnight schedule is still largely the rule. As the best policeman and as the best means of keeping one's town on the map, the author is a strong advocate of the all-night schedule for street lighting. Should the question of the extra cost deter your Council, then halve the existing charge, the increased annual load factor resulting from the adoption of the all-night schedule is not to be despised in a small Undertaking.

Recently an influential Society with speculative rather than operative characteristics, held a series of meetings in K.W.T. and the members on wending their way to their hotels in the early hours of the morning, were so surprised at finding their pocket torches unnecessary that on returning to their home towns they put up their Ward members on the Council to endeavour to obtain similar amenities. It is regrettable to state that in at least one case the proposal was turned down on the score of cost.

From a perusal of the yearly statistics already mentioned it would appear that the charge for street lighting in many small towns is largely a matter of expediency. In the author's view a high street lighting tariff suggests that the Undertaking needs a prop and this brings up the question of :—

Departmental Charges with regard to which controversy may possibly be raised in stating that in the author's opinion, the principle of "robbing Peter to pay Paul" and vice versa is fundamentally wrong. The Electricity Undertaking is a manufacturing business and should be run on strictly business lines. Provided that the surpluses are not absorbed in that bottomless pit, the General Fund (rate relief it is called in the large towns), it should be possible to lay aside each year, from 15% to 20% of the revenue for plant renewal and development, any surplus going back to the consumers in the form of reduced tariffs ,and avoiding to a large extent those apt-to-be unpleasant public meetings necessary when a loan is required. If plant extension etc., can be financed out of revenue, why stir up a hornet's nest in the shape of a ratepayer's meeting.

When asked by our President to prepare a paper for presentation to this Convention, the author was frightened at the prospect of having to bring his own little Undertaking and its achievements into the flood light. Much advise has been tendered and what **should** be done for the development of a small Electricity Undertaking, has been, perhaps, too frequently advanced. Lest, however, it should be thought that we have not practised what we have preached, a brief summary of the results of putting into practice the principles advocated in this paper, may prove of interest. During the last fourteen years the Undertaking's plant has been augmented four times and its output increased seven fold. Full trading powers have been exercised for the past twenty years. Fully 75% of all the domestic and 100% of the industrial installations have been carried out by the Undertaking's staff. Out of a total capital, including contracts recently entered into, of £132,000, £80,000 has been provided out of revenue. While a sliding scale H & C tariff of 3d. to 1½d. had been in operation from as far back as 1914, an unrestricted all-electric cooking tariff of .75d. has been operative for the past four years and 50% of the output sold is at .75d. Substantial reductions in the tariffs have been made from time to time and

meter rents were abolished some years ago, probably no other reduction in the consumer's monthly account having been so appreciated as this. The all-night street lighting schedule has been in operation for the past sixteen years and the departmental charge for this service of 2d. per unit cannot be said to be excessive, working out with maintenance, as it does, to only £2 per lamp per annum. The average price for all domestic electricity sold in 1930 was 2.6d. and for all units sold 2.1d.. The average annual total consumption of a five roomed all-electric home we find to be 5,750 units. The foreging details, it is thought cover the points brought forward in the paper.

The paper is written, primarily for the encouragement of the Engineer Manager of the small Undertaking. The author has endeavoured to show that development of his Undertaking, in the absence of the big and amply capitalized contractors to be found in all the large towns, depends entirely upon him and the progressive element on his Council and if the arguments put forward in favour of full trading powers have impressed the Councillor Delegates from some of our smaller towns to the extent of giving the matter serious consideration, the author will not regret his intrusion into the field of Convention paper writing.

DISCUSSION.

The President : I feel sure I voice the opinion of the meeting in congratulating Mr. Vowles on his very excellent paper. I do not remember a better all round contribution on a Local Authority Undertaking covering such a wide field. Several interesting and important points are raised.

The first, that of service, is a most vital question; unless consumers' receive good service the supply authority's domestic load must suffer. I feel we have not done enough in Pretoria in this respect. We have given the Electrical Contractors an opportunity to meet their obligations, and

if they do not give the service we expect, they must not be dissatisfied if the Municipality decides to carry out the maintenance of domestic appliances in its determination to give service to its consumers.

The paper is open to discussion.

Mr. Rodwell (Johannesburg) : Mr. Vowles has pointed out many of the difficulties experienced by the Electrical Engineer of a small town in attempting to develop domestic load.

The author has referred to the consumer who promotes thrift by economy in the use of electricity; 50 or 60 units consumption per month by the average consumer is unfortunately often considered exrtavagant, and, until electric cooking and high wattage apparatus is used more generally making the monthly units run into hundreds and thousands, also making consumers realise that electricity is not a luxury but a necessity, the fullest advantages of its use will not be attained.

The author advocates full trading powers for the electricity undertaking. This is a debatable point and its adoption depends upon local conditions. Where registered electricians only are permitted to perform work on installations connected to the urban authority's system, such work is usually carried out in a thorough manner and is depended upon for a livelihood. It appears to me that the onus on the undertaking is not to undertake such work but to safeguard the public by allowing only qualified electricians to operate. Where facilities for undertaking such work are not available, the supply undertaking should certainly provide service in the consumers' and their own interest. I agree with the author that "service" is the greatest salesman. A sound commercial maxim is—"Give your consumer more attention after the order for apparatus is placed, than before". This point cannot be emphasised unduly.

Regarding deferred payment or loan schemes, this is the only way to benefit a certain class of consumer owing to the comparatively high cost of

electrical apparatus. It is sometimes difficult to understand how the high cost of electrical appliances can be justified, and, where not justified, the undertaking should take steps to provide such equipment for their consumers.

I cannot agree with the suggestion that one type of cooking stove only should be utilised in an area. Whilst it is highly desirable that standardization should be attained wherever possible, my experience is that immediately it is known that standardization is being effected, the cost of the equipment rises and the only method of keeping down to reasonable charges is by competition. This, of course, applies more particularly to the larger undertakings, and, where small quantities of equipment are required, possibly standardization is advisable.

The cost given for house service connections at Kingwilliamstown is remarkably low and detailed costs would be useful. In the area under the control of the City Council of Johannesburg, cable connections between the mains, whether overhead or underground, is by means of service cable buried in the ground, with consequent high cost for connection. I hope in the near future that it will be possible to instal overhead service connections in the outlaying areas. The use of twin cable for service connections advocated by the author I consider unsatisfactory.

Service connection cable with a loading of two kilowatts, suggested by the author, appears very conservative and does not allow for expansion. The undertaking I represent instals 3-wire service connection cable free-of-charge where cooking loads are required, thus allowing for additional loading for the future.

Regarding all-night lighting, this depends partly on generation costs and the size of the town. There can be no question but that large towns should have all-night street lighting.

The question of departmental charges raised by the author is one of particular interest to us all

and brings forward the well founded grievance of the appropriation of profits to the relief of rates. I understand that the Commission in Britain limits the amount which may be taken from profits to 1.5% to 2%. It is equitable that those who support the electrical undertaking and provide the profits should be the first to benefit by development and reduced tariffs.

From the statistics submitted of Kingwilliamstown undertaking, it appears to be developing on progressive lines and compares favourably with even the large towns with an all electric cooking tariff of .75d. per unit.

The author has raised many pertinent points and is to be congratulated on his useful contribution to the proceedings.

Mr. J. J. Wud (Swellendam) : At a previous Convention it was advocated by a member that there should be "More of the Salesman and less of the Engineer". Rightly so and we in the smaller towns having an inexperienced and inadequate staff are compelled to undertake this work. Undoubtedly as Mr. Vowles rightly points out efficient service and a satisfied consumer is the best advertising medium.

My Council have started full trading and hire purchase of domestic appliances, and although we have only been going for a few months it is surprising what a difference it has already made.

I do not agree with the writer that Refrigerators should not be hire purchased. A consumer endeavours to have an all electric house but because he requires an applance which is not rated in K.W.'s he is debarred from acquiring one. After all, if it were not for the facilities given through hire-purchase there would be many homes only using lighting.

As regards public lighting and an all night schedule this is out of the question in very small towns apart from the additional or increased load factor derived therefrom. Invariably after midnight a small generating set is in commission.

Mr. Sparks (Pietersburg) : As an engineer from a smaller town I wish to congratulate Mr. Vowles on his very helpful and encouraging paper. I should like a little more information about this system of water heating and the construction of the heaters. Is the water heating restricted to certain hours or not?

The introduction of water heating in a town where coal is cheap is a very difficult matter indeed except to meet a particular case.

I have been experimenting in another direction, that is to heat up the water in its initial stages by means of a flat solar boiler which is heated by the sun, the electricity is only used to give the water a final boost in heat. So far my apparatus is in the experimental but provided the initial cost can be kept low the future looks promising for a Solar cum Electricity Water Heater.

In regard to installation costs, the figure given £2 10s. 0d. is remarkably cheap, I should be pleased to know what this figure includes.

Mr. L. Ralston (Dundee) :
With reference to domestic supply the scheme in which I am in charge has a 220 volt D.C. Distribution and I think Enginers will agree that to try to develop a domestic load on such a system is very difficult. I put forward to my Council the suggestion of 2/6 minimum charge and a 1d. per unit for the use of current for domestic purposes. The cost of the installation in the first instance being 30/- through a separate meter for the first plug and 15/- for every additional plug. The demand has not come up to expectation but this is due mainly to the fact that coal is so cheap in this District and the only domestic load which one can get is electric irons, kettles, toasters, etc.

Mr. J. Hooper (Robertson) : I have much pleasure in congratulating Mr. Vowles on his paper

which would encourage those in small towns. To start a domestic supply with a D.C. station, operating most unfavourably requires a deal of pluck. Domestic load is essential even at risk of loss. Our tariff for cooking load was 4d. and lighting rate 1/- until I recommended the Council to reduce the cooking rate to a minimum of 15 units for 5/- and thereafter 1d. per unit.

Mr. Ewer (P.M. Burg) : I would draw attention to the Thermal storage type of water heater, in the hopes that we may hear the experience of other engineers on this development.

Mr. Swingler (Cape town) : I would be glad to know what is the number of consumers and what percentage that number represents to the whole of cookers (of 3,500 watts and over) you have installed in relation to your domestic consumer.

I am a firm believer in the necessity for your mains to be adequate and the pressure sufficient to meet the demand before you commence developing domestic load, otherwise cooking cannot be done satisfactorily. A good service must be available from the very start, if not electric cookery is damned without even having a fair chance.

To wait until a stove is installed before you extend your mains, or vice versa, to my mind, is bad policy.

In Capetown 810 Cookers of 3,500 watts and over have been installed on the hire purchase system during the last six months; this represents a connected load of some 5,600 K.W. The sum of £37,000 was spent on the Hire Purchase of appliances during the same period. I am absolutely satisfied that without deferred payment or hire purchase system, no undertaking can develop at a reasonable rate.

I think Mr. Vowles is to be congratulated on his work at Kingwiliams Town. When one advocates a high rate of charge for street lighting

you cannot very well complain that any surplus profit should not go towards the reduction of the general rates. Ratepayers on the whole should have some small return for backing the electricity undertaking loans, although one can argue that the very fact that electricity supply is available the value of the property is enhanced, which in itself is sufficient return to the ratepayer who does not take electricity. On the other hand by virtue of high charges for street lighting or direct taxation, consumers of electricity are not entitled to have cheaper supply, it is just robbing Peter to pay Paul. If an electricity undertaking cannot make both ends meet without excessive charge for municipal services or direct contribution to general rates, then it has no right to exist.

Water heating cannot be considered in terms of a general formula, as every town has its own peculiarities. Climatic conditions have a lot to do with an economic hot water supply by electricity. For instance, in Capetown you require quite a lot more heat to get the desired results than in Durban, and for that matter you would want a good deal more hot water. It is difficult to develop a hot water load in towns where the winter temperature is very low. At one time I was opposed to encouraging the cooking load and Mr. John Roberts may remember, my experience being the Stoves then on the market were very unsatisfactory, but I submit to-day it is quite a different proposition.

We are getting complete satisfaction from every cooker that is sold and it is most gratifying to have consumers' testimonials to the good results obtaind, economic and otherwise.

I do not agree with Mr. Vowle's remarks regarding refrigerators. In Capetown we have sold £9,000 worth during the six months previously mentioned. The conditions on which the sales are made control the ecohomics of the transactions, for whilst the consumption of electricity is only in the vicinity of 60 units per month, the load factor is high and the amount we receive in the

shape of discounts from the supplier is considerable and on the whole we are doing better from the refrigerators than from the stove.

In Capetown the policy of the Council was to have the Street Lights on every night with the exception of moonlight nights, but a year or so ago it was decided to have the Street lights on continuously from sunset to sunrise. The cost was only some £300 or £400 per year more and the results have been much more satisfactory from the ratepayers points of view, particularly in thickly wooded residential areas.

I agree with Mr. Vowles' view that one make of stove only should be sold if possible; this simplifies the servicing and does away with a good many other difficulties. On the other hand the more makes of stoves you sell the more people you have to help to pay for your advertising. We have some 60 models and 12 makes to deal with, but the assistance we get from the 12 firms concerned in helping to spread the electrical home idea, is considerable.

The President : I suggest that Mr. Vowles replies to the discussion of his paper at a later date and I will call on Mr. Ralston to read his paper.

THE ADVANTAGES OF ELECTRIC BULK SUPPLIES COMPARED WITH MUNICIPAL POWER STATIONS.

By **LOUIS RALSTON, A.M.I.E.E. (S.A.)** Cert.
Borough Engineer, Dundee.

Introduction.

The scope of this paper is a brief outline of the question on which an Engineer in charge of an existing Power Station may have to report to his Council when additions to plant have to be considered. It may be of general interest to

know that before any additions above 10% of existing plant is contemplated, the Administrator has the right to send the application to the Electricity Commission for a Report, when the question of Bulk Supply may be considered.

South Africa like all countries of the world must develop electrically, and such development must be cheap and reliable, it being realised that all industries which have to compete with the world's markets of manufactured articles, do in one way or another largely depend on their power, whether electrical or steam.

The advance of Turbine design, and efficiency in boiler and Turbine plant have been the wonders of the Engineering world. In 1909 there were very few Turbines greater than 10,000 K.W. and today we find that it is common to talk of 30,000 to 70,000 K.W. Boiler plant has made strides never thought possible, and steam pressures are reaching amazing figures, 1,000 lbs. becoming common practice. Combined with these great improvements comes transmssion of electrical energy reaching figures equally astounding, 132 K.V.A. now being considered usual practice. On account of these improvements, bulk supplies have been possible, and with the improvement of insulators, transformers and switch gear the day will come when what is considered a super station will become a sub station receiving its power from our great sources of untapped energy such as the Victoria Falls, transmission being by super voltages. Schemes like the Shannon in Ireland and many of the super stations in England and America go to shew what development has taken place in the direction of bulk supplies. Advancing ability to generate electricity by large units and transmit large amounts with reasonable ease and certainty cannot fail to revolutionize the electrical world.

Bulk Supplies.

The question of bulk supply is in no way new to South Africa, the Rand Mines having been supplied by the Victoria Falls Power Co. (1909), for many years past, and also many small towns,

and in many instances the supply to one mine alone is larger than all the small towns in the Union put together. Unfortunately, as the towns in the Union are so far apart, bulk supply does not become an economic factor, for small town loads on account of long transmissian lines. Where loads do not reach a peak in any one instance of more than 500 K.W., the question of £ s. d. for transmission lines, capital charges, plus K.V.A., and unit charges places bulk supply in the pale. South Africa is so sparsely populated that true rural electrification outlook progress is likely to be very slow, and where it is possible in or about the area of the Commission's power stations such as in the Natal Undertaking the towns which wouid take power are far apart and are very small loads, and, therefore, not likely to become an economical business possibility. When double feeder lines are to be considered, and this is a very important factor especially in parts of Natal, the picture is anything but rosy and it does not seem possible to develop to an intergraded electric supply.

Bulk supplies based on K.V.A. charges, plus unit charges, as shown from the experience in Natal appear to require some modification as now in operation by the Electricity Supply Commission, and the maximum demands on short duration are not conducive to development, especially when a Municipality wants to develop a combined domestic and power load, and street lighting improvement. Extra K.V.A. on peak at a small Corporation's own station does not cost as much as K.V.A. purchased when the life of a power station, say, is taken at twenty years. Continuity of supply being of prime importance, duplicate feeders should be considered, one of which should be laid underground to minimise the effects of lighting, especially in Natal. Locally operated power stations have very few shut downs and the trouble in connection with the shut down is local and easily and quickly attended to. Municipal Councils are always anxious to maintain, and rightly so, what is considered their birthright, such as

water-works, power stations, etc. When they have control of such departments they are able to govern them to their own liking and are not so likely to be under the strained conditions which may be laid down by the suppliers of any of these commodities. Even with all these drawbacks there is no doubt that bulk supply must come, and the day of small, and in some instances, inefficient power stations must make way for more modern development. We may in this country consider these advantages too soon, but perhaps the experience gained will be all to the good for the future.

Points for consideration in the report.

In framing a report on proposed alterations or a change over to bulk supplies the Engineer has to take every aspect into consideration, including future developments. The fact of asking for more plant raises the question whether this is to be extra plant for immediate load or to serve as stand by plant. When there is existing plant, the capital charges, interest and redemption, depreciation, etc., must appear in his figures. These charges are to be met in any case even if it is a bulk supply. Replacement of consumers plant such as motors, fans, etc., is to be contemplated, and re-wiring of houses will in many cases have to be faced. Alterations to mains, various line improvements, how and where the supply is to be started, the class of feeder, what charges will be on the feeder and for what period, are all points that must be considered. The point at which the supply is to be metered is an important factor, and if the lines are long, whether there is to be a co-operative system adopted between the Suppliers and the Municipal Staff in regard to maintenance. All these points must be carefully studied, and appear clearly in his report. Councillors are not expected to have such knowledge as to be able to say that because a Bulk Supply is quoted at £'s. per K.W., and the unit at .d. that the scheme will have a decided advantage over their own power station. The sale of existing plant may have a big bearing on

the change over. If there is a decided prospect of development in the way of industries, the question does not become so difficult but when it is only for the modern engineering development one must be careful not to increase the Capital Charges beyond the point of return in Interest for the next, say, ten years, especially in small towns.

Comparative Costs of Generation.

Steam plant of modern design non condensing and using nine lbs. of coal per unit at 14/6 per ton, can generate electricity at 1.75d. per unit. Suction gas and heavy oil plants can generate as low as 1.17d. to 1.35d., with Oil at £7/10/-, Antracite Coal 35/- per ton, with reasonable load factors.

In the case of steam plant the fuel can be reduced to .5d. or about that if condensing plant were installed. Therefore, before the Engineer can report he has to take these facts into consideration. The reliability of plant too must have bearing because on this depends continuity of supply, and no matter how cheap electricity can be supplied, if continuity is not to be depended upon, the ratepayer will have cause for dissatisfaction and the position of a Council will not be enviable. When a charge per K.W. is made for a number of years, let us take for example twenty years, the cost say £5 per K.VA., 150 K.W. = £15,000; plant installed say at £84 per K.W., £12,750, which means that after writing down depreciation, etc., the Council has still an asset at the end of this period.

Comparative Outline.

It is not possible to place rigid comparative figures on Municipal Power Stations operating against bulk supply as all towns have varied conditions, but taking the Municipal Statistics for the year 1930, the average price per unit sold by the various Municipalities would be in the neighbourhood of 6d. Comparing these figures with the Electricity Commission's undertakings they read as follows :—

Natal Central—per unit sold	0.736d.
Witbank	0.115d.
Capetown	1.055d.
Durban	0.379d.

From these figures it would seem that if conditions were favourable bulk supply must come into its own for eliminating such stations as Bulawayo, Bloemfontein, Capetown and Queenstown. There is no station turning out current under 1d. per unit sold. It must be realized that even were it possible to consider bulk supply the question of the existing plant must be taken into consideration because the charges of interest and redemption must be met in any case, even though the station itself is shut down, and where plant is still serving good purpose it is difficult to see the reason for shutting down power stations, which after all serve as a source of employment, and therefore circulate monies in the town.

Comparative Figures : Bulk Supply and Station Costs.

I have taken this opportunity of putting forward some comparative figures on a bulk supply scheme against a Municipal operated Power Station. The supply was based on 150 K.W., and the existing steam plant has a capacity of 185 K.W.

The following figures will be of interest :—

COST OF BULK SUPPLY.		POWER STATION COSTS.			
150 K.W. @ £5/6/-	£795	Coal	£444	12	0
273,790 @ .318d.	363	Oil & E.R. Stores	179	3	1
Standing Charges—annual	330	Water Charge	110	0	0
		Wages, Rations & Ptn: E. E. Salary (£175)	835	14	3
TOTAL	£1,488	TOTAL	£1,569	9	4
This equals 1.31d. per unit purchased.		This equals 1.38d. per unit generated.			

It will be seen that whilst in the Power Station particulars, a proportion of the Engineer's salary is included against generating charges, no like provision has been made in regard to Bulk

Supplies, also that the power station has a capacity of 185 K.W. which would cost no more at peak, whereas extra K.V.A. would cost more on the Bulk Supply.

Tariff

No subject in electrical engineering has been more fruitful of discord than the subject of charges for electricity, and it is difficult to form and prove a system that will be both clear and simple, and which would apply in every case in connection with electrical charges. I do not think that it is possible for a bulk supply station to form a tariff which can be accepted in every case.

In some instances the capital charges, etc., on existing plant is very high, and in such cases the consumers must meet the liabilities they have already incurred because these charges cannot be liquidated by any other means. Distances from the point of supply and capital costs for transmission lines become more costly in one case than another, also the existing plant may be in good condition whereas some plant may have already served a useful life, and therefore, are no longer an asset, and in this instance consideration is to be given to the complete reconstruction.

The following are the actual results found to be the position when a K.V.A. charge was based on lighting principally. The Engineer in charge was out to develop the sales end of his department, and found that after pushing stoves, etc., his K.V.A. peaked over the lighting, and the position was as follows :—

Stipulated maximum demand 75 K.V.A.

This peak was the maximum in the Summer months. During the Winter months the peak reached 100 K.V.A. The Summer load conditions were ideal in so much as it improved the load factor. Maximum demand for the Winter proved to be out of proportion to the units sold and made a difference of £125 for the year. Private consumers cannot understand why they should not use current during peak and be under time con-

ditions, they are not concerned about maximum demands. All the Public know is that current is something like .3d., and when they go to the expense of installing stoves etc., cannot understand why they should be debarred of their use at any time, and the Engineers would find it very difficult to try and impose time clauses in the tariff.

Coal.

Whilst on the subject of bulk supplies one cannot pass without making mention of the matter which is a very important item affecting the whole of the electrical and industrial progress of South Africa, this being the question of coal railage costs, and while South Africa has been very favourably placed in connection with its huge coal fields it would seem that really cheap electrical energy will not become possible until something is done to relieve the enormous rail charges on coal. This pertinent question calls for early attention.

Transmission.

Here we have the most important item to deal with. The transmission line to a Municipality which takes Bulk supply must be laid down, constructed, and operated in such a manner so as to more or less guarantee the supply to be of an uninterrupted character Operation of switches should be automatic so that in the event of a feeder failing the other comes into operation with the least possible delay. The size of conductor should receive such consideration that apart from the current density mechanical strength should be given favour; span and size of pole should be designed in correct mechanical relation in order to withstand weather conditions. In regard to the nature of the soil, one can see great difficulties because of the varying conditions to be met with. Black bog soil with springs of water after heavy rains needs careful consideration when planting poles, especially if construction is carried out in the dry months, when the conditions are likely to be misleading, and trouble may only be ex-

perienced after the line has been erected, due to rains having moistened the ground. The line weight and strain is likely to make the poles lean if they have not been planted with bases and on a firm foundation.

Lightning Protection.

Experience has shown that no perfect Arrester has been devised; the Peroxide Pellet Arresters however seem to be doing well. A pair of lines earthed to every pole above the mains appear to serve the purpose as well as many of the expensive types of arresters. It would be interesting to hear the experience of Bulk Supply Station Engineers, on Power Lines, in the way of costs, and maintenance as transmission costs play an important part in the question of change over.

Town Lay Out.

In connection with the lay out of the Town I would put forward the following :—

That it consist of the ring main principle, the switch gear to be of iron clad type, condensers to be used, and the whole of the plant to be as simple as possible without using too many complicated relays, for after all, the main high tension feeder part is looked after by the suppliers.

CONCLUSION.

Advantages of Municipal Controlled Power Stations and Bulk Supplies.

In the authors opinion the advantages of Municipal controlled Power Stations are :—

(1) The point of control is easily and efficiently attended to with the least delay.

(2) The Management is under the Council and conditions of supply can be arranged at the Council's pleasure.

(3) Employment for Whites is avaibale and therefore, more money is spent in the town.

(4) The chances of a shut down are more remote, a steady voltage is available and peak loads are carried at less cost.

(5) The Municipality has an Asset in the way of plant and buildings, and is not subject to outside interferences such as strikes, etc.

The conditions in regard to Bulk Supplies, should be modified as follows :—

(1) That there be no K.V.A. charge, or if any, a K.W. charge and this must be very low, realizing that Municipalities are not casual consumers and do not come on and off the suppliers mains at a moments notice, their demand is always on the increase, and they help in many instances to give an excellent load factor, bulk stations having large plant it is to their advantage to load up.

(2) That duplicate supply is always on hand and such supplies must be operated automatically by suitable switchgear so that in the event of a failure on one feeder line, other lines come into service immediately. Provision for ample lightning protection sectionalizing switches, especially on pole lines, if the lines are over five miles in length.

(3) Voltage regulation. Maximum demand period to be on yearly basis or six monthly, low cost of unit, standard voltages to be adopted, co-operation between the bulk suppliers and the local Municipalities in connection with all services on feeder lines.

In my opinion the advantages of a bulk supply as against a Power Station are :—

That increased load does not mean large capital outlay on generator and boiler plant, etc., operation is reduced to a minimum, flexibility of development is on a far better basis and the general operation costs must eventually be less .

DISCUSSION.

Mr. A. M. Jacobs (Electricity Supply Commissioner : Mr. Ralston's paper raises a number of points of great general interest, and of particular interest to operating and consulting engineers whose sphere of action lies within or close to the field of operation of a possible bulk supply.

As Mr. Ralston correctly points out the framing of a simple—and at the same time fair—tariff is no easy matter. It is difficult to understand why he should state that the demand charge should be based on K.W., rather than K.V.A., As far as the electrical part of an electricity supply system is concerned, the capital costs are surely determined by the K.V.A., and not by the K.W. rating. The cross-section of the windings of an alternator depends upon the current to be carried, the number of coils and the thickness of the insulation depends upon the voltage; the size of the exciter depends upon the power factor at which the generator is to operate; all electrical factors are related to the K.V.A., rather than to K.W. Looking at the question from another point of view, to generate 1,000 K.W., at power factors of 0.8, 0.9 and unity respectively requires alternators rated at 1,250, 1,110 and 1,000 K.V.A., respectively.

Similar reasoning applies to power station cables, switch gear, transformers and transmission line conductors. Hence there is every reason to base the demand charge on K.V.A., and not on K.W.

It must be granted at once that the metering of demands in K.V.A. is rather more expensive than the metering in K.W., but the metering is one of the supplier's problems, not one of the consumer's.

It may be argued that the consumer is, nevertheless, affected by a demand metered in K.V.A., rather than in K.W. and so he is. Assuming that there are two consumers each requiring 150 K.W., at points the same distance from the power station and that the one load has a power factor of .75 whilst the other has a power factor of 0.9. The one draws 200 K.V.A., from the network, and the other takes only 167 K.V.A. The one loads up the alternator and all intervening plant with K.V.A., proportional to 200, and the other requires K.V.A., proportional to 167. At the same voltage the currents are in the ratio of 90 to 75 and the ohmic losses in the ratio of 8,100 to 5,625 or 1.44 to 1. Surely the consumer with the better power factor has a claim to a lower price for his requirements, since he does not require so much plant at the generating end nor does he occasion so much loss in transmission as does the other consumer. In a case such as the above it is only the unprogressive lower factor client who is likely to press for a demand change based on K.W.

The causes of low power factor and their cure forms an interesting chapter in electro-technics; but this is hardly the proper occasion to go into this subject.

In developing a two part tariff, it is necessary to segregate the fixed and the variable costs. The fixed costs are those which are within limits—independent of the actual output of the power station. The main constituent of the fixed costs is the annual capital charges, and their magnitude depends upon the method of financing and the provision made for meeting all the obligations incurred by the supplier.

If equipment has been purchased out of loan monies it will be necessary to provide for interest and loan repayment charges. It will also be necessary to accumulate at least

a moderate reserve for betterment and for meeting major expediture arising from breakdowns not covered by insurance.

Having determined the total fixed annual charges, how is the demand charge arrived at? Not by dividing by the total **installed** capacity, but by dividing by the capacity available at all times to meet the consumer's requirements. A power station may have 100,000 K.V.A., installed, but, after making allowances for stand-by plant, the **available** capacity may be only 80,000 K.V.A. If the supplier is going to cover his costs he must base his demand charge on the smaller of the two figures mentioned above.

This brings us to the point that when comparing costs of a purchased supply and a self-generating supply, it is essential to make sure that the same basis is used throughout. When Mr. Ralston compares the cost of purchasing 150 K.W., with the cost of generating the same amount of energy in a station with a capacity of 185 K.W., I am not sure that he is comparing two similar things. The bulk supplier has to arrange to have the 150 K.W., available at all times; but it seems doubtful whether the 183 K.W. power station could count with certainty on being able to supply the 150 K.W. with the same degree of continuity.

If the small station's equipment consisted, say, of three 75 K.W. sets—two to run and one to stand by—it would be in a fair position to take on commitments totalling 150 K.W. on simultaneous demand; but the cost of such a station, and the annual capital charges would be greater than the corresponding figures for a station of .185 K.W.

Mr. Ralston is quite correct in loading the cost of a bulk supply with the standing charges in an existing local power station; but, of course, the latter charges may be ex-

pected to disappear after a certain period, i.e. when the original loan has been wiped out. It is a fact that even in South Africa cases are on record where comparatively new stations have been shut down in order to take a bulk supply.

This does not mean that the bulk supplier will be able in every instance to offer advantages over local generation. The distance between the consumer and the bulk generating station migh easily entail such an expenditure in transmission, and such high costs of patrol service, etc., as to put a bulk supply out of court entirely.

The argument is frequently put forward in favour of local generation, as has been done in the paper under discussion, that after the loan has been repaid the Council has still an "asset". Most power stations that have seen 20-25 years of service are liabilities rather than assets; and those that are still in good condition have had large sums spent on them in maintenance over the period. It is common experience that the time arrives when it is cheaper to replace plant equipment entirely rather than to spend the considerable amounts required to keep in in running condition. Where is the value of such an "asset"? The only asset worth serious consideration is the amount available in the Reserve, Betterment or Depreciation Fund, however it may be named

Here again the point arises as to whether it is equitable to accumulate very large sums in such funds. Suppose, for instance, that this fund has reached the value of the original loan by the time the loan period expires. You may then be in a position to replace your entire equipment; but have you been fair to the present generation? You have made them pay interest, you have made them repay the loan, and you have made them provide funds for building a new plant for the benefit of the next generation.

If you agree that the reserve should be kept down to a reasonable figure, then that figure,—whatever it may be——is practically the whole of the assets arising from local generation which may fairly be used in a comparison with bulk supply.

The difficulties arising out of the application of an annual demand charge have doubtless been experienced by most bulk suppliers; and whatever line of argument one may take as a supplier to support the reasonableness of such a charge, one has to admit that in many cases it may press heavily in the consumer.

One form of relief might be attempted is to work on a basis of monthly demand. It is possible that the supplier will be able to meet his costs on this basis; he may even do a little better. In any event he will certainly do away with one source of annoyance to the consumer.

Where the bulk purchaser is an industrialist he can frequently take advantage of the reduced cost per unit which accompanies an improvement in loan-factor, as is inherent in the two part tariff. In many cases a rearrangement of the works programme will prevent the overlapping of peaks in different departments; and this does not necessarily always entail a serious dislocation of production.

However, as Mr. Ralston points out, the domestic consumer is impatient of any restriction and sees no reason why he should not have his 'juice' at such times and in such quantities as he would like to have it. The situation is, of course, quite different from the suppliers point of view. The only thing he can do is to make it worth the other's while to keep off the peak. Recourse may be had to the multiple tariffs, with a time switch to change the meter over. A

simple device to be found in the 'load-leveller' which cuts out certain appliances, say the water heater when the stove is in use.

The question is by no means easy to solve, nor is it peculiar to this country—I note that Mr. Vowles advocates eliminating all restrictions and no doubt this proposal will bring forth some spirited discussion.

Mr. President, ladies and gentlemen, I am greatly obliged to you for giving me the opportunity of making these remarks, discursive as they have been. If they contribute in any useful way towards the discussion of Mr. Ralston's interesting and timely paper, I shall be well satisfied.

Mr. Swingler (Capetown) emphasised the fact that each case should be tried on its merits, one cannot make sweeping statements and say that a bulk supply is, or is not, more favourable until you have all the facts that bear on the economies of the case before you. One thing engineers should remeber when comparing bulk supply with your own proposition is that you only pay for K.V.A. demand when and as you require it, whereas in extending one's own plant you have to build ahead of the load and at times you are paying quite a lot in the shape of capital charges on plant which you are not as yet able to employ to advantage. If Engineers would spend more time on looking for a new load and inducing Consumers to take more electricity, it would often be much more to their Council's benefit than spending time hanging around the power station.

Mr. Ritson (Stellenbosch) : We took a bulk supply in 1929 at a cost of £4,750 for the change over for 816 consumers. Last year's profit was £657 against £500 on our own generating. I consider Mr. Swingler is quite correct in saying an engineer has more time to look for new business when he purchases in bulk.

In regard to hire purchase I am wholly in favour of this and propose asking my Council to support the idea.

Mr. Rodwell (Johannesburg) : The paper furnished by Mr. Ralston is on a subject which should be of particular interest to supply undertakings at the present time.

I am at a loss to understand the Author's statement that the average price per unit sold by the various municipalities is 6d. per unit.

The price of the unit "sent out" from the Johannesburg Municipal Jeppe Street Power Station, including all production charges such as Interest and Redemption, Rents, Rates and Insurances, Management, General Expenses and Renewals Fund, is 0.2948d. per unit. With this new station, improvements in efficiency are being effected and it is expected that a considerably lower cost than that given will be obtained in the near future.

The total average cost of the unit to the Johannesburg consumer is 1.6526d. per unit. Even in small undertakings, the cost given by the Author of 6d. per unit appears to be high. The costs per unit quoted for bulk supplies to various large undertakings cannot be compared on the same basis. It may be noted that they range from 1.055d. per unit to 0.115d. per unit.

The enormous bulk supply to the mines from the Electricity Supply Commission's Witbank Station at .115d. cannot be compared with the supply from Salt River Power Station to Cape Town at 1.555d. for partial supply only.

Neither is the partial bulk suply to Cape Town comparable with the bulk supply from the Electricity Supply Commission's Station at Congella to the Durban Corporation at .3790d. per unit. This latter supply was bulk supply and obviously did not include for distribution charges on the mains reticulation system to the thousands of consumers.

The costs of the unit given by the author cannot therefore be compared with the total cost of the unit supplied to small consumers in urban areas or to the price paid per unit by such a consumer.

Generally, the cost of the unit to consumers in urban areas is not affected by the extremely slight difference in cost (either way) between a bulk supply and the total cost of local generation with modern plant, even in small stations.

The greater portion of the charge to the consumer in urban areas is often due to reticulation and other costs when the local authority has a large number of consumers, each taking a comparatively small amount of electric energy.

I am in agreement with the author that the continuity of supply in urban areas is of paramount importance. This especially applies where there are a number of sub-stations having direct current rotary converters installed for supplying energy of Tramways. Even a momentary cessation of the bulk supply to such a system entails a considerable period to start up the converting plant and sychronise to restore direct current to the transport system, with serious inconvenience to the public and loss of revenue to the local authority. In addition, lighting and power consumers are deprived of electric energy.

Many points of interest have been rasied by the author which should serve to lead to useful discussion.

Mr. J. Roberts (Durban) : Mr. Ralston has apparently lost sight of the extension of the load if he took supply from the Commission and by continuing his own Generating he would find it difficult to deal with increasing domestic load. As an example, Stellenbosch increased its output 50% when they went on to a Bulk Supply and have now practically doubled it. Many factors have to be taken into consideration before taking bulk supply. Storms have an effect on long supp-

ly lines. Though some power stations have no shut-downs over 5 years, but for some time to come those who take bulk supplies may have to put up with interruptions. In Durban we have practically no interruption from the Commission's supply because there is no transmission difficulty. The peak question is a burning one as Mr. Ralston evidently finds and the engineer must deal with this in his power station. Perhaps bulk suppliers have not done all they can in that way.

VISITS AND DINNER.

In the afternoon the party were motored out to the Hartesbeestpoort Dam where tea was provided, and in the evening they were entertained to dinner by His Worship the Mayor and later on were motored out to the Premier Diamond Mine to witness the midnight blast.

WEDNESDAY 25th MARCH, 1931.

The Convention resumed its proceedings at 10 a.m. with the President (Mr. L. L. Horrell) in the Chair. There being present 42 Members, 15 Councillor Delegates and 23 Visitors.

ANNOUNCEMENTS.

The President announced that a letter had been received from the Secretary of the Country Club, Waterkloof, extending the privileges of the Club to members of the Association.

Also a letter has been received from Dr. Randall of the Witwatersrand University, inviting delegates to vist the University.

APOLOGY.

An apology had been received from Mr. Samuel, Chairman, Electricity Committee, Harrismith, at not being able to attend.

DISCUSSION ON MR. VOWLES PAPER.

The President : I will now call on Mr. Vowles to reply to the discussion on his paper.

REPLY.

Mr. Vowles (Kingwilliamstown) : I have to thank you for the way in which you have received my paper. In reply to the point raised by Mr. Rodwell, I might state that I do not advocate the elimination of the contractor unless the service to the consumer, which several speakers agree is so essential, fails. On my way to Pretoria I stopped at Johannesburg and being in an all electric house of a friend, I was asked how the oven elements, which have failed, were put in. I at once asked if there was a service and was told definitely that there was no service. That, in my opinion, is not conducive to the continued growth of the cooking load in Johannesburg.

Regarding the cost of installation, I would make it clear that the cost as given in the paper is an internal cost only and includes every detail in this connection. All our overhead services having long been standardized on No. 10 S.W.G., it has not been necessary to augment or alter any service.

Regarding the loading of 2 K.W. upon which information was sought, I would state that this represents the average load on any group of from 20 to 30 cookers of average maximum capacity of 5½ K.W.. It will thus be seen that the diversity factor may be taken into account when calculating copper and transformer capacity for any particular residential district.

In reply to Mr. Sparks I would state that the water heating supply, like all other classes of supply, is quite unrestricted. The

heaters are designed on the assumption that hot water is required throughout the day time; the elements are so arranged that no matter what the capacity of the water container may be, the period required to bring the water up to say 190 degrees Fah., is approximately 10 hours. Water heating economically in my view must be considered from the climatic zone point of view. While K.W. Town, along with several other towns, is in the temperate zone, where the initial temperature of the water does not usually fall below 60 deg. Fah., water heating electrically therefore becomes an economic possibility. These towns situated on the high tableland are in a very different position and I should consider I was doing a dis-service to a consumer by recommending electrical water heating." The slow combustion solid fuel method is, I am sure, the most satisfactory method. The reference in the paper to coal heaters is perhaps unfortunate. I had in mind the difference in climatic conditions as existing at the warm coast town and those situate in the temperate zone.

The method of sun water heating mentioned by Mr. Sparks is decidedly interesting and I should say is full of possibilities, but the subject after all is only indirectly concerned with electrical development.

In reply to Mr. Hooper I may state that we are unfortunately burdened with a legacy of the past when tariffs were, so to speak, in the raw state and the boiling pot was still a long way off, in the shape of several hundred separate heating and cooking meters with separate circuits, but the room tariff has been operative for the past few years. It is unfortunately optional.

The member for Maritzburg brought up the question of Thermal storage stove. This idea originated, if my memory serves me, in Sweden some eight years ago. It is

so full of promise that many engineers are now working on the problem but, despite its very high efficiency, its adoption must necessarily be a slow process for the reason than any radical departure from the conventional is usually looked upon with suspicion.

Mr. Swingler asks what the percentage is of all electric consumers to the total domestic and I may say at once that we progress slowly. After four years of hard intensive work the percentage has only reached 15%, but each year has shown an encouraging increase upon the previous year. I may say this figure of 15% only relates to cookers of 5,000 watts and upwards. I regard such matters as the pressure of supply mentioned by Mr. Swingler as a part of the essential service without which we cannot hope to build up a domestic load. I should like, with your permission to read a brief extract (a) from the budget speech of the Chairman of the Finance of one of our eight large cities, as also an extract (b) from the Electricity Commission's report upon the proposals of one of our small towns which has been in the habit of starving its Electrical Undertaking for many years in order to provide money for extraneous purposes."

EXTRACTS.

(a) "I am not at all convinced of the wisdom "of flying to the expedient of charging capital "wherever possible. It is obvious that large under-"takings cannot be financed from revenue, but in "view of the heavy continuous obligations set up, "it is much cheaper to pay as you go whenever it "can be done."

(b) "The data submitted in respect of the "years 1927/8 and 1928/9, discloses a surplus at the "rate of approximately £2,000 per annum. In 1929/ "30 the accounts (not audited) shew a surplus of

"£810. (These surpluses are transferred to the "credit of the Municipality's General Revenue Account, i.e. in effect, in relief of rates.)

"The consulting engineer's estimates of revenue "and expenditure for the year 1932/33, do not call "for particular comment, except to observe that, on "the basis of these estimates, scope exists in the "proposed review of tariffs for reduction, which "should promote more rapid development to the "mutual advantage of the Municipal Undertaking "and its consumers. The Commission would also "suggest that a more liberal annual contribution "should be made to the Renewals Fund, particularly "in the event of a portion of the balance now avail-"able in the Fund, being utilized for the proposed "extension of the scheme."

The President : I will now call on Mr. Ralston to reply to the discussion on his paper.

REPLY.

Mr Ralston (Dundee) : In reply to Mr. Swingler, I did not say, nor do I wish it to be understood, that loads under 500 K.W. are not worth going after. The question must be considered on its merits. From experience in Natal it has been found, owing to long transmission line, also the question of double feeders and the fact that there is no other load on the way, that the load was not large and therefore it was left out. Remember that I am dealing with cheap coal which places a different aspect on the subject. Mr. Swingler places himself in the suppliers' position and does not like to hear the poor little consumer asking for anything outside what he has to offer. He says we want double feeders, well we have at least two generators. If a line comes down it may be out for a few hours, a generator set can be got away in 15 minutes. Large suppliers will have to consider the demands of Municipal undertakings just as we have to consider the public.

In reply to Mr. Jacobs, I thank him for his detailed technical explanation of K.V.A. I would like to know how may a Municipality charge the consumer on a K.V.A. basis and what about the voltage?

In reply to Mr. Rodwell, the average figure of 6d. is taken on small stations; this figure was taken from the Year Book, page 5, and from the Power Journal of about 8 weeks ago.

In reply to Mr. Roberts, I have taken the question of development into consideration and say that where the engineer can see this the position is easily dealt with and that no electric load should be overlooked.

I wish to thank all those who took part in the discussion of this paper and take the opportunity to say that the paper was prepared to raise discussion. This I think is the first time that Bulk Supply has been before the Municipal Engineers Convention.

The President : I have much pleasure in welcoming Mr. Bullock to our Convention and will now ask him to read his report on the Electrical Development Association.

REPORT ON THE WORK OF THE ORGANISING COMMITTEE, ELECTRICAL DEVELOPMENT ASSOCIATION OF SOUTHERN AFRICA.

By **J. B. Bullock,** Chairman of Organising Committee.

Mr. President and Gentlemen.

You will recall that on the occasion of the last Convention, at Bloemfontein, a Committee was appointed to examine ways and means of organising an Electrical Development Association for South Africa. This step was taken as the result of Dr. H. J. van der Bijl's paper, read to that Con-

vention. This Committee now wishes to report, through me its Chairman, the results of its investigations.

Its first procedure was to frame a draft constitution, a copy of which is attached to this report. This gave an outline of the work it is intended to do, the method by which it is suggested funds should be raised for that purpose, and the means whereby this money and the affairs of the Association generally should be administered. As no criticism has been levelled at this document, one may assume, or at least hope, that it is felt to cover the ground, in outline at least, in a fairly adequate manner, and that it may be worked to for the time being in any advance it may be decided to attempt.

This draft constitution and a covering letter were sent to all towns in the Union and Rhodesia having electricity undertakings, and to as many merchant houses as were known to the Committee. I am glad to say that, in quite a number of important instances, support for the Association was promised in due course.

At the same time no surprise or disappointment was occasioned by finding that a few sheets of typewritten matter failed to carry conviction to those to whom this movement was thus introduced for the first time.

An opportunity occurred, however, for me to visit a number of towns, last Winter, in company with Mr. E. S. Evans of the Lighting Service Bureau, and to meet Councils and their officials, and explain the objects of the Association in detail. The conclusion I am led to by the experience of this tour is that when an Association is started on an effective basis and its methods and the services it can render are generally understood, there will be few, if any towns that will not support it with enthusiasm. Several new supporters have promised to join when the Association gets going. With the latter towns I have every sympathy, for there have been movements in the past which have started off like a rocket and finished up like its stick.

I would, however, observe at this point that my Committee, on the evidence it has collected, recommends that this Association should be started, and believes that it can give vitally useful service to the Electrical Industry in this sub-continent. There is no reason, it feels, why the Association should not grow steadily in financial strength and thus in usefulness, year by year. The position, therefore of those more courageous members who have promised to join at the outset, and who by their contributions will thus lay the foundations of this organisation for service, will, my Committee thinks, be deserving of consideration, say at the end of the first year of endeavour. The consideration, it is felt, might take the form of charging the late-comers an entrance fee, to furnish their share of the foundation expenses. This, however, is a matter for their discretion in the future.

So far the business side of the industry has not been individually canvassed for membership and subscriptions. A meeting of wholesalers and manufacturers' representatives has been held in Johannesburg, at which the objects of the Association were explained, and a few weeks ago Mr. H. Marryat, M.I.E.E. etc., the Chairman of the British E.D.A., who was passing through, was kind enough to address a further well-attended meeting. The result is that an encouraging amount of support is assured from certain merchant firms. Taking this in conjunction with the amounts promised by Municipalities, the Electricity Supply Commission, and the Victoria Falls and Transvaal Power Co., Ltd., the Committee estimates that £3,000 can be collected wherewith to start the Association. When this is actually in being, we anticipate that others will decide to become members and give the movement a better chance to prove itself, with somewhat more ample funds.

In our decision to recommend a start being made, we have not depended upon possible augmentation of the primary amount of £3,000, but consider that the latter sum is a sufficient one

for immediate needs, on a modest and carefully scrutinised basis. We would point out that the work of the Lighting Service Bureau in this country is being carried on with a similar annual sum, and that since the foundations of this have been put down, its influence in the cause of better lighting is increasing in a very satisfactory and encouraging manner, and may be looked to to continue on that course.

As to the proportions contributed to the £3,000 mentioned, by the Supply and Trade sections, we would point out that this is approximately in line with our original idea that a fair basis would be two-thirds from the former and one-third from the latter. The basis of this idea, of course, is that each individual piece of development achieved entails a single transaction, a sale of apparatus say, to the merchant, and a permanent increase in consumption for the Supply Authority.

Thus while the amount in sight is perhaps one third of what is possible, given 100 per cent support throughout the country, the manner of its make-up seems equitable, and we expect that under a competent Director and a zealous Executive Committee the amount will steadily increase. The fact should not be lost sight of that the work of organising has so far been on a voluntary and honorary basis, done by busy men, and that more effective results should follow as soon as there is someone definitely engaged and paid to continue the work.

The assistance so freely and generously given by the Electricity Supply Commission in many directions should here be mentioned and gratefully acknowledged. Without it the progress we are able to report could not have been achieved.

The Committee has only considered the possible budget to cover £3,000 in outline, and in comparison with the Lighting Service Bureau. The details will be the province of the Executive Committee when appointed. We recognise that a great deal depends, at the outset, upon the wise choice of a Director, upon whom the progress and future

of the Association will depend. With its somewhat modest initial funds, the Executive Committee will not be able to afford more than say £600 per annum as a starting salary, but it is scarcely necessary to point out that there are attractive prospects for the right man. The Organising Committee suggests a young man with plenty of energy and enthusiasm. He will require ability to write and to lecture, and a knowledge of publicity methods in addition to a grasp of the business of electricity supply. We by no means despair of securing a suitable person, by judicious advertisement of the post.

As to headquarters, you will have noted from the constitution that these are to be in Johannesburg. I do not think this is a matter for argument, as organisation is best carried out from the business centre of gravity of the country. Local activity in areas distant from Johannesburg will not, I am sure, be prejudiced by this choice, if the example of similar Associations in other parts of the world be studied.

The Committee has received two suggestions for housing the Association, which will be passed to the Executive for consideration.

As to what may be termed provincial activities, pourparlers have been conducted with the Committee of the Lighting Service Bureau, and it has been tentatively agreed that the funds available for work away from Johannesburg be pooled. Under this scheme of co-operation, the Director of either body, when on tour, will work on behalf of both, while the one remaining at headquarters will, it is hoped, be able to keep the activities of both going there.

We recognise that lighting development is the spearhead of general development, and while we do not suggest anything amounting to a merger, with loss of identity, we wish to stress the importance of co-operation achieved through the respective Executive Committees. The arrangement above described is calculated to strengthen the

work of both bodies away from Johannesburg. I need not emphasize the importance of that part of the work.

Further, it is hoped that if the E.D.A. is in need of a lecture room in Johannesburg, it will be possible to use the L.S. Bureau on an agreed basis, while clerical assistance might in emergency be exchanged.

It will be for the Executive Committee to consider these questions in due coure, and to seek ratification as seems fit to it.

Mr. President and Gentlemen, this gives an outline of the work of the Organising Committee. Details of its work and correspondence will be found in its files, which will be at the disposal of the Executive Committee in due course. We have not presumed to carry the E.D.A. to the stage of "un fait accompli," but we are anxious now to hand the nucleus over to the controlling bodies mentioned in the Draft Constitution.

After the position has been fully discussed today, I hope you will see fit to proceed with the election of a Council, and that this will meet forthwith and choose an Executive to galvanise our framework into life.

Dr. H. J. van der Bijl, who has already shown his keen interest in this movement, has been asked by the Organising Committee if he will consent to be the first President of the E.D.A. of Southern Africa, and he has agreed. I feel sure my Committee will not be criticised for taking this step, and that you will heartily endorse the idea.

We next come to six members of Council to be chosen from among engineers of Municipal undertakings, one of them to be the President of the Association of Municipal Electrical Engineers. Before I close I shall give you a list of towns, first those which are definitely ready to join forthwith, next those which I count on as members as soon

as the Association is in being. I would suggest that the remaining five members of Council to be elected be nominated from among the engineers of the towns which are definitely joining, and that the ballot, if any, be open to the engineers of all towns on the list, provided they are present at this Convention and endorse the conclusion that their Councils are likely to join. Needless to remark, by taking part in any such ballot, they are committing neither their Councils nor themselves.

We then have six members of Council who may be either Councillors who are members of Electricity Committees or Town Clerks. I submit that a similar procedure would be fitting in this case.

As to manufacturers' representatives and wholesalers, I have already pointed out that these are not as yet organised, vis a vis the E.D.A., but four members of the Organising Committee, each representing firms who will join forthwith have agreed, at my suggestion, to attend the first Council meeting on behalf of manufacturing interests, in an acting capacity, so that the Council may function without delay. These four gentlemen, Messrs. Winstanley, Lane, Weyhausen and Murgatroyd, are due special thanks for falling in with the suggestion. They will render their contribution to the cause complete when they organise their section and the formal choice of its representatives on the Council.

Retailers and contractors do not as yet come into the picture. We hope they will presently constitute an important and vitally useful section of the Association, but my Committee has not seen fit to issue an open invitation to them, unorganised as they are in most centres, to become members of the Association. The organising of this section of the industry in the E.D.A we leave to the Council-to-be.

Representation on the Council goes with taxation, as in other spheres. Two other representatives so far have to be added to its numbers, from the Electricity Supply Commission, and from the Victoria Falls and Transvaal Power Co., Ltd. These have been arranged for and I submit that if this report be agreed to, the way is clear for immediate action. My Committee trusts that such action will be taken, and that the Association will thus come into effective being at this Convention.

If I may so far presume as to refer to the first and a most important duty of the Council, the election of an Executive Committee, I will do so merely in the light of the deliberations of the Organising Committee. We have felt that the principle of appointing alternatives for members residing at a distance from Johannesburg, if judiciously applied, should prove useful. It is necessary for the effective conduct of the business of the Association that a full meeting of the Executive Committee be possible at short notice at any time, at the headquarters, but this, we feel, need not mean that all the members need be drawn from the Southern Transvaal. A well-distributed representation would assist the Association's work materially and ensure that its activities are meeting the needs of members in all parts of the country. Thus members of the Executive Committee, who are unable to attend ordinary meetings in Johannesburg should have alternates resident there and, if I may say so, a definite say in their choice.

In the event of the procedure suggested being followed at this Convention, I would like to point out that some at least of the towns which will be joining, and have an appropriation set aside for the E.D.A. also have a financial year ending 30th June next, and that it therefore behoves the Council and Executive Committee to be prompt in reaching such a stage that the subscriptions can justifiably be called up, with the least possible delay.

My Committee has to record, with the deepest regret, having lost a very valued member, through the death of Mr. W. B. Phelp. Mr. H. B. Murgatroyd was co-opted to fill the vacancy and subsequently Mr. W. M. Winstanley accepted an invitation to serve.

MUNICIPALITIES.

The following Councils have definitely promised to join the Association :—

Capetown
Cradock
East London
Graaf Reinet
Johannesburg
Kokstad
Kroonstad
Ladysmith
Molteno
Mossel Bay
Pretoria
Queenstown
Uitenhage
Umtata
Volksrust
Worcester

The following is a list of towns which have either promised to join when the Association is in being, or are expected so to do :—

Alice
Aliwal North
Bloefmontein
Burghersdorp
Cambridge
Durban
Escourt
Frankfort
George
Grahamstown
King William's Town
Ladybrand
Matatiele
Pitermaritzburg
Pietersburg
Que Que
Salisbury
Springs
Umkomaas
Umtali
Vryheid

The President :—As you no doubt all know, the proposal to form an Electrical Development Association in this country is entirely due to the initiative of Dr. van der Byl, and we appreciate very much what he has done to promote it. He has, however, been most ably supported by Mr. Bullock, and our thanks are due to him for the excellent manner in which he has carried on the work. We are much obliged for the intresting and comprehensive report he has presented to us.

DISCUSSION.

Mr. Jacobs (Electrical Supply Commission) : Mr. President and Gentlemen. Dr. van der Bijl has asked me to express his regret at being unable to address you on this occassion on the subject of the proposed Electrical Development Association with which his name was linked at your last conference. At a late hour he requested me to take his place; and I would like to make it clear, in fairness to him, that my remarks express my own personal views and not necessarily those of Dr. van der Bijl, as I have had no indication of the lines along which he would haxe spoken had he been able to be present to-day.

You have had presented to you a fairly exhaustive report on the work done by the Organizing Committee to-date. It has been a pleasure to me to represent the Eiectricity Supply Commission on that committee; and I would like to assure you of the great interest which the Commission has in this project, an interest which it has been the privilege of the Commission to express in the most practical way possible. It would not have been possible for the Commission to assist in the way it has done had it not been convinced that all practically minded men would support the movement after the foundations had been well and truly laid by the Organizing Committee.

Over and above any appeal to logic, imagination and business sense, there is the **fact** that in other countries similar associations have been able to show the most satisfactory results.

The very modest budget which has been prepared for the first year of operations bears no comparison with the sums which are being fruitfully expended in other countries on similar work. With good

organization and with whole hearted support, there is no reason evident to make us anticipate anything but success. I appeal to you for that co-operation which alone will bring about the desired results.

I am well aware of the fact that several of the larger Municipalities have been pressing steadily forward with their own electrical development schemes: That those centres are advertising extensively; that showrooms and demonstrations form a part of their routine propaganda; in short, that much of the work that might have been initiated by an Electrical Development Association has already been launched successfully by the Municipalities in question. There have been, however, welcome indications of a broad—and I may say unselfish—outlook in those quarters. It is recognized that the smaller undertakings would reap the greater benefit at first from membership in an E.D.A., and that the larger undertakings would begin to participate only after the initial stages of growth had been left behind. The E.D.A., will require the staunch support of the large undertakings now in order that it may get under way. There is no doubt but that in the near future a powerful E.D.A., will be able in turn to render the most useful services even to the most highly developed producers and distributors. Remember the classic fable of the Lion and the Mouse; and if that does not carry conviction then let me mention that the N.E. Coast Power Company—one of the largest in the United Kingdom and one which spends impressive sums on the sales side in its own territory—is also one of the most loyal supporters of the British E.D.A.

Gentlement, hard-headed business men, such as the executives of the N.E. Coast Power Co., do not put funds into unproductive ventures. They support their E.D.A., because they know that they obtain a com-

mensurate return for their capital. Take heart of grace from their example and give your support to the South African E.D.A.

In this movement the most satisfactory results will be achieved by co-ordinated action all along the line. The electricity producers will have to bring their best efforts to bear on the question of evolving attractive tariffs and the manufacturers and retailers of appliances will have to see that they offer their wares at the most attractive price compatible with quality.

In Holland, the Association of Electrical Undertakings maintains a well staffed and equipped testing centre for installation material, appliances, etc. Approved goods are entitled to be stamped with a special mark of indentification. It should not be beyond the scope of practical politics in this proposed association to formulate some means of assisting the public to secure satisfactory appliances.

Mr. President and Gentlemen, you have many weighty items in your programme still to be taken care of and I do not propose to detain you any longer. I do sincerely hope that the efforts put out by the Organizing Committee will not be allowed to remain sterile; but that the close of your Convention will see South Africa in line with the older countries and in possession of a lusty and vigorous young E.D.A."

(Mr. Jacobs asked permission to read a statement submitted by Mr. E. G. Weyhausen, Siemens (S.A.) Ltd and member of organizing Committee, E.D.A.)

Mr. Bullock remarked that retailers and contractors do not yet come into the picture as far as the E.D.A. is concerned. The reason is most probably that contractors in most parts of the Union suffer so much

under severe competition, that they cannot make both ends meet, and certainly have no funds left to pay as contribution to the E.D.A.

If we take into consideration that competition has driven contractors in Johannesburg to accept contracts at 12/6d. per point, it is evident that such an amount may pay perhaps for labour, but certainly not for material as well, modest as this may be, and the result is that either the job is executed in a manner which is no credit to the community of the Electrical Engineers, or that the contractor cannot pay the Importer or his Buyer overseas for the material employed. Although I understand that conditions in other parts of the Union (especially at Cape Town) are more favourable, there might be a possibility of improving conditions by assisting such contractors who are prepared to join the E.D.A. in some way or other; say by establishing a branch of the E.D.A. which would act as a kind of Co-operative Society of Contractors with the following objects :

(1) A Contractor who is a Member of the E.D.A. would receive an emblem which he can use in his shop as a proof of his membership.

(2) Such contractor will undertake to execute installations in strict accordance with the wiring regulations laid down by the E.D.A. or his respective Municipality.

(3) In exchange for such undertaking the respective Municipality will see to it that such a contractor receives preference with regard to prices.

(4) The E.D.A. might put aside certain funds to finance such contractors and through a special Buying Department

purchase for the whole of the member contractors at considerably lower prices than the individual contractor could do and advance money to him on sufficient security.

It may not be known to the Municipal Engineers but is certainly an only too well known fact to the Importers that the whole of the Electrical Business in this country is suffering from the unsound financial condition of the contractors and, if a way could be found on the basis of my above rough outline, the E.D.A. could do perhaps more for the improvement of the Electrical Business than by advertisements and lectures.

It would lead me too far to-day to go into details but I feel sure that a Sub-Committee would be able to work out a basis for such a scheme.

(The President announced that the Municipalaties of Harrismith and Vryheid had agreed to join E.D.A.)

Mr. Swingler (Capetown) : I am of opinion that with only £3,000 per year at its disposal the E.D.A could not be expected to do very much. Capetown alone spends that amount on propaganda, advertising and showrooms and the like, notwithstanding this I considered it was my duty to join the E.D.A. movement because of the wider outlook. If we can get the electrical idea in the minds of the people of the country as a whole our task is very much easier and whilst doing quite a lot in that direction locally, I do feel that a national movement is necessary and that we all must benefit. I have recommended my Council to subscribe not less than £100 or more than £250 to the E.D.A. until such time as a branch is established in Capetown. I am not in favour of the E.D.A. opening showrooms at this stage because they cost quite a bit of money to run successfully. I think that the preparation of suitable literature and other propaganda should be their first step,

then they could push the red seal idea, instal more plugs in your homes. The E.D.A. in England have started this scheme and the Red Seal Commission in Canada has spread very rapidly throughout the States. There is plenty of room for activities for the E.D.A. in the shape of national educational matter.

Mr. J. Roberts (Durban) : I am very glad to support Mr. Swingler's proposal. I am not in favour of showrooms as it would not be possible to establish more than four or five. I think E.D.A. could spend £3,000 very profitably by the circulation of suitable literature to all towns in the Union. I have found that propaganda work, lasted only a few months after which it was difficult to keep it going. I now find it difficult to give time to prepare bulletins. E.D.A. should have a live man who should start by getting out posters, (which were very successful in Durban) particularly with a South African appeal, and ordering say 1,000 so that all towns in the Union could be plastered with same design. A blank space could be left for the insertion of local colour. The Durban Town Council has had an appeal for funds from E.D.A. and I have reported that the matter was coming before this convention. I feel that if I had a satisfactory scheme to place before the Council, they would subscribe £250. As regards the smaller towns, they would benefit by being able to get literature and posters which they might not have time to devise nor the money to produce in small numbers, for say £20 to £25 a year. They would get a service they could not get for three times the amount, if they tried to do it themselves. I would like to hear what Mr. Bullock thinks of my views, and that it would be decided right away how the work was to be carried out.

Major Rendell (V.F.P). : The Victoria Falls and Transvaal Power Co. Ltd. are very keenly interested in the suggestion to form an E.D.A. and would do all in its power to further the interests of such an Association and to make it a success. Every engineer is of opinion that an E.D.A. would

be of real value. The financial side presents a difficulty and it is for the E.D.A. to arrange for propaganda to get Town Councils interested and point out that by co-operation, especially in the case of small municipalities, any money they subscribed, would go much farther and they would get far better service than they could possibly put forward themselves. It is possible that much of the literature of the British E.D.A. may be applicable to this country and at a comparatively small cost some of their posters can be obtained. The first consideration is to avoid any large expenditure such as showrooms, and to devote the whole of the funds, £3,000, to a definite National publicity campaign. If there could be really readable and constructive posters in every town of the Union, then the Association will immediately begin to interest both the public and the councils. I suggest that it may be well worth while to arrange in the constitution for a nominee of the Institute of Civil Engineers to be a member, who could do quite a lot in helping the Association. The E.D.A. will start under exceptional favourable circumstances in having the advice of the S.A. Electric Lighting Bureau; most of the work is covered at the present time. The E.D.A. can start functioning very much quicker. The V.F.P. are most anxious to further the project in every possible way and will only be too pleased to take part in the proceedings.

Cr. Adcock (Port Elizabeth) : I admire the engineers, who have been working very hard in trying to bring down costs. From a Town Councillors point of view I do not think a council should have to sell goods, as this is entering into competition. If the price of electricity is reduced it is for the dealer in electric commodities to sell his goods. Wiring contractors get substantial discount on the sale of a commodity. If he got the profit on his work and the price were reduced by that discount, it would reduce the price of the commodity. I consider that wiring contractors should be satisfied with the profit they make for their work and should surrender the discount.

Mr. Rodwell (Johannesburg) : The success of the Electrical Development Association depends primarily on finance, and largely on the enthusiasm of the members.

It has been shown that the initial annual income is expected to be in the neighbourhood of £3,000.

Intensive propaganda work in Johannesburg has cost the City Council large sums of money, but these have been amply repaid in the huge volume of business resulting.

The propaganda of Johannesburg, by reason of extensive advertising in the press, has benefitted not only that city but also the Rand generally and other towns, and this goes to prove that the work of the Electrical Development Association would re-act and be of mutual benefit to all those desiring to further the uses of electricity. A broad outlook should be engendered and, what is equally important, maintained.

The Johannesburg Council has agreed under certain conditions to contribute £500 to the movement for the first year, and each interested body should do all in its power in its own interest to further the movement.

I was astounded at Mr. Bullock's assertion that Johannesburg contractors accept contracts at 12/6d. per point, and still further surprised to hear that these contractors either execute the work in a manner which is no credit to the community or, alternatively, that the contractors cannot pay for their material. Under the stringent by-laws in force in Johannesburg, the former contingency cannot arise.

Whilst I do not expect the Electrical Development Association to cure such evils, the existence of which I was not aware, I am wholly in support of the movement and shall do all in my power to further its interests.

Mr. L. B. Sparks (Pietersburg) : I feel that the first subscriptions should be set aside to cover the expense of interviewing the smaller municipalities. It is a difficult matter to convince them, but if the procedure followed is on the lines suggested by Mr. Roberts, the appeal would be easier. I think there is a need for someone to go along to the municipalities, as a personal visit is worth a great deal.

Mr. W. M. Mail (Kokstad) : Though my Council are not very keen I feel sure if they could hear what was happening at the Convention they would accept it whole heartedly.

Mr. I. J. Nicholas (Umtata) : A difficulty which I see is that the plants in some of the smaller towns are so small as not to permit of expansion as regards the load. I think the Electricity Supply Commission should help and give smaller towns a plant a little bigger than they need at present.

Mr. J. Vowles (K.W.T.) : I would draw attention to the existing Publicity Associations, the smaller towns say "What do we get out if it?" It has gone so far that some are refusing to contribute to the Publicity Association, but I have told my Council they can not very well stay out of E.D.A. The Publicity Association has militated against acceptance by some towns.

Mr. E. S. Evans (Lamp Service Bureau) : The Activities of the Association would be limited to funds available. There are more things that could be done beyond the publication of literature and posters. Engineers are very interested in technical reports, and the British E.D.A. issue reports on many subjects of which it is very difficult to obtain any definite information—these reports will be available for the small man. The Bureau, with which I am associated has prepared lectures with suitable lantern slides and suitable equipment which could be circulated and would be of great help to E.D.A. I hope the E.D.A. will advise on the best method of training lecturers and

demonstrators. In showrooms people are in direct contact with the public. One man cannot be expected to revolutionize an industry or double your turnover but he can help to do so. It must not be forgotten that when a subscription is paid the subscriber has only just started his work in the E.D.A. movement.

Mr. L. Ralston (Dundee) : I think a personal interview with my council would be beneficial. My council considered it was for me to write articles as a means of developing in my town. Mr. Bullock has been to Dundee and explained matters.

Mr. A. R. Metelerkamp (Salisbury) : I am not against electrical development but wonder if a subscription of say £80 could not be better spent on efficient services in a small town rather than on leaflets and technical pamphlets, which are not of much value to the consumer. The suggestions put forward in the original circular of E.D.A. were very much in the air and as Town Councils require something concrete as to what was going to be done I have had to leave the matter in abeyance. I hope after the diccussion to know a little more about the movement.

Mr. J. Roberts (Durban) : I think the Convention might consider approximate figures. Out of the £3,000 say £2,000 came from Municipalities and £1,000 from contractors. Suppose 50 small towns contributed £20 a year, that would be £1,000, leaving £1,000 to be contributed by larger towns, and if four towns give £250 each, the tax on any municipality would not be too heavy. If everyone came in, the contribution for smaller towns would be £20 and not £80.

Mr. J. Burnard Bullock : I do not consider Salisbury can be looked upon as a small town. The Orgainizing Committee had suggested a contribution on the basis of revenue obtained from electricity in each town and thought that the fair way.

Mr. Swingler (Capetown) : I consider publicity is absolutely essential in the progress of any undertaking. I have records that prove immediately we started consistent advertising the progress became increasingly steady and permanent.

Were I in Mr. Ralston's place I would tell my Council that I was not a writer but an Engineer and it would be cheaper for the Council and better for myself to be employed on work I could do well, than to try and write articles or design posters which the E.D.A. would specialise in.

Cr. Clark (Durban) : Expressions of opinion should be obtained from council's especially in the smaller towns. I heartily support the movement as it would benefit the country by influencing the development of cheaper electricity. When the matter came before the Durban Town Council, they had a letter from Mr. Bullock stating that the fees would be 0.2% on their revenue, and, therefore, the amount that Durban would have to pay would be somewhere in the region of £500. Councillors look at their money very closely and also from the ratepayers' point of view. Mr. Roberts has used extensive propaganda in Durban and has done very fine work for the selling of juice to the public through downright advocacy of this movement. E.D.A. is now to take the place of personal effort. As it will be of great benefit to large consumers such as the V.F.P. I think they should pay a very large amount to help the movement, especially as they are trying to get towns along the Reef to take their juice. As regards the benefit to wiring contractors and suppliers of equipment, they are making large profits and would be interested in E.D.A. because it would boom their business on the cheap. On commencing the domestic cooking supply we had a conference with the suppliers of apparatus and we told them that they were charging too much and if they were prepared to come down the Council were prepared to help them. An agreement was arrived at and one supplier said the Council was out to kill his business. He was told that was not so, but that where he put in one stove the Council

wanted him to put in 100. The Council has put large amounts of money through their hands, the Council guaranteeing the money and taking the responsibility. Suppliers should support E.D.A. by coming in and a basis laid down as to what they should pay. I do not think technical reports of very much use to the consumer but engineers should have them, as they will get the most up-to-date way of doing things. The Electricity Supply Commission should be looked upon as a supplier as they are out to boom electricity and it would be in their interests to come in and contribute. The E.D.A. will be of very great value to small undertakings in developing their plant and also their load factor and, in fact, everything in connection with electricity. I will do what I can to involve the Durban Town Council in an expenditure in this direction. I do not see why large municipalities should not help the smaller municipalities. We have had applications for help from engineers of smaller municipalities and have helped them which I looked on as "brotherly love" and that it should continue.

Mr. J. Burnard Bullock : I am very gratified at the reception given to this report, especially as many speakers have expressed the national view point. We are trying to take the broad view for the benefit of South Africa.

Major Rendell recommended us to have a nominee of the S.A. Institute of Electrical Engineers on the Council. I said in my report that there is no taxation without representation. In the constitution it is provided for a representative from the Institute but I trust the Institute will contribute something.

I know the Publicity Association has been the cause of people saying. "This is just another of these associations, in connection with which you pay your money and hear no more about it". If I could have prefaced my report with the same little talk I

gave to the municipalities on my tour last year a lot of the discussion would not have been called for. We have been dealing with all these points for the past year and we have settled them all. With co-operation the Association would have a flying start "wealthy" wholesalers have put together. and not meet with difficulty.

I would like to emphasise that a strong feature of an electric supply undertaking is trading; it has something to sell and has a bigger turnover than many of these wealthy" wholesalers have put together.. We want to assist the undertaking in its trading department, we want to assist the other branches of electricity and we also want to assist the 'man in the street'. We want to give service to the people of S. Africa and it is by co-operation we hope to do that.

'Various digs have been given at the V.F.P. about the large amount of money it should contribute. After all the V.F.P. is on our side. You must remember that over 9% of its output is supplied to the mining industry and a very small percentage of their supply goes to municipalities.

The Electricity Supply Commission is also with us. I have already thanked them for the support they have given us. You must remember that the Commission has not got any funds, from the air, which it can pump into this Association and if it wishes to give a large subscription it will have to apply to the Government. Large bodies will do all in their power to assist us. Spectacular sums should not be looked for because the capital runs into millions.

The word 'technical' came into the discussion as a bugbear. It was thought technical literature woud be issued to the consumer; this is not so. Such literature is for the engineers, to teach them so that they

can help their consumers. There is literature for the consumer that is non-technical and suitable.

Showrooms have been mentioned. It is thought the Association meant to establish its own showroom which is far from the facts of the case. We can render assistance to those undertakings which at the present time have no showrooms. We can give them advice as to getting the best results with a minimum of expenditure. That is as far as the Association is concerned.

The spending of the money will be the business of the organization, the body you appoint will do as they think fit. We have no programme saying that you shall do this and you shall not do that, it is for you to administer it as you think fit.

I agree that posters and literature should come very early and stand high in the work of the organization.

Another thing we have had in mind was to constitute the E.D.A., or an official of it in his spare time perhaps, as the electrical editor of the lay press of this country, that is to say, he would be at their disposal e.g. if they wished to run an electric page and he could edit articles for them. Such a man should be of very great use.

Yet another thing E.D.A. can do is to introduce the "electric house" idea and encourage every undertaking to set one up if it can. Get a house in the building stage and get it finished off as an electrical home; you open it for a while as a showroom and eventually let or sell it. The result is bound to be very good and helpful.

If funds permit your executive committee will be able to consider the engaging of a competent lady demonstrator to travel, to go to towns where they ask for her ser-

vices and actually get right into touch with consumers in that town. I hope that having got one such lady demonstrator, we could get, through the domestic science schools, young girls to undertake similar work.

The Contractors' side has been mentioned. It is a pity but the outstanding feature about the contractors is their lack of organization. The industry I hope will organize as a whole in this Association, for its own good. Durban has already shewn us what can be done to regularise the position as between undertaking and contractor.

I hope you decide to go forward with this organization; elect a good executive committee and tell them to get on with it. The results of 16 months work are at the disposal of the executive committee.

Miss Bisset (Member, Electrical Association for Women, England): I have been very interested in the discussion this morning regarding electrical development in South Africa and I would now venture to say that the Electrical Association for Women has done a great deal towards electricity development. Its object is to promote a wider use of electricity in the service of women and of course largely applies to domestic electrification. It is very important to have the women's point of view as regards electrical appliances for use in our homes and for the simplifying and aid in home life, to reduce labour and create a fuller life for the women in the home. Now, this Association for Women which promotes the wider used of electricity does so by collecting useful information and distributing it. It also caters generally for the needs of the women in the home and the engineer in the construction of electrical appliances, may I say, does so from the engineering point of view; he needs the application of the woman's point of view as to its successful use in the home. At the last

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electrical conference I attended there were delegates from all over the world and we realised and heard that Britain had been very reluctant to see the advantages of the development of domestic electrification. Most countries were far ahead of us, but in recent time Britain has made great strides. The Association has interested many women by explaining to them the uses of electrical appliances and I think it would be probably a very valuable association as regards electrical development in South Africa.

I very much appreciate having been allowed to come in on a very interesting occasion, and I feel it will be very interesting when I go back and tell the Association for Women what is now being done in South Africa as regards domestic electrification."

Mr. Ewer (P.M. Burg) : I have worked very closely with the E.D.A. in England and used their posters and leaflets. The posters were placed on sub-stations, lorries, etc. and were lit up at night and the results have justified what has been paid out.

Mr J. Burnard Bullock : You should proceed with the election of the council, that is the business before this Convention. After that the Council will be in a position to elect its executive committee. I have suggested in my report a means whereby two sections of the Council could be elected. To begin with there are Engineer members, one of them to be the President of your Association leaving five Engineers to be elected. There will be at you disposal four representatives of manufacturers who will act for that section, there will also be a representative of the Electricity Supply Commission and one of the V.F.P. The Council then elects its executive committee to whom it entrusts the actual business. The Council would meet on the occasion of your Convention and present the accounts and report for the year.

But the executive committee is the active and vital body and in the appointment of that you will have to be particularly careful.

The President : Is this Convention in favour of an Electrical Development Association being formed for the Union of South Africa and Rhodesia? This is the first thing to be decided and I shall therefore be glad if someone will put forward a proposition.

Mr. Swingler (Capetown) : I propose that the Association be formed. Mr. Macaulay (Bloemfontein) : I beg to second.

Carried unaminously.

The President : I understand that Dr. van der Bijl on being approached to become the first President of the Electrical Development Association intimated he would be pleased to accept providing the Convention was in favour of the suggestion. I am sure Gentlemen we should be very honoured to have him as President of the E.D.A. and feel every one here will readily agree.

Mr. J. Roberts (Durban) : I consider that the headquarters of the Association should be in Johannesburg, and if the Executive Committee is comprised of members in the vicinity they will be able to meet as often as necessary, whereas if the executive members were scattered all over the country, they will merely be names on paper. There could be three from Johannesburg and the vicinity and three from smaller towns, Engineers will then take an active part in the movement.

Mr. Swingler pointed out, in speaking as a Capetonian, he did not consider that everything should be done from the North. If you want to make a success of the E.D.A. you must rope in as many people as possible. Get the coast towns to feel that they are just as much part and parcel of the scheme as Johannesburg, Pretoria and the reef.

Mr. Rodwell (Johannesburg) : I am of opinion that whilst the Convention proposed to elect the council, the operations will be in the hands of the executive committee. I agree with Mr Swingler that all bodies should be represented on that council is possible. It would be a very big loss to have to carry on the organization without the advice and moral support of Messrs. Roberts and Swingler. If the council were appointed they could advise the executive committee.

Mr Roberts (Durban) : I would explain that the Transvaal members would represent us and they could have monthly meetings. They could control the class of literature to be issued which is a most essential thing. I would like to know that Mr. Horrell and Mr. Rodwell were getting on with the work.

The President : I think that the Council might be elected at once and then the Executive could be elected to get on with the work. It should be comprised of members who can attend meetings in Johannseburg. I suggest that a meeting of the elected Council and Councillor delegates be held to-night.

Mr. Roberts (Durban) : Perhaps the President will explain if the Railways and other outside bodies will be eligible for admission to the Association.

The President : The Railways will be very welcome but will naturally be expected to contribute to the funds.

Mr. Rodwell (Johannesburg) : I would further explain that the whole scheme has been circulated and I imagine that all people interested in the movement have made themselves acquainted with all the details.

Mr. J. Burnard Bullock : The whole scheme has been circulated but it has not been subjected to destructive criticism. The Organization Committee wanted everyone to have a reasonable say in the Association. The council should meet when this Convention meets, and its members should be kept in touch by reports; it should make suggestions or criticisms to the executive which will be the business body of the Association. The council will be a body representative of those members who are going to subscribe to the Association. I do not think it will be necessary for it to meet more often than I have suggested to consider reports of the Executive and to lay its own report before this Convention when it meets. No hard and fast rules need be laid down here.

The President : I now ask if the Convention is in favour of the election of the council, omitting retailers and the S.A. Railways.

RESOLVED that the Engineer members of the Council shall be Messrs. Horrell, Macaulay, Roberts, Rodwell, Swingler and Vowles.

Mr. S.V.R. Lewis (Aliwal North) : I do hope that the smaller municipalities will be able to draw upon the experience of larger towns represented by such as Messrs. Roberts, Swingler and Rodwell, etc. They know where we can save money, they have the whole thing at their finger tips and I do think this experience should be at the disposal of the E.D.A. I put this forward as a proposition."

Mr. J. Nicholas (Umtata) : I have much pleasure in seconding.
Agreed to.

The President : There is now the question of nominating six towns to be represented on the council.

Cr. Clark (Durban) : I could not bind my Council. It had better be left to the town councils to nominate their own representatives.

Mr. Swingler (Capetown) : I consider that all councillor delegates present should be invited to attend the meeting to be held that night.

Agreed to.

VISITS :

In the afternoon a visit was paid to the Power station and various Sub-Stations.

THURSDAY 26th MARCH, 1931.

The Convention resumed its proceedings at 10 a.m. with the President (Mr. L. L. Horrell) in the Chair. There being present 28 Members, 12 Councillors Delegates and 5 Visitors.

The President : I have to announce the election as members of the Association of Mr. C. F. L. Noakes (Carolina) and Mr. G. R. E. Wright (Benoni).

ALTERATION TO CONSTITUTION.

Mr. Roberts (Durban) : I would take this opportunity of bringing forward the case of Mr. West of Colenso, who would like to apply for membership. As he is not a Municipal Engineer and is not actually supplying electricity to the public, the constitution of the Association does not permit of his application being approved.

The President : I would very much like to see Mr. West one our members and to meet the case I move the following clause for insertion in our constitution :—The Council shall have power to elect as a Member or Associate Member any person in the employ of the V.F.P. Co. or the Electricity Supply Commission, who may be engaged in the public supply of electricity to Municipal bodies.

Mr. T. Millar (Harrismith) : I have much pleasure in seconding.

Mr. Brown (Vrede),: I beg to move as an amendment that the election shall be confined to the class of Associate Member only.

The President : I agree to the amendment.

The clause as amended was put and **Agreed to.**

The President : Banking. The Bank will require the approval of the Association in regard to our Account and I put it that the account be operated as before or alternatively by two members of the Council. **Agreed.**

The next business on our Agenda is the paper by Mr. Nils B. Eckbo, whom I have much pleasure in introducing and I must apologise for the sparse attendance at the Convention today.

Mr. Eckbo : I am very glad indeed to have this opportunity of reading a paper on the impregnation of wooden poles for electric supply and telephone lines purposes. Those of you who have read the paper will know that it is certainly a subject of great importance in other countries, and I am personally convinced that it will be of great importance here. Perhaps, Mr. President, you can arrange for any of your members who may wish to do so, to come out to our station at Pretoria West to see how the work is carried out.

PRESERVATION OF POLES FOR ELECTRIC SUPPLY AND TELEPHONE LINES.

Nils B. Eckbo, M.F. Officer in charge, Timber Investigations, Forest Department, Pretoria.

Most woods are of a highly perishable nature subject to attack by decay, insects and other destructive agents.

The ancient art of preservation dates back to early Egyptian history when antiseptics were introduced to counteract deterioration. Since those early days the art has been further developed to meet present day needs in an effective manner.

In order to understand the essential features of this work it is necessary to visualize the general structure of wood.

The building material in this structure consists chiefly of cellulose and lignin, arranged as a fine tissue somewhat on the principle of a honeycomb.

This tissue forming the framework of the structure is saturated with moisture (sap) in the living tree, with the innumerable interspaces or cell cavities more or less filled with free fluid.

The fluid which consists very largely of water represents roughly 50% of the weight of green wood. The latter may easily have an actual weight of 80 lbs. per cubic foot from which 40 lbs. or four gallons of water may be evaporated without causing a corresponding volume reduction.

For the purposes of this paper therefore it may be proper to consider wood as a honey comb full of liquid and preservation as a process of emptying the water and pouring back antiseptics.

Developments in other Countries.

You may travel the world over and you will find there is hardly a spot where electric supply and telephone lines are not carried on specially prepared wooden poles. In countries wnere rot is rampant, teeming with termites and destructive borers, in other countries where snow and ice load down the wires to an almost unbelievable extent; the wooden pole does the work in face of adverse conditions.

Great Britain manufactures steel poles mainly for export and imports wooden poles from the Baltic for her own use.

The United States is also a higly developed steel country conspicuous by the absence of steel poles and it is of interest to mention a few figures concerning the wood preserving industry in that country. There are 193 large treating plants using annually 248 million gallons of various oils, 23½ million pounds of Zinc Chloride and smaller amounts of other miscellaneous preservatives.

The materials treated annually consist of :—

Sleepers	73	millions
Piles	¾	„
Poles, Telephone & Electric Transmission	3½	„
Cross Arms	2	„
Wood Blocks	1½	„ sq. yards
Construction timbers	24	„ cu. feet
Miscellaneous	10	„ „

Even after due allowance is made for the magnitude of that country compared with the Union of South Africa, the figures given above are somewaht staggering and certainly open up vistas of possibilities in the way of future industrial development with a successfully grown local raw product.

Present Position in South Africa.

This country has approximately 600,000 acres of plantations comparing favourably with the best of plantations anywhere. During the life cycle or rotation of a plantation it is necessary to thin it out from time to time to make room for the trees selected to form the final crop. These thinnings mean cutting of a great many trees of pole size and it is evident without going into figures that the poles produced far exceed the maximum that may be required for electric supply or telephone lines.

Strength tests have shown that most of the woods produced are fully as strong or stronger than the woods used for poles elsewhere, but it has long since become equally clear that many of them are nondurable in contact with the ground.

It was for this reason that an experimental treating plant was erected in Pretoria in 1922.

Plant and Processes.

The plant consisted to begin with of steam heated open tanks, a high pressure cylinder, necessary auxiliary equipment and a chemical laboratory.

The plant has been improved upon from time to time so as to make it possible to duplicate any one of the commercial processes used anywhere. There are a great many of these processes that can be divided roughly into "full cell" and "empty cell" treatments.

The "full cell" process is briefly as follows :— After the poles are placed inside the treating cylinder and the door securely fastened, a vacuum is drawn, hot preservative fluid admitted, pressure introduced, cylinder drained and final vacuum applied.

The time required to complete the whole process is only about one hour, but depends on the nature of the wood, kind of preservative used and the degree of absorption desired.

By this process the cell walls become saturated with preservative and as the name indicates, the cell cavities are left more or less filled with preservative.

The procedure with the "empty cell" process is somewhat different. Instead of starting with an initial vacuum, air is actually pumped into the cylinder until a pressure of 50 or more pounds are registered. The preservative is then forced in against this pressure until the desired absorption is obtained. When the cylinder is drained, the compressed air inside the wood expels a certain amount of the free preservative in the cell cavities without detracting from the thoroughness of the treatment of the cell wall intself. To stimulate this action a final vacuum is usually made use of as well.

Regardless of cost the former method is to be preferred, but if the same absorption is aimed at in either case it is evident that the empty cell process would penetrate much deeper into the wood and hence be much more desirable.

With reference to the open tank or non pressure treatment it is interesting to note that it is possible to obtain as high absorptions with this as by pressure processes, but it takes a much longer time.

What is accomplished in the pressure cylinder in an hour may take about 24 hours in an open tank.

Preservatives and Absorptions.

Creosote is undoubtedly a most excellent preservative of old standing. It is effective against all onslaughts by fungi or insects and has a great affinity for wood. Depending on the kind of wood used absorptions may be obtained varying from a very few pounds up to about twenty pounds per cubic foot.

Up to the present time it has not been possible to obtain creosote of the grade required locally so we have had to import it in drums which is somewhat expensive, say about 1/9 per gallon delivered Pretoria.

Our tests with petroleum oils have shown these to possess certain toxic properties and since it is comparatively inexpensive it has been tried both by itself and in various combinations with creosote.

Ordinary tar has preservative qualities but it does not compare favourably with creosote in toxic qualities nor in viscosity and it also leaves a coating on the surface of the timber that interferes with convenient handling of the treated material.

Other oils like carbolinium, solignum, Silvertown, a large number of other proprietory oils and combinations have been investigated numbering fifteen in all.

Aside from the oils there are numerous waterborne metallic salts that have been given a great deal of attention.

The most important of these is Zinc chloride which is used to a very large extent in the United States. Absorptions of solutions vary from ten pounds to thirty pounds per cubic foot of wood equivalent to an absorption of from one half pound to one pound of dry salt per cubic foot.

Zinc chloride costs 3 pence to 4 pence per lb. delivered Pretoria which works out very much cheaper than any of the oils. It is a very good preservative against decay and insects under conditions where the wood is not subjected to serious leaching.

Sodium fluoride is a salt largely used in Europe and has been found here to be very similar to Zinc chloride in every respect.

Arsenite of soda and arsenious oxide have been found to be useful against decay but more particularly so as protection aginst termites,

borers and other insects. Even very weak solutions giving an absorption of one quarter pound or even less per cubic foot of wood has proved very effective. For this reason it is largely used for cattle dips with very good results as well.

The salt itself or strong solutions are very poisonous to man and beast so it should not be handled except by experienced hands.

A total of fourteen different water-borne salts and combinations are being observed under service tests.

In addition to the above, experiments have been carried out with salt treated material coated with oils, alcohol-borne chemicals like naphtaline and others, several molten preservatives like sulphur and in miscellaneous other ways.

Pilot Experiments.

Determination of the relative value of different preservatives applied by various processes to many different timbers is at best a very lengthy performance.

In order to overcome this as far as possible a Termite Experiment Station was started at Pienaars River, Transvaal, in 1923. The site is considered one of the worst termite areas in the Union and the conditions are very favourable for rot as well.

Intensive studies of numerous small specimens, usually 12″ long by 4″ diameter, of untreated wood have frequently shown that these have been completely devoured by termites in less than 12 months, sometimes assisted by decay.

Experiments with over 50 different species of the more common woods have shown conclusively that all sapwood regardless of species is non durable and records have been kept on the relative durability of the various heartwoods in an untreated condition.

Conjointly with these experiments, specimens treated in every imaginable way have been subjected to test with a view to collect data in regard to the actual amount of preservative required to secure immunity as well as the relative efficiency of about forty insecticides.

There are altogether approximately 1,500 specimens that have to be unearthed twice a year when their condition is recorded.

Similar experiments have been carried out on a specially selected site in Durban and one experiment of an international nature, duplicate specimens being tested simultaneously in Australia, the Panama Canal Zone and Hawaii.

In order to get quick results in regard to decay by itself, experiments have been carried out in a similar manner in two of the deep-level Rand gold mines, the Ferreira Deep and Consolidated Main Reef.

A mass of information has been collected that has proven invaluable in connection with selection of preservatives, absorptions to be aimed at, etc., when planning work on a larger scale.

Large Scale Experiments.

Instead of small specimens treated on a laboratory scale, it was a different matter to treat materials like droppers, laths, fence posts, straining posts, building poles, telephone poles, electric transmission poles and piles in the preserving plant.

Small quantities were treated to begin with but as experience was gained the size of the experiments increased so as to make it possible to draw conclusions from average results rather than isolated tests.

The total output from our experimental plant amounts to approximately 100,000 pieces of various sizes and the annual output at the present has reached 40,000 cu. ft.

Most of the material treated last year consisted of building poles for sheds of various descriptions but a number of experiments were initiated with telephone poles and electric supply poles as well. We have treated all told 15,000 telephone and 1,000 supply poles as reflected in detail on the statement aattached.

The forty treatments employed in the pilot tests have been boiled down to about ten in the large scale experiments. These ten will be further reduced as data become available from actual service tests.

Service Tests.

All the treated material has been disposed of at reasonable market prices to Government Institutions, Municipalities or private individuals that are interested in the use of this promising material on a practical scale.

A complete record is kept of all material sent out including particulars of the wood itself as well as the treatment. Each pole bears a metal plate with a number inscribed from which details may be looked up at any time.

Our earliest tests go back to 1923 with fence posts, the first telephone poles were placed in 1925 and electric transmission poles in 1926.

Judging by the present condition of the treated poles compared with the untreated poles placed at the same time important conclusions may be drawn.

The life of the untreated poles may be said to vary from 1½ to 3 years, when they will be found to have either rotted or been eaten by termites to such an extent that they break off at the ground line.

The metallic salt treatments may be said to be effective in poles placed in contact with the ground for 6 to 12 years. The portion of the pole above ground level has a much longer life but that is often of doubtful value.

In order to produce a better balanced pole a very large number have been given an extra butt treatment in oil. This brings the life of the vulnerable portion more in line with the remainder and will probably increase the life of it by at least four years, making a total of 10 to 17 years. This treatment has been adopted as standard for telephone poles used by the Railway Administration. It is an inexpensive treatment when the cost is figured per year of service and it is a general recommendation that poles placed in the ground should be treated in this way and metallic salt for poles used above ground only.

Aside from the intial cost it has been shewn that a full oil treatment is certainly the best and most of the transmission poles sent out have been treated in this way. The life of such poles is accepted in the United States at 30 years from actual experience. In this country, our tests indicate a life say of 15 to 25 years as a conservative estimate.

Relative cost of untreated and treated wood.

Wood	Cost in pence per cu. ft.	Life in years.	Cost in pence per year.
Untreated	12	3	4
Metallic salt Treatment	18	9	2
M.S. and Butt Oil Treatment	24	13½	1.8
All oil treatment	30	20	1.5

*When placed in the ground fully exposed to the weather.

The above figures denote the position as nearly as can be reflected from the service data to date. The treated wood show a greatly increased life at a materially reduced cost per year. In addition to these advantages, replacement costs would be brought to a minimum by using material specially treated for the purpose involved.

As far as strength is concerned the South African poles run considerably higher than the pine poles used elsewhere and we have no record of any breakages nor damage from veld fires.

Metallic salt treated poles take paints very well but not so with the oil treated ones. The oil works through ordinary paints in time and the only one we have found to give satisfaction is a special aluminium paint.

Sizes and costs of wooden poles.

Poles are obtainable from the plantations in almost any size desired but since the cost of them is directly proportional to their cubic contents it is of advantage to use them as small as possible consistent with safety.

The cost of a fully oil treated pole 24′ long with a 4″ to 5″ top is 11/6 while others with the same top diameter increase in price as follows : 27′—15/6, 30′—21/- and 35′—29/-.

The price of a 35′ pole is almost twice that of a 27′ one without being increased in strength in the same proportion. It may be more advantageous therefore to use the smaller pole with reduced escapement as long as the line does not fall below the minimum height required.

Railage is an important item and it is noteworthy in this connection that the South African wood poles can be sent in truckloads at Tariff No. 9 as against Tariff No. 2 for iron poles.

Over a distance of 500 miles the actual rates amount to 183d. per ton against 2,000d. respectively or a saving on the wooden poles of £7 11s. 0d. per ton.

It may also be mentioned that the poles can be placed without base plates or concrete, making erection comparatively inexpensive and there is no need to paint the poles unless that is desired for appearance sake.

Conclusions.

1. South Africa is fortunate in having plantations producing poles on an adequate scale for all potential requirements.

2. The experiments show that these poles can be perfectly seasoned and impregnated with preservatives so as to withstand ravages by fungi, termites or other insects.

3. The service tests indicates that the service life of these impregnated poles will compare favourably with treated poles used elsewhere.

4. The price of the poles is fixed in a favourable relation to their utility and they can be railed at a comparatively inexpensive rate.

5. The use of these poles should go far in making telephone facilities and electricity more generally available at low costs.

6. Wooden poles are in almost universal use in other countries for the above purposes, and there seems no good reason why a considerable local industry should not be developed in South Africa.

Service Tests of Telephone poles and Electric Transmission poles placed in different parts of the Union.

Telephone poles	Transmission poles	Location.	Year placed
310		Vrede	November, 192
677		Nylstroom	February, 192
66		Isidenge plantation	March, 1925
325		S.A.R. Addo	October, 1926
200		Forest Dept. Loerie	November, 192
652		„ „ Fort Cunyghame	June, 1926
	60	Municipality, Harrismith	June, 1926
30		S.A.R. Nylstroom	September, 192
36		Fort Grey	April, 1926
467		S.A.R. Citrus	May, 1926
201		„ Cape Town	May. 1926
46		French Hoek	January, 1926
30		Woodbush	January, 1926
	24	Pilgrims Rest	February, 192
388		S.A.R. Maquassi	April, 1927
20		„ Godfrey—Senekal	April, 1927
126		Forest Dept. Middelkop	May, 1927
54		Klerksdorp—Ottosval, S.A.R	August, 1927
768		S.A.R. Potchesfstroom—Losberg.	September, 192
696		„ Brits—Beestekraal	October, 1927
10		„ George	December, 192
20		„ Acornhoek	December, 192
204		„ Klerksdorp Ottosdal	December, 192
535		„ Maquassi	January, 1927
774		„ Oudtshoorn	January, 1927
20		„ Maquassi	February, 192
200		„ „	„ „
150		„ „	„ „
320		„ „	March, 1927
190		„ „	January, 1927
85		„ „	April, 1927
30		„ „	January, 1928
10		„ „	February, 192
	100	Cradock	February, 192
36		Ermelo	March, 1928
36		Fort Grey	April, 1928
	30	Ladybrand	May, 1928
43		Berlin Plantation, Godwin River	July, 1928
26		„ „	June, 1928
613		S.A.R. Empangeni	June, 1928
12		Waterval Klein Sabie	July, 1928
13		Telegraph Inspector, Bloemfontein	August, 1928
18		D.F.O. Port Elizabeth	August, 1928

Telephone poles	Transmission poles	Location.	Year placed
924		S.A.R.	December, 1928
98		Forest Dept. Waterval.	February, 1929
145		" " "	March, 1929
100		" " Lottring	April, 1929
24		" " Tweefontein	April, 1929
782		Telegraph Inspector, Kimberley	May, 1929
32		Forest Dept. Harrismith Plantation.	June, 1929
32		Telegraph Inspector, Wonderkop	July, 1929
2		Schuttesdraai	July, 1929
10		Telegraph Inspector, Breyton	August, 1929
24		" " Bothaville	August, 1929
75		Forest Dept. Witte Els Bosch	August, 1929
130		Telegraph Inspector, Empangeni	August, 1929
104		Forest Dept. Lottering	April, 1929
800		Telegraph Inspector, Molteno	October, 1929
60		" " Arlington	November, 1929
300		" " Molteno	November, 1929
234		Forest Dept. Klein Australia	November, 1929
99		Telegraph Inspector, Koopmansfontein	November, 1929
72		Storms River, Assegaibosch	December, 1930
	13	Pretoria Municipality	December, 1930
	15	Boschoff Municipality	December, 1930
73		G.P.O. Flexington	November, 1930
35		Forest Dept. Port Durnford	November, 1930
20		G.P.O. Vermaas	November, 1930
30		Telegraph Inspector, Koopmansfontein	November, 1930
21		Tinley Manor	November, 1930
22		G.P.O. Umhlatuzi	November, 1930
40		Forest Dept. Grenshoek	November, 1930
290		Electrician (G.P.O.) Kwambonambi	November, 1930
7		G.P.O. Memel	November, 1930
5		" "	November, 1930
	10	Pretoria Municipality	October, 1930
20		Telegraph Inspector, Capetown.	November, 1930
15		Forest Dept. Ceylon	October, 1930
120		" " Coetzeestroom	September, 1930
	40	Newcastle Municipality	September, 1930
70		Forest Dept. Storms River	September, 1930
	8	Hartebeestpoort Expt. Station.	September, 1930
40		Forest Dept. Lottering	August, 1930

Telephone poles	Transmission poles	Location.	Year placed
	50	Pietermaritzburg Municipality	August, 1930
	12	Pretoria Municipality	August, 1930
3		S.A.R. Johannesburg	August, 1930
	50	Pretoria Municipality	July, 1930
15		De Hoek Forest Reserve	July, 1930
65		Forest Dept. De Hoek	July, 1930
200		G.P.O. Umfolosi	July, 1930
107		„ Umhlali	June, 1930
26		Telegraph Inspector, Lothair	June, 1930
12		Forest Dept. Elgin	June, 1930
12		Telegraph Inspector, Vermaas	May, 1930
630		„ „ Utrecht	March, 1930
57		Forest Dept. Ceylon Settlement	March, 1930
270		„ „ Tweefontein	March, 1930
141		„ „ Sabie	February, 1930
	70	A.E.G. Maquassi	February, 1930
	35	„ Nylstroom	February, 1930
	335	„ Nylstroom	Jan. or Feb 1930
	72	Pretoria Municipality	March, 1931
	60	„ „	February, 1931
119		Forest Dept. Utenhage Division	February, 1931
387		G.P.O.	February, 1931
52		Forest Dept. Blaauwkrantz, Knysna	January, 1931
	50	Harrismith Municipality	January, 1931
15,388	984		

DISCUSSION.

The President : We are all very much obliged to Mr. Eckbo for contributing this paper to our proceedings. It is not considered likely that a municipality will erect wooden poles in the main streets, but where long transmission lines are required to supply farms some distance away, wooden poles are most useful, especially in vew of the cheaper cost. I am sure I am voicing the wishes of all here in proposing a hearty vote of thanks to Mr. Eckbo.

Mr. Roberts (Durban) : We are very much indebted to Mr. Eckbo in bringing this paper before us and I am sorry we have not heard of this official or the activity of the Government in developing the use of wooden poles for electrical purposes before. This is the first time at our conventions that the Forestry Department have thought to bring their activities to our attention.

It is very unlikely, in the larger municipalities, that wooden poles will be used in the urban area itself, As some municipalities are extending their lines to thinly populated parts of the country, if prices of electricity are to be kept within reasonable limits, it will be necessary to reduce the cost of transmission.

In Durban we have been active in putting electricity over a large area. We have used some creosoted wooden poles which we purchased in England, impregnated in accordance with British standard specifications. We have not yet had them in long enough to form an idea of the life. If the life of the poles does not come up to our expectations, we shall be able to replace these quite economically. If the expectations of the Forest Department are realised, then there is no doubt, I think, that there should be a very large future for these poles in the extension of electricity to rural parts. This is very important so that the country dwellings and the farmers shall be able to get electricity supplies the same as the townsmen. No mention is made of the kinds of timber treated, but I suppose various kinds have been tried. I should like to know from what trees the transmission poles have been cut.

Mr. B. Marchand (Witbank) : I would be glad to know if treatment affect the twisting of wooden poles, as untreated poles have twisted causing trouble with the wires. Has Mr. Eckbo any figure shewing the tensile strength of the poles?

Mr. J. Roberts (Durban) : We have had trouble with poles that have cracked and split very badly. Mr. Eckbo has referred to splitting. I would like to know if the poles split before inpregnation, if not the oils would not reach the centre.

Mr. L. B. Sparks (Pietersburg) : Mr. Eckbo's paper is a very useful one. Smaller Municipalities required cheap poles and when sufficient revenue was earned wooden poles could be replaced with iron ones. I have had untreated poles in use for 10 years fitted into second hand piping so that the pole did not therefore come in actual contact with the ground. I do not use cross arms but fasten the insulators direct to the pole.

Mr. Metelerkamp (Salisbury) : Pienaar's River is described as the worst locality for termites and it would be of interest to know if the Forest Department had supplied any poles for any transmission lines in that area or have tests been confined to their investigation station, and were locally treated poles as good as those imported from overseas, so far as warping and other features are concerned. I question whether the mounting of insulators on poles as referred to by Mr. Sparks is not against Government regulations as in the event of a cracked insulator there would be trouble.

Mr. T. Millar (Harrismith) : In 1926 I used 60 wooden poles for transmission work outside my town areas and they have stood up very well indeed. It was a straight line and there is no indication of twisting or cracking.

Mr. Vowles (K. W. T.)My experience is similar to Mr. Millar's and I would have no hesitation in buying more wooden poles. I have experienced no trouble as regards opening-up, shrinking, twisting or cracking and have every confidence in the poles.

Mr. E. Poole (Durban) : When at Silverton I saw some wooden poles very badly cracked and I was able to penetrate them with a knife blade some four inches. I am of opinion cracking must weaken the poles and that was a point to bear in mind when selecting them. The poles in use at Durban are generally 30 feet in length, the diameter being 6 inches at top and 8¾ inches near the butt. I notice that the poles at Silverton were not so regular in their shape as they are in Durban the uneveness where the branches had been were not shaved off as closely as might be. Imported poles seem to go through a machine, and are perfectly straight, with scarcely any sign of where any branches have been.

Mr. I. J. Nicholas (Umtata) : I have tried 30 poles and am quite satisfied with them, but I think their appearance is against them and for that reason I did not use them in the centre of the town. As regards the class of wood, I think gum or pine might prove a better looking pole. I have been 12 months in getting information from the Forest Department and I think they should advertise freely.

Mr. J. Vowles (K. W. T.) : Local Forest officers do not apear to have any information, one has to apply to headquarters and that should not be so.

Mr. J. J. Wud (Swellendam) : A number of wooden poles are in use on the outskirts of this town and if there had been no alternative it is doubtful whether, with the comparatively high cost of suitable steel poles, we would have been successful in obtaining these additional consumers. A number of gum poles were planted direct in the ground and others bolted to five lengths of railway metal lightly concreted in the ground. This is a very satisfactory method and overcomes the trouble of rotting at the ground level and below. The poles were given two coats of tar and have given no trouble.

I have also treated a number of poles and incidentally other woodwork with ordinary Fuel Oil. These poles so treated after a short period take an ordinary paint very well.

REPLY.

Mr. Nils B. Eckbo : In regard to the remarks that poles were not advertised and also that local Forest officers knew very little about the work that has been goining on, I am afraid are only too true. The reason is that we have been carrying on on a very small experimental scale. Since we started we have had more enquiries for treated material than we could deal with. The whole output has been absorbed without any advertising.

I hope we shall be able to increase the output of poles over and above future increased demand, and would then go ahead with advertising. When results justify, it is our hope that private firms will take up the treatment on a large scale. We intend informing the local officers more fully as to what we have been doing.

Kind of timber. Our experiments have been carried out with, I suppose, the best part of 50 different species other than indigeneous. Sap wood is invariably subject to very rapid decay. As regards heart wood, some species are very durable, others rot readily.

Cracking is a fairly common feature with many woods; some gums split into four sections at the butt. During the seasoning before the treatment, we let the poles crack as much as they like. Poles must be absolutely dried regardless of how much cracking you get. If you don't and you put unseasoned wood into preservative, you will save cracking, temporarily, at the expense of durability While cracking causes a samall reduction in the strength of a pole it is not sufifcient to detract from the utility of a sound pole.

Straightness. Some of the worst looking poles are frequently the best poles as far as durability is concerned, while beautiful straight poles are sometimes very poor. Saligna or Pine poles are beautifully straight but rot rapidly. They absorb preventatives readily but you have the cracking in Saligna which is sometimes very bad. Bear in mind,, durability ahead of appearance.

"Metallising wood. We have done no metallising in connection with poles and the only metallising I know of has been with aeroplane propellors, making them waterproof by sheathing.

Twisting of poles. Several speakers have stated they have not been troubled with twisting. I have had reports from certain parts of the country, where twisting has been considered a serious item. Unfortunately it is very difficult to ascertain how much twisting is going on. A man will say the poles turn round and look at you. In Pretoria we erected a line with poles with metal rods at top and bottom, and over a period of two years we measured the movement by means of plumb bob over a fixed point on the ground. The movement was, practically speaking, very small indeed. I think your President carried out an experiment on that point and satisfied himself. It is an item, to my mind, of not sufficient importance to interfere seriously with the usefulness of the poles, but care should be taken in their selection and preparation.

For telephone lines, and it would hold for transmission lines, you cannot string the wires as tightly as you can with steel and iron poles. There is admittedly a very slight movement in connection with the wooden pole which you do not have in the others. A certain telephone line erected on wooden poles was stretched very tightly and caused trouble by snapping until the wire was relaxed. With wooden poles you must not stretch your wire tightly.

"Tensile strength. The strength of hardwoods like birch or maple equal, weight for weight, to that of poor grade iron, but this is of little value as the wooden pole is not subject to direct tension. In comparative tests many eucalypts are stronger than birch or maple hence they would also compare favourably with poor grade iron."

Shrinkage. The shrinkage in poles from the green to an air dried condition is not great and any fluctuations that take place in the preserved pole due to changes in weather conditions is usually considered negligible.

The quality of locally produced as compared with imported poles is difficult to gauge at the present because we are not yet in position to make many comparisons. It may be admitted however that the imported article has a better appearance, but they are not as strong as our hardwood poles. As far as durability is concerned the indications are very strong that the locally produced poles will compare favourably with the imported.

Degeree of Impregnation. When it comes to the impregnation of eucalyptus and most hard woods, with few exceptions, even under heavy pressures, it is not possible to impregnate the hard heart portion, the preservative only penetrates the sap. We have tried with an incision instrument to get at the heart without success. A section of a treated gum pole which shows typical absorption from the outside leaving the inside core untreated. This outside portion is ordinarily sufficient to protect the inside portion so it is not necessary to treat 100% of the poles to have it durable. The heart itself is in some hard woods durable by itself. When it comes to a pine pole then you can treat it right through to the middle without much difficulty. I placed some poles of pinus pinneter in a pergola in my garden, and planted creepers each side of the poles. Water was applied round the creepers yet I found that after seven years the poles were perfectly all right.

Price and Weight. The price f.o.r. Pretoria West and weight of different sized poles treated full length with oil are as follows :

Length Feet	Diam. Top inches	Approx. weight lbs.	Price each f.o.r. Pretoria West
24	4 to 5	250	11/6
24	5 to 6	300	15/–
27	4 to 5	325	15/6
27	5 to 6	450	20/6
27	6 to 7	600	28/–
30	4 to 5	450	21/–
30	5 to 6	550	27/–
30	6 to 7	750	36/–
35	4 to 5	600	29/–
35	5 to 6	800	39/–
35	6 to 7	1,100	50/–

*Poles treated throughout with metallic salt and given an extra butt treatment with oily cost approximately 15% less than the above poles.

A question has been asked why locally produced creosote is unsuitable?

The creosote used in other countries have to meet very detailed grade specifications. These grades have proven very satisfactory over a long period of years. We have unfortunately not been able to obtain locally made creosote to the above specifications but we are experimenting with the local product on a small scale and hope that the results will be favourable both as to the quality and price. When this comes about it may be taken for granted that we shall take full advantage of this supply.

I am very pleased indeed that several of the engineers present have already used wooden poles for some time and have found them sufficiently satisfactory to inspire full confidence.

If my replies to the many questions raised are not sufficiently clear or further information is desired on other points, I should welcome correspondence later on.

The President : We are very much indebted to Mr. Eckbo for coming here to-day and I propose a hearty vote of thanks for so very interesting a paper. **Carried by acclamation.**

VISIT TO JOHANNESBURG.

(S.A. Lamp Association). The party then motored to J.H. Burg. where they were entertained to lunch by the S.A. Lamp Association, after which Mr. E. S. Evans of the Lamp Association gave the following lecture :—

THE DEVELOPMENT OF THE LIGHTING MARKET IN SOUTH AFRICA.

BY E. S. EVANS Director, S.A.E.L.A. Lighting Service Bureau.

Lighting, the Foundation of Electrical Industry.

Throughout the world the development of the electrical industry has made rapid strides since its comparatively recent inception. Electric light created the demand for electricity, and the original electrical supply plants were laid down for supplying current for lighting purposes. This is particularly the case in South Africa, and in Mr. E. Poole's excellent historical contribution to the 21st Birthday Celebration Number of the Journal of the South African Institute of Electrical Engineers, he gives details of the foundation of the lighting undertakings in the principal cities and towns of South Africa. Kimberley was apparently the first town to use electricity, when in 1882 plant was laid down to supply current for street lighting. In 1886 the Durban Corporation installed plant for lighting the Town Hall; in 1891 the Johannesburg Lighting Company installed plant for street lighting purposes, and in 1895 the Cape Town and Suburban Lighting Syndicate installed plant for domestic lighting purposes.

From these small beginnings, the present-day Supply Undertakings have matured; the result of constant endeavour and consideration to the development of the new uses for electricity.

Misuse of Modern Electric Light Sources.

Electric light was so much better than all previous illuminants that it was rapidly adopted by the public in all phases of life, and the majority of Supply Undertakings felt that its development could well take care of itself. From time to time new and more efficient light sources were introduced and quickly adopted by the consumer. Unfortunately, few appreciated that new forms of electric light sources needed special application; the misuse of electric light was not peculiar to South Africa, and when shortly after the war, a rough survey was made throughout the world of existing lighting conditions, it was found that approximately 90% of lighting installations were utilising modern electric lamps in equipment designed for the early types of low efficiency small candle power lamps. Even in more developed countries similar conditions obtained. Several of the large electric lamp and lighting fittings manufacturers commenced individual development campaigns, but few met with the success they deserved, probably owing to the fact that consumers imagined their efforts were merely of a commercial nature and not with a view to improving lighting conditions.

Glare.

The principal defect in the existing lighting conditions was that larger sizes of clear gasfilled lamps were being used in open type obsolete reflectors, the resulting glare being almost unbearable, and it was no uncommon occurrence to hear of a lighting installation described as having too much light. Actually, too much electric light is difficult to imagine, if used in the correct manner, as the intensity of light on a bright day would be as high as 5,000 foot candles—in the shade 1,000 foot candles, and in a well-lighted room 200-300

foot candles. In a well artificially lighted interior, the intensity would be in the region of 15-25 foot candles, which clearly indicates that we must advance considerably before approaching anything like daylight intensities, although it must at all times be remembered that the method of installation has everything to do with the lighting effect. It was therefore seen that glare was acting as a considerable brake to lighting development and methods had to be introduced to eliminate obsolete lighting installations before the consumer could obtain the fullest benefit from the development of artificial light sources.

History of Development of the Electric Lamp.

The evolution of the electric lamp is of great interest; the first suggestion of obtaining light by electricity was in 1802, when Sir Humphrey Davey presented before the Royal Society of England a demonstration in which he passed electric current through a platinum wire and heated it to incandescence. In 1841 the first electric lamp patent was granted to an Englishman, Frederick de Moleyns (English Patent No. 9,053, August 21st, 1841). Numerous electric lamp patents were then granted including J. W. Starr (Patent No. 10,919, November 4th, 1845), de la Rue, Grove, Staite, Lane Fox, etc., all utilising either platinum, iridium, carbon or graphite as light sources.

Carbon Lamp.

It was not until 1878 that the first commercially successful electric lamp was introduced, when Swan (Great Britain, December 1878) and Edison (U.S.A., October 1879) produced their electric lamps with filaments of carbon, each being the result of many years of patient research by these two famous inventors.

The early carbon lamp consumed nearly six watts per candle and emitted only 8 or 16 candle power. Improvements were obtained in candle power and these lamps were the principal source of electric light until 1906, although during that

period several others were introduced, but did not meet with great commercial success. These included those of Dr. Walther Nernst 1897, with a filament consisting of a pencil of rare earth oxides such as Cerium and Yttrium; Dr. Auer Von Welsbach 1898 with a filament of Osmium, and Dr. Werner Von Bolton 1903 with a filament of Tantalum.

Tungesten Lamp.

In 1904 Just and Hanaman (Austria) discovered a method of producing a filament of tungsten, from which a lamp was produced and marketed in 1906, known as the Squirted Tungsten Filament Lamp. The filament burned in vacuum and consumed slightly over one watt per candle, a considerable improvement in efficiency over previous lamps.

Unfortunately, owing to the process of manufacture, these lamps were very fragile, but in 1908 Dr. William Coolidge (U.S.A.) invented an improved process for the production of tungsten filaments, in which tungsten was made ductile by the swaging or hammering principle. This remarkable introduction paved the way for the manufacturer of the present day efficient and higher candle power lamps. By this method, filaments as small as .0005 inches diameter have been produced.

Until 1913 the majority of filaments had burned in vacuum, for if the bulbs were not exhausted the hot filament would chemically combine with the oxygen in the air and evaporate. A practical instance of this is when, owing to faulty manufacture or mechanical damage, air enters the bulb and the filament evaporates into a yellowish white smoke and the bulb becomes coated with powder of this colour, actually yellow trioxide of tungsten. Burning the filament in vacuum also eliminated the loss of heat by convention and conduction.

Gasfilled Lamp.

In 1913, Dr. Irving Langmuir (U.S.A.) discovered that by inserting an inert gas, such as nitrogen or argon, into the bulb and altering the the design of the filament, the filament could be burned at a much higher temperature, thus improving the efficiency of the lamp, which in the larger sizes is half a watt per candle, although this decreases in the smaller sizes.

The gasfilled lamp has rapidly made its mark for artificial lighting and many further improvements have been introduced by the principal lamp manufacturers during the past few years, the most recent being the introduction of bulbs of opal and internally frosted glass.

Lamp Specifications.

It will be appreciated that, as with all other products, cheap and inferior copies have been made and the difficulties of large consumers became so great that it became necessary to set up stringent specifications for electric lamps, for such matters as life, light efficiency, current consumption, etc.

The British Engineering Standards Association (B.E.S.A.) Specification No. 161 (1930), for Tungsten Filament Electric Lamps, is probably the most important and critical specification introduced for electric lamps, and throughout the world large consumers are demanding that their lamps comply with this specification. In addition to this specification, the lamps manufactured and supplied by Members of the South African Electric Lamp Association also comply with a very strict specification adopted by the leading manufacturers throughout the world, and in order to ensure that lamps of all Members strictly comply with these specifications, a large testing laboratory has been set up at Geneva, where the products of all Members of the Lamp Association are constantly tested. In addition to this central testing laboratory, the principal manufacturers

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have their own testing and experimental laboratries, and from time to time important methods of lamp manufacture are discovered. These are leased to other Members of the Association in order that at all times the products of Members shall be of the highest possible efficiency and quality.

Light Economics.

Need for the highest possible efficiency of an electric lamp is not generally appreciated, but the following example taken from B.E.S.A. Specification and present conditions, shows very definitely the price of current and efficiency are the greatest factors in the economics of light production.

Economics. Depends on three factors—

1. The Efficiency of the Lamp.
2. The Price of the Lamp.
3. The Price of Current.

EXAMPLE.

230 V. 100 W. Lamp. 1,000 hours life, 1,160 Lumens initial output (Average 90%=1,044 lumens). Current 6d. per unit. Price of Lamp 4/-.

$$\frac{\text{Lumen output x Life of Lamp}}{\text{Cost of Lamp + Current}} = \frac{1{,}044 \times 1{,}000}{4/- + 50/-}$$

All factors normal	1,611 lumens hours per 1d.
10% reduction in price of lamp	1,623 lumens hours per 1d.
10% improvement in light output	1,772 lumens hours per 1d.
10% reduction in price of current	1,776 lumens hours per 1d.
Lamp Free.	1,740 lumens hours per 1d.

Time does not permit of further details of lamp manufacture or the economies of electric lamps, but if required, they will be readily supplied by the Saela Lighting Service Bureau.

Lighting Development Methods.

Many of the large lamp and fittings manufacturers considered the best methods of developing the lighting market, and bringing lighting conditions up to modern standards, and it was eventually decided that only by co-operative methods could fullest success be achieved. Realising that light is difficult to discuss with the layman, the obvious method of development is to demonstrate to the consumer the most suitable lighting scheme for his work or conditions, also, it is necessary to have available some source from which the consumer could receive free, unbiassed advice and information on all systems of lighting, therefore several Lighting Service Bureaux were established in U.S.A. and Europe.

These Bureaux achieved great success, all co-operating in their work, there being a central organization from which the results of the research and practical development of all countries are distributed to all Bureau.

Saela Lighting Service Bureau.

The South African Electric Lamp Association, a branch of the International Organization, decided a Bureau was necessary for the satisfactory development of illumination in South Africa, and the Saela Lighting Service Bureau was opened on February 14th, 1930. Johannesburg was the natural centre, but in the course of time it may be possible to set up Bureaux in other important areas in South Africa. Meanwhile, the Bureaux Manager from time to time, undertakes lighting activities in provincial areas, when lectures and demonstrations are arranged for the electrical trade and the principal bodies of consumers.

The Bureau is financially supported by all Members of the South African Lamp Association, and the equipment used in the Bureau is obtained from all Members and changed when new and improved designs are introduced. Advice and in-

formation given is entirely free and no efforts are made to compel visitors to buy from Members. Many suppliers outside the Association naturally derive considerable benefit from Bureau activities, but it is realised that being the principal suppliers of lamps and lighting equipment, Members must of necessity obtain the largest share of benefits; also, many larger consumers show their appreciation of the Association's bold development policy by giving full support to its members products.

Interior of "SAELA" Showroom.

The cost of organizing a Bureau in any country is very considerable, but with support from Municipalities, Government Departments and large consumers, the lamp market will undoubtedly grow with rapid strides, and the Members of the Association will then find it possible to allocate more funds for development work.

Value of Lighting Loand.

It is generally considered that the lamp manufacturer has most to gain from lighting development, but a little thought will quickly show the

fallacy of such an idea. A 100 watt lamp, in the course of its life of 1,000 hours, consumes 100 units of electricity, which, at 6d. per unit, which is a fair average for lighting in this country uses 50/- worth of electricity. The cost of that lamp to the public is 4/-. out of which the manufacturer has to manufacture the lamp, ship it to this country, allow a reasonable discount for the electrical trade to re-sell, and to advertise and develop the use of electric lamps. It will thus be seen that the Electricity Supply Undertaking has considerably more to gain from lighting development than the lamp manufacturer.

Some returns from a questionnaire form recently sent out to Supply Undertakings, show that for 15 towns varying from populations of 60,000 to 600, the percentage annual output for lighting purposes was 56%, while the percentage revenue for that current was 76%, definitely proving that the lighting load does pay very handsomely.

Showrooms.

To further assist in lighting development, it is suggested that Supply Authorities, Electrical Contractors and Manufacturers should organize showrooms where all classes of consumers may see correct lighting for their particular requirements.

The general method of suspending from the ceiling numerous lighting fittings of all types, does not meet with the fullest success, and while it is not possible to set up a Lighting Service Bureau in every town, there is little doubt that the scientific layout of a showroom will do much to help the consumer to appreciate the lighting effects in his or her particular surroundings.

When the layout of the Bureau has been demonstrated, it will be seen that it is not a question of lavish expenditure, but a question of careful consideration of layout, with regard to the impression given to the visitor. In order to be successful, it is of course essential that Bureau work should have a sound engineering and

scientific foundation, but it must be of a practical nature, principally by demonstration and the distribution of appropriate literature. Already the work of the Bureau has met with considerable success, and numerous instances can be given of modern up-to-date installations in public buildings, shops, factories, private dwellings, etc., as the result of the owners receiving information and advice from the Bureau.

Excepting those who have had the opportunity of visiting Europe or America during the past few years, it is difficult to appreciate the possibility of the lighting market; some of the larger stores have an all-day and evening load of of 2,000-3,000 Kilowatts, and even small shops have a load of 8 or 10 Kilowatts instead of the usual few hundred watts. Theatres, restaurants, public buildings make lavish use of lighting effects, all to the eventual benefit of the electrical manufacturers and supply undertakings.

Conditions in South Africa.

At the present time it is difficult to make a reasonably accurate estimate of the value of the lighting market in South Africa, but from observations it must be a very considerable figure, especially when one remembers that approximately one third of one's waking life in South Africa is spent in artificial illumination. Accurate statistics of lighting conditions in South Africa are lacking, but a questionnaire form has recently been sent out by the Saela Lighting Service Bureau to every Supply Undertaking in the country, and already a considerable number of replies have been received. The completion of this questionnaire form naturally involves a certain amount of work by the Supply Undertaking, but it is confidently anticipated that the information obtained will well compensate for trouble involved, and when all forms are eventually returned, the information will be carefully tabulated and circulated to all Supply Undertakings.

In the short time available it is impossible to enter even briefly into the question of lighting fundamentals, light measurement or the design of fittings and equipment for various purposes, each of which can be the subject of an individual lecture. Under the circumstances, it is proposed to briefly demonstrate the layout of the Bureau and the method of demonstrating to visitors.

Layout of Bureau.

In arranging the layout of the Bureau, consideration is given to the fact that the average consumer knows little or nothing of modern methods of illumination, and is very sceptical as to the results to be obtained. It is therefore necessary to substantiate all statements by some practical demonstration or experiment, which is supplementary to the main lighting demonstrations. Although there are many types of lighting units in the Bureau, all are arranged in a definite manner and show some particular method of lighting,

Industrial Lighting.

Let us first consider the question of industrial lighting,

Six Drop Pendants.

This is a typical example of factory lighting employing shades designed for use with carbon lamps, but being used with modern gasfilled lamps. The result is extremely objectional glare, insufficient light on the working plane, and a generally gloomy appearance. Surveys show that this is a most prevalent type of factory lighting installation.

Accidents.

In addition to the foregoing disadvantages, such a system is definitely conducive to accidents and reports of factory inspectors show that 29% more accidents occur during the hours when artificial light is being used. It must be appreciated that the majority of factories are incorrectly

lighted, and the Chief Inspector of factories of Great Britain stated that, as a result of careful investigation, he saw no reason why this percentage should not be reduced to that of daylight hours, if the lighting installations were brought up to reasonable modern standards.

The enormous cost of accidents to industry is clearly shown in the British Government report covering the period 1919-28 inclusive, when as the result of industrial accidents 27,910 persons were killed and 4,144,721 were injured; the cost in compensation alone reached the amazing figure of £61,000,000, and it was estimated that as the result of loss of output, difficulties in replacing skilled labour and idle machinery, this figure would eventually reach the astounding sum of £300,000,000. In this respect alone, good lighting is well worthy of consideration.

(2) 500 Watt Bare Lamp.

This is an instance of a lighting system employed by the consumer who imagines that, if he instals one of the largest electric lamps obtainable, he must obtain the best lighting effects. Here the glare is almost unbearable and the distribution of light extremely bad, and everywhere are hard shadows together with a most unpleasant general appearance of the room. To be satisfactory, a lighting system must have good distribution and in order to prove the good or bad points of each system, foot candle readings of the various lighting installations have been taken in nine set positions in the Bureau. Under this system the readings are as follows :—(1) 1½. (2) 11. (3) 2½. (4) 3½. (5) 32. (6) 2½. (7) 2. (8) 6. (9) 2. Total 63. Average 7. Diversity Factor 21-1.

Such a diversity in the amount of light in an installation is definitely undesirable, and in this installation the hard shadows make work difficult, distort the shape of objects and are often the cause of accidents.

(3) Concentrating Reflectors.

In this system there are employed scientifically designed reflectors which concentrate light in the downward direction, and glare has been eliminated. There is a decided improvement in the installation, but owing to the light distribution of the reflectors they are unsuitable for use as at present installed, resulting in patches of light immediately below the reflectors and dark areas between. Concentrating reflectors should only be used with either close spacing or at considerable mounting height. The foot candle readings of this installation are as follows :—
(1) 3½. (2) 20. (3) 12. (4) 6. (5) 18. (6) 7. (7) 4½. (8) 14. (9) 5. Total 90. Average 10. Diversity Factor 6-1.

Illumination and increased Efficiency.

On seeing this installation many factory owners might be inclined to think that it would be quite suitable for their work, and when the question of intensity of light was discussed, would feel that the suggestion of higher intensities to improve output and general conditions, was merely an effort on the part of the salesman to sell more lamps and fittings. The simple but convincing demonstration of a revolving disc on a gramophone motor under varying intensities of light, readily shows that higher intensity lighting definitely assists in one's ability to see detail.

Illuminating Engineers in conjunction with factory executives have from time to time carried out a considerable number of investigations and tests, all of which have proved conclusively that higher levels of illumination result in increased production.

The Department of Scientific and Industrial Research of Great Britain was particularly interested in this question, and to prove the statements of Illuminating Engineers, carried out an exhaustive investigation into the effects of artificial light upon type-setting by hand, which was

considered to be one of the most trying and difficult of manual operations. The following chart shows in graph form the findings of the investigation, and it will be seen that 24 foot candles can be effectively used in this work without wastage and that 20 foot candles are required to reach daylight levels of output.

(4)Standard Dispersive Reflectors.

As the result of lighting research and experience, a standard industrial reflector has been designed which is suitable for 90% of lighting installations, and is known as the Standard Dispersive or R.L.M. Reflector. It is generally made to B.E.S.A. Specification No. 232 for Industrial Dispersive Reflectors No. 1, which details such points as dimensions, degree of cut-off, minimum percentage of reflection, etc. Under an installation of such reflectors, it will immediately be seen that the distribution is practically even, harsh shadows are eliminated and there is no glare; an almost ideal system of lighting for the majority of working conditions. It will be observed that the lamps used are of the diffusing type, either bowl sprayed, white sprayed or opal, this being in keeping with the general recommendation that open type reflectors should be used with diffusing lamps if mounted less than 20 feet from floor level.

The foot candle readings of this installation are as follows:—
(1) 10½. (2) 12. (3) 12. (4) 11. (5) 12. (6) 11. (7) 10½. (8) 12. (9) 12. Total 103. Average 11.5 Diversity Factor 1.14-1, an installation showing a low diversity factor and good intensity.

Many would imagine this installation to be sufficiently high in intensity for the majority of work, but it is now no uncommon occurrence to find factories in America and Europe using general lighting installations of 30 foot candles. The foot candle intensity obtained from this installation is not as high as possible, owing to the lamps being purposely underrun 10%; quite common practice,

owing to the belief of a large number of consumers that the life of a lamp is its sole criterion, without regard to efficiency or light output compared with consumption. There is a definite constant for Tungsten Filaments namely, that a 1% drop in voltage causes a 3% drop in light output with a 1.5% drop in current consumption. In this instance the result is that 30% of the light is being lost. By using the rated voltage (230) our foot candle readings will prove the truth of this statement. The readings now being :—

(1) 15. (2) 18. (3) 19. (4) 17. (5) 19. (6) 18. (7) 15. (8) 18. (9) 19. Total 158. Average 17.5. Diversity Factor 1.26-1.

It is natural that varying intensities will be required for different classes of work, and committees have carefully investigated all conditions and recommended foot candles intensities have been laid down, which for certain industries, are as high as 50 foot candles. Saela Electric Illumination Handbook No. S.A.1. includes details of lighting intensities recommended for various classes of work.

It is only as a result of training and experience that the Illuminating Engineer is able to recommend the most suitable method of obtaining these intensities, and in addition to advice which is readily given by the Bureau, the majority of manufacturers employ illuminating engineers to advise consumers.

Commercial Lighting.

It will have been observed that for Industrial Lighting some form of direct lighting is used, by means of reflectors directing the light in the downward direction. For Commercial Lighting different methods of light distribution are employed, as the principal aim is to create a bright appearance in the whole of the office or shop. For that reason, the totally enclosing unit is one of the most popular and suitable types, as is shown by the installation of six totally enclosing units. A bright, inviting ap-

pearance is created, together with sufficient light on the working plane, and harsh shadows and glare are entirely eliminated. Under this system the foot candle readings are as follows :—
(1) 18. (2) 20. (3) 20. (4) 18. (5) 20. (6) 16. (7) 16. (8) 16, (9) 20. Total 164. Average 18.25. Diversity Factor 1.25-1.

Other types of installations for commercial lighting include artificial daylight, in which daylight blue lamps or daylight diffusers are employed, also totally indirect units give a pleasing effect, entirely free from glare and almost entirely free from shadow.

Of recent years, architectral lighting has been widely used for commercial purposes, but whenever such methods are considered, complete cooperation between the architect and illuminating engineer must be obtained, otherwise the lighting effects may be entirely out of harmony with the architectural and general decorative scheme.

Shop Window Lighting.

Shop Window lighting is becoming increasingly appreciated and used by modern shopkeepers, and in the demonstration shop window various lighting methods can be effectively shown.

Suspended bare lamps are the most common methods employed but are entirely unsatisfactory owing to the prevalence of glare, waste of light and unfavourable appearance of the window. By raising these same lamps into correct focus with suitable shop window reflectors, it will immediately be seen that conditions have entirely changed by the elimination of glare and waste light, and there is about three times the amount of light on the display. In addition, the window now has a most favourable appearance and a stage lighting effect has been created. The intensity can be increased by adding extra reflectors or larger lamps.

The general recommendation for window lighting is as follows :—

Shops in Main Streets : 1, 100 watt Gasfilled lamp in Shop Window reflector, every one foot run of window.

In Central Areas : 150-200 watt lamps should be used.

Shops in Side Streets : 1, 100 watt Gasfilled lamp in Shop Window reflector every two foot run of window.

Footlights and Sidelights may also be used, but must always be arranged to be free from glare.

Coloured lighting makes an irresistable appeal and can be easily adapted to the modern shop window reflector by means of colour screens of either gelatine or glass colour media. Coloured lamps can also be used, although not with such good effect.

Special Lighting Problems.

Street lighting, Foodlighting and Poster lighting can also be effectively demonstrated by means of carefully arranged installations in the Bureau. Each subject is too involved to discuss in the time at our disposal, but it will be seen that the exhibits are very comprehensive.

Domestic Lighting.

The domestic lighting load is of great importance and value to the electrical industry, but in probably no other sphere is electric light so frequently misused. To effectively demonstrate the tne requirements of domestic lighting, three small rooms fitted as a lounge, bedroom and kitchen, have been equipped to show incorrect and correct methods.

A brief demonstration will show how effective is this arrangement, especially when all outlets are arranged for quick interchange of fittings.

This method of installation is ideal for electrical showrooms, as it is possible to show the customer any type of fitting in appropriate surroundings.

During the short time at my disposal, it has only been possible to deal very briefly with the lighting requirements of the various fields, but each can be made the subject of an interesting individual lecture.

From time to time, courses of lectures are given to staffs of Members of the South African Electric Lamp Association, and recently a course was given to the Engineers and staffs of Municipal Undertakings in the Transvaal, at which there was a regular attendance of between 55 and 65. It is intended to give other courses in the near future in the Transvaal area, and also during a forthcoming tour of Provincial areas, Illumination Design Courses will be given in Cape Town Durban, Port Elizabeth and East London.

The Bureau is open to the public, but it is especially hoped that all sections of the electrical industry will make every use of its services, and whenever possible introduce customers who are interested in any lighting matters. To the Engineers situated at long distances from the Bureau, written advice will always willingly be given, and on frequent occasions, plans and details of definite lighting schemes have been sent to various parts of the country.

(Johannesburg Power Station). The party next visited the New Power Station of the Johannesburg Municipality.

(S.A. Inst. Elec. Engs). In the evening the party were the guests of the President and members of the S.A. Inst. of Elec. Engs. to dinner, after which they attended the monthly meeting of the Institute of which Mr. A. Rodwell, City Elect. Engr. read a paper on "Trolley Buses".

FIFTH DAY.
FRIDAY 27th MARCH, 1931.

The Convention resumed its Proceedings at 10 a.m. with the President (Mr. L. L. Horrell) in the Chair, there being present 39 Members, 13 Councillor Delegates and 11 Visitors.

DISCUSSION—(Contd). on E.D.A.

The President : I have to announce that the members elected to the Council of the E.D.A. held a meeting attended by Councillor Delegates last night. The meeting was very successful and most encouraging. It has been decided that the Executive Committee shall be comprised of 2 Councillor Delegates, 3 Engineers, 2 representatives from the merchants, one from the V.F.P. and one from the Electricity Supply Commission. The question before the Convention now is the election of the Executive Committee.

Mr J. Roberts (Durban). I sugegst that the three engineers be elected from those available for attending meetings in Johannesburg. I think it would be a good thing if the Committee had the power to co-opt. an extra member, so that if a Councillor or Engineer coming up to Johannesburg, he could be given a chance to confer with the Committee on any points. I beg to nominate Messrs. Horrell and Rodwell as members of the Executive Committee..

Mr Swingler (Cape Town) : I beg to second.

Mr. A. T. Rodwell (Johannesburg) : I beg to nominate Mr. Wright of Benoni; Mr. Macaulay (Bloemfontein) : I beg to second.

Mr. G. H. Swingler (Cape Town) : I beg to propose that Mr. J. Roberts be elected to the Executive Committee, and that Mr. Wright be his alternate.

Agreed : That Messrs.. Horrell, Rodwell and Roberts be members of the Executive Committee, with Mr. Wright of Benoni as alternate for Mr. Roberts.

Mr. J. Roberts (Durban) : I consider that the first step to be taken is for them to go to their Councils. Some representations should be made to Councils appealing for funds and a report should be drawn up, outlining the points that have emerged during our discussion. Firstly, an initial income of £3,000 instead of £10,000 has been decided on. Secondly, that for the time being no showrooms would be established, but that the preparation and circulation of literature and posters will proceed. Thirdly, that Council has been elected and also an Executive Committee this would be an indication that there is a Committee working who would communicate with each municipality as soon as possible. I move that it be an instruction to the Executive Committee to meet in Johannesburg as soon as possible to draw up a scheme of their organization; secondly, as to the funds they wish to collect from municipalities; and thirdly, give as precisely as possible, an explanation of their programme of work for the first year or two.

Mr. Swingler (Capetown) : I wish to point out that the acting committee a year ago had stated how they proposed organizing, and submitted a programme which was much bigger than the one we find we have sufficient cash for carrying out now. Mr. Bullock had given, I think, a very excellent report and the executive Committee should take the meat out of that and embody the information given by the acting Committee in the shape of a report that could be sent to each member for submission to his Council.

Cr. Duxbury (Pretoria) : I am very much in favour of the suggestion by Mr. Roberts but it will be difficult to get votes through the Councils. No harm can possibly be done in bringing the matter definitely before the Councils and it would be something for Councillors to get on with. The matter brooks no delay as Councils would shortly be busy with their estimates. I am very much in favour of the very practical suggestion put forward by Mr. Roberts.

Cr. Clark (Durban) : I would point out that the Association could not bind any member of a council, whereas Councillors could bind themselves. There would be no end of trouble to get municipal associations to come to any unanimous opinion to what should be done and Councillors must take action themselves.

Mr. Roberts' proposal was therefore put and agreed to.

The President announced that the C.M.A. (S.A.) have promised to subscribe £50 a year towards E.D.A.

NEW MEMBER.

The President : I have pleasure in announcing that Mr. West of Colenso has been elected an Associate Member, and Mr. C. R. Tee of Reitz as a Member.

OFFERS OF PAPERS: Last year two or three papers had been offered but when the time came they were not forthcoming and it is to be hoped that those promising papers will not let the Secretary down. Mr. Withinshaw will endeavour to give a paper on the "Betterment Fund" at the next Convention. A paper on "Rural Electirification" will also be welcome; and perhaps someone will undertake to prepare such a paper.

Mr. Rodwell (Johannesburg) : I think an appeal might be sent to members for papers but there might be subjects of absorbing interest arising before the next Convention.

Mr. Swingler (Capetown) : We are drafting a new set of wiring regulations and conditions of supply and if the Association wished, I will put them forward as proposed standard set for adoption by the Association. The discussion on such a subject would almost be sufficient to necessitate a week's convention in itself. I would like Mr. Ritson to give a paper on the cost and trouble involved in changing over from Direct Current to Alternating on a distribution system with some 800 consumers.

Paper Award : On the motion of Mr. Swingler, seconded by Mr. Rodwell, it was decided that no award be offered for the best paper submitted.

HOUSE SERVICE WIRES.

The President : Several of our members view with much concern, the last Government Regulation regarding this matter.

Mr. Swingler explained the alterations to the Mines and Works Regulations requiring service connections to be covered, and said: I have made application to be allowed to continue using a wire similar to that known as "P.B.J." of which there are some 300 miles in use in Capetown, but my application has been turned down.

When in Johannesburg yesterday I asked Dr. Pirow if he would receive a Deputation on the subject, and he was willing to do so at 4 p.m. on Monday next. I therefore propose that the Association should send a deputation to Dr. Pirow to ask him to approve of a wire similar to that known as P.B.J., or better still to approve of a specification which would be based on the British Post Office specificaton P.B.J. but would specify "cambric" instead of paper". The present method of approving of a wire by a certain trade name was of very little value without you had details of the specification to which it was made; you were helpless, you could not prove or disprove a thing, you just had to trust to the Manufacurer's words.

Mr. Rodwell (Johannesburg) : I heartily support the proposal not that I am implicated at the moment, as I am not putting in overhead connections, but may be involved later. I consider the regulation as amended a hardship, and a very unnecessary and expensive one.

Mr. H. L. Dawe (Chairman of the S.A. Cable Makers Association) : I am pleased to support the proposal in that I have already tried to obtain an interview and have a standard laid down. I ask that one of my Association's members be allowed to accompany the deputation.

Mr. Swingler (Capetown) : I understand that a representative of the C.M.A., was being invited by the Government Mining Engineer.

I am against interference or dictation from London. The C.M.A. advise that they are not in as good position as Mr. J. Roberts and other members of this Association to know what we require and what would stand up to our climatic conditions. The fact is that Capetown have some 300 miles of this P.B.J. wire installed or erected and that any portion of it can be taken down and tested. The wire that had been tested had proved to be entirely satisfactory for South African conditions.

Chairman, (C.M.A.) : If this Association got the Government to agree to some other wire, we as cable manufacturers will be able to comply with any specification.

Mr. Swingler (Capetown) : The selection of P.B.J. wire was not made by them on the matter of price, it was selected because of the fact that the British Post Ofifce were satisfied with it and that from the information we could get from the Continent and elsewhere, it was the most likely wire to meet the adverse requirements. Any insulation with rubber in the compound, in my opinion, sooner or later was sure to give trouble with the sunshine we have and the changing climatic conditions are such as to make rubber compound wires exposed to the atmosphere less reliable in the long run than wire insulated in the same way as P.B.J., but using varnish cambric instead of paper.

Agreed that a deputation from this Convention be sent to interview Dr. Pirow, consisting of as many of the Council as possible.

LICENSING OF ELECTRICIANS.

The President : I have to announce that as a result of a conference between the Council and the Master Builders Federation, on the question

of the Licensing of Electricians which a special committee had been dealing with during the year and which has been circulated among all members, the following amendments were arrived at :—

1. That an electrical contractor should hold a general dealer's license as well as a contractors licence.

2. Examination fee for candidates for workmen's licence shall be 10/6 (page 10).

3. Electrical contractors shall pay £5 for contractor's licences, plus general dealer's licence; new men to pay half for first two years.

4. Endorsement of licence of workman travelling to other centres should be at discretion of engineer—should not be compulsory.

5. Amend words in brackets under "Transfer of Tradesmen" to read (or obtain a provincial sanction to proceed subject to them presenting themselves for examination at the next meeting of the Board."

6. That the inspectors employed by local authorities be qualified men holding at least a workman's licence.

7. That a local committee be appointed consising of Messrs. Horrell, Missing and Rodwell to go through the draft amendments to the Bill and to present a final draft to be sent to Capetown. Port Elizabeth, Durban and Bloemfontein, which centres should acknowledge receipt and say when they will give reply. If no reply received in two months, assumption to be that no objections are made to final draft.

8. That these conditions shall not apply to towns not falling within the area to which the National Building Agreement applies.

Mr. G. C. Brown (Vrede) : May I ask whether there is not a possibility of a town outside the area mentioned under (8) being able to ask for a licence for an electrical engineer, his Council and himself might demand it.

Mr. J. Roberts (Durban) : I understand there will be no objection to any workman outside the area going to the nearest centre to take out a licence, he could then operate outside the area and nobody could prevent him.

Mr. G. H. Swingler (Cape Town) : It is permissive but not compulsory.

Mr. J. Roberts (Durban) : It will not be permissible for anyone in the outer areas to set up an examining board, chiefly for the reason they have not the necessary machinery to do so. A man can get a licence and go out into the country and say he is a licenced man.

Mr. Bickell (Port Elizabeth) : I propose that the amendments be agreed to.

Mr. J. Roberts (Durban) : Small municipalities might still make their own regulations. They can make a regulation that no wiring shall be done from their mains unless the workman is licenced. They could not issue a licence that would have to send a workman into the next available town to get a licence.

Mr. G. H. Swingler (Capetown) : I beg to second Mr. Bickell's proposal. They had it on the best advice that if they made it compulsory it would be a dead letter. They could not expect the country as a whole to be prepared to pay for a licensed man from a centre to do small jobs. It would be a different position if the Act laid that down.

Amendment agreed to.

ALTERNATING CURRENT DISTRIBUTION IN RESIDENTIAL AREAS.

By **D. J. Hugo, B.Sc. (Eng.)** Technical Assistant to Municipal Electrical Engineer, Pretoria.

In Pretoria, as in other towns, an almost phenomenal increase in the domestic demand for electric energy has been experienced during latter years. This increase was particularly noticeable in the Eastern Suburbs—a very popular residential area—and led to an almost entire reconstruction of the supply mains in these districts. Two distinct schemes have been adopted for forming the connecting link between the High Tension Underground System with the Low Tension Overhead Distributor Network and it is proposed to draw a comparison between the two schemes particularly from the points of view of Capital Expenditure and Good Service.

In the one scheme (referred to as the Low Tension Scheme) the load is carried by heavy overhead Low Tension Feeders from a sub-main Transformer Substation of comparatively large capacity situated at approximately the centre of the load; the sub-main Transformer Substation being connected to a main Distributor Substation, by an underground High Tension Main. In the other (referred to as the High Tension Scheme) the High Tension (Primary) underground system is extended from the main Distribution Substation to supply pole mounted Transformers and thence to the Low Tension Distributors.

A diagrammatic comparison of the two schemes is shown in Figure 1. In theory the two schemes appear to bear a very close relationship to each other, the only outstanding difference being that in the High Tension scheme the sub-main Transformer Substation of the Low Tension Scheme is divided into several smaller Transformer Substations. In practice, however, each scheme exhibits such widely different characteristics as to justify the use of the previous expression "distinct schemes".

Low Tension Scheme.

The method of supplying an urban district by means of Low Tension Overhead Feeders from a large Transformer Substation to the Distributors

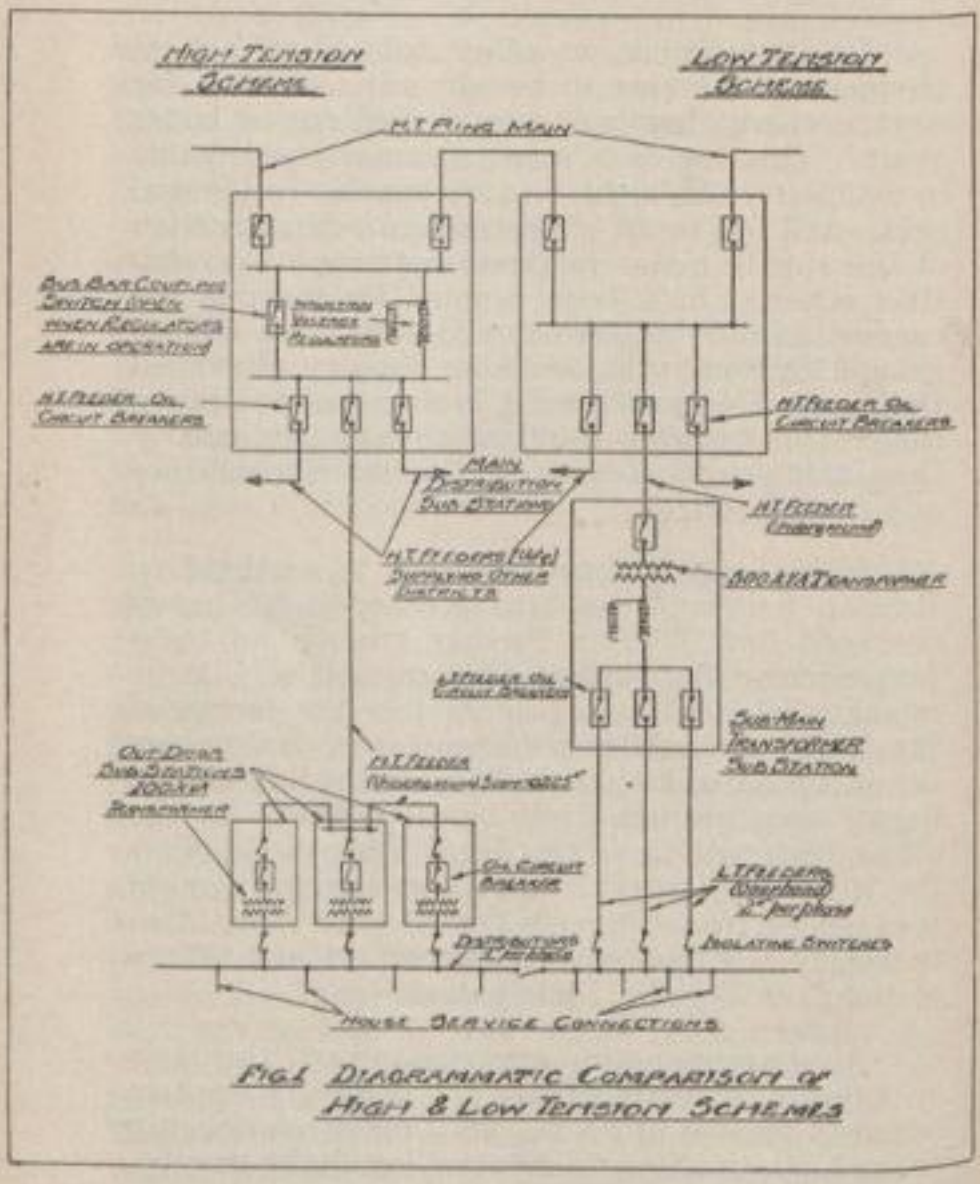


FIG. 1 DIAGRAMMATIC COMPARISON OF HIGH & LOW TENSION SCHEMES

has of course been common practice. Modern electrical requirements of a thickly populated residential area, however, render the supply by this method somewhat restricted if not wholly inadequate. The heavy loads to be carried necessitate numerous Sub-stations and comparatively short

feeders of large cross-sectional area, and, in order to limit the variations in the supply pressure, Voltage Regulators are essential. Extension to cope with an increasing demand or expansion of the area supplied are restricted; increasing the length of a feeder means an increase in the IR drop; additional feeders, if erected overhead, cannot be added indefinitely; if laid underground the increased cost immediately leads to the consideration of extending the primary system. Sub-station sites in popular suburbs are becoming increasingly difficult to procure. This was strikingly illustrated in a recent case in Pretoria where, owing to the restrictions imposed by a certain servitude which does not allow of land being purchased for the purpose of erecting Substations thereon, it was necessary to effect extensive excavations and locate a sub-main Transformer Substation under the side-walk.

A brief description of this underground substation together with the overhead feeders radiating from it is perhaps merited. The substation supplies portion of a suburb where the electric stove load is probably the densest in Pretoria.

This underground building has internal dimensions of 30 feet long x 17 feet wide x 11 feet deep and houses :—

1—500 K.V.A. 6,600/433/250 Volt Transformer.

3—17.5 K.V.A. Low Tension Induction Voltage Regulators.

1—High Tension Feeder Panel Controlling the supply to the Transformer.

5—Low Tension Feeder Panels.

The arrangement provides for the installation of a further 500 K.V.A. Transformer at a later date, if required.

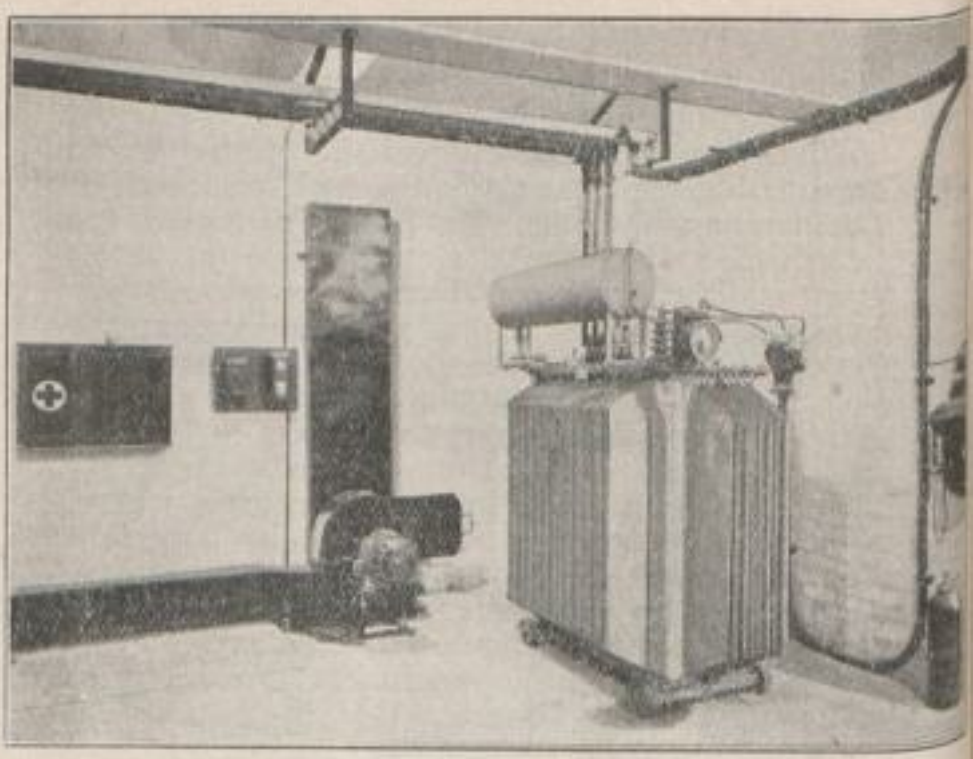


Fig 2. Underground Substation 500 K.V.A. Transformer and Ventilating Fan.

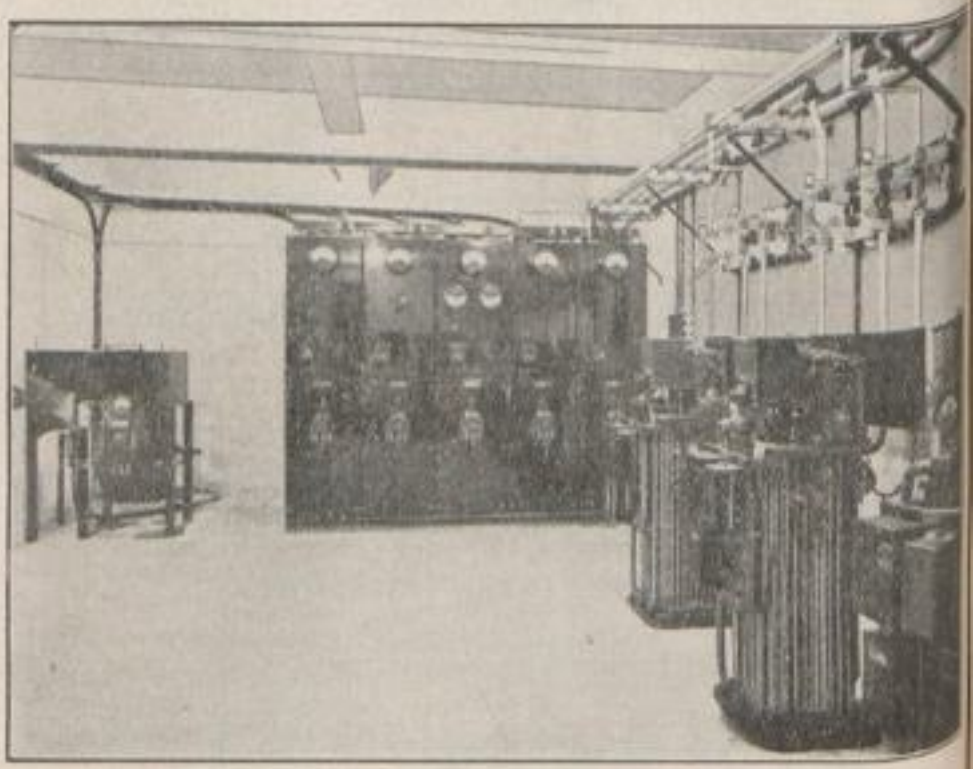


Fig 3. Underground Substation. High Tension and Low Tension Feeder Panels and Induction Voltage Regulators.

Figures II, III and IV are views of this Substation and in the photograph of the Induction Voltage Regulators, the Low Tension Bus-Bars are clearly seen together with the system of short-circuiting the regulators, if necessary.

Arrangements have been made for cooling by means of a ventilating fan controlled by a time-switch, and a small centrifugal pump with float control gear disposes of any storm water or seepage.

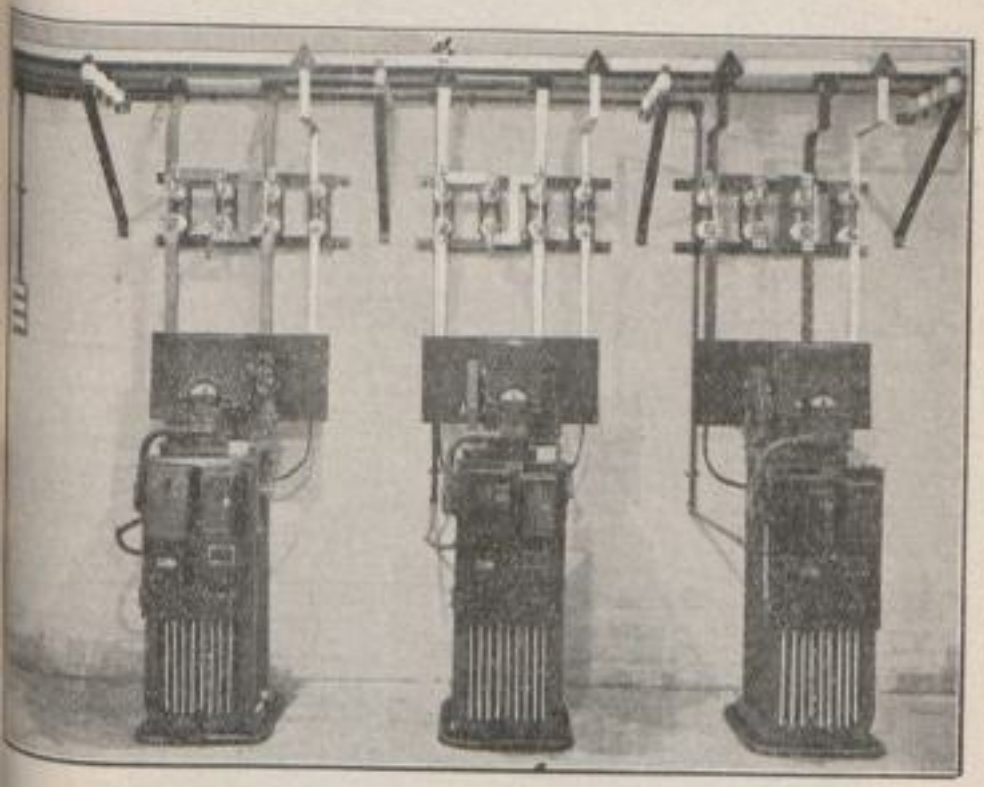


Fig 4. Underground Substation. Induction Voltage Regulator.

Five double 19/.083 per phase feeders, giving a cross-sectional area of .2 square inches per phase per feeder radiate from this point and vary in length from 304 yards to 1,019 yards, the total length of the five feeders being 3,286 yards. The neutrals are of the same cross-section as the phases.

The large amount of copper to be carried overhead in the Low Tension scheme and limitations previously mentioned, to future additions is clear-

ly shown in Figure V of an Angle Strain Pole carrying two feeders and a distributor. Excluding Street Lighting Wires, Earth Wire, Telephone and Trip Indicator Lines the total cross-section of copper is 2.0 square inches.

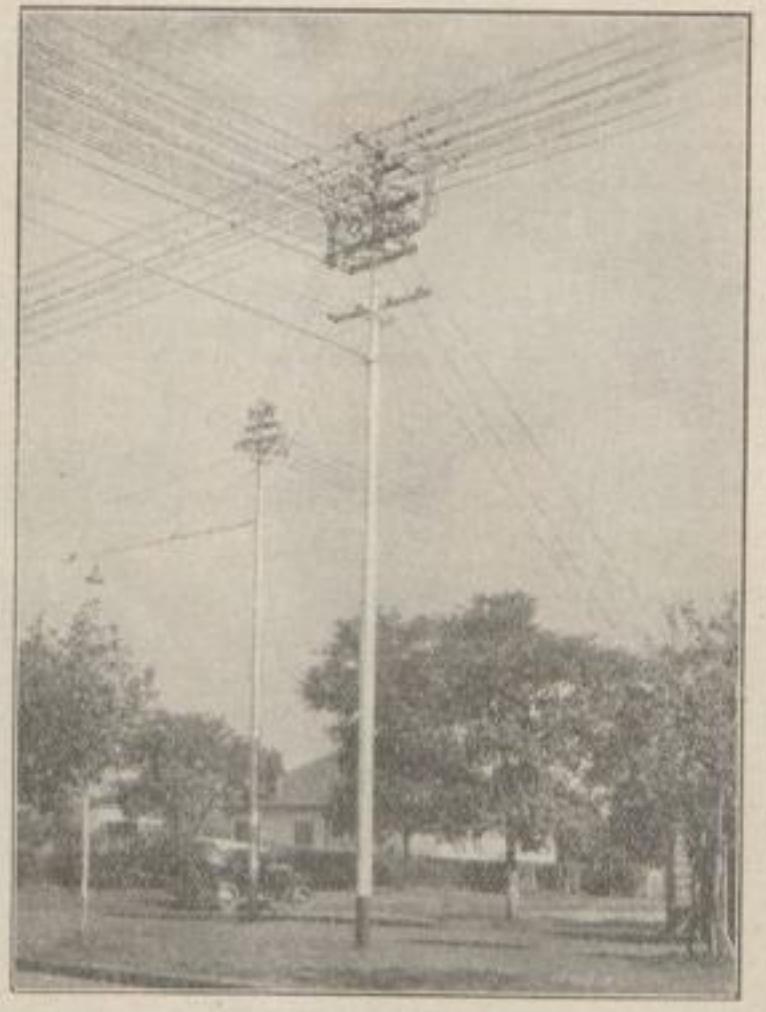


Fig 5. Low Tension Scheme. Overhead Construction.

The area supplied is approximately 410,000 square yards (.132 square miles) and contains 287 consumers at present, of whom 87 have electric stoves. The district is by no means densely populated, however, and residences may increase by 50%.

The approximate cost of the Substation is as follows :—

Excavations for Building	£271	0	0
Substation Building	623	0	0
Gear Erected Complete	2,228	0	0
Total for Complete Substation	£3,122	0	0

The five feeders erected complete including the necessary poles cost £3,772 or approximately 23/- per yard of 3 phase, 4 wire, 19/.083 feeder.

The cost of the primary Supply Cable and of Distributors are not included as these figures are not required in making a comparison later on with the High Tension Scheme.

High Tension Scheme.

Pole Mounted Transformers, supplied direct from the Primary System, were first utilised in Pretoria some six years ago. At the time, low voltage at certain points of the system made it necessary for immediate steps to be taken to improve regulation, and, as a temporary measure only, Outdoor Substations consisting of a pole Mounted Transformer and a small Switch Cubicle on the side-walk were erected at certain points, until such time as the Low Tension Overhead Feeder System could be extended.

The advantages of this High Tension Scheme were not immediately realised, and, it was only last year after the construction of the Underground Substation and Overhead Feeders previously mentioned that the distinct merits of the High Tension as compared with the Low Tension were fully appreciated both from the point of view of expenditure and good service. There is no doubt that in the future the policy in Pretoria will be to extend the primary system and erect Outdoor Substations throughout, wherever extensions are necessary.

Referring again to Figure I, it will be seen that from a Main Distribution Substation connected to a heavy High Tension Ring Main (either .12 or .2 square inches per phase) High Tension Feeders of much smaller cross-sectional area radiate to supply the Outdoor Substations. A single Truck in the Main Distribution Substation

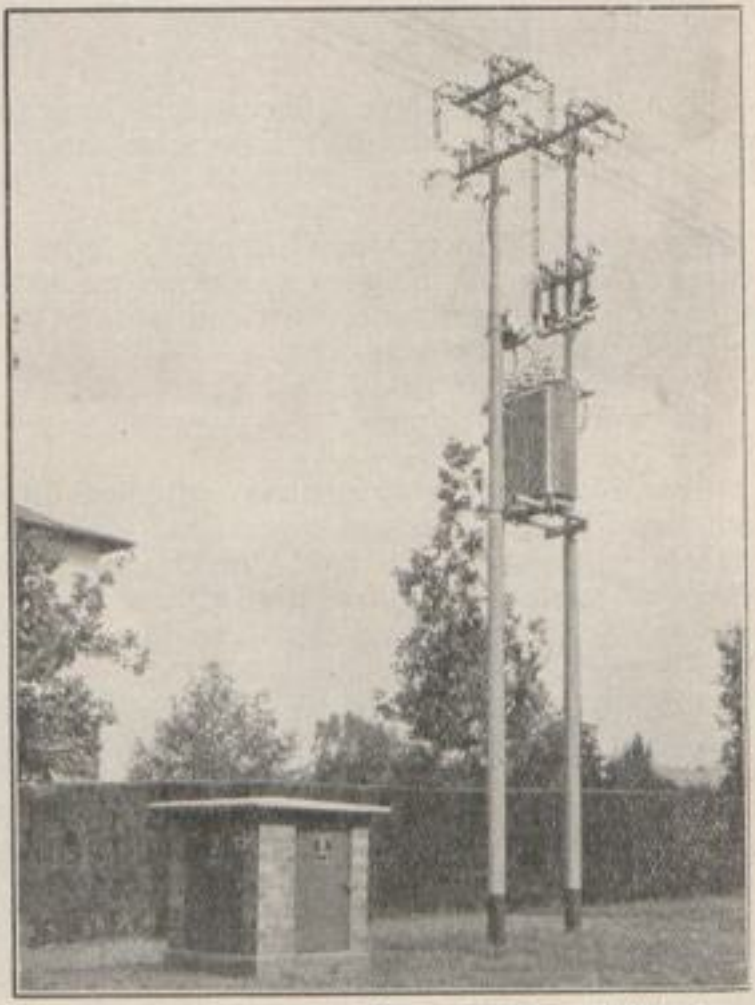


Fig 6. High Tension Scheme Outdoor Substation.

controls the supply to either three or four Outdoor Substations, the connecting Cable being .0225 square inch per phase. The installation of High Tension Induction Voltage Regulators between the Ring Main Bus Bars and Feeders Bus Bars in the Main Distribution Substation is generally adopted, in order to improve regulation and so give better service.

A considerable amount of time and labour has been devoted to the design of the Outdoor Substations with a view to improving the general appearance of gear erected overhead and reducing the size of the switch cubicles on the ground to a minimum.

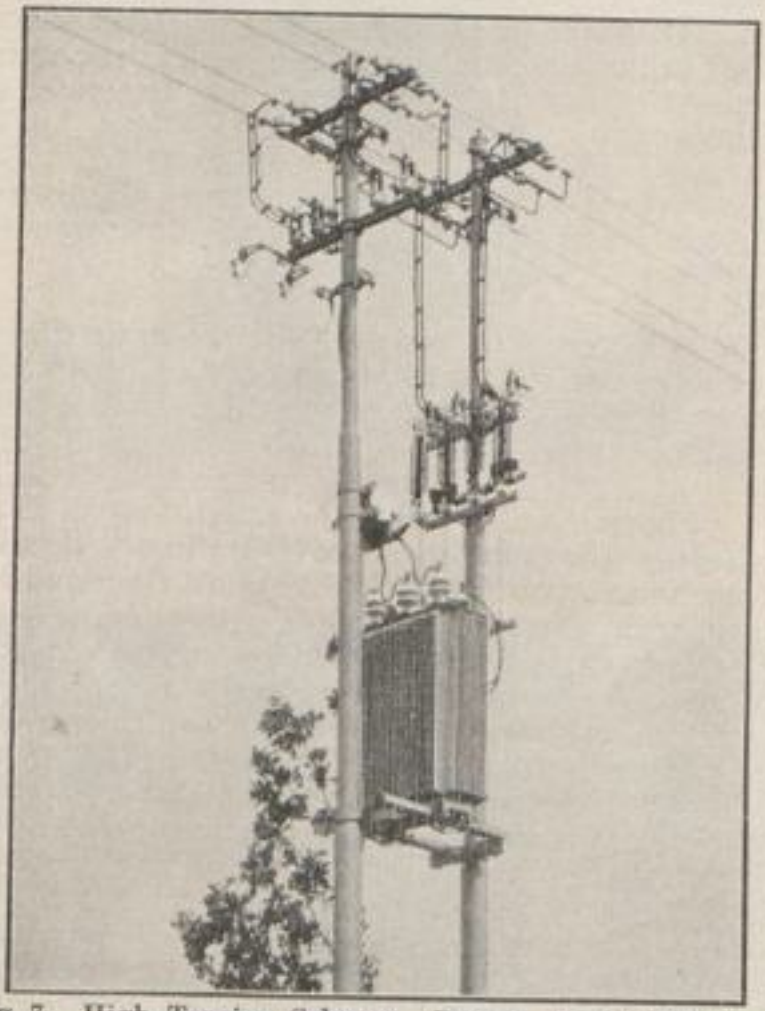


Fig 7. High Tension Scheme. Details of Pole Mounted 100 K.V.A. Transformer.

Figure VI is a view of an Outdoor Substation and Figure VII shows clearly the method of mounting the Transformer with Isolating Switches, Choke Coils and Lightning Arrestors. The Coils are sufficiently large to flatten out any transmitted waves due to lightning or other surges while the time lag of the arrestor gap is short enough to enable coil and arrestor to function correctly together as a single unit.

The 100 K.V.A. size has been adopted as standard for the Transformers.

From these plates also the neat yet adequate overhead construction is apparent — the pole mounted Transformer feeding direct into the 19/.083 per phase distributors—and in striking contrast to the almost clumsy arrangement necessary under the Low Tension Scheme as illustrated in Figure V.

Figures VIII and IX are views of the Switch Cubicle which has outside overall dimensions of 4′ 7″ x 4′ 6″ x 5′ 0″ high.

In Figure VIII are seen the incoming feeder, the links controlling the supply to the Substation, and the outgoing feeders to other Outdoor Substations.

Figure IX illustrates the small Control Panel carrying the hand-operated Oil Circuit Breaker Mechanism, two Inverse Time Limit Overload Relays with Circuit Opening Contacts which are shunted across the transformer operated trip coils of the Circuit Breaker, the special recording receptacles enabling the current transformer secondary circuits to be broken without danger to the operator, an ammeter and a tumbler switch for disconnecting the trip alarm. The current transformers are obscured by the panel.

At the bottom of the panel is sufficient room for a portable panel carrying three recording ammeters which may be connected in the current transformers secondaries by means of the recording receptacles.

The cost of an Outdoor Substation complete with Transformer and Switch Cubicle and all gear erected in place is approximately £338.

The residential area is divided into districts varying from approximately 140,000 to 200,000 square yards. From the Main Distribution Substation a High Tension Underground Feeder is

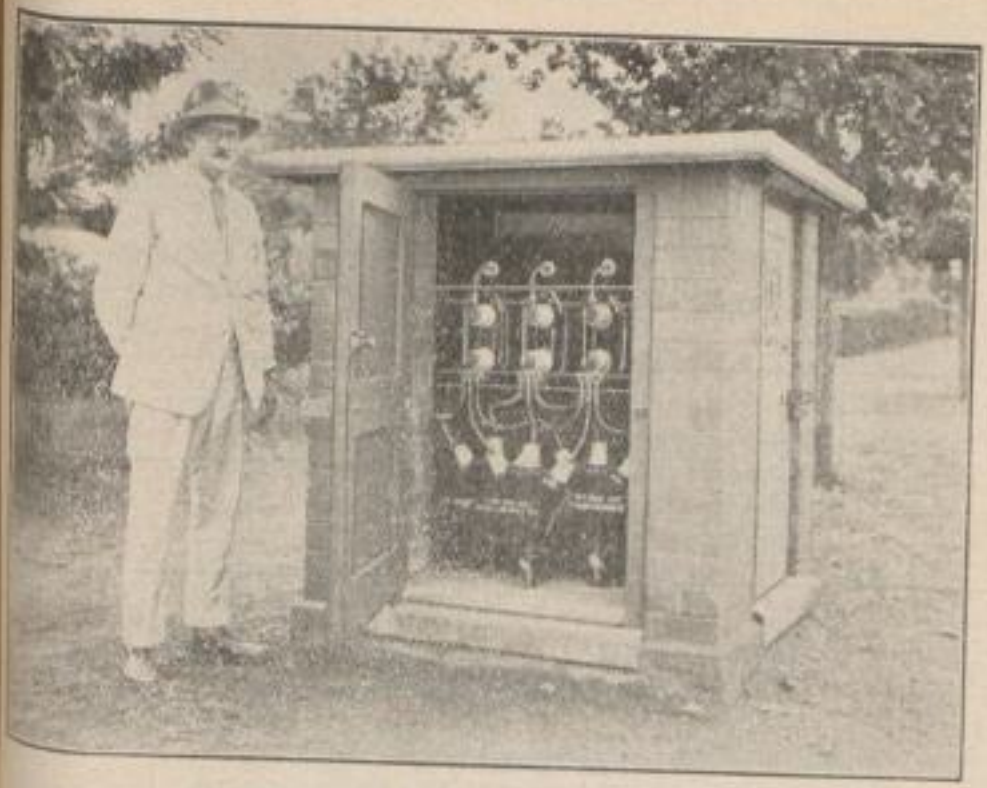


Fig 8. High Tension Scheme. Switch Cubicle of Outdoor Substation.

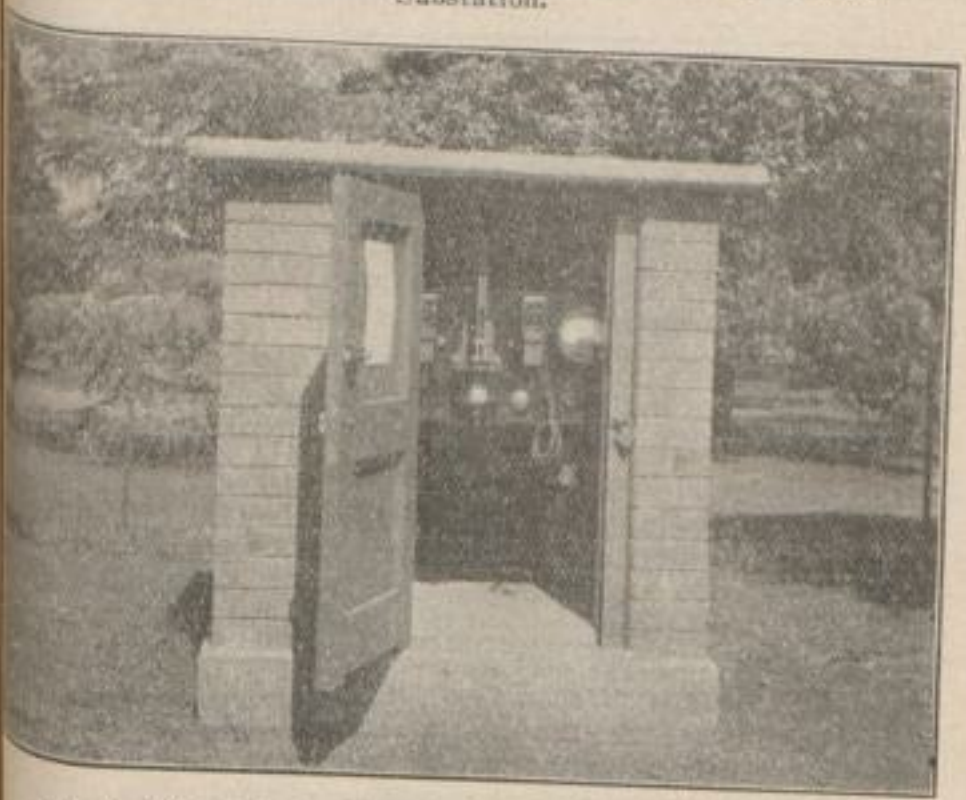


Fig 9. High Tension Scheme. Switch Cubicle of Outdoor Substation.

laid to each district and supplies either 3 or 4 Outdoor Substations. The districts are entirely isolated from each other by means of section switches in the Low Tension Distributors and only under abnormal conditions are they interconnected. The following table gives details of the three districts supplied by means of the High Tension Scheme :—

District	Approx. size of District Sq. yards	No. of 100 K.V.A. Outdoor Sub-stations	No. of Consumers.		
			Ordinary	Stove	Total
Arcadia E.	194,000	4	84	25	109
Arcadia W.	139,000	4	148	26	174
Clydesdale.	145,000	3	137	42	179

An attempt is made at spacing Outdoor Substations evenly over a district provided the arrangement meets with the requirements of the present and estimated future demands.

Comparison of Schemes.

The main advantages of the High Tension as compared with the Low Tension Scheme are :—

1. **Greater Flexibility.** Extensions to provide for an increased demand or expansion of the supply area can be effected at a smaller cost with less practical difficulties and a minimum of circuit rearrangement, and may virtually be continued indefinitely. Extensions to the Low Tension Scheme are limited by the amount of copper the poles will carry and the cross-sectional area of the feeders.

2. **Substation Sites Unnecessary.** No provision has to be made for the purchase of Substation Sites other than for the Main Distribution Substations as the Switch Cubicles are erected on the Sidewalk.

3. **Better Voltage Regulation.** Outdoor Substations can usually be located at points where the loading is the heaviest and the voltage at the supply terminals of any one may be varied independently of the others. In the Low Tension Scheme the voltage on a particular feeder can only be increased by "Stepping-up" the voltage over the whole district.

4. **Decreased Maintenance Costs.** There is considerable saving in the maintenance of an underground scheme as compared with an Overhead System. The Overhead distributors are of course common to both schemes.

5. **Increased Efficiency.** The losses in the High Tension Scheme are considerably less than in the Low Tension Overhead Feeder System.

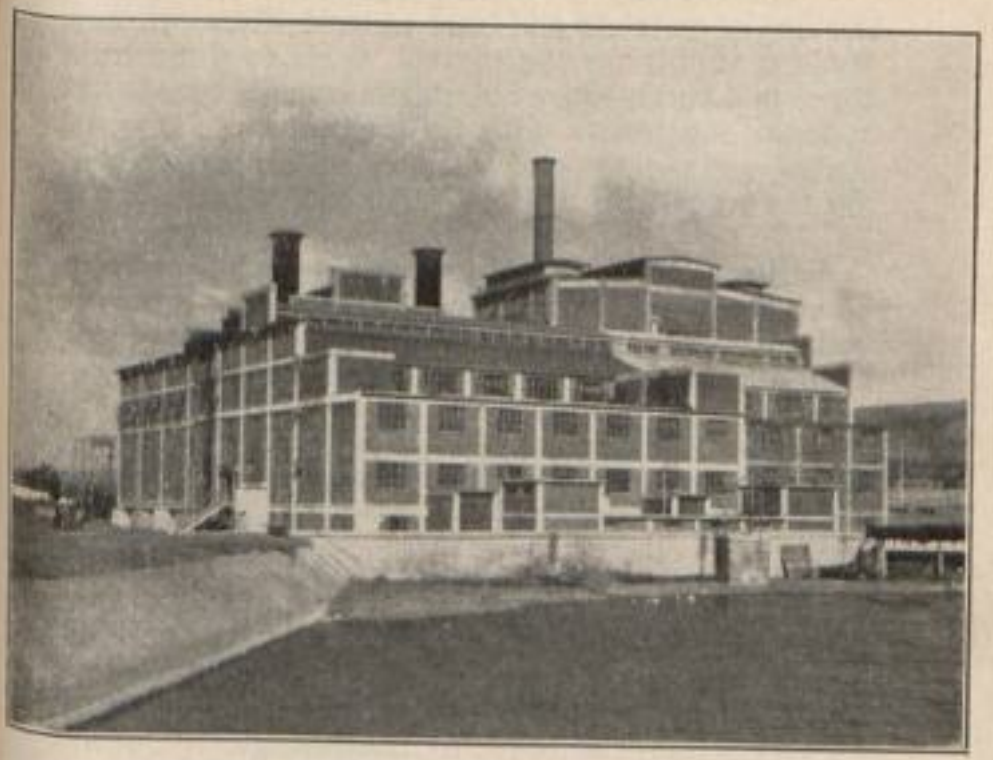
6. **Saving in Capital Expenditure.** In order to be able to draw a comparison from the point of view of Capital Expenditure it is proposed to consider an Imaginary Area and compare the cost of supplying this area by the two alternative schemes. In order not to penalise the Low Tension Scheme this area should not be less in size than the district supplied from the Underground Transformer Substation previously mentioned. It is submitted that for this size of district (namely 400,000 square yards) and which will include say 440 consumers of whom half have electric stoves equally good service is obtained from either system (pro-

The relative costs are therefore :—

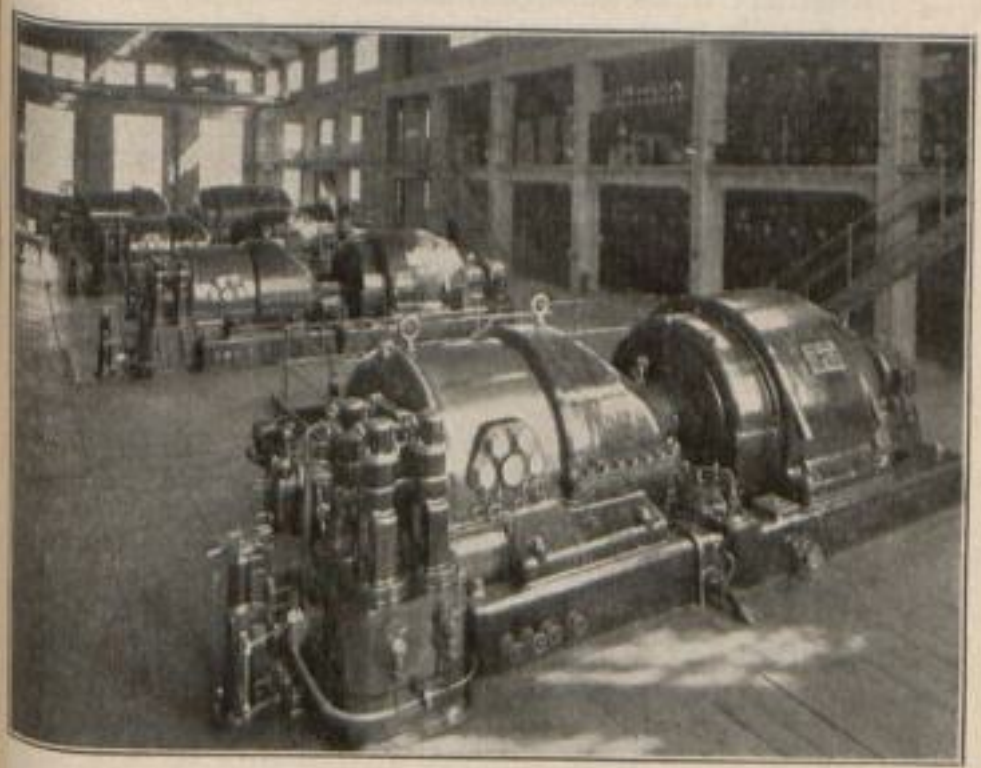
Low Tension Scheme		High Tension Scheme	
Substation Complete with all gear including Voltage Regulators	£3,122	5 —Outdoor Sub-Station Complete	£1,690
Low Tension Feeders	£1,520	Proportion Voltage Regulators	£315
		High Tension Feeders	£ 780
	£4,642		£2,785

It is of course appreciated that this is by no means a true economic comparison and that this can only be effected by determining the total annual charges (which will include capital charges, supervision, maintenance, and copper and transformer losses, etc) of each scheme.

There is one point in the operation of the High Tension Scheme which detracts somewhat from its other advantages. During times of heavy loading—on a severe winter night say—the tripping of one Outdoor Substation on overload immediately transfers the load to the remainder of the Outdoor Substations which will then also be automatically disconnected. In order to resume supply it is not possible to close the Circuit Breaker of any particular Pole Transformer as it will immediately trip on overload. The Operator is compelled therefore to open the Breaker, in the Main Distribution Substation, controlling the supply to the Outdoor Substations effected, close in at each individual Outdoor Substation and then return to the Main Distribution- Substation to close the Main Feeder Breaker. Whether he is assisted or not, considerable delay therefore takes place before supply is resumed. With ample transformer capacity in a district, however, the conditions outlined above are seldom encountered.



POWER STATION, PRETORIA.



Interior of Power Station Pretoria.

The remedy would appear to be to increase the size of districts and have at least three primary feeders supplying the district each feeding from three to four Outdoor Substations so designed that at least one feeder with its transformers may be out of commission at peak load without overloading the remainder of the equipment.

The advantages of artificial regulation must be stressed. A residential area requires a steady voltage in order to limit fluctuations in illumination and the installation of Induction Voltage Regulators is the means to this end. In Pretoria they are used extensively in both H.T. and L.T. Schemes and installed at points on the system previously indicated.

An interesting point arises with regard to artificial dimming of lights, as a time signal, in a town where numerous Automatic Induction Voltage Regulators are installed. The Regulators would of course immediately tend to compensate for any attempt at reducing the voltage. It would appear somewhat paradoxical, therefore, for an Engineer to instal apparatus at the supply end of a distribution system for reducing the pressure and apparatus at the receiver end which opposes any variations in voltage.

While this paper largely reflects the conditions in a comparatively large town, the author can see no reason why outdoor substations cannot with advantage be used in small undertakings the supply to such Substations being controlled direct from a High Tension switch or switches in the Power Station.

In passing it might be mentioned that reducing the cross-sectional area of distributors to a minimum is a weak policy which will be regretted sooner or later. In Pretoria it was the practice to erect Single No. 4 s.w.g. but with the growth of the stove load it was found necessary to add an additional wire of similar size so that at present only 19/.083 conductors per phase are erected as distributors whether for extensions or reconstruction in areas being converted from D.C. to A.C.

In conclusion I wish to acknowledge the assistance given by my chief Mr. L. L. Horrell, Municipal Electrical Engineer of Pretoria, and colleagues which has considerably facilitated the preparation of these notes. All photographs are by Mr. Alan Yates of Pretoria.

DISCUSSION.

Mr. G. H. Swingler (Capetown) : I have to thank Mr. Hugo for his paper. The arrangement of distributing points was more or less the same as used in Johannesburg and in Capetown in the residential areas, only in Johannesburg and Capetown transformers were not put on the poles; small kiosks were erected to house the transformers as well as the switchgear. The arrangement shown in Pretoria would not suit an old city like Capetown where many of the footpaths are not more than 5 ft. wide. The method adopted in Pretoria for distribution I think is quite good, but as years go on you will find that loads are such that substations, that are relatively speaking large transformers, will have to be provided. We found this necessary at Muizenberg and Kalk Bay, also in Wynburg and other districts and I recommend that you should procure the requisite sites on which substations can be provided. As regards losses I don't quite agree with Mr. Hugo's statement. The over-all loss from the energy. on power for which we pay for in Capetown is 11.8% notwithstanding that quite a good lot of it is still converted to direct current.

We have one or two outdoor substations in the city area and most of our rural area substations are outdoors, but we find it more convenient to put the transformers where ground is available on ground level sooner than elevate them. It is bad enough to have to work on gear under storm conditions when they are on the ground, and much more so when they are up on the pole. Our experience has been as far as the City proper is concerned we much prefer to have our switchgear and the men operating it

under cover. With our form of cubicle the men have to stand out in the rain (which often beats into the cubicle) to operate the gear. We have transformers in sub-tations in all manner of places, but generally speaking we prefer to buy or reserve a plot of land well ahead of development.

Mr. J. Roberts (Durban) : Mr. Hugo's is a very good paper indeed and is full of meat and Mr. Hugo need not be disappointed at not having had the opportunity of reading it (or perhaps the limited time for discussion) because it is one of those papers which could be put in an engineer's library and referred to whenever the problems of transmission came up. Ho also gives photographs and figures. He has arrived after very careful consideration of the problem at the position found in Durban. Low tension copper is very costly and so the nearer one gets to the consumer with H.T. current the less are the losses. In Durban we have transformers spaced out at less than ¼ of a mile apart. Our standard transformer is from 100 K.W. to 150 K.W. One must be prepared to supply 150 K.W.; the Durban system is to put the transformer in a pit having good ventilation. I see Mr. Swingler's difficulty as to narrow footpaths but he must work according to conditions. It would not be beyond the ingenuity of Mr. Swingler to put his transformer, as well as switch underground. As regards pole transformers we do not use them within the town as they are rather unsightly. They have been used rather extensively in the suburbs. Provision should be made for the safety of operators so that a man going up should, under no circumstances, come into dangerous contact with the overhead system. The ideal system would be to bring down the L.T. and H.T. to pillars. I think that Mr. Hugo will find that he may not have arrived at the last word yet from the point of view of safety and now that there are inspectors on our track it was very necessary that engineers should secure themselves in putting up installations as safe as possible. I would like to refer to the first paragraph on the last page of Mr. Hugo's paper. I have to con-

fess that Mr. Hugo has given me quite a new point and pointed out a difficulty in our 8 o'clock dimming. As I had not realised that there was no automatic regulator on our system though it is likely we may put them in later on.

It would affect the time signal in Durban, but I must get over it. It might be necessary to put up a time switch and cut the regulator out for 5 minutes so that we would be sure not to have our signals beaten by our regulator. I am very much obliged to Mr. Hugo for giving us the tip.

Mr. E. Poole (Durban) : As regards the time signal, probably this might be overcome by inserting a time lag.

Mr. A. T. Rodwell (J.H. Burg) : Mr. Hugo is to be congratulated on presenting a paper so full of interest to those contemplating extensions to their reticulation systems.

Distribution in residential areas has presented many problems in the past and to-day problems are accentuated with the ever increasing demand for electric energy for cooking stoves and domestic appliances.

The method adopted in Pretoria is sound. It has been found necessary to use similar methods for many years in Johannesburg. In large cities it is difficult to obtain suitable sites for transformer and switch substations. In Johannesburg there are a number of large rotary converter and motor converter sub-stations for operating the tramway system.

To meet the growing demand for light and power for industrial purposes, ironclad switchgear has been erected in the sub-stations controlling large transformer banks in the open air. In addition, it has been found necessary to obtain basements in large buildings for this purpose. Sy-- tems similar to that described by Mr. Hugo are in use in the suburban areas and in this respect the paper will be of great value to smaller towns which desire to prepare for electrical development.

The brick built transformers appear to be suitable for Pretoria, where there is ample space.

In Johannesburg, large number of steel pressed transformer 3-compartment kiosks or sub-stations, manufactured departmentally are erected in the outlying suburbs to house transformers and equipment up to 150 K.W. capacity. Pole transformers have been mounted. Whilst objection has been raised to the steel pressed kiosks, yet stronger objections have been raised by the public from an aesthetic point of view against the erection of the pole type of transformers. Further, the latter type of sub-station does not compare favourably with the steel pressed kiosk either from a cost or operating point of view.

The author apparently is not in favour of underground transformer sub-stations, as the one mentioned in his paper appears to have been installed on account of certain restrictions imposed prohibiting a surface erection. I am not in favour of placing transformers underground, where such a course can be avoided. Two large underground sub-stations have been replaced by sub-stations on the surface in Johannesburg.

I would again congratulate the author on his informative and excellent contribution.

Mr. A. R. Metelerkamp (Salisbury) : I also wish to thank Mr. Hugo for his paper. In smaller towns capital costs are of vital importance and while my criticism might appear to be destructive I think the elimination of low tension protection is breaking away from the usual convention. If that is done why not go further and eliminate choke coils and arrestors? With regard to regulators Mr. Hugo states that on the Low Tension scheme regulators are essential. In the High Tension the voltage regulator is included, now what drop is that regulator taking care of? I understand that the effect of the regulator taking care of the dimming would depend on the K.V.A. rating of the regulator.

Mr. G. H. Swingler (Capetown) :

How was Mr. Roberts going to arange his dimming when his station got parallel with Colenso. I should think now-a-days with electric clocks, time signals by wireless and so forth, that this dimming business would have been damned.

Mr. J. Roberts (Durban) : Mr. Swingler has has not looked on our dimming stunt with pleasure At one time we gave it up but there was such an insistent demand for it; letters in the paper and people wanted it back, so that we carried it out but in a much simpler way. If we ever linked up with Colenso, 150 miles away, there would be no difficulty. We would be able to work from Durban with one switch. It might be done by means of wireless, or direct line, but there was no engineering difficulty about it. When we paralleled with Congella we were a little doubtful, but it has been done without difficulty.

THE DIFFICULTIES OF DEVELOPING A MUNICIPAL ELECTRICAL SCHEME WITH GAS ENGINES, AS PRIME MOVERS.

By **A. R. METELERKAMP**, Town Elect. Engineer, (Salisbury).

These notes are the outcome of the Vice-President's invitation to write a paper on Gas versus Steam for Electrical Undertakings, at somewhat short notice, owing to several papers not being available.

As however, the difficulties in connection with gas prime movers are in my opinion greater than with steam engines, I have attempted to point these out.

Any Municipal Electrical Undertaking which aims at progress or development must definitely operate on A.C. This is now an accepted fact, and it would be beyond the scope of this paper to

enlarge on the advantages of A.C. The undertaking would naturally cater for a power as well as a lighting load; and a three phase system with four wire low tension distribution is taken for granted, and a 24 hour supply with approximate load factor of 35%.

All discussions are therefore based on the fact that the prime movers would have to operate alternators of standard frequency in parallel, and further that the units would operate continuously in parallel on load, and not merely to enable a change of units.

These notes refer to Municipal Electrical Undertakings, and do not apply to the many successful small Industrial and mining concerns, especially those in Rhodesia operating on wood fuel with gas engines.

The limits of the argument are for stations with peak loads from 100 to 2,000 K.W., it is taken for granted that in stations with loads exceeding this, steam turbines would be installed.

Types of Plant.

The development of the gas engine was the outcome of utilising the waste gases from blast furnaces, where in the majority of cases the fuel is coke; the bye-product gas, when cleaned, resulting in a gas free from tar, and suitable for use in engines for the generation of electricity or the driving of blowers, in connection with the works.

It is however assumed that the gas station will operate on producer gas with coal or wood as fuel.

It is not proposed to enter into a discussion on the relative merits of various types of gas plants as to horizontal versus vertical engines, or double draft versus up draft producers, etc. in use at various gas stations. The engines are, however, required to drive alternators in parallel. The cyclic variation of the sets must therefore be such as to give satisfactory operation under varying

conditions of load, and a few facts relating to the various types must be mentioned to emphasise difficulties mentioned later. Due to the fact, that the majority of gas engines are single acting, and that there is no compression at the end of each stroke and the speed, as compared with high speed steam engines of the same size, must be considerably lower. The question therefore, of obtaining uniform angular velocity without the introduction of massive fly-wheels, is a difficult and expensive problem, due to the lower speed and other factors. The vertical cylinder totally enclosed type of gas sets, are generally considered preferable for the class of work under discussion.

When considering steam plant, mechanical stokers and steam of 200 lbs. pressure superheated to 600°F, economisers, and adequate draught, is assumed to obtain reasonable efficiencies. Further the prime movers would be compound or triple expansion of the high speed self lubricated type in the smaller sizes, and turbines in the larger.

Capital Costs.

The locality of the station, and the distance from the coast would affect the capital costs of the station, on account of the question of railage.

It may be argued that the capital costs on small complete stations with maximum loads of 100 K.W. would be less for gas engines than for steam, and this may be so up to units of 300 K.W. There is, however, the increased weight due to the fly wheel, alternator, and engine of the gas set on account of its lower speed. It may, however, be taken that the capital costs for stations suitable for peak loads up to 200 K.W. are in favour of gas. From 200 K.W. to 500 K.W., gas and steam are about equal, and after 500K.W., the difference is in favour of steam, and when approaching 1,000 K.W. steam has a decided advantage including the buildings and cooling pond.

Owing to the fact that steam plant is more reliable and capable of longer running hours, less spare plant is required, with consequent decreased capital costs.

Assuming capital charges at 10% of the capital cost for steam plants, the relative figure for gas plants may be taken as 12%, owing to the fact that this figure should be in proportion to the life of the plant. There can be no doubt as to the relative lives of the plants in question.

Fuel Costs.

One of the greatest arguments in favour of the installation of gas sets in their higher overall thermal efficiency. When considering fuel costs it is the fuel cost in pence, not the lbs. per unit which is of prime importance. The cost of the fuel at the power station must therefore be taken into account; railage and the locality of the station will determine this.

The fuel for gas stations is either anthracite or bituminous coal and in some places, wood. No true anthracite coal, is found in the Union or Rhodesia, but coal with volatile matter of approximately 10% is found in the Dundee district of Natal, and the Ermelo district of the Transvaal. The average price of this coal may be taken at 21/- per short ton, at the pit-head. Bituminous coal is found over a much wider area in Natal and the Transvaal and at Wankie in Rhodesia. The average price at the pit-head may be taken as 7/- in the Union and 11/6 in Rhodesia per short ton of average calorific value of 12,000 B.T.U's. Wood in Rhodesia may be taken at the average price of 15/- per cord of 4-ft.x 4-ft. x 8-ft. i.e. 128 cubic feet. The average weight per cord of air dried wood, as sold in Rhodesia, is approximately 2,800 lbs. of approximate calorific value of 5,800 B.T.H.Us.

Considering the fuel costs for gas producer sets, the following figures are taken from the Electricity Commissions Report of Electrical Power Stations in Great Britain for the year ending 31st March, 1929.

Total output of all stations	14,915,912 units. generated
Number of stations	51.
Total fuel consumption	14,235 tons.

This gives an average consumption of 2.28 lbs. per unit generated, for gas producer sets, and may be taken as being fairly representative, with average load factor. The majority of this fuel may be taken as anthracite coal with a calorific value of 13,000 B.T.H.Us.

Gas stations therefore operating with anthracite coal would have to show a thermal efficiency of three times that of a steam station ,other figures being equal to give the same fuel costs due to the difference in the prices of Bituminous and anthracite coals. Taking the station with a maximum load of 200 K.W., would mean that a steam station could have a coal consumption as high as 6.84 lbs. per K.W.H. without making allowance for calorific value, as that compared with gas on an average consumption of 2.82 lbs. per K.W.H. to have equal fuel costs.

Gas stations operating with bituminous coal, would only be required to show equal thermal efficiency to be equal on the question of fuel costs. The size of the units with gas stations, does not effect the fuel consumption as it does in steam stations, and the gas station has the reputation of having fairly constant thermal efficiencies over a wider range of sizes of units, and varying load factors.

It is possible in a gas station with a maximum load of 300 K.W., on the load factor assumed, to obtain a fuel consumption on bituminous coal of 3 lbs. per unit. This has been done in practice; and on test runs on full load, a consumption of under 2 lbs. has been obtained.

Steam stations as outlined previously, as far as fuel costs are concerned, are approximately equal to these figures, so that it may be taken that only gas stations with bituminous coal with a maximum load of less than 300 K.W. can show lower fuel costs than steam stations of the same size, and gas stations using anchracite cannot compete owing to the price of anchracite coal.

Wood as a fuel at 15/-, 2,800 lbs. of calorific value of 5,800 B.T.Us. is not an exceptionally cheap fuel. The moisture content and the calorific value varies widely, but a figure of 5 lbs. of wood per unit is the average for gas plants operating on wood fuel; this is a fuel cost of .32 pence per K.W.H.

Wood as a fuel must naturally be obtained in the neighbourhood and as the bush round the town is cleared so the price increases, due to higher transport costs. There are however very few towns where wood is found in sufficient quantities, and at a price sufficiently low enough, to consider this fuel as compared with coal.

Water.

Gas sets are often installed where the quantity of water is in doubt, for the reason that the water would be detrimental to boilers. In steam stations operating condensing, there would only be the question of make up, and this should be very small where blowing down of boilers is cut down to what is absolutely necessary, and not merely a routine practice of every shiftman blowing down a couple of inches of water when coming on or going off shift, thus reducing to a minimum the amount of doubtful water introduced into the boilers.

The vaporiser in the gas plant is, after all, a boiler, and not having the benefit of the condensate, there would be considerably more trouble through scale where water is doubtful. It may be argued that the circulating water in the condensers would give the same trouble; this water, however, is not vaporised and rarely run at a temperature of over 90° F. if a reasonable vacuum is carried, so that, the cleaning of condenser tubes would not have to be carried out as often, and the cleaning operation is much easier than that of cleaning vaporisers. It is also possible to clean a condenser during a week end, and still have the set available running to atmosphere .

It is policy to keep the outlet temperature of the jacket cooling water in gas sets as high as possible, at the same time, the temperature of the cylinder should be such as to ensure efficient lubrication. They are therefore more liable to scale than condenser tubes and the removing of scale from water jackets is a more difficult operation than the cleaning of boilers, condensers or vaporisers.

The total water consumption of gas plants is double that of a steam plant operating condensing. The increased consumption is accounted for by scrubber water. First of all, it is not policy to cool, settle and re-circulate scrubber water, as, if this practice is adopted with either wood or coal fuel plants, the water would eventually become an acid solution and result in increased costs in maintenance due to corrosion of pumps, piping and scrubbers. This is apart from the difficulty of the filtering of tar emulsion before it can be re-circulated.

The density of the gas, and therefore the temperature, has a definite bearing on the performance of the gas engine, and it is therefore a policy to keep the gas temperature as low as possible, this temperature being effected by the amount of water passing through the scrubbers. There is also the question of tar extraction. To condense the tar vapours in the gas to facilitate this the gas temperature must be low before going through tar extractors. The total water consumption on a steam station, as outlined, would be approximately 1½ to 3 gallons per K.W.H. whereas in a gas station with producers, it would be as high as 4 to 6 gallons per K.W.H. and certainly the latter with producers operating on bituminous coal.

Oil.

The oil consumption with gas engines is considerably higher than that of steam engines. With horizontal gas engine, the oil is generally fed through mechanical lubricators and the oil consumed depends on the rate of feed. With vertical

gas engines of the totally enclosed self lubricating type, the oil consumption may reach alarming figures, due to the oil getting past the pistons and being burnt in the cylinders, in the same way as it does in motor car engines. In steam turbine stations, oil costs are negligible. For reciprocating sets, providing the crank chambers are drained of water and the oil kept in good condition, there is merely the question of make up oil, and oil for cylinder lubrication.

Gas engines are considerably more difficult to lubricate than steam engines,and where cylinders of large diameters are employed the oil acts as a cooling medium, resulting in higher temperatures of the oil in the crank chambers. Tar coming through as a vapour, is condensed on being wire drawn through throttle valves and inlet ports etc., this quickly contaminates the oil resulting in excessive wear of working parts.

Operating Salaries and Wages.

The relative costs as to operating salaries and wages for gas and steam engines, must certainly favour the latter especially when the size of the station approaches loads of 1,000 K.W. With steam plant under review one European shiftman with native assistant can run a shift. It may also be done in a gas station, but he will require to devote more of his time to the prime mover, to the detriment of the producer plant which must necessarily not be housed too close to the engine room of the station.

This question therefore boils down to that of native labour, and due to the fact that practically the same amount of fuel is handled and has to be elevated to be fed into the producer; and the fact that gas plants require more attention; on the whole less labour will be required on steam stations.

Repairs and Maintenance.

Considering the question of repairs and maintenance, the costs under this heading are considerably higher for gas plants than for steam plants.

Assuming expenditure for maintenance and renewals, on the boilers and producer plants are equal, there is then the question of the engines.

Very few gas engines will run for 500 hours, without requiring valve cleaning, and when operating on bituminous coal or wood, a routine weekly cleaning is general, if trouble is to be avoided with sticking valves. Replacement of valves, especially exhaust valves, valve springs and valve gear is also a heavy item of expenditure, and in proof of this contention, the following figures are taken from records of Insurance Companies, giving tables of breakages. There are 15 listed organs given, and valves, valve gear account for 42.8% of the failures. The next highest item being connecting rods, and their bolts, this being 9.1%.

With reciprocating sets and turbine sets, a year's run has often been accomplished, and renewals in connection with valves and valve gear on reciprocating sets is very rare.

Owing to the higher temperatures and increased difficulty of lubricating the cylinders, rings, pistons, valves, valve gear and guides, the wear on these parts of gas engines is considerably higher than on steam engines.

The wages for maintenance and the cost of renewals, must definitely be higher with gas engines than with reciprocating steam engines, and where turbine plant is used, this item is reduced to a minmum.

Works Costs.

The most favourable conditions for a gas station to compare with steam would be where the gas station operated with bituminous coal, and where the cost of this coal in the bunkers was high; further where the maximum load does not exceed 200 K.W. The works costs of a gas station operating with bituminous coal at 20/- per ton with a coal consumption of 2½ lbs. per K.W.H. and a steam station as outlined with a consumption of 5 lbs. are compared below.

Water is taken to 2/6 per 1,000 gallons, and a load factor of 35%; operating salaries and wages are based on the fact that with either plant a staff of not less than 3 shiftsmen and eight natives would be required. Taking the rate of wages at £1 and 2/6 per day for shift men and natives respectively or a daily total of £4. under this heading.

Works Costs of 200 K.W. Gas and Steam Stations.

	Steam	Gas
Fuel	.6	.42 per K.W.H.
Oil and Stores	.035	.065 „ „
Water	.045	.095 „ „
Wages and Salaries	.57	.57 „ „
Repairs & Maintenance	.03	.10 „ „
Total	1.28	1.25 „ „

This shows an advantage of 2½% in the works costs of gas over steam under the most favourable conditions and size of plant. Any increase in the size of the plant, or lower price of fuel would be in favour of the steam plant. There are, however, other factors to consider and operating difficulties especially with gas plants using bituminous coal are worthy of consideration.

Operating Dificulties. Ignition.

Ignition is either of the L.T. or H.T. type. L.T. ignition with mechanically operated electrodes strikes one as being primitive, and introduces complications in the way of levers and arms. It however, has the advantage of giving less trouble due to the fouling of plugs, but certainly cannot be called an ideal method of ignition. H.T. ignition is generally done on the dual system but considerable trouble is experienced, if any tar comes over with the gas, with the fouling of plugs.

Governing.

The governing of gas engines introduces further complications, as with either Qualitative or Quantitative method, difficulties are experienced. With the former method, the mixture of gas to air is varied, and the volume and compression pressure remains constant, whereas, with the latter, the mixture is constant and the volume and compression pressure are varied. The economy of the internal combustion engine depends on the compression pressure. This, however, is limited to the quality of the gas on account of pre-ignition. Therefore with too rich or too lean a mixture and the resulting slow burning, exhaust valves may reach a temperature which would cause back firing, especially where they are situated one above the other. These difficulties with the plant under consideration are real, as will be mentioned later. Further, on the majority of gas engines the air regulating valve requires to be set manually for varying loads, which means constant attention.

With reciprocating or turbine sets throttle governing gives excellent results and is very simple, and where this is combined with cut off governing on reciprocating sets, governing is ideal.

Parallel Operation.

One of the greatest difficulties is the successful operation of gas sets in parallel. When two sets are on the bars on full load and one of the sets trips out for any of the reasons mentioned hereunder, the second set will also come out due to its 100% overload, resulting in a total shutdown. As is general with all alternator sets in parallel, if they once start swinging with the resulting circulating currents this naturally tends to increase, and the greatest difficulty is experienced in settling them down, even with damping windings on the pole faces. It is not an unknown thing for a gas engine to misfire, pre-ignite or back-fire and any of these causes exaggerated is sufficient to cause that set to trip. To guard against these possibilities, trip coils and protec-

tive gear have to be set to a point where they are practically not functioning with the resulting decreased protection on the alternator.

Due to the governing, sets in parallel may be found to be less stable on the one load than on another. This can be accounted for by variation in compression pressure and quality of the mixture, as is also the case with varying qualities of gas coming through from the producers. With multi cylinder gas D.C. sets in parallel it is possible to cut one of the cylinders, but the mere fact with A.C. sets, fitted with dual ignition, of a plug in one cylinder not functioning, causes the set to start swinging. It may be stated that these difficulties can be overcome by balancing and heavier flywheels, but the cyclic variation for successful paralleling is limited and this limit is not easily obtained with gas engines operating single acting on the 4 stroke cycle, and the fact there is compression on only one of the 4 strokes.

Tar.

Tar comes over with the gas in the form of vapour and tar fog, and the recognised method of extracting this, is, by means of rotary tar extractors. The rotary tar extractor will only extract the tar which is in minute particles, and all tar that comes over as a vapour is deposited later, or goes right through to the cylinders. The proof of this is, that with dry scrubbers using wood wool and saw dust as a filtering medium, this may be merely discoloured and yet beyond this, tar is found in great quantities in the gas pipes and manifold. Tar is generally found to be deposited just beyond the throttle valve in the manifold, where this type of governing is employed, due to the wire drawing of the gas and condensing of the tar vapour.

The amount of tar in the gas will naturally depend on the volatile content of the fuel. With wood fuel, the tar extracted may be as high as 4 gallons per cord of wood. Anthracite fuel with low volatile content produces less tar with consequent longer running hours and less maintenance.

A special type of double draft producer claims to eliminate tar by burning it in the lower zone of the producer. It strikes one however, that to eliminate tar by burning in a producer where air is restricted to form C.O., this method is not altogether sound and is not borne out in practice with ordinary supervision and native labour on the producers. The complete elimination of tar from producer gas would increase the realibility of this type of engine one hundred per cent. Tar also decreases running hours considerably owing to the necessity of cleaning valves, manifold plugs, etc. Tar is the cause of sticking inlet valves, contamination of oil in the totally enclosed self lubricating type, with consequent wear and increased oil consumption, fouling of plugs and the restricting of port manifold and valve passages. Tar is often responsible for bent valve stems and breakings with associated gear when starting up cold gas engines, the tar getting down valve guides and between valve seats when hot. It may even be necessary to treat all valves with a dose of paraffin and ensure that these are free before attempting to bar a cold engine.

Valves.

Inlet valves are generally of the double poppet type for the gas and air with lead on the air valve for scavenging. This introduces complications, and trouble dut to inlet valves is often obscure and difficult to trace. Exhaust valves, however, generally give more trouble due to their operating at higher temperature. The valves do not lend themselves to efficient water cooling and the exhaust valve may reach a temperature due to delayed combustion, which is sufficient to ignite the incoming mixture, causing back firing. Springs on inlet and exhaust valves require to have sufficient tension to keep the valves closed against the tendency of the atmosphere pressure to open these, when the engine is on light load and a partial vacuum in the cylinder. They are often required to close a valve which is insufficiently lubricated in the guide, due to tar. This necessitates the use of heavy section springs with increased wear of the valves and seats. Valve

springs renewals especially of exhaust valves due to breakages, are frequent and increase the cost of maintenance due to renewals.

It may be argued that internal combustion engines in motor cars do not require the maintenance or renewals mentioned, but pistons of 4" and valves of 1" diameter are the general average, whereas in gas engines pistons of 20" and valves of 10" diameter, with their increased cooling difficulties are the general average, and further, the gas as used in a motor car engine is perfectly clean.

Foul Air and Smells.

The smell due to the blowing up of producers is well known to most people who have lived near a gas station. The general cure advocated is to turn a deaf ear to complaints and allow those in the neighbourhood to become accustomed to it.

The foul air due to the leakage of producer and exhaust gas does not improve working conditions for those employed in the station, and there is always the possibility of having someone gassed, especially natives.

Advantage of Steam Plant.

The highest price including railage paid for coal in the Union and Rhodesia may be taken as 23/4 at Cape Town and 28/8 at Umtali. These towns represent the most distant point from the coal fields in both countries, with the resulting highest price paid for coal. Tabulated below are the fuel costs for varying consumptions at both places.

Lbs. per K.W.H.	Cape Town	Umtali
2 lbs.	.28d.	.342d.
3 „	.42d.	.513d.
4 „	.56d.	.684d.

From these figures it may be seen that low fuel costs may be obtained at reasonable coal figures, with fuel at its maximum price.

There is never any question of the reliability of steam plant but is is generally considered inefficient as far as fuel costs are concerned. This reputation was gained, I think, owing to the fact of the number of small steam plants operating where reliability was of prime importance and efficiency a secondary consideration.

In a small steam station, there is no reason why reasonable thermal efficiency should not be obtained. The Coal consumption for nine million units per annum at East London was 1.86 and 1.9 at Bulawayo, the Salisbury figures being 2.3 for the month of January on an output at the rate of 3½ million units per annum, these represent thermal efficiencies of 15 and 13 respectively. Practically the only difference which should occur in the overall thermal efficiency between medium and small stations is that of the prime mover itself, and there is no reason why in stations operating with units of approximately 200 K.W. why efficiencies in the neighbourhood of 7% should not be obtained, this represents a coal consumption of 4 lbs. per K.W.H. assuming the calorific value of the coal at 12,000 B.T.Us.

Conclusion.

When considering the relative merits of two types of prime movers, there is the producer station, operating with bituminous coal or wood fuel which may show a slight advantage where the maximum load is in the vicinity of 100 K.W. but however important fuel costs are, other factors must be taken into consideration, and this advantage would be outweighed by the other variable charges which determine the basic price at which the unit may be sold. The reputation therefore that the gas station has gained through its higher thermal efficiency does not warrant in my opinion the installing of gas engines for Municipal Electrical Schemes in preference to steam, except under exceptional circumstances, owing to the difficulties connected with prime movers on producer gas.

DISCUSSION.

Mr. Davison Beaufort West (Communicated): My experience as a Municipal Electrical Engineer in charge of Municipal electric light undertakings under South African conditions with Suction Gas Producer Engines as prime movers has convinced me that it is impossible for such a supply to successfully develop. It may be of interest to note that at the present time I have pointed this out to my Council and recommend they cease to have anything further to do with suction gas engines."

Mr. G. H. Swingler (Capetown) : I am very interested in this paper as I have had the pleasure of shutting down suction gas engines. Wellington has gas engines and have done well, so they say. Malmesbury had a suction plant and it worked satisfactorily but our price fortunately was more favourable to them and their plant was shut down. Mr. Ritson has had good experience in this direction. I appreciate and thank the author for his paper as I think it will give me great assistance. I am sure this paper must have been very interesting to some of the smaller town engineers and it would be very nice to hear their remarks.

Mr. Vowles (K.W.T.) : There is not a true anthracite coal in the country and as far as bituminous coal is concerned our experience has shewn that it has been as utter failure wherever tried. I could give names of towns in England as well, where bituminous coal had been an absolute failure. Uitenhage have had a wood burning gas plant running day and night and they have not had much trouble. I once put up a proposition to a council to plant trees on their commonage to produce their fuel by which power could also be produced. They were not willing as they thought the ground was more valuable for grazing.

Mr. Wud (Swellendam) : It is a pity that the writer did not include Oil Plant in his paper as both the Gas and Oil driven station have many points in common, such as high cost of maintenance, repairs and lubricating oil consumption etc.

Once a station is loaded to its full capacity it is time that steam be resorted to, either in reciprocating or turbine sets.

In connection with the paralleling of Int. Comb. sets I would like to mention that I have Multi. Two, and Single cylinder sets, having extra heavy flywheels and small cyclic variation yet parallel operation is by no means satisfactory and surging and instability, results due to bad governing etc. It is obvious that the sets must always be kept up to concert pitch.

It was mentioned by one member that they were changing over from steam to crude oil plant and judging from this it would appear that the old steam sets were very inefficient.

In U.S.A. and many countries in Europe I.C. Prime Movers more particularly Oil Driven are many, yet for flexibility and in a scheme which is to be developed they have many disadvantages.

Mr. Rodwell (Johannesburg) : It is generally agreed that the field of the gas engine is becoming more limited as the march of progress goes on.

There are still cases, however, where the gas engine demands attention as a prime mover, where the question of fuel, due entirely to means of transport, is limited to possibly the surrounding bush or local timber.

One feels, however, that the author has limited his excellent paper to a comparison between steam and gas. Why not have included the crude oil engine?

One also notes with a certain amount of sympathy the author's bias against gas engines, but why raise such points as speed and cyclic irregularity in support of such bias?

In a 3-4 or more cylinder engine, the cyclic irregularity is never worse than 1 in 250, taken on extremes in any one cycle, and when taken on Continental standards (which are based on the average during any one cycle) would approximate 1 in 500. This would appear to be good enough for parallel running over extended periods.

The comparatively low compression values necessary in a suction gas plant for perfect combustion of the fuel are surely worthy of consideration in a country where such plants are operating at altitudes varying between coast level and 7,000 or more feet above sea level.

The idea of the average cooling pond resolves itself into a saturated solution with its consequent cumulative liming effect of the water jackets of both the cylinders and the exhaust manifold.

This effect can often be eliminated by running the circulating water into a natural dam, when local conditions permit of same.

The efficiency of lubrication is purely an operating point and is not peculiar to a suction gas plant. A system of filtering the oil can usually account for a fair recovery.

The author has presented a very good case and one would not recommend a suction gas plant where steam or crude oil plants could be used. It must be borne in mind, however, that the suction gas plant has still a place in the field of generating electric energy, and we shall look forward to a paper on the efficient running of such a plant.

I desire to congratulate the author on his excellent and interesting paper.

Mr. L. B. Sparks (Pietersburg) : I have experienced gas working alongside steam and while gas has given satisfactory results, my experience has been that the load could never be developed, and this is necessary for the successful operation of any power station. I still think that the difficulties with regard to gas engines could be overcome. If working costs were considered the difficulty would be the coal. I think the policy of the people supplying the coal (and I am not referring to bituminous coal) has been very short sighted as by charging high prices they have killed their business. If they could have halved the cost of the coal, costs would now show very good figures. I blamed the coal suppliers for the high cost of development with suction gas and I would never put in suction gas if I wanted to capture a big power load. There is room for improvement and if the coal owners could only bring down the price of coal it would solve one difficulty. I believe the Forest Department is using suction gas plant with wood as fuel; the Department seems to see some posibilities in suction gas.

Mr. J. Roberts (Durban) : I was very much impressed in Queenstown at the results Mr. Ashley was getting from some plant he had put in which superseded an oil engine. Perhaps Mr. Ashley could be persuaded to give some results with oil engines as against steam.

Mr. T. P. Ashley (Queenstown) : I will only say that in my movements round the country all engineers I have met have cursed gas engines. The question of the gas mixture on two sets not being equal causes trouble. I am in agreement with Mr. Metelerkamp; and would not consider installing gas engines and have therefore not taken the matter very seriously.

Mr. Metelerkamp : Most oil plants require 1 lb. of oil per K.W. As regards cheap fuel, with oil at £7 per ton, that is .75 lb. per K.W., which is too high for fuel.

VISITS.

In the afternoon the party visited the Railway Workshops and in the evening were the guests of the Mayor and Council to a performance at the Plaza Cinema.

SIXTH DAY.

SATURDAY 28th MARCH, 1931.

The Convention resumed its proceedings at 10 a.m. with the President (Mr. L. L. Horrell) in the Chair, there being present 30 Members, 7 Councillor Delegates and 8 Visitors.

NEW MEMBERS.

The President : I have to announce the the following gentlemen had been elected members of the Association :—Messrs. Verryn (Middelburg, T.), Taylor (Bulawayo) and Ritson (Stellenbosch)

QUESTIONNAIRE RE "WORKING ON LIVE MAINS".

The President : In regard to the Questionnaire recently sent to all Municipal Electrical Engineers by the S.A. Municipal Employees Association I would mention that Mr. Poole (Hon. Secy. and Treas.) had foreseen a difficulty which might arise if members replied separately to the questionnaire and they had to thank him for sending the telegrams asking members to delay their replies until the Convention meet.

The Council met yesterday (Friday and proposed that the following replies should be sent :—

Question. Are you of the opinion that linesmen should be compelled to work on live mains in your services?

Answer. It is essential to the industry that work shall be performed on live mains as this has been the practice from the inception of the public supply of electricity, and we see no reason why this practice should be discontinued.

Question. If you consider such work necessary what do you consider should be the limit of pressure for such work?

Answer. The medium pressure as laid down in the Mines and Works Regulations.

Question. Have you any objection to, or would you welcome, national rules to govern these matters?

Answer. Conditions of work on live mains vary very much according to the nature of the work and according to the conditions of the various Undertakings, so that in our opinion it is not practicable to formulate a set of rules to govern this matter.

Question. What is the practice adopted by yourself in connection with linesmen?

Answer. To provide the necessary equipment for the protection of the workman.

Question. Are you in favour of all line work, other than that on Tramway trolley wires, being performed under the direct orders and supervision of a responsible official?

Answer. In view of the fact that the work is carried out by a competent person it is not necessary, and in practice is impracticable.

Question. What is your practice in the matter of allocating responsibility for work performed on live mains?

Answer. The practice depends upon the organization adopted by the various Undertakings, and exigencies of the service.

Question. Would you favour the formulation of formal rules aiming at a South African standard.

Answer. Same as the third answer.

Mr. Swingler (Capetown) : I would explain that the Council of this Association had formulated their replies to send to the Municipal Employees Association but would like to have the Convention behind it on the principle. It was imperative from the point of view of service and progress that they must work on live mains. I propose that in reply to the questionnaire it should be stated that working on live mains is absolutely essential. **Mr. Roberts** (Durban) : I beg to second. **Agreed to.**

Mr. Ewer (P.M. Burg) : I propose that the replies as drafted be adopted; **Mr. Ashley** (Queenstown) : I beg to second. **Agreed to.**

REPLY by Mr. D. J. Hugo, M. Sc (Eng) to the discussion on his paper.

I am very pleased that the paper has apparently created considerable interest and feel it an honour that the Engineers from the large cities have considered it of sufficient merit, to submit their criticism.

I must point out, however, that I have merely been fortunate in being called upon to describe systems, all design details of which had been settled prior to me joining the Department some 15 months ago.

With regard to Mr. Swingler's remarks, there is no question, of course, that the first requirement of every system is to meet local conditions.

Mr. Swingler considers that we must be on the lookout for sub-station sites, but I have already pointed out that as the load grows we hang another pole transformer at the point where it is required, at every corner if necessary.

I am at a loss to understand the figures for losses he has submitted because, as Mr. Roberts has already said, losses, depending on the square of the current, are vary much smaller in an H.T. than in an L.T. system.

I am sure you, Mr. President, will be the first to admit that in Pretoria we are always prepared to consider any suggested improvements, particularly when these concern the safety of life and limb. I may add that each switch cubicle of an outdoor sub-station contains a link-stick, and that on numerous occasions it has been necessary to draw links in a pouring rain. No mishap has ever occurred in this connection.

I thank Mr. Roberts for his appreciative remarks and am pleased to hear that our distribution is modelled on a system which adequately serves the domestic demand of the most electrically advanced city in the Union.

I cannot take the credit for giving Mr. Roberts the tip regarding the effect of Induction Voltage Regulators on dimming at this matter has already been discussed in Johannesburg and Pretoria and was inserted in the paper with the object of invoking discussion.

In reply to Mr. Rodwell, in Pretoria we also utilise rooms in large buildings as substations sites. Immediately we hear of any large building to be erected we make arrangements with the Architects and usually have no difficulty in procuring a site in the basement for this purpose. In some instances agreements have been concluded whereby such a room is used as a distribution point from where other large buildings in the near vicinity are also supplied.

Representatives of the smaller towns seem to consider that Induction Voltage Regulators are unnecessary frills and apparently do not agree that in the Low Tension Scheme they are essential. A point often missed is that a 10% reduction in the supply pressure means 10% less current flowing which means a reduction of 19%

in the watts and consequently in revenue. Our High Tension Regulators are designed to give 7½% buck or boost and our L.T. Regulators 10% buck or boost, the time of operation from full buck to full boost being 10 seconds.

Mr. Metelerkamp cannot see why we should not eliminate our Lightning Arrestors which are installed at transformer feeding points and also at two or three selected points in a district. Lightning Arrestors provide an easy path to earth and act as a safety valve for any induced voltages and we shall require very definite evidence that they do not serve a useful purpose before considering their elimination.

Mr. Metelerkamp (Salisbury) : I would be glad to know by what method it had been proved that arrestors were effective. I mention that at Middelburg, on a certain section, lamps were always burning out during lightning storms. and though a lightning arrestor had been put in at the point trouble still continued.

The President : Pretoria had experienced just the same trouble. I consider the best thing to be do was to re-wire a circuit where trouble was always occurring. If the insulation was torn at all on a circuit, it made a very fine lightning conductor. There was the case of lightning trouble at a house in Pretoria; and when I was called in I could find nothing wrong except, however, that the tape of a lightning conductor had a very bad joint in it and there were some very sharp bends. I told the owner of the house that I really could not say what the trouble was but would not be surprised if the lightning conductor had something to do with it. The owner did not have the tape repaired and next year the same trouble occurred. The conductor was then repaired and the owner has had no trouble since.

Mr. J. Roberts (Durban) : Lightning troubles are not very often due to direct strokes. A lightning flash causes a charge to be induced on any electrical circuit in the neighbourhood. We have

had trouble out in the country but not in the town and most of the troubles were on the longer lines.

Mr. West (Colenso) : I would mention that in the United States it had been found that lightning disperses itself within a few thousand feet; lightning arrestors are placed every 1,000 yards All the poles used for transmission are numbered, and they have plans on which they mark with a red disc each pole where they have had trouble from lightning.

Mr. Ewer (P.M. Burg) : I am of opinion that iron stone in the soil was a factor to be considered.

Mr. Vowles (K.W. Town) : I would ask whether pole transformers would not be affected by being exposed to the sun.

The President : I would explain that that question had worried us a good deal at one time; and I had thought of putting a square shield over the transformer but we have had no trouble at all. A 100 K.V.A. transformer costs say £80, and even if 50% were added the cost would be very much less than a brick cubicle.

Mr. Metelerkamp (Salisbury) : On the L.T. side we have not installed any lightning arrestors; we certainly have had a little trouble but not more trouble than where lightning arrestors had been installed.

The President : I can assure Mr. Metelerkamp that there has been no trouble whatever with the pole type transformer. We have not had one burn out, and we have not taken one down for overhaul, but fresh oil is put in ever six months.

REPLY TO DISCUSSION.

Mr Metelerkamp in reply said :—

Cyclic Variation.

Mr. Rodwell mentioned the figure of 1/250 as the figure for successful operation of engines in parallel. This method of stating that the cyclic

variation is merely the ratio of the difference between the maximum and the minimum speed to the mean speed. When however, one is dealing with alternators in parallel, the angular velocity of a $\frac{1}{4}$ cycle or 90 electrical degrees is, the maximum which should be analyzed, and this in the case of slow speed gas engines is only a small fraction of one revolution.

There is no question that gas engine makers are not manufacturing gas prime movers which are suitable for successful parallel operation, but the point as raised is, wether this uniform angular velocity is maintained, in the event of variations in the quality of the gas, ignition trouble etc.

Water.

The quantity of water required per K.W.H. is for scrubber and jacket cooling water The jacket cooling water would naturally be taken through a cooler and re-circulated with the usual loss of $2\frac{1}{2}\%$ to 5% due to evaporation.

Lubricating Oil.

The purifying of lubrication oil which is contaminated by tar is an extremely difficult proposition. It is not possible to put this oil through a mechanical separator of the centrifugal type without first allowing it to stand for long periods, to allow the tar to settle. If this is not done, the bowls of the separator become clogged with tar after a few minutes working.

Oil.

Oil was not introduced into the discussion primary, on account of the cost of fuel oil.

Until quite recently £7 0s. 0d. per long ton was the lowest price which fuel oil could be obtained at any Power Station, when return of empties and freight is taken into consideration. Fuel oil at Uitenhage, which is only 20 miles from a Coast Port, came out at £10 10s. 0d. per long ton during the year 1929/30.

Very few Municipal Undertakings, operating with oil engines show a better figure than .9 lbs. per K.H.W. this gives the following fuel costs.

Cost of fuel per long ton.	Fuel cost per K.W.H.
£7 0 0	.675d.
£10 10 0	1.01d.

These fuel costs are, in my opinion, too high to seriously consider oil engines for Municipal Undertakings.

ENGINEERS CERTIFICATE OF COMPETENCY

Mr. Vowles (K.W. Town) : I would be glad to know whether anything has been done in connection with combining the electrical engineer and mechanical engineer certificates.

The President : I do not think so. Mechanical engineers are very conservative and do not like to mix themselves up with the electrical side.

Mr. Perrow : The question of one certificate instead of two has been discussed with the Government Mining Engineer but it was felt that we were aiming at an ideal that was some years ahead of its realisation. A mechanical engineer can sit for his electrical certificate provided he has had experience; as he is in charge of plant he must have experience. Unless an electrical engineer serves his time he cannot qualify for the mechanical certificate.

GENERAL.

Mr. Evans (S.A.E.L.A.) : I would raise the point of indentifying the folks attending the Conventions and suggest either of two methods :—a badge with a number, or a badge with the name printed on it. It would be very helpful to know members of the Association.

Mr. Roberts (Durban) : I support this idea, and suggest that at the next Convention a list of members and their towns should appear in the programme—it would have been handy this year.

THANKS OF APPRECIATION.

Mr. West (Colenso) : Mr. President and Gentlemen, I would like to take this opportunity of thanking you for being invited to this Convention, further, I would like to express my appreciation of the honour I feel at being elected to be an associate member. I am very sorry indeed that I have not contributed much to the discussian on the papers. I thought I might be taking up valuable time and besides I had no copies of the papers before I came to Pretoria. I have been very much impressed with the Convention and I feel that the work done is very beneficial to engineers. It is not only the Convention itself but the time engineers have to work with the problems they have in their own undertakings. If Councils realised the important work done at these Conventions they would force their engineers to come along and also would have representatives themselves. I would like to extend an invitation to Colenso to any engineer or member of this Convention. I thank you again for your kindness.

Mr. Perrow (J.H. Burg) : I would like to associate myself with Mr. West. I would also like to say how much I have appreciated the increased discussion here as compared with Bloemfontein, not only as regards quantity but quality. It has been very nice to see men from smaller stations discussing matters so freely.

Cr. Clark (Durban) : On behalf of the Town Councillors present, I would say that we have appreciated the hospitality, the entertainments and the social events which we have been permitted to attend. I regard the Convention as very important. interesting, very imposing and there is a deal of information to be obtained. I ask that the appreciation of the Councillor Delegates should be conveyed to His Worship the Mayor and the Town Council for all they have done for them.

Mr. Ritson (Stellenbosch) : I move as an unopposed motion that the Convention wish you (Mr. President) a very successful year of office.

Mr. Roberts (Durban) : I have very great pleasure in supporting the motion and wish to thank you Mr. President for all the work you have done. I have had the advantage of knowing what you have been doing and how ever ready you have been to help Mr. Poole. It has been a very successful Convention and you will look back upon this year with very great pleasure, I shall certainly do so myself. We have not had a hitch and have been very happy together. I must thank you very much Mr. President, and wish you a very successful year of office.

The President : I thank you very much for your appreciative remarks.

Cr. Duxbury (Pretoria) : I wish to thank Cr. Clark for his very kindly reference to Pretoria and am quite sure that the Mayor will be very pleased to receive so graceful a comment. I would like to assure the Convention that, so far as the Pretoria Town Council is concerned it had been a very great happiness to have you amongst us. I would stress the tremendous value and importance of such Conventions, which have the support of the Town Council. Pretoria has been honoured in having the Convention, and I hope you have all enjoyed your stay.

Miss Bissett : I would like on this very interesting occasion, to express to you Mr. President my very sincere thanks for your invitation to attend this Convention and also to the Association of Municipal Electrical Engineers for allowing me to be present at their deliberations. I feel myself to be a most privileged person and it has been a very interesting occasion. I came in the spirit of one wishing to listen and learn and I take back to the old country some knowledge of the progress that you are making in South Africa. I am much impressed that so young a country should have reached the present stage of development, it is a very good omen for the future.

I must not take up your time so will simply express my great appreciation at being allowed

to be present here and I would thank you Mr. President for the courtesy I have been shewn. I have had a very happy time.

The President : It has given us a greater pleasure to have you here, Miss Bissett. We have been delighted to see you and we hope that the rest of your stay will be enjoyable. When you get back you will be able to tell your Association what is being done out here.

CONCLUSION.

The President : In closing I propose a hearty vote of thanks to Mr. Poole, who has been the backbone of the Association. He is going on pension next year but we all hope he will be very closely associated with the Association for many years to come.

Other votes of thanks were passed to all bodies which had contributed to the success of the Convention.

ASSOCIATION OF

Municipal Electrical Engineers

LIST OF MEMBERS, ASSOCIATE MEMBERS and HONORARY MEMBERS. as at March, 1931.

HONORARY MEMBER.

Dr. H. J. van der BIJL, Electricity Supply Commission, Johannesburg.

MEMBERS.

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BICKELL, L. F., Port Elizabeth, (*Vice-President*).
BROWN, G. C., Volkrust, Transvaal.
BOWER, W. F., Innesdale, Transvaal.
COULTHARD, R. D., Oudtshoorn, C.P.
CHALMERS, A. S., Vryheid, Natal.
COETZEE, J. A., Ladybrand, O.F.S.
DADSWELL, P. W., Cradock, C.P.
DEKENAH, G., Frankfort, O.F.S.
DAVISON, J. G., Beaufort West, C.P.
DANCE, W., Humansdorp, C.P.
EASTMAN, H. A., Capetown.
EWER, G. G. P.M. Burg., Natal.
GYLES, J. H., Durban.
GROOM, H. L., Roodepoort, T.P.
GUNTHER, E., Springfontein, O.F.S.
HOURELD, W., Randfontein, T.P.
HORRELL, L. L., Pretoria, T.P. (*President*).
HARVEY, A. S., Middelburg, C.P.
HADFIELD, A. Gwelo, Rhodesia.
HOOPER, J. Robertson, C.P.
IVERACH, J., Grahamstown, C.P.
JAGGER, T., Ladysmith, Natal.
KERSTEN, P. G., Windhoek, S.W.A.
LEWIS, S.V.R., Aliwal North, C.P.
LATEGAN, J. Boshoff, O.F.S.
MACAULAY, R., Bloemfontein, O.F.S. (*Past President*).
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MANN, F. C. D., Worcester, C.P. (*Member of Council*)
MILLAR, T., Harrismith, O.F.S. (*Member of Council*)

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MORRIS, H. A., Kimberley.
METELERKAMP, A. R., Uitenhage, C.P.
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NEWCOMBE, P. H., Alice, C.P.
NICHOLAS, I. J. Umtata, Transkei.
POOLE, E., Durban (*Hon. Sec. and Treasurer*)
PREVOST, H. A., Somerset East, C.P.
ROBERTS, J., Durban. (*Past President*)
RODWELL, A. T., Johannesburg. (*Member of Council*)
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ROSS, W. D., Potchefstroom, T.P.
RITSON, D. W., Stellenbosch, C.P.
SPARKS, L. B., Pietersburg, T.P.
SWINGLER, G. H., Capetown (*Member of Council*).
SIMPSON, H. G., Colesburg, C.P.
SMITH, J. T. Durban.
SMITH, E. F., Mossel Bay, C.P.
SYERS, F. E. Umtali, Rhodesia.
TEE, C. R. Reitz, O.F.S.
TAYLOR, F. R., Bulawayo, Rhodesia.
TORR, R., Indwe, C.P.
TUBB, B. H. J., Salisbury, S. Rhodesia.
VERRYN, A. J. Middelburg, Transvaal.
VOWLES, J., King Williamstown, C.P.
WUD, J. J., Swellendam, C.P.
WRIGHT, G. R. E., Benoni, Transvaal.
YOUNGER, J., Krugersdorp, Transvaal.

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MARCHAND, B., Witbank, T.P.
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PRICE, E. T., Johannesburg.
PROCTOR, L. B., Johannesburg.
STEWART, G. A., Johannesburg.
SUTCLIFFE, T., Benoni, Transvaal.
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