H. J. Gubler

Please return Oct 46

PROCEEDINGS

of the

Eleventh Convention

of the

Association of Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA).

HELD AT

PORT ELIZABETH

From Monday, April 3rd to Saturday, April 8th,

1933.

PRICE FIVE SHILLINGS.

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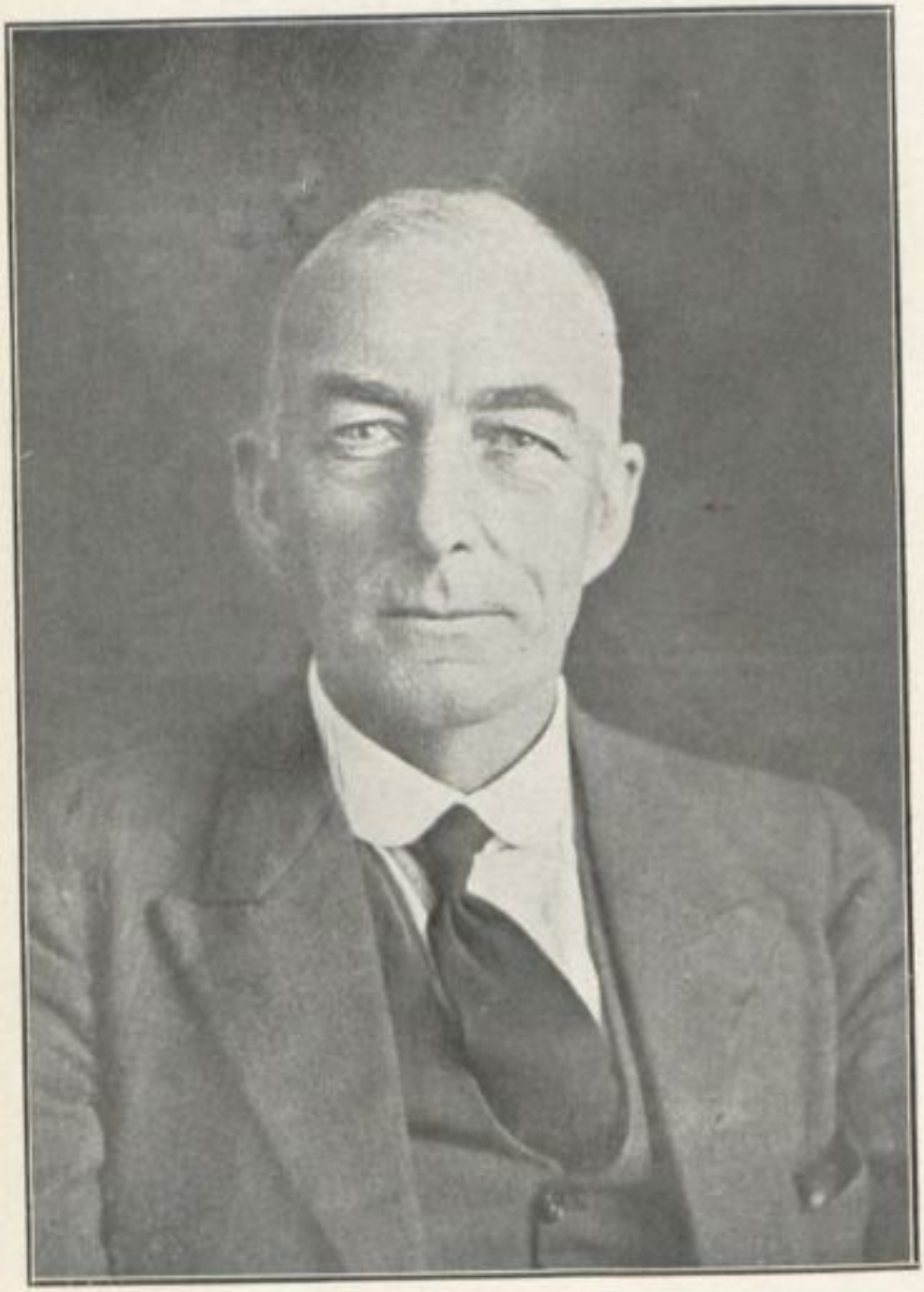

L. F. BICKELL, PRESIDENT
(City Electrical Engineer, Port Elizabeth).

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INDEX

	Page
EXECUTIVE COUNCIL	4
PAST OFFICERS & COUNCIL	5
RULES & CONSTITUTION	6
PROGRAMME OF PROCEEDINGS	10
MEMBERS & DELEGATES ATTENDING	14
MONDAY'S PROCEEDINGS :—	
Civic Welcome	16
Confirmation of Minutes	19
Apologies	20
Annual Report by Acting Hon. Sec. & Treas.	22
Balance Sheet	26
Election of President	28
Retiring President's Address	28
Presidential Address	41
TUESDAY'S PROCEEDINGS :—	
Amendment to the Subscription Rate	55
"A Change-over from Generating Direct Current System Supply to Bulk Supply Alternating Current" (Mr. D. W. Ritson)	56
Discussion	80
"Control of Circuits on Cooking Ranges" (Mr. G. H. Swingler)	84
Questionnaire	84
Discussion	96
"Notes on Inferior Electrical Materials" (Mr. L. L. Horrell)	100
Discussion	102
WEDNESDAY'S PROCEEDINGS :—	
Meeting place of next Convention	104
Discussion resumed on "Inferior Electrical Material"	107
Nomination of Vice-President	116

INDEX

Page

THURSDAY'S PROCEEDINGS :—

Address on Matter Connected with the Vereeniging Works (Mr. J. Bernard Bullock) 117
Mr. Ritson's Reply on his Paper 118
"The Utilization of Surplus Power or Heat for Delivery to a Public Electrical System," with Special Reference to the Sugar Industry (Mr. John Roberts and Mr. Colin Dawson) 122
Discussion 150
"Depreciation in Relation to Electricity Undertakings" (Councillor J. D. Low) 156
Discussion 194
"Broadcasting as it affects Municipal Electrical Undertakings from a Financial Aspect, and Conditions of Reception" (Mr. W. Mortimer Mail) 205
Discussion 209
"Notes on Radio Interference" (Mr. L. L. Horrell) 210
Discussion 212
"Earthing" (Mr. L. L. Horrell) 215
"Notes on Earth Connections" (Mr. L. L. Horrell) discussion by Mr. John Roberts 217
Discussion 222

FRIDAY'S PROCEEDINGS :—

Discussion resumed on "Earthing" 224
Consideration and Discussion on "Coal Railage Charges" (Mr. L. F. Bickell) 232
Discussion 232
"Control of Stove Circuits" 236
Discussion 233
Thanks of Appreciation 240

SATURDAY'S PROCEEDINGS :—

Letter Submitted by S.A. Electrical Lamp Association 243
Thanks of Appreciation 245

ASSOCIATION OF

Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA).

Founded 1915.

EXECUTIVE COUNCIL, 1933.

President :

L. F. BICKELL (Port Elizabeth).

Vice-President :

A. R. METELERKAMP (Salisbury).

Past-Presidents :

L. L. HORRELL (Pretoria).

R. MACAULAY (Bloemfontein).

Other Members :

G. H. SWINGLER (Cape Town).

J. H. GYLES (Durban).

A. RODWELL (Johannesburg).

T. MILLAR (Harrismith).

Hon. Secretary and Treasurer :

F. A. P. PERROW, A.M.I.E.E., M.I.R.E.

(Port Elizabeth).

Association of Municipal Electrical Engineers

(UNION OF SOUTH AFRICA AND RHODESIA)

MEMBERS AND DELEGATES AT PORT ELIZABETH, 11th CONVENTION, APRIL 3rd to 8th, 1933.

Back Row.—H. A. Tinson (Visitor), L. B. Sparks (Pietersburg), A. R. Metlerkamp (Salisbury) Vice-President, Cr. B. G. Fourie (Springs), Cr. W. R. Gray (Walmer).

Second Row.—W. H. Milton (E.S.C.), E. F. Smith (Mossel Bay), P. W. Ritson (Stellenbosch), T. J. Coppin (Walmer), T. W. Hardman (Visitor), F. R. Taylor (Bulawayo), Cr. Jas. Elsworth (Salisbury), R. W. Hayman (Visitor), A. E. Robinson (Visitor), G. Mortimer (Visitor), L. F. Munro Perry (Visitor), D. W. Ross (Potchefstroom), W. H. Bottomley (P.W.D.), R. D. Coulthard (Oudtshoorn), Cr. Rev. Lamont (Durban), W. S. Roome (P.W.D.), G. G. Ewer (Pietermaritzburg), Cr. L. I. McCaffarty (Durban), J. H. Gyles (Durban) Member of Council, Cr. G. C. Jolliffe (Pietermaritzburg).

Third Row.—R. L. Weir (Visitor), J. W. Mullins (Visitor), W. Rutherford (Visitor), F. A. P. Perrow (Hon. Sec. and Treas), E. Gunther (Springfontein), J. S. Clinton (Cradock) D. H. Hilton (Humansdorp), I. J. Nicholas (Umtata), J. Iverach (Grahamstown), W. E. Schoch (E.S.C.), E. R. Smith (S.A.C.M.A.), J. Vowles (Kingwilliamstown), J. Hooper (Robertson), J. A. West (E.S.C., Colenso), H. G. Simpson (Colesberg), A. R. Campbell (Springs), Cr. T. Ericson (Kimberley), H. J. Relihan (Paarl), Cr. W. Barnard (Potchefstroom), J. Burnard Bullock (Visitor), W. Mortimer-Mail (Kokstad), Cr. D. Nelson (Paarl), Cr. D. Shearer (Ladysmith), Cr. W. Maver (Bulawayo), L. H. L. Badham (Visitor), T. Jagger (Ladysmith), P. W. Newcombe (Alice), E. Chase Brown (Volksrust), Cr. C. J. Hookham (Johannesburg), G. E. H. Jones (Mafeking), R. Brown (Randfontein), T. P. Ashley (Queenstown), L. B. Proctor (Johannesburg), G. R. E. Wright (Benoni), J. J. Kruger (De Aar), F. Castle (Capetown), C. H. Adams (Port Alfred) Cr. D. J. Paterson (Randfontein), R. F. Botting (S.A.I.E.E., Johannesburg).

Front Row.—Cr. A. Withinshaw (Capetown), Cr. D. A. Thomson (Bloemfontein), J. Mordy-Lambe (East London), A. Rodwell (Johannesburg) Member of Council, G. H. Swingler (Capetown) Member of Council, R. Macaulay (Bloemfontein) Past President, L. F. Bickell (Port Elizabeth) President, L. L. Horrell (Pretoria) Past President, John Roberts (Durban), T. Miller (Harrismith) Member of Council, A. M. Jacobs (E.S.C.), F. C. D. Mann (Worcester).

PHOTO: W. H. B. WODEHOUSE,
618, MAIN STREET, PORT ELIZABETH.

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.
1931-33	L. L. HORRELL	Pretoria.	E. Poole.

Past Ordinary Members of Council :

1915-17 J. Roberts: W. Bellad Ellis: B. Sankey.
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.
1931-33 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 electrical 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 £2 2s. For other members £1 1s. Any member elected within six months after the Annual Congress shall pay the full subscription for the year, and if elected six months after the Congress shall pay half subscription.

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

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

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

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

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

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

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

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

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

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

17. The local Press of the town in which the Congress is held shall be notified of the time and date of the readings of all papers, but the 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.

Eleventh Convention

PORT ELIZABETH.

PROGRAMME OF PROCEEDINGS.

MONDAY, 3rd APRIL, 1933.

9. 0 a.m.—Meeting of Council (Hotel Elizabeth).

10. 0 a.m.—Registration. Issue of Programmes, etc.

10.30 a.m.—Official Opening of Convention in the Ballroom of the Hotel Elizabeth by His Worship the Mayor (Councillor W. F. Caulfield).

11. 0 a.m.—Annual General Meeting.
(Municipal Delegates and Visitors may attend, but only Members are entitled to vote.

AGENDA.

1.—Annual Report of Acting Honorary Secretary and Treasurer.

2.—Election of President.

3.—Valedictory Address by Retiring President.

4.—Election of Acting 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 :
L. L. Horrell, Pretoria.

Vice-President :
L. F. Bickell, Port Elizabeth.

Past Presidents :
R. Macaulay, Bloemfontein.
John Roberts, Durban.

Members :
G. H. Swingler, Cape Town.
F. C. D. Mann, Worcester.
A. Rodwell, Johannesburg.
T. Millar, Harrismith.

7.—Place of meeting of next Convention.

8.—Presidential Address.

9.—Discussions arising.

2.30 p.m.—Motor Trip to Seaview.

TUESDAY, 4th APRIL, 1933.

8.30—9.30 a.m.—Meeting of Council (Hotel Elizabeth).

9.30 a.m.—Offical Photograph. To be taken in grounds of Hotel Elizabeth.

10. 0 a.m.—Paper by D. W. Ritson, **"Changing Over from Direct Current to Alternating Current."** Discussion on Mr. Ritson's paper.

11. 0 a.m.—Consideration and discussion re **"Control of Circuits on Cooking Ranges,"** introduced by Mr. G. H. Swingler, Capetown.

11.30 a.m.—Consideration and discussion on subject of **"Inferior Electrical Material,"** introduced by Mr. L. L. Horrell, Past President.

2. 0 p.m.—Visit to Power Station, Cradock Place Supertension Substation. Eastern Province Cement Coy. General Motors and Ford Factories, etc.

Visitors will be divided into parties, one party proceeding to factories whilst the other visits Power Station, and vice-versa.

7.30 p.m.—Civic Dinner at the Hotel Elizabeth.

WEDNESDAY, 5th APRIL, 1933.

9. 0 a.m.—Meeting of Council (Hotel Elizabeth).

10. 0 a.m.—Reply by D. W. Ritson.

10.30 a.m.—Paper by Mr. John Roberts and Mr. C. Dawson: **"The Utilisation of Surplus Power or Heat for Delivery to a Public Electrical System."**
Discussion on Mr. Robert's and Mr. Dawson's paper.

11.45 a.m.—Exhibition of Cable Making film, and film depicting Construction of Scottish 132 K.V. Power Line—at Metro Theatre, by kind permission of the Management.

Afternoon.—Bowls, Golf, Tennis, or visit to Snake Park and Museum.
Members should make arrangements with the Convention Secretary.

THURSDAY, 6th APRIL, 1933.

9. 0 a.m.—Meeting of Council (Hotel Elizabeth).

10. 0 a.m.—Reply by Mr. John Roberts.

10.30 a.m.—Paper by J. D. Low, Esq., Capetown Chairman, Electricity Committee: **"Provision for Depreciation in regard to Public Utilities."**
Discussion on Mr. Low's paper.

11.30 a.m.—Short paper by Mr. W. Mortimer Mail, Kokstad, on **"Broadcasting as it Affects Municipal Electrical Undertakings, etc."**
Discussion on Mr. W. Mortimer Mail's paper.

2. 0 p.m.—Inspection of Port Elizabeth/Uitenhage Supertension Transmission Line Substation, etc., at Uitenhage. Return to Port Elizabeth, via Redhill and Greenbushes.

7.45 p.m.—Visit to performance at Metro Theatre.

FRIDAY, 7th APRIL, 1933.

9. 0 a.m.—Meeting of Council (Hotel Elizabeth).

10. 0 a.m.—Reply by J. D. Low, Esq.

10.30 a.m.—Reply by Mr. W. Mortimer Mail.

11. 0 a.m.—Consideration and discussion on "**Coal Railage Charges,**" introduced by the President, L. F. Bickell, Esq., Port Elizabeth.

11.30 a.m.—Consideration and discussion on subject of "**Earthing,**" introduced by Mr. L. L. Horrell, Pretoria.

12 noon.—Consideration and discussion of suggested "Model" Regulations, introduced by Mr. G. H. Swingler, Capetown.

2.30 p.m.—Tug Trip around the Bay and inspection of Harbour Construction work.

8.15 p.m.—Moonlight Motor Trip to Schoenmaker's via Marine Drive. Tea at the Outspan; return via Walmer.

SATURDAY, 8th APRIL, 1933.

10. 0 a.m.—Final Discussions.
Any other business.
Close of Eleventh Convention.

HONORARY MEMBERSHIPS.

The President and Members of the following Associations have kindly extended to all Delegates attending the Convention, the full privileges of membership during their stay in Port Elizabeth:—

St. George's Club.

Port Elizabeth Golf Club.

Eastern Province Bowling Association.

Zwartkops Yacht Club.

ASSOCIATION OF

Municipal Electrical Engineers

MEMBERS AND DELEGATES ATTENDING THE CONVENTION.

Alice—
P. H. Newcombe.

Benoni—
G. R. E. Wright.

Bloemfontein—
R. Macaulay.
Clr. D. A. Thomson.

Bulawayo—
F. R. Taylor.
Clr. W. Maver
(Mayor of Bulawayo).

Capetown—
G. H. Swingler.
Clr. A. Withinshaw.

Colesburg—
G. H. Simpson.

Colenso—
J. A. West.

Cradock—
J. S. Clinton, Elect. Engr.

Durban—
John Roberts, Hon. Mem.
J. H. Gyles.
Clr. A. Lamont.
Clr. L. I. McCafferty.

De Aar—
J. J. Kruger.

East London—
J. Mordey Lambe.

Elect. Supply Commission Delegates—
A. M. Jacobs.
W. H. Milton.
W. E. Schoch.

Grahamstown—
J. Iverach.

Harrismith—
T. Millar.

Humansdorp—
D. H. Hilton, Elect. Engr.

Johannesburg—
A. T. Rodwell.
Clr. J. Hookham.

Kingwilliamstown—
J. Vowles.

Kimberley—
Clr. T. Ericson.

Kokstad—
W. Mortimer Mail.

Ladysmith—
T. Jagger.
Clr. D. Shearer.

Mossel Bay—
E. F. Smith.

Mafeking—
G. E. H. Jones.

Oudtshoorn—
R. D. Coulthard.

Paarl—
H. J. Relihan.
Clr. D. Nelson.

Pietermaritzburg—
G. G. Ewer.
Clr. G. C. Jolliffe.

Pietersburg—
L. B. Sparks.

Potchefstroom—
W. D. Ross.
Clr. W. B. Barnard.

Pretoria—
L. L. Horrell.
Clr. F. Hopf.

Port Alfred—
C. H. Adams, Elect. Engr.

Port Elizabeth—
L. F. Bickell.
Clr. W. F. Caulfield
(Mayor).

Queenstown—
T. P. Ashley.

Randfontein—
R. Brown, Engineer.
Clr. D. J. Paterson.

Robertson—
J. Hooper.

Salisbury—
A. R. Metelerkamp.
Clr. J. W. Elsworth.

Springs—
A. R. Campbell.
Clr. B. G. Fourie.

Springfontein—
E. Gunther.

Stellenbosch—
D. W. Ritson.

Uitenhage—
A. Elliot.

Umtata—
I. J. Nicholas.

Volksrust—
G. C. Brown.

Walmer—
T. Coppin.
Clr. W. R. Gray.

Worcester—
F. C. D. Mann.

ASSOCIATE MEMBERS.

F. Castle, L. B. Proctor,

F. A. P. PERROW, Honorary Secretary and Treasurer.

VISITORS.

E. R. Smith, S.A.C.M.A.; R. F. Botting, S.A. Inst. Elect. Engrs.; C. H. Clutterbuck, (Chief Inspector of Factories, Engineering); W. H. Bottomley, P.W.D.; W. C. Roome, P.W.D.; R. M. S. Gilchrist, S. B. Isacke, E. A. Behrens, G. Begg, R. L. Weir, H. S. Hull, A. E. Robinson, R. W. Hayman, J. Mortimer, L. F. Munro-Perry, G. M. Gunn, T. W. Hardman, R. N. Thompson, J. W. Mullins, H. A. Tinson, J. B. Bullock, L. H. L. Badham, A. Stanton, T. Hoy.

PROCEEDINGS

OF THE

Eleventh Convention

MONDAY, APRIL 3rd, 1933.

INTRODUCTORY.

The Eleventh Convention of the Association of Municipal Electrical Engineers (Union of South Africa and Rhodesia) was opened in the Ballroom of the Hotel Elizabeth, Humewood, Port Elizabeth, on Monday, April 3rd, 1933.

Mr. L. L. Horrell, City Electrical Engineer, Pretoria, and retiring President of the Association, was in the Chair, and introduced His Worship the Mayor of Port Elizabeth (Cr. W. F. Caulfield), who had kindly consented to open the Convention, which was attended by 41 Members, 28 Councillors and Official Delegates and 15 Visitors.

CIVIC WELCOME.

His Worship the Mayor of Port Elizabeth **(Councillor W. F. Caulfield),** Mr. President and Gentlemen, in opening this, the Eleventh Convention of your Association, I wish to extend to you all a very hearty welcome to our City. I want to say, at the outset, how very pleased I am to be here this morning. Port Elizabeth is indeed honoured by your making this centre the venue of your gathering.

I think the last time you were here was in 1919, many years have passed and much development has taken place since that time, and I believe you will find, if you have the time to go around Port Elizabeth, that we have developed our Electrical Undertaking tremendously since your last visit.

I should just like to say that we are doing all we can to develop and extend the activities of the Electrical Department and hope presently to get a very large increase in the number of domestic consumers.

It has been, as you are all no doubt aware, a task beset with many difficulties, but our energetic Electrical Engineer, Mr. L. F. Bickell, has overcome all these difficulties and we are confident that we shall have very big developments in that direction in the near future.

You will notice from the Programme that we have arranged certain things for you to see, and we hope you will find time to see them. I hope your deliberations and discussions will result in a greater knowledge regarding the Generation, Distribution and Application of Electricity. Electricity appals me; I am afraid of it. Sometimes I ask people about Electricity, but the explanations go round and round me and I say: "Yes, but you have not told me anything. How do you get it? How do you catch it?" It is rather difficult, but I have no doubt that you know all about it and that you gentlemen in this room will have an Electrical atmosphere.

You will find that our boundaries have been extended tremendously since you were last here. There are undertakings here as great, I submit, as anywhere else, and they have continued and will continue to grow.

Electricity has a tremendous power. It is a wonderful thing, and I suppose that is the reason why the best brains of the world follow the Electrical Profession. I am sure we shall appreciate any views you express, and anything that can be done to develop our ideas of electricity—one of the greatest, if not the greatest factor in present-day civilization. You will find that Electricity has played an important part in the development of our Seafront and Bathing

Beach, which, by the way, offers the finest and safest bathing to be found on the South African coast.

We have here, I understand, Members of the Electricity Supply Commission, Municipal Associations, and in fact, Representatives of every branch of Electrical endeavour. I hope your stay here will be satisfactory in every way. You will find that the privilege of Honorary Membership of the various Social and Sporting Clubs, has been extended to you, and it is hoped that you will avail yourselves of these facilities on every possible occasion.

On behalf of the people of Port Elizabeth I again welcome you all and hope you will have a very happy time.

The Chairman: Mr. Mayor, I thank you on behalf of the Association for the very cordial welcome to your City. You will see by the number of delegates present, how much we appreciate the opportunity of visiting Port Elizabeth. We have a long agenda before us, but I sincerely hope we shall find time to take advantage of the excellent programme of entertainment provided for us.

Many present, will remember the last visit to Port Elizabeth, when the late Mr. Sankey, who had done so much to foster the Association, was in the chair. We have kind memories of him as President and one wonders what would have happened if he had not taken such an interest in our affairs. We congratulate you on the advancement made in your City, especially in regard to your Electricity Undertaking. I thank you again for your very cordial welcome.

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. A. Rodwell, seconded by Mr. J. H. Gyles.

Mr. John Roberts (Durban) said: It is a very great honour to be given the pleasant and important task of welcoming our new members. I have not made their acquaintances personally, but I am satisfied that they will be an acquisition to our Association. With regard to our visitors, we have members of the Electricity Supply Commission and Staff, headed by Mr. Jacobs, Chief Engineer of the Commission, who, owing to pressure of work had to take his life in his hands and fly down from Johannesburg, and I am glad to say that he arrived safely. We have also Mr. Clutterbuck, the Chief Inspector of Factories. I don't know whether we have been honoured by his appearance before, but I am glad to meet him because I look upon the Department of Factories as our best friend. In Durban we have a man who is a very keen critic of this Department, and seeing that the Factory Regulations are very strictly adhered to in Durban, I am glad we have an Official like that, because as long as the Regulations are applied we are on a good wicket. I am sure you will be glad to know that Mr. Clutterbuck takes an interest in our affairs. We also welcome Mr. Bottomley. I don't know whether it is his first visit. We look on him as a worthy successor to our late friend, Mr. Stevens, whose cheery face we miss and we will ask Mr. Bottomley to convey our kind regards to him.

Then, we have here many members of the various firms in business whom we are always glad to see, and who do so much to make our

Conventions a success from a social point of view, and providing motor cars, etc. We thank them for what they have done in the past and are glad to see them here to-day. We hope that all our visitors will have a good time and I look forward to a very pleasant week for us all.

Apologies.

The following telegrams were received during the course of the Convention:—

To President,
Municipal Electrical Engineers Conference,
Port Elizabeth.

Best wishes for successful Convention. While public appreciation of your work by its nature takes years to mature results of your deliberations must have transcending influence on our national economic future which cannot shape on modern lines without widespread application of electricity fostered by national institution of great importance like your Association.

Dr. VAN DER BYL, Chairman,
Electricity Supply Commission.

To President,
Municipal Electrical Engineers Conference,
Port Elizabeth.

Cheerio, Electrical Engineers, may Conventions deliberations still further advance South Africa's Electrical. Progress, progress, regret absence.

(Sender Unknown).

To President,
Municipal Electrical Engineers Conference,
Port Elizabeth.

Best wishes for successful Conference and convivial interludes.

VAL DAVIES.

To Secretary,
Association Electrical Engineers,
Hotel Elizabeth, Humewood,
Port Elizabeth.

Regret unable to attend wishing President Elect successful term.

MOCKE,
Piet Retief.

To President,
Municipal Electrical Engineers Conference,
Port Elizabeth.

Wish you every success what about a few K.V.A.'S.

L. RALSTON.

Apologies were also received from:—

H. Groom, Esq., Roodepoort; Capt. F. G. Pay, Capetown; A. S. Chalmers, Esq., Vryheid; P. G. Kersten, Esq., Windhoek; N. I. Beswetherick, Esq., Umkomaas; B. Marchand, Esq., Witbank; J. A. Coetzee, Esq., Ladybrand; L. Ralston, Dundee; A. J. Verryn, Middelburg, Transvaal; H. A. Prevost, Somerset East; H. A. Morris, Esq., Kimberley; S. V. Lewis, Esq., Aliwal North; G. A. Stewart, Johannesburg; Dr. H. Pirow, Government Mining Engineer, Pretoria; Bernard Price, Esq., General Manager, V.F.P.

A number of commercial representatives also regretted their inability to attend.

The Chairman: Since our last meeting we have lost by death our old friend, Mr. D. H. Dadswell (Cradock). Mr. Dadswell was a member of our Association for a number of years, and I ask you to rise as a mark of respect.

(The Convention rose in silence).

ELEVENTH REPORT AND BALANCE SHEET

OF THE

ASSOCIATION OF

MUNICIPAL ELECTRICAL ENGINEERS

FOR THE YEAR ENDING

28th FEBRUARY, 1933.

Mr. Perrow (Acting Secretary) 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 Eleventh Report and Balance Sheet of this Association, the Membership of which stood at 68 as at the last report, and now comprises the following:

Honorary Member	1
Members	65
Associate Members . .	12
	78

Obituary.

It is with much regret that I have to record the death of Mr. P. W. Dadswell, of Cradock, who has been a Member of this Association for some years.

Retirements.

The Association has unfortunately suffered a loss by the retirements from Municipal activities on having reached the pensionable

age, of Mr. John Roberts, Mr. E. Poole, and Mr. J. T. Smith, all of Durban. The Association can ill afford to lose such old-time Members, particularly the first two mentioned, who were foundation Members. It is pleasing to record, however, that Mr. Roberts and Mr. Poole will retain their interests with the Association as Associate Members. To Mr. Roberts, the Association owes a deep debt of gratitude for all he has done, and for his many contributions to the Proceedings, and equally indebted the Association must be to Mr. Poole for his several years' work as Honorary Secretary and Treasurer, and it is hoped that these retired Members will enoy their well-earned pensions.

Resignations and New Members.

There are four resignations for sundry reasons, but we are pleased to welcome seven new Members since the last Convention.

Secretarial.

The Secretarial work of this Association has undergone a change through the Honorary Secretary and Treasurer, Mr. E. Poole, having proceeded Overseas for a holiday, and the undersigned was appointed by the Council to carry on those duties, and you will be asked at this Convention to confirm the Acting Appointment.

Financial.

The Balance Sheet shows the financial position to be satisfactory, considering two years have elapsed since the last Convention, and consequently the Association had to meet the financial obligations in the time which is usually spread over a year to eighteen months. It is to be hoped that the period between the Conventions of the future will not be quite so

long. The accumulated fund to our credit is shown as £289 2s. 1d., or an advance of £54 10s. 11d. since our last report.

The support given by Members and Councils for the purchase of Proceedings has largely helped the fund, and it is sincerely hoped that this support will be even greater in the future, and a special appeal is made to this end.

Outstanding Subscriptions.

There are only three outstanding subscriptions, and although these Gentlemen have been repeatedly written to, requesting payment, but without response; and I recommend that these subscriptions amounting to £5 5s. be written off and these names removed from the Membership List.

Membership.

The Membership of this Association could be increased. It is hoped that additional Members will be found by inclusion of the Electrical Engineers of those Towns not now represented, and at this Convention some suggestions and amendments to our Rules and Constitution may be introduced to increase our Membership.

Official Journal "S.A. Engineer and Electrical Review."

It is felt that the sustained lack of interest that is being taken by Members under the heading of Association Notes in this Journal, through the lack of contributions, is not in keeping with the aims and objects of this Association. Without the whole-hearted co-operation of Members, by submitting contributions to this section through the Honorary Secretary, the Association loses touch with its

Members to a large extent, and it is hoped that the future will see an improvement in the standard of our notes in this Paper.

This report brings my term of office to a close, and when Mr. Poole approached me about carrying on in an Acting Capacity, I felt very diffident about stepping into the position so ably held by him. I trust that my services have met with the satisfaction of the Council, and I particularly wish to place on record the courteous and generous assistance Mr. Horrell has at all times rendered to me, making my position a pleasant one indeed.

I am,

Mr. President and Gentlemen,

Yours faithfully,

W. W. PITTAWAY,

Acting Honorary Secretary & Treasurer.

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Mr. President and Gentlemen,

Yours faithfully,

W. W. PITTAWAY,

Acting Honorary Secretary & Treasurer.

THE ASSOCIATION OF

MUNICIPAL ELECTRICAL ENGINEERS

(Union of South Africa and Rhodesia)

REVENUE AND EXPENDITURE ACCOUNT

for the period

5th MARCH, 1931, to 28th FEBRUARY, 1933.

EXPENDITURE.

	£	s.	d.
To Expenses at Pretoria:			
Hire of Hall ..	6	6	0
Sundry	4	2	4
Typing Papers ..	14	12	0
Printing	12	9	6
Reporter	22	2	0
Secretarial	16	6	2
	75	18	0
Printing Proceedings ..	85	16	4
Honorariums ..	7	7	0
Statistical Tables	20	0	0
Bank Charges (less collected)	3	18	2
Sundry Printing (stationery) ..	13	14	6
President's Expenses	7	1	6
Secretarial Expenses:			
Stamps 17 3 9			
Telegrams 4 0 9			
I.M.E.A. 4 6 8			
Rail charges 0 18 5			
Sundry 2 5 2			
	28	14	9
Acting Secretary Honorarium ..	16	0	0
	258	10	3
Balance, being excess of Revenue over Expenditure	58	15	11
	£317	6	2

REVENUE.

	£	s.	d.
By Subscriptions:			
Collected	158	12	0
Outstanding ..	5	5	0
	163	17	0
Sale of Proceedings ..	65	10	0
Advertisements	26	19	8
I.M.E.A.	9	12	0
Statistical Tables	41	7	6
Donation	10	0	0
	£317	6	2

LIABILITIES	£	s.	d.	ASSETS.	£	s.	d.
Subscription in Advance	1	0	0	Cash at Standard Bank ..	289	2	1
Accumulated Fund as at 4th March 1931	234	11	2	Sundry Debtors	5	5	0
Excess Revenue Current Period	58	15	11				
	£294	7	1		£294	7	1

Signed W. W. PITTAWAY,
Acting Honorary Secretary & Treasurer.

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.
12th March, 1933. Chartered Accountant (S.A.).

The Report and Balance Sheet were taken as read and were adopted on the motion of Mr. F. C. D. Mann, seconded by Mr. A. Rodwell.

The Auditors' Fees of £3 3s., and Typist's charge of £2 2s. were formally approved. The Chairman announced that the Council had on the previous night agreed to the transfer of the Banking Account from Durban to Port Elizabeth, and asked the sanction of the Convention.

The Convention agreed to the transfer.

ELECTION OF PRESIDENT.

The Chairman: The next item on the agenda is the election of the incoming President. I have much pleasure in proposing Mr. L. F. Bickell, whom we have known for many years, as one of our most energetic supporters. But for the assistance which I received from Mr. Bickell during my term of office, it would have been very difficult to carry on. We know that he has the interests of the Association at heart and will prove worthy of the honour. I formally propose Mr. Bickell.

Mr. R. Macauley seconded.

There being no other nomination, Mr. Bickell was unanimously elected as President, and took the chair.

RETIRING PRESIDENT'S ADDRESS.

VALEDICTORY ADDRESS.

By L. L. HORRELL, A.M.I.E.E.

In vacating the chair as President of our Association, I wish to extend a very hearty welcome to my successor and to express to all members with whom I have had dealings, either directly or indirectly, my cordial appreciation of their co-operation and assistance in making my period of office a happy one.

In accordance with our custom I propose reviewing the events which have occurred during my term of office and so bridge the gap between this and our last conference.

I deeply regret to record the death of Mr. J. W. H. Dadswell of Cradock who was present at our last Convention. I know all will join with me in extending sincere sympathy to the relatives of the deceased.

I would like to mention the amicable relationships which exist between our Association and kindred societies and other bodies, and in particular the Electricity Supply Commission whose Chairman, Dr. H. J. van der Bijl, we have the honour to number amongst our members. Unfortunately Dr. van der Bijl is at present on the high seas, on his way to England, and so is unable to be with us to-day.

The ready manner in which the Commission is always prepared to lend assistance. makes dealings with its Chairman and Staff more than a pleasure and as will be seen from my remarks to follow, the Association has reason to be indeed grateful to this body. for more reasons than one.

Dealing firstly with the affairs of the Association, since the last Convention, members are aware that as the result of representations made to the Government Mining Engineer, we were successful in obtaining his approval to the use of weather-proof cambric insulated wire, now known as "A.M.E. Wire" for house service connections, resulting in considerable saving to our Municipalities. I would remind members, however, that A.M.E. wire was placed on the approval list for a limited period only, which expires on the 31st December of this year.

Accordingly, it will be necessary to reconsider the position in a very short while. I suggest that a small Sub-Committee be formed to co-ordinate the results of experience gained with A.M.E. wire and place the matter before the responsible authorities.

The high hopes entertained of forming an Electrical Development Association of South Africa, as the result of resolutions taken at the last Convention, were unfortunately temporarily dashed to the ground, for owing to the

world-wide depression, it was impossible to obtain the necessary financial support to launch the scheme even in a small way.

It is sincerely hoped, however, that the matter has been shelved for the time being only and that it will be reviewed at an early date. Had it not been for the support, both financial and otherwise, given by the Electricity Supply Commission, the preliminary work in connection with the formation of an Electrical Development Association could never have been advanced to the extent it has. The very trying period through which not only the Electrical Industry has passed, and the need for some form of stimulant again stresses the dire necessity of an Association of this nature.

Despite the adverse economic conditions, it is very gratifying to note the remarkable development of their domestic load by a number of the smaller Municipalities. This growth reflects great credit on the Engineers concerned and I offer them my hearty congratulations.

The matter of the draft bill for the Licensing of Electricians, it will be remembered, was placed in the hands of a Committee consisting of Messrs. Rodwell, Missing and myself.

Unfortunately local conditions and restrictions made it impossible for all centres to agree with our amended draft and it was impossible to reach finality. This history of this draft bill indicates how extremely difficult it is to arrange the regulations so as not to conflict with by-laws already in force. Accordingly, the aid of the Commission has been enlisted, which body will now take over the matter and we hope sponsor the bill through Parliament.

Two of the Association's foundation members, Messrs. John Roberts and E. Poole, both of Durban, have retired from Municipal employ

since last we met. Both have rendered yeoman service in the interest of our Association. Mr. Roberts, as you know, is the pioneer of the electric cooking industry in South Africa, and due to his enterprise and resourcefulness the undertaking, of which he was until recently in charge, has developed the domestic load to an enormous extent. Our Association has also reaped the benefit of his unboundless energy and owe him a great debt of gratitude. He has twice held the office of President and during his term of office administered the affairs of the Association with marked ability.

It would seem only fitting that we should indicate our appreciation of his valuable services, not only to the Association but also to the Electrical Industry, by electing him an honorary member.

Mr. Poole, as your Secretary for many years, is no less well known to you all. His energy, excellent work and grasp of the Association's affairs have made him an invaluable member, and it is almost wholly due to his careful management that the Association finds itself in such a happy financial position. For some time now it has become apparent that the work of Secretary and Treasurer is too much to be carried out by any one member in an honorary capacity, and one wonders whether it will be possible to ask Mr. Poole to accept the position of Permanent Secretary.

While on this subject, I wish to express my appreciation of Mr. Pittaway's work and the able manner in which he is carrying on during Mr. Poole's absence.

It is exactly two years since we held our last Convention and though granted that latterly times have been abnormal, I feel that, if we desire to produce concrete results and carry out the objects of our Association, to promote

the interests of Municipal Electrical Undertakings, and at the same time retain the confidence of our respective Councils, it is essential that we meet at least annually. Interest flags with long delays between conferences, and serious business becomes an impossibility.

Throughout my period of office I have represented our Association on the Electrical Committee of the South African Branch of the British Standards Institution.

During the period April, 1931, to December, 1932, eight meetings were held and 40 draft specifications were referred to the Electrical Committee by the Main Committee. A number of these were found to meet South African conditions while modifications were suggested in others. In certain instances these have proved acceptable to the authorities in London who have congratulated the Committee on the careful attention paid to different points in the specifications concerned.

The following specifications which are of particular interest to Municipal Electrical Engineers were amongst those considered:—

British Standard Voltages for new System and Installations.

Tubular Tramway Poles.

Street Lighting.

Steel Conduits and Fittings for Electrical Wiring.

Three-Position Protected Type, Three-pin Plugs and Sockets with Earthing Connections.

Braided Cables for Overhead Transmission Lines.

Cooker Control Units.

Trolley and Contact Wire for Electric Traction Mains, Operated Synchronous Clocks.

Of the above, the Specification for Braided Cables for Overhead Transmission Lines proved of particular interest and the opinion of Municipal Electrical Engineers was invited.

For the benefit of the Committee, I traced the history of the A.M.E. Wire, which in the opinion of many, has proved superior to the braided overhead cable manufactured in accordance with British Standards Specification. The authorities in London have been informed of this, and they have been asked to comment on the specifications for A.M.E. wire.

An important discussion took place at the last meeting of the Committee in connection with British Engineering Standards and Foreign Trade. The Main Committee had been approached by the British Trade Commissioner with a view to obtaining the views of engineers on the question as to whether the British manufacturer suffered adverse competition from the Foreign manufacturer in the South African market owing to the high standards laid down in British Standard Specifications.

The matter was referred to each of the Sub-Committees, including the Electrical Committee. In the report from the latter to the Main Committee, the opinion was expressed that the British manufacturer did not suffer adversely, in view of the fact that for all important contracts, Municipalities, Mining Houses, and other important industrial users, when laying down the guarantee conditions under which the machinery is to be supplied, almost invariably adopt the British Standard Specification. It was further stated that in the opinion of the Committee, any lowering of the standard of British products would prove harmful to British interests in the South African market.

It may be mentioned that the name "British Engineering Standards Association" has been changed to "British Standards Institution" to cover the standardisation of industrial products other than those of a purely engineering character.

I have noticed in the past that in presenting his valedictory address it is usual for the Retiring President to mention some of the outstanding developments which have taken place during his period of office.

I therefore intend saying a few words in this respect. It is interesting to note that, in spite of adverse conditions, remarkable strides have nevertheless taken place in the electrical world.

By far the most important development during latter years, as far as we are concerned, is the manufacture on a commercial scale of the grid-controlled mercury arc rectifier in sizes up to 2,000 K.W. and more. This device is certain to cause revolutionary changes in the world of electricity as it is capable of converting D.C. to A.C. or from A.C. to D.C. at any pressure, frequency, polyphase or single phase. The principle of this apparatus is the same as that of the three electrode thermonic wireless valve. A grid is placed near each anode of the rectifier and a connection is brought from this grid to terminals outside the rectifier. By varying the potential of this grid relative to the cathode the rectifier can be made to do all sorts of amazing stunts. For example by making all the grids instantaneously negative with reference to the cathode it is possible to interrupt the current flowing through the rectifier in less than 1/50th of a second. The necessity of A.C. or D.C. Switchgear is thereby eliminated. Amongst numerous other operations the grid controlled rectifier is capable of and is supplying Direct Current at any voltage up to the maximum fixed by the A.C. supply; to give a

single phase supply from a three-phase supply at a different frequency; to generate A.C. voltage at any frequency when fed by direct current or by alternating current at some other frequency; to provide a link between A.C. and D.C. systems through which energy can be supplied in either direction; the attainment of high Direct Current operating voltages—the practicability of 50,000 volts has already been established.

The possibilities opened up by these developments gives much food for thought. Will the tendency in a few years be a reversion to direct current for all purposes? Transmission of electrical energy at extra-high tension direct current is now more than a possibility with the consequent elimination of surges, corora loss and the like, while the sizes of insulators and thickness of insulation material will be reduced.

Outdoor Sub-stations are in general use, but a further stage has now been reached by the construction of outdoor Power Stations involving the use of totally enclosed machines, and resulting in the buildings, housing and generators being dispensed with. 220,000 Volt Cable has been manufactured for use on the Continent. The cable is naturally oil-filled and necessitates specially designed and constructed joints and oil reservoirs and feeding tanks.

Important developments in the manufacture of switchgear and new methods of controlling the arc have been evolved. A 3 million K.V.A. rupturing capacity circuit breaker has actually been put into service on a 220,000 volt system.

In order to effect economies in space miniature Power Station Control Boards are now coming into use. A complete control and metering board for a 200,000 K.W. Station comprising 5 generators, 5 transformers, 4 out-

going feeders with all attendant switching and synchronising arrangements can be placed in a space of 12 feet by 3 feet 6 inches.

Considerable and varied improvements continue in the world of wireless and television. Ultra short waves open up new fields in the elimination of atmospherics and fading. Wave lengths down to, and below one meter, are no longer uncommon.

Conferences have been arranged where the various members have been interconnected by transmitters and loud speakers thereby avoiding the necessity of bringing all the members together. There is certainly ample scope for the practical application of this innovation in the case of our Association.

It is interesting to know that small supplies up to 3 kilowatts can be obtained from high tension lines by a string of suspension type capacitors which in appearance resemble suspension type insulators.

A distinct innovation in electric street signals for traffic control is the electromatic system, which dispenses with the fixed time cycle of traffic control. The traffic is regulated according to the flow in either direction. This is effected through the vehicle passing over control trips in the road, and so initiating the impulses which operate the signals.

In conclusion, Gentlemen, I have one other very pleasant duty to perform and that is formally to submit for your approval a proposal which was unanimously adopted at the Meeting of the Council held the previous evening.

The following are the terms of the motion:

That in placing on record the valuable services rendered by **Mr. John Roberts** and **Mr. E. Poole** to the progress of Municipal Electrical

Undertakings in South Africa, and more particularly to the very prominent part they have both played in the interests of this Association, both in its foundation and in the conduct of its affairs, the Association has great pleasure in electing them to Honorary Membership.

Convention unanimously approved of the election to Honorary Membership of Mr. John Roberts and Mr. E. Poole.

Mr. G. H. Swingler (Cape) proposed a vote of thanks to the retiring President for the energy and efforts he had put in during his presidency for the last two years. We knew his personality would pervade in any case, and we knew his untiring efforts on behalf of the Association in years gone by, and I think we should have a record of our thanks. Not only did he put his soul into the job, but his body, and like me, he has a lot of body to put in. I would like to propose a hearty vote of thanks for the address, and also for the work he has done for the Association.

Mr. L. I. McCafferty (Deputy Mayor of Durban and Chairman of the Electricity Committee): I would like to take the liberty at this early stage to suggest that when anybody gets up to speak that he give his name so that we shall know who is speaking.

Mr. Jacobs (Electricity Supply Commission): On behalf of the Electricity Supply Commission, I should like to thank your Association very much for your invitation to us to attend your Convention and also for the opportunity to share the hosptiality of the host of the City of Port Elizabeth. I know that our Chairman, Dr. van der Bijl, regrets exceedingly being unable to attend. We shall follow your deliberations with interest as we have come down to gain knowledge of our problems, and for you to make us able to render better service to the Country through your energy.

Mr. Roberts: I consider it a very great honour to be elected an Honorary Member. It was in 1915 that our Association was first formed as a result of a letter I wrote to Professor Dobson. He took up the idea with fervour and this Association came into being. Of those who were at the first Convention, which was held in a room in the Johannesburg Town Hall, there remain four, Mr. Swingler, Mr. Jagger, Mr. Millar and Mr. Castle. I think that the total number present was about 15.

It has been an Association which I think has been of very great service to Municipal Electricity Undertakings in South Africa because before the establishment of the Electricity Supply Commission, the distribution of Electricity throughout this whole country was in the hands of those men who met in annual Convention, except for those of the Victoria Falls and Rand Mines Power Supply Company. We have, during the years that have elapsed, benefitted very greatly by these Conventions which afford the only opportunity in the year of discussing our problems, technical and otherwise. I must say it was a very excellent move which was made at the Durban Conference in introducing Town Councillors into our deliberations. Nothing but good has resulted from that move and it gives me great pleasure that you are appointing my friend, Mr. Poole, an assistant of mine for over 30 years, to this honour of Honorary Membership. I am sure he will be very pleased and appreciative of that honour.

Mr. R. F. Botting (Past President, South African Institute of Electrical Engineers): I have been asked to convey the hearty greetings of the Institute. Meetings such as these should be held regularly every year because the progress of Electricity is such that the man who wants to keep in touch must tackle these problems frequently. The President of the

Institute has asked me to convey the Institute's greetings to you and hopes for the continual success of your deliberations.

The Secretary read the invitations which had been received from Salisbury and Bulawayo to hold the next meeting in Rhodesia. Each town extended an Invitation separately, but there was an alternative proposal to hold it partly at Salisbury and partly Bulawayo.

The Chairman: I would like to have the views of Delegates on this subject. There is one other town in the Union which we have not yet visited, and that is Maritzburg. We will consider that one as well although we have no invitation.

Councillor J. W. Elsworth (Member of Salisbury Town Council): Mr. Chairman and Gentlemen, my Council will deem it a very great honour if you will decide to hold your next Meeting at the Capital of Southern Rhodesia, which is Salisbury. It is true that Salisbury is further from the Union than Bulawayo, but the actual time for the journey between the towns is now eleven hours. I would like to tell you something about Salisbury.

Councillor Elsworth then proceeded to give details of the civic progress of Salisbury and the attractions it holds for visitors.

Councillor Maver (Mayor of Bulawayo): I am here on your kind invitation to Delegates, and it gives me extreme pleasure to be here this morning. I look upon Port Elizabeth as my mother City in South Africa. It was the place I came to and I lived here for years until I went to Rhodesia 21 years ago. My Council has asked me to extend to you a hearty invitation to hold the next Convention in Bulawayo. I can assure you Bulawayo has all the advantages Mr. Elsworth has put before you, and perhaps a few more.

Councillor Lamont wished the difference between the Mayor of Bulawayo and Mr. Elsworth could be adjusted. He had never been in either city. The distance between the two places counted for very little and he hoped to see both.

Councillor McCafferty: I think we should consider the matter very, very carefully and not only from the Association's point of view, but from that of the Councillors who have to find the money. We have to consider the smaller Municipalities, whether they can afford the expense of sending to Rhodesia. I suggest we defer a definite decision for a couple of days. I think that would meet with the approval of everyone here.

Mr. Swingler: I wish to support going to Rhodesia. I would like to say that the Association of Civil Engineers, when they went to Rhodesia, had a record attendance. That I would like members and delegates to bear in mind.

Mr. Sparks (Pietersburg): Speaking on behalf of the smaller Municipalities the question of expense is important, and the fact that the Civil Engineers had a successful Meeting there is not analogous. It is only the larger towns that can afford county Engineers, as well as Electrical Engineers, and I do not think that the smaller Municipalities could afford to send so far away as Salisbury, and I suggest it be decided more on the question of expense.

Councillor Ericsen (Kimberley) suggested that they should meet half-way and decide upon Kimberley. Kimberley certainly was the mother of Electricity in South Africa. He felt that an Electrical Convention Meeting, to learn about Electricity, should come to Kimberley. I put this forward at Bloemfontein, and I hope you will consider Kimberley, and I heartily

extend an invitation to come to Kimberley for the next Convention.

The Chairman: This subject has been before the Council and it is thought an opportunity should be given to the delegates after hearing all sides of the question and the correspondence. To leave it to a later date, and I suggest that members leave it until, say, Wednesday morning.

This was agreed to.

On the motion of Mr. Horrell, seconded by Mr. Rodwell, the election of four members of the Council was postponed until Wednesday.

On the motion of Mr. Horrell, who stated that Mr. Poole would be overseas and could attend the International Electrical Conference, and represent the Association, it was agreed to Mr. Poole being appointed to represent the Association.

PRESIDENTIAL ADDRESS.

L. F. BICKELL, A.M.I.E.E.

Gentlemen,

I do not attempt here to adequately express my sincere appreciation of the honour you have conferred on me in electing me to the position of President of this Association.

I accept it as a gesture of friendship and goodwill and, also, as a compliment to the City which I have the honour of representing at this Convention.

I am fully conscious of the fact that it is no light task to maintain that standard set by my Predecessors-in-Office who have done so much for the progress and development of Electrical Undertakings in this Country.

In looking round for a theme for my Address, I happened to read our late President's Address wherein he referred to the difficulties of communication available to Council Members when wishing to discuss matters of urgent import, and affecting the interests of the Association.

In the course of his remarks, Mr. Horrell stated that, " the only method at present available is to correspond either by letter, telegraph or telephone which when the matters are urgent, are cumbersome and unsatisfactory."

This, then, suggested to me that it might not be out of place if I took this opportunity of referring, in a brief manner, to the work of Electrical Engineers and Electrical Scientists in advancing the means and methods of Communication. Telephonic communication is now possible over practically the whole world; we can talk to Great Britain within a few minutes, and to Pretoria and Johannesburg in, probably, less time. Pictures can now be transmitted electrically from one side of the world to the other. While one speaker can be heard at the same time all over the world by those possessing Wireless Apparatus.

The vast progress made during the last 60 years in Electrical Science has been of enormous service to mankind, although, perhaps, not so fully appreciated by the General Public as by the Man of Science.

It was only with the advent of Broadcasting that the General Public realized the Wonders of Wireless, Telegraphy and Telephony. In the same way Television, although now in practical use, is not as yet appreciated by the man in the street.

In spite of the marvellous improvements effected in the application of Electricity, whether it be connected with Wireless,

Telegraphy and Telephony, or its adoption for all purposes in our Homes, there is no sign at all that the scope for its application has been fully developed, and it is doubtful if we have more than touched the fringe of them.

We, as Engineers, are all trying to instil into the minds of our consumers the advantages of Electricity for nearly all purposes in the Home. We know that many already so use it, but there is still room for considerable improvement and extension.

Now, in what way is this being done?

Manufacturers are effecting continual improvements in methods of generation and efficiencies of turbines and accessory-plant. Likewise, methods of distribution are being improved and with a view to further encouraging extended application and use of Electricity, Tariffs are being revised and yearly we note the marked advances in consumption of Electricity in the Home, Factory and Workshop.

Dealing with Electrical Engineering, it seems incredible that at the time of the birth of many of us, electric lighting was practically unknown, the telephone had not been invented, electric trams and railways had not been thought of, whilst wireless telegraphy and telephony—which have now attained such universal prominence—were not even dreamt of. The dynamo entered the arena of Commercial use less than 60 years ago and it still seems almost miraculous that the turning of a mass of iron enclosed in wire in an electromagnetic field should give us lighting, traction and power in such various ways and to such an enormous extent as we have to-day.

How far has Engineering, and especially Electrical Engineering, already contributed to human development by improving human progress and efficiency?

The following are some of the contributions:

(i) Our profession enables us to make better use of material by increasing the number of varieties in existence, by producing these more cheaply, and by making better use of their properties.

(ii) It enables us to make better use of all the available forms of energy.

(iii) It increases the space that can be inhabited and made use of by man.

(iv) It increases the physical and mental power and efficiency of each individual of the whole human race.

(v) In our Hospitals it is used in the alleviation of sickness and disease.

(vi) The various forms of rapid communication and transport are all in the main due to the work of the Electrical Engineer.

To bring about a nearer approach of the Electrical Age, the Manufacturer of Electrical Plant has done his best to give us the most economical machinery, so that we must look to our generating costs and more efficient distribution for the future progress of our Undertakings.

Much more might be done in propaganda work, and it seems a great pity that the proposal of two or three years ago, for the establishment of an Electrical Development Association did not mature, owing to lack of enthusiasm!

I think we should all try and impress our Committees of the necessity of more actively supporting Associations dealing with Publicity Work and Electrical Research.

Most of the important towns in the Union are now actively encouraging the demand for the further uses of Electricity in the Home by the establishment of Hire Purchase Schemes, and I was glad to see the other day in the Record and Achievements of the Electricity Supply Commission that it has already instituted a System of Hire Purchase of Electrical Appliances.

Port Elizabeth has not yet adopted a Hire Purchase System, but it is hoped that one will be brought into operation at an early date.

The Industrial Development in Port Elizabeth will be appreciated from the following figures which reflect the growth of the Port Elizabeth Electricity Undertaking during recent years:

	Units Sold
1927	9,738,662
1928	12,277,275
1929	18,598,066
1930	22,813,646
1931	24,185,075
1932	25,559,742

Whilst the economical depression, from which the world has been suffering for the past few years, now shows a slight improvement, there yet seems to be no immediate prospect of great Industrial Development.

There is, therefore, little likelihood of any considerable increased demand for Power in Industries at the present time and it behoves us, as Municipal Electrical Engineers, to explore other avenues for expansion of our Undertakings' activities; in this connection, I am of the opinion that the inauguration of Hire Purchase Schemes will fill that need and create an increased demand for power which in many cases will total several millions of units per annum.

The advent of such schemes will, however, bring most of us another problem and that is the provision which must be made to meet the growing loads on our Low Tension Networks.

The further increasing demands for Electricity for Domestic Purposes which invariably follow the inauguration of Hire Purchase Schemes must alter our plans in mapping future requirements.

From a Distribution point of view it is difficult to foresee to what extent this load may shortly develop, more especially the short period load. We, no doubt, all welcome the Cooking Load of larger dimensions, but the Peak Load at, say, 6 o'clock on a cold and wet Winter's Day, when the cooking load is just commencing, is a very different matter. This point is one which must be seriously considered, and the sooner the better.

This brings me to the question of the System of Supply which should be adopted on Low Tension Networks to cope with these prospective heavy loads, namely, Direct Current or Alternating Current.

Most Undertakings of any size have already completely changed from Direct Current to Alternating Current, and others have decided that the sooner existing Networks are changed over to Alternating Current, the better will it be able to supply the growing demand.

Alternating current distribution is undoubtedly more flexible and easier to extend. It is realized that difficulties have to be faced in changing over, due to the varied nature of apparatus installed, but apart from Electro-Medical-Apparatus, Printing Works and Lifts, etc., most of these difficulties can be overcome.

With a view to keeping down expenditure on Converting Plant, it would appear to me, therefore, that the best policy would be to change-over whatever Direct Current Plant there may be connected to the supply mains as rapidly as possible.

This question is being dealt with more fully by Mr. Ritson in his Paper.

Although no one will deny that better voltage regulation is generally obtained from Converting Plant than from Transformers, yet the modern voltage regulator in static substations will, I think, tend to balance the advantages previously held by the Converter.

It is largely a matter of cost, but, perhaps, in the near future, Manufacturers may develop and market a less expensive form of regulator.

There can be no doubt that the distribution of Electricity to meet modern growing requirements, and coupled with it the necessity of proper control of pressure, is fast becoming a serious matter to say nothing of the cost which will require very serious consideration by those of us who are in charge of Electrical Undertakings.

In conclusion, I would like to refer briefly to the question of Registration of Wiring Contractors and Licensing of Wiremen.

No doubt many of you will remember that this question was discussed at the last Convention and certain recommendations were adopted; unfortunately, legal difficulties precluded these recommendations being put into effect.

It is hoped, howeve,r that ways and means will yet be devised to overcome such obstacles.

The local Examining Board for the Licensing of Electricians and Registration of Wiring Contractors have requested me to bring before this Convention, for consideration, the question of: "UNIFORMITY OF EXAMINATION PAPERS AT THE DIFFERENT LICENSING BOARD CENTRES," and also the possibility of demanding that "ELECTRICAL WIRING CONTRACTORS HAVE FULLY-EQUIPPED WORKSHOPS" before being registered.

I am afraid, however, that in regard to this latter resolution, the legal difficulties already referred to would prevent the adoption of such a ruling.

Mr. Rodwell (Johannesburg): I propose a hearty vote of thanks to the President for his address. I think you will agree that it covers an extremely wide field and we shall be in a position to discuss it fully when we have had an opportunity of reading it. One thing I would like to remark on, and that was the statement that the Electrical Development in South Africa was suffering from a lack of enthusiasm. I do not think that quite expresses the case. You will remember it was the intention to start a South African Electrical Development Association in Johannesburg, but it failed, owing to the difficulty of obtaining the necessary finance, and this was only to be expected at that period of depression, but I am confident that it will be inaugurated at a later date.

I was somewhat surprised to learn that in this, otherwise progressive City of Port Elizabeth, there was no Hire Purchase Scheme in operation, as such schemes had been inaugurated in most progressive towns. A possible reason is that there is some fear in the minds of our City Fathers, that people might attempt to take advantage of such a scheme, who can ill afford to do so. I am reminded of the time when a scheme was recommended at Johannes-

burg about two and a half years ago. It was put forward as a Hire Purchase Scheme, the Council did not seem to take to it, but when it was put as a deferred payment scheme, that appeared to meet the case, though there was little difference in the two schemes. With those few remarks I desire, Mr. President, to say how much we appreciate your address.

Mr. Swingler associated himself with Mr. Rodwell's remarks.

The Chairman asked if they would like an opportunity of discussing it later on.

A delegate suggested it was inadvisable to postpone everything to Wednesday, or they would have a terrific rush.

The Mayor of Bulawayo: With regard to giving assistance, Bulawayo has been doing this for three or four years, and it has lead to very much increased consumption, and we are seriously thinking of adding to that assistance in installing Refrigerators. We have not quite decided yet, but I think it will come to that, so you see that Bulawayo is progressive.

Councillor Elsworth: Salisbury assists purchasers in obtaining every Electrical device.

Mr. Swingler: The observation I have to make in regard to your address, Mr. President, when dealing with Hire Purchase, is that I was one of those who were reluctant to commence in a scheme that would increase our domestic load beyond the capacity of our mains, prior to the date when we were able to take on an unlimited number of stoves. During the last 30 months we made records. In January, after the scheme had been in force 2½ years, we sold 300 stoves on the Hire Purchase System, and in 30 months had sold 4,500, and had connected 30,900 K.W. through these schemes—over 1,000 K.W. load per month. We are still

getting 1,000 kilowatts load per month. As far as the peak was concerned, delegates would be surprised that it did not happen when you expected it to develop. I figure that the load factor is at least 30%. My advice is, don't start any Hire Purchase Scheme until you have your mains sufficiently heavy to meet the demand, so that your voltage regulation can be maintained steady to give service. If you start any scheme before you are ready, and before you can give good service, it will militate against your progress and give much more trouble than it should.

I had thought that the question as to whether we were going to have D.C. or A.C. was settled years ago. Notwithstanding the development made, and with the records of the last few years, I think we are all convinced that we must have A.C. for loads. Our experience is that we can regulate A.C. to a nicety, but with D.C. you get into trouble. Over an area of 35 miles you would have to have some sub-stations, and the cost would be prohibitive. The transformer regulator costs half as much as the induction regulator, and if the variations are not much, you will see no flicker. You will be surprised at the regularity. For the benefit of the people who have not much experience, and have competition in the shape of the gas industry, I believe when you instal a stove or whatever it may be, that it should be a complete installation. Give the consumer the stove installed in the kitchen, ready for work, and if you are not in a very compact locality of the town, you should give service. If you are some distance out from Port Elizabeth you can't get a contractor at a moment's notice to fix it. If you don't give service you will lose a lot of goodwill and the gas people will say, "Gas will never let you down; it never fails." The reason we are selling increased numbers of stoves, notwithstanding that we have been over two years at the job, is because people are getting good service. You must not only sell

the stove, but sell good service. It is no good selling the stove if you don't give satisfaction. It is most essential that you live up to your promise, just as in other businesses. I would impress upon Port Elizabeth to go in for the whole thing, and not half. The finance scheme has been a success in Durban, but I don't think it is a success in Johannesburg.

Mr. Jacobs (Johannesburg) said the President made reference in his address to the Electrical Development Association, and he wished to say something on the subject. Members of the Association are probably aware that after the Pretoria Convention was concluded, a very strong committee was set up in Johannesburg, which met in the offices of the Commission many times, and we suggested a constitution for the South African Electrical Development Association, which was circulated throughout the Union. As Mr. Rodwell pointed out, there was no lack of enthusiasm in tackling the points projected, and it only failed through economic conditions.

Just before I left Johannesburg, Mr. Liebrand, who acted as Secretary to the Committee, gave me a memo bearing on the subject, and while I am not prepared to say that we could go ahead immediately and pick up the thread of the scheme where we dropped it, I may say that Mr. Liebrand has been in communication with the Electrical Development Association in England and hopes shortly to put forward to the members of this Association, a scheme by which you will at least derive some little of the development, which we had hopes, would have been derived from the Electrical Development Association in South Africa. The scheme is not fully developed, but, I think, there has been a certain amount of correspondence between Mr. Liebrand and this Association. Briefly indicated, some of the things foreshadowed in the arrangement between South Africa and England were: Membership

of the Association provided (1) Circulation to every member of copy of the the Association monthly sales. (2) Copies of the books and pamphlets were circulated for perusal. (3) Booklets and pamphlets supplied cheaply. (4) Advisory Service Department at the disposal of members. I may add that the assessment for the membership in the South African Association was to be based on the actual output of the various undertakings. This proposal of Mr. Liebrand will be based on the flat annual membership fee which he mentioned of £5 per member. The matter was mentioned to the Chairman of the Electricity Supply Commission, and he thought it was a matter of great interest to all of us.

Mr. J. Hooper (Robertson) associated himself with the remarks of the previous speakers. He knew the Electricity Commissions were very interested in the Hire Purchase. As a member of a small Municipality that was endeavouring to develop this system, might he put it to Mr. Jacobs for serious consideration, that Electrical Development might be achieved by the assistance of the Supply Commission in financing the smaller undertaking for this purpose. The Electricity Commission had access to sources of finance to which the smaller Municipalities had no possible access. He put it for the serious consideration of the Commission that the possibility of cheap money for the smaller Municipalities would urge things on.

Mr. Brown (Volksrust) said, from the remarks of the Provincial Auditor in regard to development in his town, the Auditor considered the best interest of the Council and the ratepayers would be served, not by expanding sales, but rather by discouraging in every possible way such sales, in order to enable the present plant to cope with the load for some years to come. That was the thing they found. They were subject to this interference from the Provincial Auditor. They were all there to push electricity but they could not sell it below the cost—3.08 pence in his case. It was handi-

capping the country, because Councils took more notice of the Provincial Auditor than of their own Engineer.

Mr. Wright (Benoni) said, it was rather difficult to make comparison between different towns situated, as most of them were, in different provinces. He had been working on the deferred payment scheme, trying to get something suitable. He circularised various towns and found conditions varied to a great extent, and in trying to get a model form of agreement, he and his Council came across all sorts of difficulties which could not be overcome on the spur of the moment. For instance, in Cape Town and Durban they could lend money to anybody. In the Transvaal they were confined to owners of property. He thought it would help everybody and encourage the selling of Electricity if there was a system which could be applicable to the whole of South Africa. He thought it would come. It was only a matter of time and the Local Government Ordinance might be amended and he thought if a system did eventually evolve they would all be placed on the same footing.

A member said he recommended his Council to follow out the course of Cape Town. Some Councillors agreed to it, and some did not. The chief argument against it was that Durban had done well, Cape Town, however, had done better. And then they asked, "Why should we give service?" He had raised the same point with Mr. Swingler that to give satisfactory service you must have a man on the spot within fifteen minutes. If a man has to go to work and his wife gets up and finds the stove out of order, and he had to go without breakfast a few times, there was a dissatisfied consumer, and it does more harm than a dozen satisfied consumers do good.

Councillor Hopf (Pretoria) was glad a feature had been made of the Hire Purchase System, and hearing someone from Cape Town speak of rapid progress there, made him keen

to push the principles of the Hire Purchase System. Unfortunately in most Municipalities they had not only the City Fathers, but the City Grandfathers. He hoped that before the Conference broke up that something would be drawn up so that there would be no retarding of progress.

Councillor McCafferty (Durban) said, Durban had for a number of years been the shining example in Electrical Work, and not only to towns in the Union, but in the world. Durban's sales under the system were £250,000 and they had not had a bad debt. Of course the way they went about getting guarantees had a lot to do with that. They could not lend money to every Tom, Dick and Harry. They had to safeguard themselves. If they were not property owners they must have a guarantee from a man who was a property owner and that had been responsible for them selling the amount of appliances they had, and making no bad debts. If anybody wanted an ironclad scheme, he need only write to Durban and they would be only too happy to help him.

Mr. Elliott (Uitenhage) stated they got their supply from Port Elizabeth for the last few years. He hoped, on Thursday, as many members as possible would avail themselves of the opportunity of visiting them and seeing their system. They had gone in for the Hire Purchase System and Assisted Wiring, and the response to their scheme had been really remarkable. In addition, they had under consideration, a scheme to supply electric current to farmers. He did not know if they had such a scheme elsewhere but he hoped, at no distant date, this scheme would be revived and carried through.

The Convention then adjourned until Tuesday morning at 9.30 a.m.

In the afternoon Members and Delegates, together with their wives, participated in a motor trip to Seaview, via Walmer, tea was served at the Pagoda, the party returning via Greenbushes and Cape Road.

TUESDAY, 4th APRIL, 1933.

The Convention resumed its proceedings at 9.30 a.m. with the President **(Mr. L. F. Bickell)** in the Chair, there being present 38 Members, 28 Delegates and 13 Visitors.

The Chairman: At the Council Meeting, held yesterday morning, we discussed an amendment to the subscription rate and it was decided that we should leave that matter to the Convention to decide. Mr. Horrell would move a resolution.

Mr. Horrell (Pretoria): At the Pretoria Convention, two years ago, it was agreed that the annual subscriptions to the Association should be in proportion to the units sold by the undertaking which the member represents. Subscriptions accordingly range from £2 2s. to £5 5s., which, on further consideration appears too high in some instances. I move that subscriptions be reduced to the same rate as obtained prior to the last Conference—namely, £2 2s. per annum.

Mr. Roberts (Durban) formally seconded the proposition.

Mr. Swingler (Cape Town) moved that it remain, that you should pay in proportion to what you receive. He moved that those who could pay should pay. Chief Engineers and Assistants should be based on the units sold by the Undertaking; up to 5 million, £2 2s.; over five and under ten million, £3 3s.; ten to twenty million, £4 4s.; twenty million units and upwards, £5 5s.

The amendment was lost and the original motion that the subscription be £2 2s. was carried.

The President then called on Mr. D. W. Ritson, Stellenbosch, to read his paper on: "A Change-over from Generating Direct Current System to Bulk Supply Alternating Current."

"A CHANGE-OVER FROM GENERATING DIRECT CURRENT SYSTEM SUPPLY TO BULK SUPPLY ALTERNATING CURRENT."

By Mr. D. W. RITSON, Municipal Electrical Engineer of Stellenbosch.

Change-over from Generating to Bulk Supply.

The aim of this Paper is to give an idea of the cost, difficulties and pleasures met with whilst carrying out a change-over involving not only a change from Direct to Alternating Current but at the same time the change-over from Generating to Purchasing the Electricity retailed to our consumers.

In making up the Estimates for 1928, the Council was confronted with the problem of increasing the capacity of the Generating Station, or alternatively, of taking a supply of electricity in bulk from the Electricity Supply Commission and closing down the Generating Station entirely. The plant installed at that time consisted of two 100 K.W. and one 80 K.W. Diesel-engine driven generating sets supplying energy at 440/220 volts direct current. The 100 K.W. sets were installed in May, 1925, in a new building and the 80 K.W. set was at that time already in service in the old Station. Both Stations are close together and are controlled from one main switch board.

The cost of the two 100 K.W. sets installed in 1925, was £7,105.

During the winter of 1927, the maximum load on the System was 220 K.W. To meet this load it was necessary to run all three generating sets and our spare plant was, therefore, nil. It was necessary to consider the immediate installation of a 200 K.W. Generating set to be

followed a year or two by a second machine of similar size or larger. The approximate cost of the new generating set installed ready for use was estimated at £4,000, but before recommending this expenditure other alternatives were considered and the Electricity Supply Commission was asked to submit a proposal for the Bulk Supply.

On receipt of the Electricity Supply Commission's proposals, meetings were arranged between the Municipality and the Officials of the Electricity Supply Commission and the whole matter was discussed in all its bearings.

Estimates based on the Maker's figures of running costs and our own experience of using a similar type of generating plant indicated that the overall cost of electricity on the generating station's busbars would be approximately the same for both Schemes. One point which stood out in favour of a bulk supply was that the installation of generating plant commits the owner of the plant over a period represented by its useful life to a gradually increasing cost of generation, as the efficiency of any plant may be expected to fall off with age and the cost of repairs and maintenance is bound to increase, whereas there was every indication that the cost of a Bulk Supply from the Electricity Supply Commission would in all probability show a gradual reduction over a period of years.

A further point which appeared to favour a Bulk Supply was the question of making provision for replacing plant at the end of its useful life, or modernising same, as this is likely to become advisable owing to improvements in design making the existing plant obsolete. Small undertakings do not always build up a reserve fund to meet such expenditure as the necessity for same is not apparent to the lay mind and the engineer lives for his day and not the future man's. In the absence of such

provision the only alternative is to continue to use uneconomical plant or to raise new loans for replacing it, if the Administrator can be persuaded to sanction this.

Another point which may have a considerable bearing in deciding the advisability or otherwise of generating as compared with taking a Bulk Supply is that with a small Undertaking the Chief Engineer has of necessity also to act as a canvasser and Salesman. If a large portion of his time is taken up in running the plant and reducing the cost of production to the lowest possible figure, the commercial part of the job is apt to become somewhat overlooked whereas if energy is purchased in bulk the Engineer can spend a large proportion of his time in looking for and obtaining new business.

Still another point is that in a small Municipality it is sometimes difficult to persuade the Council that further loan expenditure is warranted and the position may become so difficult that it is necessary to turn down loads which are offered or, alternatively, if this is not actually necessary, to put obstacles in the way of additional load being connected up. With energy purchased in bulk unrestricted supplies are available at a cost which is definitely known beforehand, and the fear of taking on too many consumers disappears.

Against the proposal to take a bulk supply was the fact that our plant was practically new and that it would have to be sold for what it would fetch, coupled with the prospect of having to change over this System of Distribution from Direct to Alternating Current. This represented a large immediate expenditure and would not bring in any additional revenue. On the other hand, the tendency throughout the world to-day is to change existing direct current supplies to alternating current. If, therefore, it was accepted that the change-over had even-

tually to take place, the sooner it was done the better, every additional piece of D.C. apparatus connected up and every extension of mains carried out on a D.C. System representing a liability for change-over, which has sooner or later to be liquidated.

Weighing up all the pros and cons of the case, it became evident that the correct procedure was to take a bulk supply from the Electricity Supply Commission and to change the System at once from Direct to Alternating Current; and it may here be stated that the results achieved since the change-over have amply justified the action then taken.

When the decision to take a Bulk Supply had been made the proposal was submitted to, and approved by the ratepayers. At a Meeting of ratepayers specially called to sanction the expenditure involved in taking a bulk supply and changing over, the voting was unanimously in favour of the proposal submitted. An application to raise the necessary loan was sent to the Administrator, together with detailed estimates, specifications, etc., and was duly sanctioned by him. As soon as the Administrator's sanction to raise the loan was received, specification for the necessary material were issued and tenders invited, and alterations to the reticulation system were put in hand. The tenders received showed an extraordinary variation in price which is indicated below:—

	Lowest.	Highest.
Switchboard	£545 0 0	£2,103 0 0
Meters—10 amp. Single Phase . . . . . each	£0 16 0	£1 2 6
Transformers	£212 0 0	£600 0 0
Motors—3 H.P. size, each	£8 14 0	£19 17 6

With regard to the Switchboard, it is the practice of the Electricity Supply Commission to have the main switch and metering panels out of doors. After discussion with the Electricity Commission's Engineers it was, however,

arranged to have these panels placed in the Substation, forming, to all intents and purposes, part of the main switchboard, this arrangement being a much more compact and neater job than having separate switchboards for each purpose.

Until the material was received no actual steps could be taken to effect the changeover, but work on the overhead distribution system and on consumers' premises was carried out as far as possible.

The reticulation system consisted of 3-core underground cables from the Generating Station to the feeder pillars at various points within the Municipality and 3-wire overhead distribution. There were six 3-core underground feeder cables, each having 2 cores of 0.1824 sq. in. cross section. These cables were unsuitable for three phase work but we could not afford to scrap them.

To make the most effective use of the cables it was decided that for the time being at any rate they should be used at a pressure of 550 volts, this being considered the highest pressure that the cable could safely stand. Provision was, however, made which enabled us to connect the main transformer to give a voltage of 3,300 and the same precaution was taken in regard to the main switchboard which had been designed for a voltage of 3,300, but is in the meantime being used for 550; so that in the event of the load developing sufficiently to justify new cables it would be a comparatively simple matter to convert the main distribution from 550 to 3,300 volts.

Auto transformers, having a ratio of 550/220 volts, were placed in kiosks and connected between the underground feeders and the overhead reticulation. This arrangement, although somewhat unorthodox, has given entirely satisfactory results, and as the kiosks have been made large enough to

accommodate auto transformers capable of using the full capacity of the feeders, larger auto transformers can be installed as the load increases at very little extra expense.

In the portion of the town where the load is heaviest the arrangement of the low tension overhead wires was two outers, and two street lighting wires on a four wire cross arm with a neutral wire carried on insulators at the top of the poles. This was altered to three mains and a neutral on a four wire cross arm with two street lighting control wires on a two wire cross arm higher up. It was necessary to carry out this re-construction on approximately 400 poles, the remainder of the distribution being used without alteration until such time as the load increases sufficiently to justify reconstruction of the lines and the addition of the extra wires.

It should be mentioned that about 250 houses had the leading in wires between the point of termination of the overhead service and the metering position in separate tubes. In these cases new leading wires were provided.

By the time the switchboard and other material arrived, the alterations to the overhead network were complete. The new switchboard was then installed in the old Generating Station and the auto transformers were placed in position and everything was tried out.

We were then in the position to commence the actual work of transferring consumers from the D.C. supply to the new supply. The first portion to be actually changed over was a small section of 98 consumers none of whom had any apparatus requiring alteration. On the day of the changeover the D.C. Meters were disconnected and the consumers were connected to the new supply without meters. This enabled us to deal with the changeover of the whole of the section in one day. Within three days all

the new meters had been put into service and the changeover of this section was complete.

This comparatively small changeover gave the staff concerned experience in the work and confidence in themselves to handle the more difficult sections. The other sections were dealt with in a similar manner, leaving the business section, which naturally had the most appliances, until last.

Alternating current was switched on for the first time in August, 1929, and the whole changeover was completed by December 30th, 1929.

In dealing with the changeover of consumers' apparatus we adopted the following practice:

We supplied new apparatus to replace as nearly as possible each consumers' existing apparatus, the basic idea being that after the changeover the consumer would at least be as well served as before. Consumers were charged the actual cost of alterations to their internal wiring, but we connected up and placed the new apparatus in service.

Planning the changeover is perhaps more difficult than carrying it out, for all plans must be laid to a very definite time schedule. It often happens that these have to be re-made several times to suit altered conditions; as after making arrangements to change a certain section over, one consumer refused to allow us to proceed unless at his convenience.

At this point the writer offers a little advice to others who may possibly have to "Change Over."

Make up your minds before you begin that you are undertaking a very strenuous job and concentrate on doing it well. The satisfaction

of having carried out a difficult piece of work without causing inconvenience to your consumers is worth all the trouble you take, and

Keep everyone who is assisting you in any way fully informed as to what you intend to do, and how you propose doing it. The mere talking it over with others helps you to visualise the job; it keeps the others interested and eases considerably the immense mental strain under which, for the time being, at any rate, you will necessarily have to work.

It is only to be expected when undertaking a job of this nature that complaints will be made during the actual work of changing over. Some of these will be of a minor nature but I think they bear repeating, being illustrative of what the Engineer is likely to have to put up with. On the whole, however, nothing of importance occurred to disturb the good relations existing between the Electrical Staff and the Consumer.

One customer of a certain fraternity came to the Office to buy three dozen second hand lamps, having heard that we were changing all the lamps. Another consumer who had one of the old type B.G.E. direct current motors wanted to know why we were installing a smaller H.P. motor than he had had before. Another threatened to hand the matter over to his attorney as he was convinced that we had not installed a motor of the same capacity as the one which had been removed. Another complained that we had connected his rival in business before himself.

One rather serious question was the changeover of the four dentists who had the usual dental equipment of a certain make. Whilst the Council was quite prepared to supply new dental equipment, the dentists in question definitely requested that the equipment should be of the same make as that

replaced. Had the Council agreed to this it would have involved the expenditure of something like £500. The difficulty was, however, surmounted by the installation of a small motor generator set in the Station, giving them a D.C. supply by means of a separate line. It was quite convenient to carry out this work as all the four dentists were in the same street and close together.

One consumer had a reducing apparatus, 220-6 Volts, which had cost £45. We supplied a Tungar rectifier and car battery in exchange at a cost to the Council of about £9.

Consumers who complained that their motors were running too fast or too slow were satisfied by the expedient of changing the pulley in order to compensate for the speed.

Butchers' shops presented a problem as we were unfortunately unable to do anything with regard to sausage machines as the motor is part and parcel of the machine and in all cases we had to instal new machines.

It may be of interest to quote the original estimated cost of carrying out the changeover, together with what the estimate included, and its comparison with the final actual cost:

Original Estimate	£4,500
Final Cost	4,600
	£150

Included in the above cost were the following items:

New Meters	1150
Motors (1/6 - 35 H.P.)	75
Fans	37
Heavy Mains	6 miles
Street Lighting Mains	3 miles

The Engineer, after completing his change-over, will have to brush up his commercial faculties for now starts the working up of the business side of supply, and it is surprising, by using a large amount of tact, how interesting it is to find a consumer has installed apparatus after you have gone into the "pros and cons" of electricity with him or her. Even after the apparatus is installed he must keep in touch with this consumer as you hear that "Mr. or Mrs. So-and-So have seen it and are greatly interested." His next job is to see Mr. or Mrs. So-and-So.

In the papers given at last year's Conference mention was made of the fact that a K.V.A. charge of £5 6s. 0d. p.a., plus a charge of .318d. per unit, was made by the Bulk Suppliers, and these figures were adversely compared with Municipal supply.

The Commission's charge to the Council is on a two-part tariff with a monthly load factor basis on the following sliding scale:

First 250 K.V.A.	@	13/7	per month.
Second do. do.	@	12/3	do.
All over 500 do.	@	8/4	do.

plus a unit charge as under:

First 100,000 Units	@	.5d.	per month.
Second 200,000 do.	@	.4d.	do.
All units above	@	.3d.	do.

and on this tariff it has been possible to obtain results which show a saving over local generation. Details of cost are shown on the attached Schedule.

The advantage of the change-over was noticed in the first year, even after the Lighting had been reduced from 10d. to 9d. per unit, Domestic Power from 3d. to 1½d. and Industrial Power from 3d. to 2d.

In 1931 the Domestic Rate was further reduced to 1d. per unit.

In the meantime Exhibitions were held to encourage the use of Domestic Appliances, and the resulting increase in units sold for domestic purposes is shown in the attached table.

Since the changeover the main metering current transformers have been changed at the Substation due to increased load, a transformer has been altered to a larger capacity and the feeders strengthened as required. This feeder question will always, no doubt, have to be under consideration if we carry on as in the past.

Whilst preparing this paper the author had to refer to various statistics of other stations and was struck by the vast difference in the number of units generated by these Stations and his own plant, and had at the back of his mind " What must these Engineers think of the Engineer and his small Substation."

But going through some old papers the author found how the " Big Men " had helped the " Small Fry " which gave him courage to proceed with his paper.

This paper was given, not only to show the costs, etc., but to give the Engineer contemplating a changeover a method of procedure to be followed out, and especially after completion, that the development is up to him and that he and his Council should work on progressive lines.

If this paper will be of any use in future to an Engineer who carries out a " Changeover," the author will not be sorry that he undertook the President's request to give a paper on a " Changeover from D.C. to A.C. Bulk Supply " for the next Convention.

SCHEDULE OF COSTS

	1922	1929	1930	1931	1932
No. of Consumers	523	816	876	966	1,005
Units Generated) Purchased)	165,720 (G)	509,752 (G)	713,417	881,152	1,020,000
Units Sold	120,154	314,611	462,738	588,038	706,353
Units Sold, Light	94,762	158,280	180,908	190,150	190,727
Units Sold, Domestic	25,428	156,331)	218,830)	289,002	395,811
Units Sold, Industrial	—)	—)	—)	108,886	119,815
Generating Costs	£2,507	£5,012	£3,841	£4,283	£4,440
Generating Costs, per Unit ..	3.6d	2.4d	1.28d	1.16d	1.04d
Received Average Price, Light		11d	9.8d	9d	9d
Received Average Price, Power		3.45d	2.2d	1.85d	1.84d
Peak Load	120 K.W.	200 K.W.	273 K.W.	300 K.W.	350 K.W.

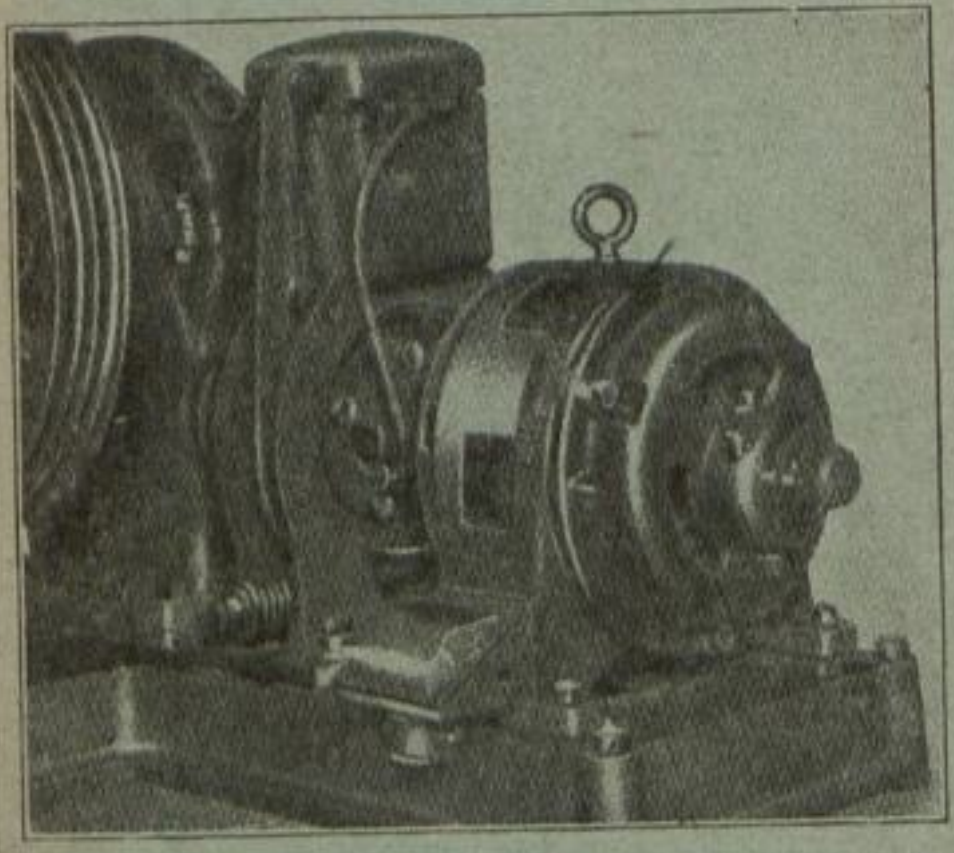
Mr. A. T. Rodwell (Johannesburg): The paper presented by the Author is an interesting and practical resumé for the Engineer who contemplates changing over from direct to alternating current supply, particularly bulk supply, as no generating problems are involved, the chief point of interest being the layout and change over operations of the distribution system.

While the subject matter of the paper is of special interest to small undertakings from the practical point of view, larger reticulation schemes have their own particular problems where different forms of supply need to be retained for a period for economic reasons.

One phase of the work common to all, however, is the method of attack in approaching consumers, and the endeavour to continue cordial relations between the power supply company and consumers about to be changed over.

The central area of Johannesburg was originally reticulated for direct current supply. This is being gradually changed over to alternating current supply, and it may be of interest to record the method of procedure adopted by the Johannesburg Electricity Department. When a section to be changed over is definitely decided upon, all property owners are notified by circular letter advising them of the proposal, and also warning them that no additional loading on the existing direct current mains is permissible. An inventory of all apparatus on each stand is made by a representative of the Department, and in the case of large buildings or blocks of flats it is found advisable to obtain the owner's signature on the completed schedule. This procedure has the effect of preventing the "dumping" of old apparatus into a building with the hope of having it renewed on an alternating current basis, and where additional apparatus—especially domes-

ALTERNATING CURRENT LIFT EQUIPMENT:



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tic appliances—is required prior to the change over, this must be of the universal type, if possible, making it suitable for either the existing or proposed supply.

Wireless sets in some cases have to be changed, but where arrangements are previously made with suppliers, component parts only are replaced resulting in an appreciable saving in cost to the supply authority. It should be noted that all direct current wireless sets removed are not offered for re-sale because the possibility of their finding their way to other areas of the system under the change over programme.

The actual change over is effected by a mutual arrangement between the owner, tenant, and Council, the work commencing at a definite time on a specified day, thereby expediting its completion and causing a minimum of inconvenience to the tenant, and these arrangements have worked very well indeed.

The information contained in the paper is of considerable value to those who have not yet changed over to alternating current supply and will form a useful contribution to the proceedings, and our thanks are due to the Author.

Mr. T. Jagger (Ladysmith): A number of Engineers attending this meeting have, no doubt, had the same experience in changing over from Direct Current to Alternating Current, and we know that in a few years there may be other Engineers contemplating carrying out the same class of work, and for their benefit I will just mention one part of the work we carried out in Ladysmith at that time. I notice in Mr. Ritson's paper he states that Alternating Current was switched on during August, 1929, and completed by December 30th, 1929. When I had the work of changing over our system, and I made every effort to cut down the time of

completing the change over. The whole of the work was completed and the Direct Current closed down on March 19th. It took us 19 days to change over.

Mr. J. Nicholas (Umtata) : I notice by Mr. Ritson's paper that in obviating changing certain apparatus he saved £500, and in doing that he has not completely changed over to Alternating Current. I have been in a small town, where we are not confronted with such difficulties as in the larger towns, and I can say that we can go full out for Alternating Current. In changing over in the case of Umtata in 1927, the point to my mind was to test the capital cost, and in our case it cost us £3,500 to change the town completely over to Alternating Current. We had some idea of trying to save £500, but in thinking it over, that was worth £50 a year, but once you change over you find the town develops out of all proportion to what you expect. If you change to Alternating Current you are going to develop, and so go straight for it. The matter of saving £500 is simply a matter of £4 a month. We adopted a policy of giving 12 months' notice in the press prohibiting any Direct Current Extensions. In the meantime we took a census of the town and in that way we were able to estimate the exact cost of our change over. In changing over we changed section by section and left the motors to the last, and when that day came we kept a very small staff going, and used the remainder of the staff to change the motors, and we had the street lights going continually. It was a small town and so it could be adopted, and in doing that we actually saved £200 on the change over.

Mr. A. R. Metelerkamp (Salisbury) did not understand the procedure of utilising the existing 3-wire D.C. Cables, as 3-phase feeders with Auto-transformers.

With the existing 3-wire D.C. Cables, the current carrying capacity is limited to size of

the middle wire, which in the case is .09 sq. in. At 550 volts, assuming 1,000 amps. per sq. in. the power transmitted is 1.73 x 550 x 90 — 85.3 K.W.

It would have been possible to utilise the existing cables on a single phase 3-wire A.C. at 440/220 volts. Gaining the advantage of the increased area of the outers of the cable of .18 sq. in. the power transmitted would then be —440 x 180 — 79.2 K.W.

This shows an advantage of approximately 7% on the system as used, but this would be more than outweighed by the extra cost of utilising Auto-transformers, which it is assumed from the paper, could not be adapted for use at a later date on 3,300 volts.

To obtain single phase 3-wire 440/220 volts, it is possible to utilise single phase transformers with a ratio of 3,300 volts to 440/220 volts, i.e., with the L.T. winding grouped 2 x 220 volts. These transformers could always be used at a later date, by paralleling the L.T. winding to give 220 volts, and using three in a bank "Starred" to give a standard 3-phase 4-wire supply at 380/220 volts.

One speaker stressed the importance of the time required to effect a change over from D.C. to A.C. Mr. Ritson states, "Meters were disconnected and the consumers were connected to the new supply without meters." There is no reason why the A.C. supply should not be given through the D.C. meters, thereby eliminating the time taken to make separate visits to consumers to disconnect D.C. meters.

Mr. Horrell (Pretoria): I congratulate Mr. Ritson on his interesting and instructive paper.

The following procedure has been carried out in Pretoria where practically the entire system has been changed over.

Notifying Consumers.

A notice is published in the local press notifying consumers of the Council's intention to change the supply from Direct Current to Alternating Current, setting out the area to be changed, and also that the Council will replace and change over, free of cost to the consumer, all apparatus in the area affected by the change of current provided a return of all such apparatus is handed in to the Electrical Engineer within one month of the date of the notice.

Inventory.

A circular, in the form of an inventory is then sent out by the Supply Department, requesting consumers to fill in all particulars regarding their apparatus and to return the same to the Electrical Engineer without delay.

As soon as these forms have been received, an inspection is carried out by the officials of the Supply Department for the purpose of checking the H.P., voltage and the class of work the motor is required for. After this return has been completed, no further apparatus is considered by the Council.

Apparatus.

These forms are now scheduled as follows:—Motors, Fans, Motor Generators, Dental Equipment, Electromatic Appliances, Radio Sets, Eliminators, Rectifying Valves, Battery Chargers. When this is completed the new apparatus and appliances are ordered.

Reconstruction.

The reconstruction of the O.H. distribution and the installing of the E.H.T. and L.T. Underground Mains, Sub-stations, and Kiosks, is then put in hand and the entire area prepared for the A.C. Supply. All street lamps and house services are connected to their proper phases. Consumers' Mains are rewired where these are

in separate tubes and all meter loops are altered to suit the new A.C. meters. The rewiring of the internal portion of Power Consumers' wiring has also to be effected at this time.

Supply Maintained.

The D.C. supply is maintained until the entire district has been reconstructed.

Reconstruction Completed.

As soon as the Reconstruction is completed the Transformers placed in position and all the required apparatus and appliances are to hand the change over is proceeded with.

Method Adopted.

On the day on which it is decided to commence the change over, all D.C. meter loops are disconnected, the D.C. supply is switched off the section to be changed and all temporary Bridges on the O.H. lines, which were used in maintaining the D.C. supply during Reconstruction, are removed. The A.C. current is then switched on to the O.H. lines and the new A.C. meters are placed in position. As many as 210 consumers have been changed over in one day. If the change over is well organized one man can replace as many as 35 meters in a day. Where motors are installed, these are, if possible, changed on the same day. Where consumers are unable to stop their plants, a temporary D.C. supply is given until the end of the week, or until such time as the consumer is able to stop his plant.

The same method is adopted the following day when a further section is taken over. It must be remembered that some sections are more difficult to change over and it may only be possible to complete 50 to 100 consumers a day in such cases.

Difficulties.

When changing over a system to A.C. many difficulties have to be overcome and the Engineer in charge is called upon to solve some very difficult problems. His position during this time is certainly very trying and requires his whole attention. First of all there is the human element to contend with. People are always very doubtful as to the value and efficiency of the new plant or appliances. Many complain of the size of the new A.C. motor compared with that of the old D.C. motor of the same H.P. In one or two instances this has led to some very heated arguments and a few consumers have become very aggresive in view of the A.C. motor being very much smaller than the old D.C. motor.

In one particular instance where we changed over, the D.C. motor was a very old Bruce Peebles Square Frame Type of 25 H.P., 950 R.P.M., 500 volts, and was used for driving a 3ft. 6in. circular saw in a timber yard. This was replaced by a 25 H.P., 950 R.P.M., 3-phase, 433 volts, slip ring type of motor. The new motor gave continual trouble; whenever large logs were being cut. The protection gear was set up to the maximum, this being raised even above the rated output of the motor, but still the trouble continued. At last a test was taken and this revealed the extraordinary fact that the actual H.P. required for this class of work was 55 H.P., thus proving to what extent the old type of D.C. motors could be over loaded. Therefore, when changing over, it is very important to know the class of work for which the motor is required. Another great problem is the speed of direct coupled motors and geared motors. In some cases special motors were imported to replace the D.C. motors. One consumer has a small Buff Lathe, made out of an old D.C. Ceiling Fan with an R.P.M. of 24 to 50, for polishing pipe stems. The whole outfit was not worth carrying away but we

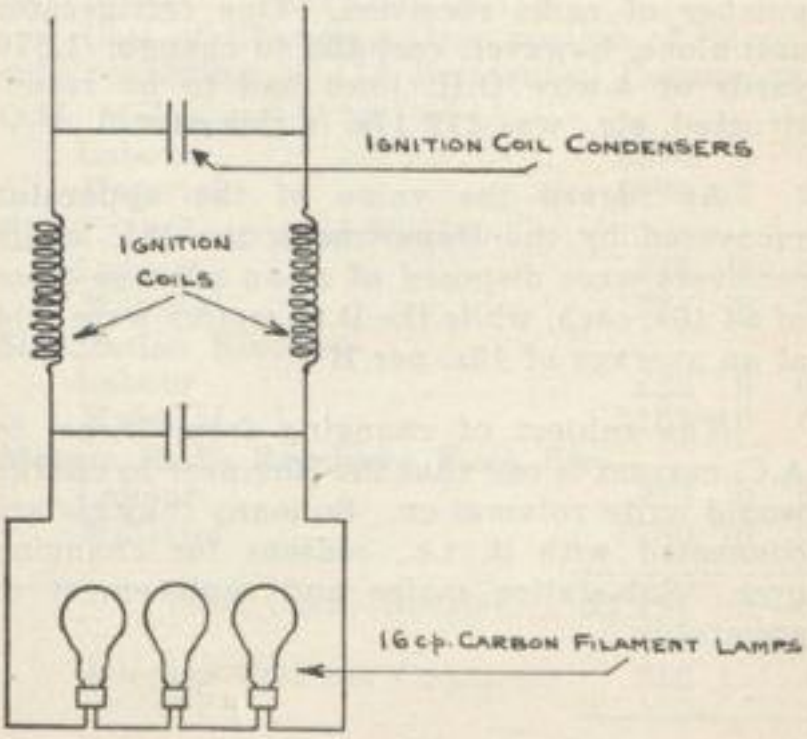
were compelled to construct an apparatus to give the same R.P.M. which cost the Council the sum of £22.

Dentists and Doctors.

While changing the appliances, used by Dentists and Doctors, it was found more economical to replace the D.C. apparatus with complete new machines of the same make and type.

Radio Receivers.

Radio receivers constitute one of the most difficult problems owing to the large number of home-made sets. Some of these consist of the most weird contraptions. In one case the set was built in the inside of an ordinary petrol box. In another case, a D.C. eliminator consisted of two Ford ignition coils as chokes combined with two condensers to form a smoothing filter, and 3 carbon filament lamps in series as a potential divider, as shown diagrammatically below. The output of this apparatus was rated as 15 milli-amps. at 150 volts and was replaced by a commercial apparatus rated at 20 milli-amps. at 180 volts with 5 tappings to 50 volts.



A considerable amount of experimenting had to be carried out before many of these sets were made to give satisfaction. In a large number of cases the owners were not prepared to accept commercial articles, thereby increasing considerably the cost of the change over.

Cost of Changing Over.

(1) For the sake of comparitive costs, two districts are considered. The one comprised 430 consumers of whom 403 were domestic and 27 industrial. Between them they had 87 motors, a large number of radio sets and many other appliances. One garage alone had 22 motors ranging from 1/16th H.P. to 20 H.P., 8,500 yards of 4-wire overhead lines had to be constructed at a cost of £2,412. The cost per consumer, including all reconstruction, E.H.T. cables, kiosks and transformers, etc., was £17 14s.

(2) The second district comprised 114 domestic consumers and the apparatus changed comprised only 6 small motors but a very large number of radio receivers. One refrigerator unit alone, however, cost £55 to change. 1,870 yards of 4-wire O.H. lines had to be reconstructed, etc., was £12 17s. in this case.

As regard the value of the apparatus recovered by the Department, the D.C. radio receivers were disposed of at an average price of £4 10s. each, while the D.C. motors were sold at an average of 15s. per H.P.

The subject of changing from Direct to A.C. current is one that the Engineer in charge would write volumes on. So many subjects are connected with it, i.e., reasons for changing over. Sub-station mains and replacement of apparatus.

COST OF CHANGING OVER.

S.W. Town Consisting of 430 Consumers.

27 Industrial. 403 Residential.

DISTRICT No. 1.

O.H. Mains— (8,500 yds)			
Labour	£1,164	0	0
Material	£1,248	0	0
E.H.T. Underground Mains—			
Labour	£444	0	0
Material	£1,020	0	0
Sub-Station Kiosks—			
Labour	£285	0	0
Material	£692	0	0
Motors, Radio Receivers, Fans, Etc.—			
Labour	£865	0	0
Material	£1,892	0	0
Total Cost—District	£7,610	0	0
Average Cost per Consumer	£17	14	0

DISTRICT No. 2.

Cost of Changing Over portion of Sunnyside consisting of 114 Residential Consumers.

O.H. Mains— (1,870 yds)			
Labour	£370	0	0
Material	£490	0	0
E.H.T. Underground Mains—			
Labour	£42	0	0
Material	£84	0	0
Sub-Station Kiosks—			
Labour	£25	0	0
Material	£185	10	0
Motors, Radio Receivers, Fans, Etc.—			
Labour	£10	0	0
Material	£260	10	0
Total Cost—District	£1,467	0	0
Average Cost per Consumer	£12	17	4

Mr. G. H. Swingler (Cape Town): The little experience we had at Cape Town may be of interest to others. At Cape Town, we not only had to change over, but had to carry out the reconstruction and standardisation of our system some eight or nine years ago. We had some eight systems, 550 2-wires, 220 D.C., 440 D.C., 440 3-wire A.C., and so on. So the first thing to do was standardise the system. If we had a motor in Cape Town, it would not suit Muizenburg. So we had to advise what we were going to do. With regard to standardising we decided to standardise for a pressure of 220 volts, 4-wire and primary transformation be 11,000 volts. I envy those fellows who have been able to change over in 18 days. We have had 8 years at the job up to now. Not only did we come across the difficulty from D.C. to A.C., but the difficulty from A.C. to D.C. We had to change motors practically everywhere, with the exception of Muizenburg and Maitland. Mr. Horrell's experience has been ours. We did not know there were so many gadgets working by electricity as we found. The money spent has been just short of a million pounds, and we are not finished yet, but we are through the worst of it. For years we battled against increases of D.C., yet we could not catch up with the increases, but last year we really got on top. We had bought some converters, but they have only been in use two years and now they are obsolete, because fortunately we have got on top of the job, so much so that there is only a very small area we are concerned with, but that is the central part.

I, like my friend from Umtata, believe in going the whole hog, but we never found a large job where we could not get the consent of the owners. We saved £2,500 on the change over of the Cape Times Printing Works, from D.C. entirely to A.C. without rectifiers. The lifts are no more a difficulty. We found the best policy to get rid of lifts was to help the people by making a contribution towards the

scrapping of an old lift. When there is a great deal of repair to a D.C. lift, the manufacturers will suggest to the people that it would be better to put in a new lift, and that the Municipality will contribute. That helps to reduce the difficulty of the lifts. The policy we work under is to give a man equal to what he had. In the early days, if a man was impossible, we have left them on D.C. and hoped that something would happen and that they would have to replace the lift. At any rate when the time comes that we must get rid of D.C. at any price, it will be sufficient time to decide whether it will be possible to get legislation to compel people to take A.C. Only as far as new consumers are concerned we have refused to give anything but A.C., but if people want extensions in D.C. we try to fix them up with apparatus on our hands. Our policy is to give supply, but if possible to avoid increasing our liability to change over. It is really a liability, and the longer you wait the more it costs you.

We at once experienced the necessity of getting an inventory. In fact, before the public knows, you should really get round and see what is installed in the large consumer's premises. We have been offering to sell a lot of our D.C. junk that we have from the change over. We sold quite a number of D.C. motors, and they are cheap, provided the buyer does not live in Rhodesia, or where the railway would cost too much.

The great thing is to plan your job well ahead. If anyone wants any information as to the difficulties to be experienced, we can furnish it. We have been changing over and reconstructing our system, commencing with 16,000 consumers and finishing with 30,000. It costs you practically double to reconstruct a job than to put it up in the first instance.

In conclusion, Mr. Swingler said: "You must give service to keep your customers. You

have to waste many hours, and spend money, in giving service to meet the conditions."

Mr. J. Roberts (Durban): I won't detain you many minutes because in Durban I fear our experience in changing over has been so little that I cannot throw much light on the subject, but when I hear it cost a million pounds in Cape Town to change over from D.C. to A.C. and I think that in Durban our entire net debit is only £800,000, I congratulate myself we never had D.C. Many years ago, when we started up, we had a system which was A.C. Afterwards D.C. became the fashion (1900-1902) but I must confess I never could see that D.C. was suitable for covering such an area as ours, and we stuck to A.C. Those who changed to D.C. in 1902 have within the last few years been reverting to A.C. One question I would like to ask is in regard to the statement by Mr. Ritson that the consumers were charged the actual cost of internal alterations. We have always gone on the principle that if for our convenience we have changed any consumer's pressure supply, that it is up to us to do it free of all cost to the consumer. I would like to ask if there was any trouble when consumers were asked to pay for changes in their internal wiring.

Mr. Swingler (Cape Town): It did not cost a million to change over from D.C. to A.C. I said it cost a million to reconstruct our system and standardise our system. Of course we did not have all D.C. We had quite a lot of A.C. The Cape Town system has been reconstructed and is almost a new system to-day. With regard to the installation costs, that is the wiring from the D.C. to A.C. job, we have not yet met anybody, that when tactfully handled, has refused to rewire their premises. Even big factories like A. & J. Buchanan, and all our bigger consumers are realising that they are getting new lamps for old and are really getting a better job. If you have the right sort of man on the

job it is easy to show the consumer that he is getting a better job, and he is agreeable.

Mr. L. B. Sparks (Pietersburg): Usually in changing from 3-wire D.C. to A.C., and leaving the wires practically the same, there is considerable trouble with what is called the floating neutral. I would like, with regard to this 3-wire distribution, to have the view of anyone who has had experience. It seems to me this 4-wire, 3-phase costs quite a considerable amount of money, and in the earlier stages we might save a considerable amount of money if we simply ran a 3-wire system. I would like to know the experience of any Engineer with knowledge of the 3-wire system. I feel it may help us a bit in the small towns, and there is one thing that may help people who are contemplating a change over, and that is to use plenty of shackling off points. If you have a long line and want to change, it is difficult, but if you have plenty of shackling off points on the overhead mains, it simplifies considerably.

Mr. Roberts (Durban): I would like to say something on the question raised by Mr. Sparks because it is an important one. We found 3 wires single phase very convenient and economical. It is very simple to take the 3-wire down almost any street where there are two or three consumers. I think it is better than 4-wires, 3-phase. We have done the whole of the Berea with that system and for purely residential work our experience has been that 3-wire distribution is most economical. That is what we started in 1898, and we have had no reason to change it.

Mr. Swingler (Cape Town): We have 3-phase, 4-wire system and have had experience in single phase, 3-wire system. If anything, the result is in favour of 4-wire, and for overhead construction you can take four wires. It only means you spring an extra wire. The other wires are smaller in sectional area. Be-

fore we started the job we asked our consultants, and ascertained that the three-phase, four-wire was going to be the system in New York in 1929. They were changing over to that system. I am one of those who is absolutely convinced that from the point of view of cost there is nothing in it and the flexibility is on the side of the 3-phase, 4-wire job.

Mr. Clark (————————) said he had to change over to A.C. and he thought if it was anticipated early enough, the alterations could be easily done. I may say that I have been for the past 2 years gradually adding to my distribution system in such a manner that the actual change over will be comparatively simple. I find the increased domestic load quite satisfactory.

Mr. Mordy Lambe (East London) stated that though they, one and all, greatly admired the way in which Durban had pioneered the use of electricity, he personally differed from Mr. Roberts in regard to the merits of the single-phase, 3-wire system of distribution. East London had standardised on the 3-phase, 4-wire system. A few years ago they were called upon to give supply to the neighbouring municipality of Cambridge. At the urgent request of the Cambridge Council they installed a single-phase, 3-wire system, in order that the capital cost should be reduced to the lowest possible figure. The policy adopted had since been proved to be penny wise and pound foolish, because they were now being forced by the increasing domestic load to convert the system to 3-phase, 4-wire. This, as they would readily understand, was being done at considerable additional expense to the Cambridge Municipality and at very great inconvenience to consumers. The change had, however, been fully justified and had resulted in very much improved pressure regulation. Mr. Roberts, he knew, was referring to purely residential areas, but in the case of a young and expanding town

the residential area of to-day was the business and industrial area of to-morrow. Was it not very much better to have one standard system of distribution throughout the area supplied? In East London they had certainly found it to be so.

Mr. G. H. Swingler (Cape Town): With regard to Mr. Sparks's inquiry about what sort of neutral, I may say, in the new job we use the same wire. We tried to be clever and run direct down the street, as suggested by Mr. Roberts, and so utilise the same neutral, that is 3-phase wire, one section and neutral, and we got into trouble, but as an expedient we used a balancer at the end of the line. Copper is generally less expensive and gives less trouble.

Mr. Roberts (Durban): Please understand that I am referring chiefly to the supply of residential areas in my preference for three-wire single phase distribution to four-wire, three-phase, and the three-wire system seems to have a great advantage in supplying side streets as it is much easier to preserve a balance on the circuit.

"CONTROL OF CIRCUITS ON COOKING RANGES."

Introduced by Mr. G. H. SWINGLER, Cape Town.

Mr. G. H. Swingler (Cape Town): At the request of certain manufacturers' representatives I undertook to send out a questionnaire to all the different municipalities undertaking dealing with the requirements for stoves, and also in view of the benefits that would accrue to purchasers from standardisation, to bring

the matter before the Convention. You have the questionnaire and the replies from which you will see that all great minds do not think alike.

QUESTIONNAIRE.

Schedule of Replies to Questionnaire on Control of Circuits on Electric Cooking Ranges received from Municipal Electrical Engineers.

QUESTION (a).

What are the requirements relating to the protection of various circuits on ranges by fusible cut-outs or otherwise?

1—BLOEMFONTEIN.

Answer: No regulation. Practically all ranges installed are provided with separate cut-outs for various circuits on the range.

2—BULAWAYO.

Answer: Each range circuit must be protected by separate fuse, either cartridge or bridge type, mounted in a convenient position on the range. Prefers substantial fuses of bridge type.

3—DURBAN.

Answer: Prefers all range circuits to be protected separately by fuses.

4—EAST LONDON.

Answer: Each circuit must be separately controlled and protected by fuses.

5—GRAHAMSTOWN.

Answer: Each circuit must be separately protected by fuses wherever possible.

6—JOHANNESBURG.

Answer: All circuits must be separately protected by cartridge, screwed or porcelain bridge types of fuses.

7—KIMBERLEY.

Answer: Practice is for every circuit of ranges having total loading over 3.5 K.W. to be protected by at least a single pole fusible cut-out.

8—KINGWILLIAMSTOWN.

Answer: Each circuit must be separately protected by a fuse.

9—LADYSMITH.

Answer: Circuits must be separately protected by fuses.

10—PIETERMARITZBURG.

Answer: Each circuit must be separately protected by single pole fuses.

11—PRETORIA.

Answer: Each circuit must be separately protected by a cut-out of the cool handle or cartridge type, provided that where the range wiring does not permit of use of separate fuses for each element the rest of hot plates and the oven may each be controlled by a pair of fuses.

12—QUEENSTOWN.

Answer: Each circuit must be separately protected by fuses.

13—SALISBURY.

Answer: No regulations relating to this. Of 250 ranges installed all circuits on each are separately protected by fuses.

14—STELLENBOSCH.

Answer: Usual fuses fitted by makers to ranges at present time are allowed.

15—WORCESTER.

Answer: All ranges in use have circuits separately protected by fuses.

16—CAPE TOWN.

Answer: No regulation relating to this. No objection has been raised to any of the various methods of connection and protection adopted by makers of ranges.

QUESTION (b).

Are you in favour of socket outlets being fitted on ranges? If so, what type is stipulated?

1—BLOEMFONTEIN.

Answer: No, but no objection has been raised to their use.

2—BULAWAYO.

Answer: No. Their use has not been prohibited as these are standard fittings on most ranges. Prefers 3-pin outlets. It is far better to provide one or more plugs on the wall in convenient positions in the kitchen.

3—DURBAN.

Answer: No. If fitted, should be 3-pin type.

4—EAST LONDON.

Answer: Neither definitely in favour nor averse to socket outlets on ranges. If these are fitted, 3-pin type are strongly recommended.

5—GRAHAMSTOWN.

Answer: Yes, 3-pin outlets.

6—JOHANNESBURG.

Answer: Yes, 2-pin (question of using 3-pin plugs is a matter which calls for full investigation. The stove in most cases being close to the water tap offers a temptation for the kettle to be filled without disconnecting the plug).

7—KIMBERLEY.

Answer: No. Recommends two or three wall sockets (10/15 amp.) approximately 6ins. apart above the kitchen table, each socket having fitted above it a differently coloured pilot lamp. A socket outlet or an earthed range must be of the 3-pin type.

8—KINGWILLIAMSTOWN.

Answer: Yes. No stipulation made regarding type but all plugs so far fitted are 3-pin type.

9—LADYSMITH.

Answer: Yes. 2-pin type with maximum loading of 15 amps.

10—PIETERMARITZBURG.

Answer: Yes. 3-pin type recommended but not at present stipulated.

11—PRETORIA.

Answer: Yes. B.E.S.A. 2-pin, 5 ampere type. Is not in favour of these owing to recent instances of shock sustained by consumers using faulty kettles.

12—QUEENSTOWN.

Answer: Yes. 3-pin type.

13—SALISBURY.

Answer: Yes. 3-pin type.

14—STELLENBOSCH.

Answer: No.

15—WORCESTER.

Answer: No. No particular type is stipulated.

16—CAPE TOWN.

Answer: Yes. 3-pin type essential and preferably connected on a separate range circuit.

QUESTION (c).

Must range socket outlet be controlled by a separate switch?

1—BLOEMFONTEIN.

Answer: Switch not necessary if fuses are provided.

2—BULAWAYO.

Answer: Separate switch not insisted upon but considered desirable.

3—DURBAN.

Answer: (———).

4—EAST LONDON.
Answer: No.

5—GRAHAMSTOWN.
Answer: Yes.

6—JOHANNESBURG.
Answer: Yes.

7—KIMBERLEY.
Answer: Yes. Alternatively a quick break pattern socket is approved.

8—KINGWILLIAMSTOWN.
Answer: Yes.

9—LADYSMITH.
Answer: Yes.

10—PIETERMARITZBURG.
Answer: Recommended but not stipulated.

11—PRETORIA.
Answer: No.

12—QUEENSTOWN.
Answer: Not necessarily.

13—SALISBURY.
Answer: Yes. If range socket outlets of the Wylex type are used, a switch is considered unnecessary.

14—STELLENBOSCH.
Answer: (———).

15—WORCESTER.
Answer: Preferred but not insisted upon.

16—CAPE TOWN.
Answer: Not necessarily.

QUESTION (d).

What are the requirements relating to the connection and protection (by fusible cut-outs or otherwise) or socket outlets on ranges?

1—BLOEMFONTEIN.
Answer: No regulation.

2—BULAWAYO.
Answer: Must be protected by a fusible cut-out.

3—DURBAN.

Answer: Should be protected separately by a fuse.

4—EAST LONDON.

Answer: No.

5—GRAHAMSTOWN.

Answer: Must be protected separately by fuse.

6—JOHANNESBURG.

Answer: Socket must be protected separately by fuse.

7—KIMBERLEY.

Answer: Regulations do not stipulate separate protection. Socket outlet should be separately protected by fuse.

8—KINGWILLIAMSTOWN.

Answer: Must be separately protected by fuse.

9—LADYSMITH.

Answer: Must be separately protected by fuse.

10—PIETERMARITZBURG.

Answer: Must be separately protected by a single pole fuse.

11—PRETORIA.

Answer: Must be separately protected by a fuse.

12—QUEENSTOWN.

Answer: Must be separately protected by a fuse.

13—SALISBURY.

Answer: No regulations relating to this.

14—STELLENBOSCH.

Answer: (———).

15—WORCESTER.

Answer: No regulations.

16—CAPE TOWN.

Answer: Must be separately protected by fuses.

QUESTION (e).

In the case of A.C. supply do you stipulate that the various circuits shall be connected up to bring about as nearly as possible a balance on the phases?

1—BLOEMFONTEIN.

Answer: 3-phase connection insisted on only if total loading exceeds 50 amps. Practically all ranges are connected single phase.

2—BULAWAYO.

Answer: Phases must be balanced.

3—DURBAN.

Answer: 3-phase supply given only to large ranges and phases are balanced as far as possible.

4—EAST LONDON.

Answer: Yes, in case of ranges having total loading or 6.6 K.W. or more.

5—GRAHAMSTOWN.

Answer: Supply to range as follows:—

Total Loading.	Connection.
Up to 4 K.W.	1-phase.
4 to 9 K.W.	2-phase.
Over 9 K.W.	3-phase.

6—JOHANNESBURG.

Answer: On the 3-phase 4-wire distribution system the service connection is made with 3 wires (2-phases and neutral). Range and lighting circuits are balances between 2 wires and neutral.

7—KIMBERLEY.

Answer: Yes. In some instances circuits of ranges may be connected to two phases.

8—KINGWILLIAMSTOWN.

Answer: Yes.

9—LADYSMITH.

Answer: Yes. Supply to range as follows:

Total Loading.	Connection.
15 amps	1-phase.
20 to 40 amps.	2-phase.
Over 40 amps.	3-phase.

10—PIETERMARITZBURG.

Answer: Yes.

11—PRETORIA.

Answer: Yes.

12—QUEENSTOWN.

Answer: Yes.

13—SALISBURY.

Answer: Yes, where ranges have a total loading over 10 amperes.

14—STELLENBOSCH.

Answer: Yes. All ranges connected to 3-phases.

15—WORCESTER.

Answer: Range circuits are balanced on 3 wires (3-wire D.C. supply).

16—CAPE TOWN.

Answer: Yes. Ranges having a total loading over 3.5 K.W. must be connected to three-phases and neutral. Ranges with a loading under 3.5 K.W. may be connected for a single phase supply through a three-pin socket outlet.

QUESTION (f).

Must the connection to the range be made direct to the wiring installation or is it permissible to connect it to the installation by means of a socket outlet?

1—BLOEMFONTEIN.

Answer: Small ranges or breakfast cookers may be connected to socket outlets. Other (larger) ranges must be connected direct to distribution board.

2—BULAWAYO.

Answer: Ranges must be connected direct to wiring installation. Small cookers not exceeding 2.5 K.W. may be connected to socket outlets.

3—DURBAN.

Answer: Direct to distribution board through double pole switch. Small stoves may be connected to 3-pin socket outlet.

4—EAST LONDON.

Answer: Yes, through a metallic disconnecting box placed closely adjacent to the range. Wall sockets for ranges are not permitted.

5—GRAHAMSTOWN.

Answer: Ranges over 4 K.W. loading connected direct to ironclad switch and cut-outs.

6—JOHANNESBURG.

Answer: Ranges consuming 10 amps. and under may be connected to wiring circuits through socket outlets controlled by switches. Ranges consuming over 10 amps. are connected direct to the distribution board through a double pole ironclad switch and cut-outs.

7—KIMBERLEY.

Answer: Only ranges up to 3½ K.W. may be connected to a socket outlet.

8—KINGWILLIAMSTOWN.

Answer: Must be made directly to mains at distribution board.

9—LADYSMITH.

Answer: Must be connected directly to wiring installation.

10—PIETERMARITZBURG.

Answer: Direct to wiring installation except in case of small ranges of less than 3.3 K.W. which may be connected to a 3-pin socket outlet.

11—PRETORIA.

Answer: Direct to wiring installation through a pair of cut-outs and double pole ironclad switch. Ranges having a total load of 2½ K.W. or less may be connected to a socket outlet on a separate circuit.

12—QUEENSTOWN.

Answer: Connection usually made direct to wiring installation but no objection would be raised to connecting the range to the installation through a socket outlet.

13—SALISBURY.

Answer: Direct to installation through a switch installed within 3 feet of the range.

14—STELLENBOSCH.

Answer: Direct to installation through a 3-phase switch with fuses close to the range and sprague tubing.

15—WORCESTER.

Answer: Ranges over 2 K.W. usually connected direct to installation.

16—CAPE TOWN.

Answer: Except for ranges of less than 3.5 K.W. total loading range circuit is taken direct from three fuses on an ironclad main switch and distribution board. (The main switch and distribution board also contains fuses for lighting, heating, etc., circuits). The connection from the range to the conductors from the distribution board is made by 4-pin (3-pin and earth pin) metal clad socket and plug. Conductors from range to plug are protected by flexible conduit. Ranges less than 3.5 K.W. leading may be connected to wiring installation by means of 3-pin (2-pin and earth pin) plug and socket and flexible conductor.

QUESTION (g).

Must the range circuit be kept separate from other circuits radiating from the distribution board?

1—BLOEMFONTEIN.

Answer: Yes. Through double pole cut-outs.

2—BULAWAYO.

Answer: Yes. This not only prevents faults on range affecting remainder of installation but allows range to be completely isolated, which is of great assistance in preventing damage to the range during thunder storms.

3—DURBAN.

Answer: Yes. Through double pole switch.

4—EAST LONDON.

Answer: Yes.

5—GRAHAMSTOWN.

Answer: Yes. Connected direct to distribution board.

6—JOHANNESBURG.

Answer: Yes.

7—KIMBERLEY.

Answer: No. Range connection is made with heavy wiring which may be "looped-in" to wall socket-outlets. Such outlets must be provided with fusible cut-outs.

8—KINGWILLIAMSTOWN.

Answer: Yes, except that water heater may be taken off.

9—LADYSMITH.

Answer: Yes.

10—PIETERMARITZBURG.

Answer: Yes. Controlled by double pole switch adjacent to the range.

11—PRETORIA.
Answer: Yes.

12—QUEENSTOWN.
Answer: Yes. Controlled by ironclad combined switch and fuses.

13—SALISBURY.
Answer: Yes.

14—STELLENBOSCH.
Answer: Yes.

15—WORCESTER.
Answer: Not necessarily.

16—CAPE TOWN.
Answer: Yes.

When we started to really seriously consider the business of installing stoves we felt that just to instal the stove was not sufficient. We wanted to get the house electrified and therefore, having gone so far as to include the installation of stoves on the "First Payment" system, we thought we would like to make it possible, and it would be good business to spend another pound and to simplify the extension from the stove to heater and refrigerator, or other useful things, and in addition we had in mind the question of moving from one house to another. In Cape Town about 14 per cent. of our consumers move every year, or 7,000 every year, therefore, to move these stoves an electrician must be called in to make provision ,and this would not cost less than £1 each—practically £7,000 a year wasted. So we decided to have a standard plug so that all that would be necessary would be to take out the plug and plug it in. That put up the cost about 17s. 6d. in this town. I have samples of the plug and switch here that we have in use. The switch takes the plug of the consumer's main switch. We don't consider it a stove if it does not exceed 3,500 watts. We find the cost

of 3-phase, 4-wire is a little more. We don't ask for any additional fuses on it. We only ask to put the fuse on the plug which is generally installed on the stove. The liability of the flex to become worn was the only source of danger of a fuse blowing. By giving 3-phase, 4-wire, we have done away with the necessity for multiplicity of fuses. The more fuses you have, the more trouble you have. All we do is to put the motor below the main fuse, otherwise that switch is given to the consumer and controlled entirely by him.

The main thing I have to bring before you is the manufacturers' point of view of what is best in the interest of the purchaser. Should each plate be individually fused on the stove or should it not. In the old days when the plate, or hot point and other elements were more questionable, I think it was necessary, but to-day renewals are so seldom, particularly on the normal plate. The high speed plates still give a certain amount of trouble, but the ordinary plate and elements in the oven, they don't burn out, but once in a blue moon, provided your regulations are everywhere within reason. I think I have done my duty to introduce this subject and I hope it will bring forth a discussion that will give some satisfaction to all concerned. The price of the switch varies but the one in front of you cost about £2. It was wonderful value. Some 1,000 or 1,500 we ordered cost less than £2 each.

Mr. Robinson (Manufacturers' Representative) said this matter was very interesting from the point of view of the manufacturers. It was a question of manufacturing costs. Some little time ago his people made a survey of the requirements of the large towns in regard to control circuits, and found that in no two centres were conditions alike, which made it difficult for the manufacturers to lay down a programme. If he made a cooker for Cape Town, it had to be altered for Port Elizabeth,

and so on. It was particularly difficult to draw on supplies made for another town without considerable trouble and expense. If they could get to a standardised cooker, the manufacturers' difficulties would be reduced to a great extent and they could sell at somewhat lower prices than at present. If they could get down to some standardisation, then they could make a standard cooker which could be sold here, Cape Town or Johannesburg.

The feature he was interested in was the Plug on the Cooker. He would like to know if this is required, two or three pin, if to British standard, its capacity—5 or 15 amp..—if it is to be switch controlled or not, and if it is necessary to be separately fuse protected. In catering for domestic demand in appliances they found that there is in use two or three dozen different types of plug and it made it exceedingly difficult for the supply house to cater for all requirements, and so the price goes up. Another point was the fusing of the Cooker circuits. Is this necessary or not? As Mr. Swingler said, cookers give very little trouble and require little attention. He would therefore trust that the Engineers would come to some decision on this matter. As a matter of fact, he had been in communication with his works and they were holding up development pending hearing that the Engineers had definitely decided on some standard type of plug and circuit control.

Mr. L. L. Horrell (Pretoria): I am quite in agreement with Mr. Swingler's remarks. Standardisation is in the interest of everybody. I propose that a small Committee be formed to investigate the matter and report at the next Convention.

Mr. Mordy Lambe (East London) suggested that the subject was of such great importance that consideration of it should be expedited in every way possible. It was much

too long a time to wait until the next Convention, the holding of which was probably a year or eighteen months ahead.

The Chairman thought a Committee might help manufacturers by doing something towards stabilisation. It was a long time to the next Convention.

Mr. Roberts asked whether 3½ Kilowatts were used with the ordinary plug. He was not sure what was the standard range, five or six K.W.

Mr. Swingler (Cape Town): We don't look upon it as a stove below 3.5 K.W. Anything over 3.5 K.W. was put on the distribution board or switch similar to that shown. To make it possible to change from one house to another we have provided a plug connection at the range itself.

Mr. Ross (Potchefstroom) said it seemed to him a pity that it could not be decided at the present time what type of plug would be adopted. It had been suggested to form a sub-committee. Could not that committee circularise members afterwards, so that it could be considered and be agreed to at the next Convention, and not have to wait 18 months to notify what had been adopted.

Mr. Mordy Lambe (East London) said that it would be interesting to know if other towns had made compulsory the provision of a standardised plug.

The Chairman: We propose in Port Elizabeth to standardise. Would you be agreeable rather than wait 18 months to have a sub-committee and let them go into the matter and report to the Convention on Friday morning?

Mr. F. Castle (Manufacturers' Representative, Cape Town) seconded the proposal. He thought the question of standardisation should be tackled right away because the smaller towns were now developing and they should take a lead from the larger towns and realise that this is absolutely essential for safety.

Mr. G. G. Ewer (P'maritzburg) thought the committee should consider the British specification. If they standardised they should, he thought, follow the British specification.

Mr. P. Nelson (Paarl) would not like to see the matter remain for another 18 months.

Mr. Rodwell (Johannesburg) said that any decision on standardisation would naturally have to be incorporated in regulation or by law. It was a big question. He agreed it was essentially a matter that should be dealt with as soon as possible. If a sub-committee was formed it would serve a very useful purpose. If the Committee were unable to reach a decision until after the Convention, each member could be circularised and decisions reached.

The Chairman suggested that they should have a sub-committee and have a representative of the manufacturers upon it.

Mr. J. Roberts (Durban) said there was one very important point that had to be considered. He did not know what was likely to become standard practice in supplying stoves, whether 3 or 4 or 2 wires. That was a point that would have to be taken into consideration. He would prefer simplicity, if possible, 2 wires, because he took it that the manufacturers would have to devise their terminals for one or other.

Mr. Robinson (Manufacturers' Representative) said that he was dealing entirely with the standardisation of the equipment on the stove.

There were about 20 to 30 types of plugs in use to-day. They would like to standardise on perhaps 2 or 3, not more. He thought 4 wires was needless expense. What he wanted was that the Committee should have a standard plug. Let them come to some standard practice of circuit control. It was against the Engineers' interest not to. The sooner there was a standard, the sooner they would get their stoves cheaper.

It was moved by Mr. Ross that a sub-committee be formed and this was agreed to.

The following Committee was appointed: G. H. Swingler, H. J. Heliham, J. Mordy Lambe, A. R. Campbell, F. R. Taylor, R. Maculay, F. Castle, A. E. Robinson, —. Milton, J. H. Gyles, G. G. Ewer, F. R. Botting, I. J. Nicholas, L. F. Bickell, (Convenor).

NOTES ON INFERIOR ELECTRICAL MATERIALS.

Introduced by L. L. HORRELL, A.M.I.E.E., Past President.

A tendency has developed in this country recently for certain firms, other than approved electrical dealers, to include amongst their goods for sale to the public, electrical fittings and materials some of which are definitely inferior and may prove a source of danger to the user.

In some cases, for instance, flexible cord is being sold at a very small sum per yard and on being tested has been found to be of poor quality and could easily be the cause of a serious accident.

I have discussed the matter with the Chairman of the Electricity Supply Commission, Dr.

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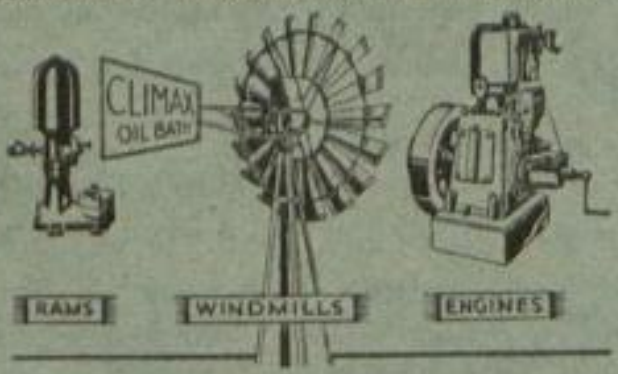

IRRIGATION WORK A SPECIALITY

THE TRADE MARK S&L OF QUALITY

H. J. v.d. Bijl and also with Mr. Jacobs, and am pleased to be able to place on record that the Commission is fully alive to the position and intends establishing a Testing Bureau where electrical materials and fittings will be tested at the request of the manufacturers. Materials approved by the Bureau will be suitably marked or stamped and it will then be at the discretion of the user whether he adopts "safety first" by buying materials thus approved or whether he is satisfied with an inferior and possibly dangerous article. Dr. van der Bijl particularly asked me to emphasise that there was no question of compulsion in the matter. The Commission merely aims at laying down a reasonable standard and Municipalities and other bodies are then open to please themselves and adopt this standard or otherwise depending entirely upon what their feelings are in the matter. Members realize only too fully, I am sure, that once an installation has been inspected, passed and connected to the supply mains there is practically no check on the additions which can be made by a consumer in the way of switches, plugs, flexible cords, multiway sockets and so forth. The consequence is that in course of time a first-class installation can become unsatisfactory and even dangerous.

In numerous countries overseas legislation exists which prohibits the sale of appliances which have not received the approval of a Testing Bureau established for the purpose.

There is no reason to believe that the standard to be laid down will be anything but reasonable and therefore the argument that the cost of installation will be increased by the above proposals does not carry much weight. As long as the public are made to understand that a Testing Bureau does exist, which aims at safety first, I have no doubt that gradually they will only purchase approved material and not subordinate safety to economy.

I feel very strongly that the Commission's proposed action deserves every support. The ultimate results will be invaluable to our Association and therefore to our respective councils, more particularly as our Association as a body, has not the funds to establish a Testing Bureau of this nature.

Accordingly, I consider that the least we can do is to give the Commission our moral support by passing a resolution at this Convention commending the Commission on its proposed action and fully agreeing to the necessity of the establishment of a Testing Bureau.

Mr. Jacobs (Electricity Supply Commission) was glad Mr. Horrell had brought forward this suggestion. The Electricity Supply Commission would like to feel that in whatever steps they might proceed to take, they had the backing of such a very strong and influential Association as the Engineers' Association. It was remarkable that when I mentioned the matter to Mr. Horrell, he had been turning it over in his mind, and Mr. Roberts also, all tending in this direction of greater safety for the buying public. Since discussing the matter with Mr. Horrell, I have turned the matter over very carefully in my mind and expressed to my fellow commissioners the desirability of seeing to it that as far as possible, whatever domestic appliance and accessories they were selling were safe.

I don't think there is any doubt that it is desirable to do something to protect the public. The question is how to do it. It seemed to me at the outset that four bodies might take steps. Government might possibly, or this Association might possibly, or the Institute of Electrical Engineers, or possibly ourselves. The Commission is not looking for more work, but it also seemed to me that when the choice was finally narrowed down, that the only body that could

possibly undertake it was the Commission. However, if I am wrong in this conclusion, I would welcome any expression of opinion from you.

Mr. Jacobs said he next got in touch with the German Institute of Engineers to find out what they had been doing in the way of making safe. Also, he got in touch with Mr. van Staaden, who was in charge of a testing Institute in Germany, and he also took steps to ascertain what was being done in the U.S.A. In the meantime they considered the establishment of such a Bureau and the Commission had approved in principle, though details had not been worked out up to the present. He took steps to find out abroad what steps were taken to enforce the purchase only of approved material, and he found that in Germany and Holland there was no compulsion on the public to buy approved material. In Holland the works themselves will ban any installation which does not meet with their approval. In Holland the Bureau will test what is submitted for approval, and then gives the manufacturers permission to brand with a mark which identifies it. In Germany they go even further. They also arrange for periodical inspections of the factories in which such approved materials are being manufactured, and so make sure that the standard is being maintained, and the manufacturers bind themselves to accept very severe penalties, he thought—£2,000. In this country they could not do anything of that, nor was it their desire to take steps which might raise the cost of such products, that would be foreign to the object in mind—the increasing use of electricity. Up to the present the steps taken are only tentative. They had no definite scheme and no doubt any number of arguments would be found to prove that the work of such a bureau was not quite so satisfying as one would like it to be, but they had to be content in certain cases with endeavouring to reach a certain goal.

It was agreed to continue the discussion next day at 9.30 a.m. and the Conference then adjourned.

Members and Delegates were entertained to dinner at the Hotel Elizabeth by His Worship the Mayor.

The speakers during the evening being His Worship the Mayor, The President, Councillors Thomson (Bloemfontein), Scott (Port Elizabeth), McLean (Port Elizabeth), McCafferty (Durban) and Messrs. Jacobs, (E.S.C.), Botting (S.A.I.E.E.) and Norman Harris, M.P.C.

In the afternoon Members and Delegates visited the Power Station, Cradock Place, Supertension Substation, Eastern Province Cement Coy., General Motors and Ford Factories, etc. Tea was served at the Power Station.

WEDNESDAY, APRIL 5th, 1933.

The Convention resumed its proceedings at 9.30 with the President (Mr. L. F. Bickell) in the Chair, there being 38 Members, 27 Delegates and 10 Visitors in attendance.

The President: The first thing to be taken is the meeting place of the next Convention.

Councillor Jolliffe (Maritzburg): I am very pleased to say I have a wire from my Council and they cordially invite the Convention to hold the next meeting in Pietermaritzburg. If the Convention comes to Pietermaritzburg it will have an opportunity of inspecting the Commission's Power Stations. It is quite an easy run to Durban or Colenso—about 1½ hours either way.

Mr. Sparks: From the point of view of the smaller Municipalities it is an excellent venue for the meeting. The smaller Municipalities have been hit very hard on account of the depression. My Municipality has dropped £150 revenue per month, which takes a lot of making up. Under the circumstances I would like to see Pietermaritzburg the venue. I would like to propose that.

Mr. Smith (Mossel Bay): I would like to second that resolution for the reason of the cost of railage and the length of time, etc., to Rhodesia, and the majority of the small Municipalities' representatives will be away 18 days on account of the branch lines. A Municipality may pay your expenses for a few days, but if it is 18 days they might jib, and next year they will jib again against paying the expenses because the precedent has been established.

Mr. L. L. Horrell (Pretoria): We must not overlook the fact that many of us would like to go to Rhodesia. We want to see the Victoria Falls. The time spent at the Falls can be taken as part of our annual leave—that is the time we take extra over the time of going there and back and holding the Convention. There is not much difference between going to Pietermaritzburg and going to Rhodesia, but if we go to Salisbury, it would mean another two or three days more than to Bulawayo. It is an unique opportunity of seeing the Falls.

Mr. J. Roberts (Durban): We are in a very awkward position, because we have asked the Rhodesian Municipalities if they will entertain the Convention. But I am not in favour of going so far away, and it is not only the smaller Municipalities that have shown restlessness about these expeditions I am afraid if we go to the Victoria Falls it will give the impression of a joy ride. I must say most Councillors who have attended the Conventions are impressed with their usefulness, but I don't think they will take this visit to the North as other than an opportunity to visit the Falls. There are other places much nearer, such as Kimberley and Pietermaritzburg, who could put up quite as good a claim. I don't think it would be in the best interests of the Association to hold the next meeting in Rhodesia.

Mr. Mordy Lambe (East London) said that whilst he appreciated the invitation ex-

tended to them by Rhodesia he felt that the distances to be travelled were a bar. Even if the extra time involved was regarded as leave the impression on the minds of their respective Councils would still remain that the opportunity was being taken for joy riding. It appeared to him, and his view was shared by many of those present, that there was too much play and not enough work at their Conventions, and he feared that the proposed visit to Rhodesia would only serve to strengthen the impression.

Mr. G. H. Swingler (Cape Town): I am happy to go where the majority like to go, but I feel that those of us who come from the coast, are just looking at it from our selfish point of view. I feel that if we cut a little of the entertainment or joy portion of the programme, we should save the time to get to a place so far away as Rhodesia. I would personally prefer going to Bulawayo.

The President: We must remember we have Rhodesia in our Association now, and Rhodesian Engineers have to come right down to Port Elizabeth. After all, what was the real difference of time between Johannesburg and Port Elizabeth, and Johannesburg and Bulawayo. I think the difference of time is in favour of Bulawayo.

Mr. A. Rodwell (Johannesburg): A very difficult question has been raised. It seemed to him no decision could now be come to, unless they came to a vote, but he did not think that should have happened and was not in the best interests of the Association.

Councillor Fourie said, as far as his Council was concerned, if a Convention was held in London, and they decided to send delegates, they would do so. He thought it was a splendid opportunity of giving delegates and members up there an opportunity of coming into closer contact with Union members and delegates.

After further discussion the President put the question whether the Convention should go to Rhodesia or one of the towns in the Union.

On the vote being taken, 30 voted in favour of Rhodesia and 18 against.

On a vote being taken as between the towns of Salisbury and Bulawayo, 16 voted for Salisbury and 12 for Bulawayo.

The Chairman: The venue of the next Convention is Salisbury in Rhodesia.

Discussion resumed on "Inferior Electrical Material."

Mr. Mordy Lambe (East London) said that he had been struck by the fact that whilst Mr. Jacobs had mentioned a number of countries in which enquiries had been made, Great Britain was not amongst them. Had Mr. Jacobs any information to give them in regard to the procedure adopted in Great Britain?

Mr. Jacobs (Electricity Commission): As far as I know there is no inspection. If you will give me the address of anybody in Great Britain, to whom we can apply for information, I shall be only too pleased to do so.

Mr. J. Roberts (Durban): This matter came prominently before the attention of our Department, when I was in charge of it last year, and it might be of interest to members if I now read a short report I placed before the Electricity Committee last October.

Extract from B.E.E.'S Report to Electricity Committee dated 25/10/32:—

Many firms besides electrical dealers are now including electrical appliances among their other goods for sale to the public, and it has come to the Department's knowledge that some of this material is unsatisfactory and

would not pass the Department's inspection test if used in a new installation which, of course, is not connected to our supply if it does not comply in every respect with our Wiring Rules and Regulations, but when once an installation is connected to our system we have practically no check over the additions which can be made by a consumer in the way of small appliances, together with the necessary attachments, such as switches, plugs, cords, lamp holders, etc., unless he notifies us that he has made these additions or alterations. The consequence is that though an installation may be in first-class condition when we connected it, it can in course of time become very unsatisfactory and even dangerous to the user.

It has consistently been the Department's aim to do whatever is possible to ensure safety, particularly in a kitchen where conditions can become dangerous, especially where the floor consists of tiles or concrete uncovered by linoleum or similar material, and considering the many thousands of appliances of many kinds now in use in Durban, freedom from accident is remarkable, but this immunity cannot be expected to continue if consumers who, under present circumstances, are compelled to economise in every direction will more and more buy cheap unsatisfactory fittings and wires which are very freely sold in Durban at the present time. Among unsatisfactory appliances must be included electric lamps, which I have good reason to believe, even at the low prices at which they are sold are not economical owing to their short life compared with lamps made by reputable manufacturers and bearing such manufacturers' name.

I am not sure whether it would be possible to obtain legislation in South Africa, similar to what I believe has been brought into force in Canada, where no electrical appliances are permitted to be sold unless they bear the stamp of approval of the Electricity Authorities. In any case it would be a lengthy business and I am of opinion that in the interests of public safety other steps should be taken without delay. I have, during the last few days, had discussions with electrical dealers of good standing in Durban and put the following proposition to them, i.e., that the Town Council should open a list of accredited

dealers in electrical appliances, wires, etc., who would be prepared to give the following undertakings:

(a) That all apparatus, appliances and wires sold by the firm for use on installations to be connected to the Durban Corporation Electricity Supply, are, and shall continue to be British Standards Institution's specification, and/or in accordance with the requirements of the Wiring Regulations issued by the Electrical Department.

(b) That all electric lamps, sold by the firm, shall bear the maker's name or manufacturer's registered trade mark.

(c) That the firm will not fix, attach or connect up wires or apparatus not in accordance with the above, which they may have been supplied by the consumer of any other party.

My proposition is that the Town Council would then furnish them with a printed certificate which they could display in their places of business and the public should be notified that they should not deal with any firm who do not apply to be placed on the list. If the scheme is approved and put into operation it would be incumbent on the Department to take steps to ensure that dealers on the list complied with the undertaking they had given and if it were found that they were disposing of goods which were not in accordance with the Department's Regulations, they would be removed from the list and the fact notified in the newspapers.

I do not see how anyone among the present dealers could complain, as they have only to give an undertaking not to sell unsatisfactory articles and they would be put on the list whether they were sole sellers of electrical goods or not, and the scheme is not designed as any restriction upon trade so far as the sale of really sound appliances and apparatus is concerned.

I am, Gentlemen,

Yours faithfully,

JOHN ROBERTS,

Borough Electrical Engineer.

I will move that the Electricity Commission approve of the types of wires and appliances for use throughout the country for Electrical Undertakings.

Mr. G. H. Swingler: I think we want to go carefully and slowly in a matter of this description. We have had quite a lot of trouble in approving and disapproving appliances as well as material. Engineers in large and small towns have the power to insist that best material be used inasmuch as they can stop it whether we have a testing bureau or not. But I challenge anybody, especially those in the bigger towns, to prevent it. You can have a crowd of inspectors, and yet this inferior stuff is bought at the bazaar, without your knowledge. There should certainly be a hall mark on appliances. The P.W.D. in this country has had the courage to stipulate "only best material to be used." If we could be sure that this proposal was such as to carry us right through to the consumer, it would be well, if the Bureau was going to act as detective down to the consumer. It would rest on the Engineers that the material supposed to be used, was used, and I think we should go carefully. Take a Canadian stove approved by the Canadian body that was quite all right for use in the home. If we had the courage of the P.W.D. and had the money to spend on inspectors to go round periodically and see that the appliances and materials are of the very best, that might get what we desire. On the other hand, why should we inspect at all? Mr. Sankey advanced that theory and it was nearly carried. If people liked to buy inferior stuff, why not? We don't stop them buying inferior furniture and clothing.

Clr. D. Nelson (Paarl): I quite agree with Mr. Swingler. What the Electricity Commission was suggesting seems to me to be taking away the responsibility of the Municipal Engineer. Whatever you do you will have the inferior quality. At present the Engineer of

each town is trying to see that the correct material is installed. I don't think that it is advisable at the present time to saddle any more responsibility on the Commission. Let the Engineers do their work as at the present time, if we find inferior stuff put in, our Engineer at once disconnects it.

Clr. Withinshaw (Cape Town): I am one who always uses the best material in work. We know the Bazaars sell a tremendous quantity of this inferior stuff, but none of that stuff comes under the purview of the inspectors. The Bazaars don't sell direct to the Contractor, they sell to the handyman, who is ever seeking to save a penny, and goes to the Bazaars and buys inferior stuff. Nothing short of an act of Parliament prohibiting Bazaars from dealing in these things, is going to help us in any way, so I don't see what use a testing Bureau is going to be.

Mr. J. Roberts (Durban): Knowing the enterprise of these Bazaars, I think that if there was a standard of material set, that the Bazaars would stock that material and the inferior material would automatically go out of use. The ordinary consumer does not want dangerous material in his house, but he does not know the danger. He buys flex, which is cheaper and looks well, and thinks it will answer his purpose.

Mr. A. T. Rodwell (Johannesburg): It would be useless if it were only a recommendation. People to-day are recommended to buy reliable material. I agree it is not a bit of use standardising unless we can insist that nothing but standardised material shall be used. I would like to refer to the statement made that Mr. Sankey almost advocated the abolition of regulations. His reason was that the insurance companies used to have inspectors to inspect the wiring of premises to prevent inferior work, but the insurance companies withdrew their inspectors and left the responsibility entirely on

the Municipalities. If anything is done, surely the insurance companies should help. They have no responsibility in the matter at all today. I feel strongly that it is all useless without subsequent inspection. If we have standardisation by the commission I don't think it will improve things a bit. It all depends upon inspection afterwards. Something has been said about the courage of the P.W.D. but it is not always a question of courage. I feel that the question of standardisation of electrical materials throughout South Africa is of greater importance. If the Commission could do something on these lines this would be real good work. I think the other suggestion is futile. I feel very strongly that it is very generous of the Commission to make this offer, but it seems to be the general opinion that it does not help much without subsequent inspection to enforce the use of standardised material and equipment.

Mr. Botting (S.A.I.E.E.): I agree with what has been said, that unless we have some legal power to enforce the prohibition of the sale of bad material, a Bureau would not be of much good. Unfortunately the Engineers of some of our smaller Municipalities are not able to exercise the bar because they don't get the support of the Council. It is becoming more and more the case that Engineers of smaller Municipalities rely more and more on the Commission. Suppose a question comes up about what material should be used and the Engineer should go to the party and say, "I don't approve of that material." That man immediately goes round to the Council and says "Your Engineer won't let me use this." But if the Engineer could say, "Well, I will ask the Commission if this material is considered suitable," it would be different. At present the smaller Municipalities have nowhere to go.

As far as I can see, a testing Bureau in South Africa would have to be a very large

thing, because there must be hundreds of makes, and they would have to be tested first. Any new article coming forward might take a couple of years to go through the Bureau because there would be so much in front of it.

Mr. Mordy Lambe (East London) asked if he was to understand that the Bureau was proposed to be set up and the consumer still left to exercise his own choice of the materials and devices which he purchased, irrespective of whether they were good or bad. If that was the case then in his opinion the proposed Bureau would be of no value. In regard to the purchase of materials, as in the case of most other things, price was very often the deciding factor. It might be, and probably would be, that the prohibition of the use of unsatisfactory materials would have the effect of increasing prices. Nevertheless, he felt very strongly that the first step to be taken was to prohibit the importation to or manufacture in the Union, of defective or poor quality materials. The next step would be the establishment of the proposed Bureau. The law prohibited the sale of adulterated food stuffs, as well as the use of for instance, steam boilers which did not conform to certain specified requirements. Why? because both were dangerous to life. He saw no greater difficulty in securing legislation in regard to defective and inferior electrical installation materials, the use of which was a danger to life, than in the case of food stuffs and boilers.

Mr. Robinson (Manufacturers' Representative) said that to his mind the weakness was in the fact that they had not got a standard set of regulations in this country. Each Engineer drew up his own specification governing wiring of buildings. Unscrupulous manufacturers knew there were no inspectors to check them. He thought if the Engineers got together and drew up a uniform set of regulations, giving in detail their requirements, the Government would

accept them and that would go far to put matters right. In England manufacturers of cookers had been handicapped because of having to satisfy the demand of different Engineers, and, therefore, there was nothing standard. Standardisation would enable the manufacturers to produce in large quantities and give good quality at low prices. There were a lot of foreign manufacturers who had been flooding the British market with shoddy goods and if the British market was closed to them owing to the recent tariff wall, they would be compelled to look for other markets and come here shortly.

He urged the Engineers to get together and draw up a set of standard regulations to ensure the use of only first quality material. The reputable manufacturers would welcome any legislation to this end. Speaking for his firm, he was sure they would support a test Bureau, such as mentioned by Mr. Jacobs.

Mr. Horrell (Pretoria): Mr. Robinson's remarks are very much to the point. The objection is not to material utilised in an installation in the first instance, but the inferior fittings which may be added from time to time, without the knowledge of the Electricity Departments. A step in the right direction would be only to permit the sale of approved articles which have been tested and stamped as such, although I doubt very much whether it will be possible to obtain the necessary legislation.

A Member: It seems to me that we are a strong organisation and can speak with a strong voice to Parliament and should be able to secure the point we require. Another point has occurred to me that something might be done in the way of Municipally Licensed Distributors of material. Then the public would know that if they went to a licensed firm they would get a good article.

Mr. Mordy Lambe (East London) said that he was not averse to the establishment of the proposed Bureau, as such, but he was opposed to establishing it at this stage because it appeared to him to be putting the cart before the horse. They were told that the Electricity Commission had been good enough to take in hand the establishment of the Bureau. Why should not the Commission extend its activities to securing the prohibition of the sale of inferior materials?

Mr. A. M. Jacobs (Electricity Supply Commission): The discussion has been of the utmost interest. Personally I would like to prohibit the importation and so forth of inferior electrical goods. Mr. Mordy Lambe has himself recognised such prohibition presupposes the existance of some body to decide what materials are inferior or not. But the real point of the suggestion put forward to this Convention was to protect the public against itself—people who go into any sort of shops and buy something and put it in themselves. Mr. Roberts had referred to a kind of flex that was inferior, and he would say he was not able to buy in Johannesburg, flex of the kind referred to by Mr. Roberts, so Johannesburg protects the interests of its citizens as far as it can.

The passing of legislation prohibiting the importation of inferior electrical goods would not only require the establishment of a central body, but also the establishment of a corps of inspectors to make sure nothing came into the country, and even if we succeeded in getting such legislation, the implementing of such legislation would be a matter of extreme difficulty, and in my resumé yesterday, I must have indicated that I and my colleagues felt that all we could do would be to try to take some steps to help the public to protect themselves. I do not think the mere testing of materials would be futile, as the Municipalities could see that the public only bought approved material by

seeing that the article was marked or branded. The consumer would make inquiries and in that way become educated up to using the article which is considered superior. I put it to you also that the natural spirit of competition between importers of electrical goods would have the effect of letting the public know that their goods had been approved. In that way I think a certain amount of good would be done. I have never heard that there has been a fatality in the country, but that does not mean that there would not have been. These cheap goods have been coming on to the market for a comparatively short time, and bad flex often requires some time to show up its bad qualities. Prevention is better than cure, and that was behind the suggestion of the Electricity Commission to undertake the establishment of this Bureau.

Mr. Mordy Lambe (East London) moved that in the interests of the safety of the public this Association requests the Electricity Supply Commission to endeavour to secure legislation having for its object the prevention of the importation, manufacture or sale of electrical appliances, devices and materials other than those approved of by an examining and testing authority to be established for the purpose.

Mr. Mordy Lambe's motion was carried unanimously.

NOMINATION OF VICE-PRESIDENT.

The President called for nomination for the office of Vice-President.

Mr. G. H. Swigler (Cape Town) asked if Rhodesia could provide a Secretary, if Mr. Metelerkamp was made President at the next Convention.

Mr. A. R. Metelerkamp (Salisbury): I think we will be able to provide a Secretary.

Mr. Metlerkamp was duly elected Vice-President.

Messrs. A. T. Rodwell, (Johannesburg); G. H. Swingler, (Cape Town); J. H. Gyles, (Durban); and T. Millar (Harrismith) were elected members of the Council for the ensuing year.

Convention adjourned after the tea interval for the purpose of viewing two films at the Metro Theatre, depicting:

I. The Manufacture of Cables; and

II. The Construction of the Scottish 132 K.V. Power Line.

THURSDAY, APRIL 6th, 1933.

The Convention resumed its proceedings at 9.30 a.m., with the President Mr. L. F. Bickell in the Chair, there being present 36 members, 24 delegates and 9 visitors.

The President called upon Mr. J. Bernard Bullock (Union Steel Corporation) to address them on a matter connected with the Vereeniging Works.

Mr. Bernard Bullock said that the Pretoria Works would be coming into operation before long and that something would have to be done if the Vereeniging Works was to be safeguarded. The Vereniging Works employd 300 white men and 600 natives. The place was dependant on the wages of the workmen. Mr. Bernard Bullock mentioned that large sums had been spent on the mills and that thy had embarked upon the production of copper wire, standards and connections. Their object in coming down was not only to meet old friends, but to put to them the work being done, and which now had been in progress for 18 months. Every difficulty had been overcome and they were now working to British Standard specification. He therefore wished to appeal to the Electrical Engineers of the Country to support the new industry by

all means in their power. The works would do everything possible to meet them in every way.

Mr. G. H. Swingler (Cape Town) : I should like to propose that we, as an Association, give this venture our support in as much that we should recommend to our Council that which is done in other cases of South African Products. A preference is given and I shall be glad to recommend to my Council that all things being equal, the usual 10% preference be given to the Union Steel Co.'s products. This, I know, is usual in other cases, and so I move accordingly.

Mr. A. T. Rodwell (Johannesburg) : The City of Johannesburg has already generously supported this South African industry. Under the conditions proposed by Mr. Swingler, I have pleasure in seconding, everything of course, hinging on that clause, "All things being equal." I do feel that.the position should be clearly defined.

Mr. Bernard Bullock remarked that Johannesburg had taken a considerable amount of this copper and it had given satisfaction.

The President: Port Elizabeth has used it and found it all right.

The motion that preference to the extent of 10% be given to the products of the Union Steel Co. was carried.

MR. RITSON'S REPLY ON HIS PAPER.

Mr. President and Gentlemen,

I was very pleased, indeed, to note the amount of discussion raised by my paper, and must thank Mr. Rodwell for his very kind remarks.

In reply to Mr. Jagger regarding the time taken for his change-over against that of Stellenbosch. He gives the time taken for his change-over as 19 days, and whilst I fail to see how a work of such magnitude could have been completed in so short a time, I must congratulate him on his achievement. It must, of course, be admitted that the conditions will vary in different centres, Stellenbosch being a University town, certain sections of the town had of necessity to be changed-over at times to fit in with the University classes. We had no extra labour engaged on the work, the whole job being carried out by our own staff.

The time I mentioned does not even include the alterations to the overhead distribution, but is dated from the time the E.S.C. gave us juice until the last job was completed.

In my opinion a job of this nature should not be rushed, in one printing works alone we had to change eleven machines and rewire at the same time, this one job alone took us 3 days, and on this we worked throughout one night and all day on a Sunday.

In reply to Mr. Metlerkamp, re 3-core supply; our underground mains were laid when additions were made to the D.C. supply in 1925, when we changed over these mains were only 3 years old and we, to use them to the best possible advantage, they were only suitable for 600 volts and we have 550 volts at the Board. From the Switchboard we run to 6 Transformer Kiosks, each containing an Auto Transformer, arranged for 550/380/220 volt, 4-wire system.

We put in Auto Transformers, firstly, because the initial cost is lower than double-wound transformers and, also, because the efficiency is higher.

With regard to the D.C. meters being left as long as possible we only had the consumers

off a meter for one evening and on account of the small amount of labour employed we had to work as smoothly as possible and not rush things. In reply to Mr. Nicholas, as to the reason for not making a complete change-over, I would mention that £500 is quite a big item for a small station, and as the Dentists are all close together it was cheaper to put in the motor-generator set.

In reply to Mr. Roberts's point concerning charging the consumer for alterations to motor installations, I personally interviewed all the consumers requiring alterations and by using a good deal of tact and stressing the superiority of the apparatus we were supplying over that of his existing equipment, I managed to get the signature of every consumer, agreeing to pay the cost of his alterations.

I may add that since the change-over I have never received a complaint in regard to apparatus installed and my advice to any Engineer contemplating a change-over, is to give your consumer a square deal, nothing is more satisfying to an Engineer than a job well done.

In connection with the point raised by Mr. Sparks, concerning 3-phase systems and shackling off points, I am of the opinion that a three-phase, 4-wire distribution is the ideal system to adopt, it lends itself to better balancing and greater flexibility and is, I believe, the system most generally adopted throughout the world. I certainly think it the most popular system amongst Engineers in South Africa.

In regard to shackling-off, this point, like other details involved in a distribution system, must be planned before starting work on the change-over. Whilst planning your change-over it is a good policy to have a chat concerning the work contemplated with all the men concerned and you will be surprised at the useful tips you will receive.

The point raised by Mr. Campbell, re the use of Auto Transformers, has been covered in my reply to the comments of Mr. Metlerkamp.

There is one question which has been put to me concerning D.C. mains wireless sets, fortunately I had none of these to change over, if any Engineer present has had experience of this aspect of a change-over job, I am sure it would be helpful if he related it, for it would surprise the Convention if it knew the number of small towns who are contemplating a change-over to A.C.

I may add that since our change-over we have installed 42 Stoves, 57 Water Heaters and 26 Refrigerators and we have at present no Hire Purchase System, we do, however, contemplate the inauguration of such a system in Stellenbosch in the near future. For this reason I am delighted to have been present at this Convention and to have heard the views of those Engineers who have so successfully inaugurated Hire Purchase Schemes in their own centres.

I thank you once again, Gentlemen,

D. W. RITSON.

The President thanked Mr. Ritson on behalf of the Conference for his very valuable paper.

The President said the next item on the agenda was a paper on "The Utilisation of Surplus Power or Heat for Delivery to a Public Electrical System with Special Reference to the Sugar Industry."

"The Utilization of Surplus Power or Heat for Delivery to a Public Electrical System," with Special Reference to the Sugar Industry.

By JOHN ROBERTS, M.I.E.E. and COLIN DAWSON of Durban.

INTRODUCTION.

It may be stated at the outset that this paper is based largely on two papers, written by the first-named, on "Electricity as a By-product," in November, 1918, read before the Natal Society for the Advancement of Science and Art, now the Natal Institute of Engineers, and a paper read before the South African Institute of Electrical Engineers on "A Waste Heat Power Station." Liberal extracts are made from both these papers in order to explain first of all the general advantages of waste heat stations, and secondly, to give some details of a waste heat station now in operation in Durban, and brought up to date by particulars of a further much more elaborate scheme which was designed specifically to suit the conditions of a modern sugar factory.

The idea of utilizing waste heat was, so far as we know, first put into practice in the admirable electric supply system of the North East Coast of England. That system has many hundreds of miles of electric lines running through one of the greatest industrial areas of the world, whose activities I need not enumerate. That Company has established auxiliary generating plants to their main stations for utilizing waste heat from blast furnaces, coke ovens, etc., and to absorb all the surplus heat available by turning it into electricity and pumping it into their mains. Here is a case,

therefore, of the electric supply fulfilling, not only the function of supplying power to those with none available, but enabling those with more power (or what is the same thing—heat) than they require to utilize the surplus which would otherwise be wasted, and I venture to make the prediction that the next striking development of electric enterprise, will be the use of electric supply systems in utilizing hitherto wasted sources of power by extensions of its mains to fetch electricity from the place where it is not wanted and carry it to another where it can be utilized.

We must imagine, first of all, that we have an extensive system of supply mains covering the district, fed by one or more supply stations, and we look round to see what waste power there is about which could be used to help out the main generating station, and so save coal. There is a certain amount of water power within a distance which may not be too great to make it commercially profitable to develop such power, and here we strike at once the benefit an electric supply system possesses in the development of a water power. For we all know, that in this country, one of the greatest troubles of our water falls from the power point of view is that owing to the great variation of river flow, a tremendous amount of power runs away to waste during some months of the year; during the remaining time the river goes down to a trickle. An all-the-year-round supply of electricity is either impossible or can only be secured at the expense of constructing huge water storage dams. But with a system of electric mains into which current may be pumped the full benefit of the fall is obtained, except in floods, while in periods of drought the steam station takes the load of the system.

When the day comes which sees the extension of electric mains among the farming community, even the smallest fall need not be wasted. A farmer, let us say, has a spasmodic

demand for power, say up to 50 kilowatts. He has a fall on his farm which for some months of the year yields 100 Kilowatts and for the remainder does not give more than 25 Kilowatts. It is, therefore, no use to him. The fall, let us imagine, gives 100 Kilowatts for four months of the year, and 25 Kilowatts for eight months. The farmer requires, say, 50 Kilowatts on an average of two hours a day throughout the year. The fall is capable of giving 432,000 Kilowatt hours per annum. The farmer requires 36,000 K.W.H. per annum. The fall is capable of giving twelve times the total energy the farmer wants, and yet it is no use to him.

We will imagine that five miles away from his farmhouse there are the mains of an electric supply system, and as he finds the fall useless he approaches the authorities and asks for terms for giving him power. They quote, let us say, 1d. per unit, but in addition require to be guaranteed the interest on the five miles of line necessary to reach him, the capital cost of the line being, let us say, £350 per mile. Eight per cent. on £1,750, the cost of five miles of line, is £140 per annum. On his annual requirement of 36,000 units the interest charge alone works out at 1d. per unit, and the total cost of the unit is 2d.

This figure the farmer finds prohibitive and so his water power is useless, and the electric supply too expensive. But suppose the electric supply authority is sufficiently wide awake to realize the value of the fall to their system. They will say to the farmer, " Give us the right to the use of your fall, which is useless to you, and we will supply you with power free," and supposing the farmer agrees, the fall is developed at a cost of £2,000. The Company then builds the line and equips the fall at a total cost of £3,750, and receives 432,000 units less 36,000 supplied to the farmer free, say 400,000 units per annum worth to them on their main distribution lines, say ½d. per unit or £835 per

annum. The interest on their investment in producing the power is 8% on £3,750 — £300. The station being automatic, the only attendance required will be for, say, a monthly inspection cost, say £25 per annum. The cost to the Company of supplying the farmer with power over and above what the fall yields in winter is £25 (12,000 units at ½d.). Total expenses are thus £350, and the surplus is £485 per annum.

In the paper from which some of the foregoing was taken, figures were given of the amount of power which could be obtained from the river Umgeni, a moderate size river for this country, and I reproduce the chart of the river flow and the power in Kilowatts which could be obtained from this flow during a wet season and a dry season. The results are shown in Chart No. 1, appended to this paper, and may be summarised in the following table:—

	Dry Year.	Wet Year.
Maximum Kilowatts in Summer	2,000	2,800
Minimum Power ..	500	1,000
Kilowatt-hours	12,600,000	19,200,000

I may say also that the flow in millions of gallons per day varies from about 15,000,000 to 90,000,000. The point brought out in connection with the utilization of this fall is that unless the power of the fall were used to feed into a large electric supply system the greatest amount of power which could be relied upon is 500 Kilowatts and everything beyond this is wasted, so that a factory situated near it could only utilize the fall to the extent of its minimum possible output. By feeding into a supply system the fall could be supplemented in winter time from the supply mains and a surplus of power from the fall in summer could be delivered into the supply system over and above the factory requirements.

It has never been possible to harness the falls for the purpose of supplying Durban on account of the expense of the line of from 50 to 60 miles which would be needed to bring in its energy, but fortunately an opportunity for employing surplus energy in a definite form, i.e., waste heat, presented itself about 7 years ago when a large sugar refinery, close to the old Durban boundary, more than doubled its plant, needing a total power from its electric generators of 1,000 Kilowatts. The following further extract from a previous paper is given:

"Up to that time, almost the whole of the power requirements of the factory had been supplied from the Durban Corporation electric system, leaving out the driving of air pumps connected with the vacuum pans, and boiler feed pumps. The total consumption of current was about 750,000 Kilowatt hours per annum. Proposals had often been considered by the Company to instal a back-pressure turbine, so that the steam used for the very extensive heating and evaporating processes required in refining, should be applied to generating electricity, the boiler pressure being about 180 lbs. and the heating pressure about 25 lbs. After going into all the pros. and cons., however, it was found that on the scale they were operating, the saving to be made did not warrant the worry and trouble involved, particularly as the Corporation supply had been reliable and they were well pleased with the great improvements in their factory working made by changing over from steam to electric power. At about the time mentioned, however, viz., June, 1925, the intention to increase the factory capacity up to about 500 tons per day placed the power matter on a different basis. The amount of steam wanted, as well as the power requirements, were such as to justify the installation of turbines within the factory and so cut out the Corporation supply altogether, except as a stand-by. It was estimated that the amount of steam to be used during the year of 10 working months was on an average at the rate of 75,000 lbs. per hour. There were no very close estimates available of what the consumption of electricity would be, as the specifications for plant for the factory were not complete, but it was thought that the consumption might be about 4,500,000 units per annum. The Company called for tenders for two 750 Kilowatt and, alternatively, two 1,000 Kilowatt back-pressure turbines suitable for their conditions, and then approached the Town Council in regard to stand-by supply.

On going into the whole matter, the Company having furnished the Corporation with all their plans and figures of amount of steam, etc., it was felt that this was a good opportunity for collaboraion between the Company and the Corporation, because it appeared on a conservative estimate that there would be about 9,000,000 units of power available, or twice the amount needed in the factory, and that both parties would greatly benefit if a suitable agreement were made. It was then suggested that two turbines should be installed by the Town Council and operated in parallel with the Town Council's system, the factory drawing off what they required, irrespective of what steam they might be using at the time, and delivering the surplus into the system of the Corporation. Should the quantity of steam being used in the factory be insufficient to generate the power requirements, the shortage would be made up from the Corporation's mains. The arrangement also covered supply to the factory when not in operation during week-ends, and for two months of the year during which time power would only be wanted for repair work and lighting, and this current was to be supplied at reduced rates. The advantages to the Company are obvious:—

(1) They would be entirely relieved from all responsibilities of manufacturing power.

(2) The arrangements proposed required the minimum capital expenditure, the plant being of the simplest possible form.

(3) If the Company had operated the plant independently a good deal of the steam would have had to be brought down from 180 lbs. to 25 lbs. wastefully. If they had wanted a stand-by service from the Town Council in case of breakdown, such supply would have been expensive, as it would have had to be on a maximum demand basis.

The proposal put to the Company by the Town Council that a joint arrangement should be made, commended itself and an agreement was drawn up. The following is a brief description of the plant :—

Two W. H. Allen's 1,500 b.h.p. turbines, 3,000 revs. per minute, stop valve pressure 180 lbs. per sq. in. superheated 100 deg. F., exhausting into a receiver at 25 lbs. pressure, direct coupled to two G.E.C. generators, 1,250 k.v.a., 0.8 power factor, 50 cycles, 25 per cent. overload for two hours. One generator operating at 6,600 volts, and one at 550 volts.

Five 250 k.v.a. Berry type transformers, for purposes of transforming "up" or "down" as required, and

necessary switchgear to synchronise with Alice Street Power Station. Consumption of turbines under above conditions was 40 lbs. per kilowatt hour at full load and 43.9 lbs. at three-quarter load.

One 10 inch "Arca" regulating valve, for controlling both turbines after being synchronised to mains, and "Electroflo" steam flow meter.

One "Arca" reducing valve on by-pass for use when turbines are not in operation.

The general layout in plan and cross section are given.

Originally it had been the intention of the Town Council to instal one 2,000 k.w. back-pressure turbine, such an arrangement being desirable owing to the low capital cost involved and simplicity in operation.

The absence of condensing plant and the presence of the public supply as a stand-by to cope with any emergency would have ensured reliability with such a set, and the financial returns would have been greater.

The Corporation met the Company's views, however, and installed two turbines, one supplying at the factory pressure, 550 volts, and one at its own pressure, 6,600 volts.

The arrangement is not a bad one in many respects, for it happens that Messrs. Hulett's consume just about half the total output, or sufficient for one machine, and though, of course, both machines are running in parallel, the great bulk of Hulett's demand is delivered to them without any transformation, and, correspondingly, the surplus output to the Council's system is turned into that system without transformation also. Messrs. Hulett's had proposed to instal geared turbines, the turbines themselves to run at from 5,000 to 6,000 revolutions per minute, and the generators or alternators to run at some such speed as 1,000 revolutions per minute. This is the type which is commonly adopted in sugar refineries in England for a similar purpose, and some makers are standardising on it. The Corporation staff, however, were not greatly predisposed in favour of this type of machine; as, obviously, it was not such a simple trouble-proof outfit as a plain direct coupled set running at 3,000 revolutions per minute. The idea, of course, of the geared arrangement is to obtain increased economy from a high speed turbine, and to use a low speed alternator, which some people consider a more reliable machine than one running at 3,000 revolutions per minute. It was

found, however, when tenders were received for alternative sets, that a direct driven set at 3,000 revolutions per minute was not materially less efficient than a geared set, and it had many advantages, as follows:—

(1) **Less Space Occupied.**—This was important in our particular case.

(2) **Quiet Running.**—This was considered to be quite important and a point which, I think, more attention should be given to in all power stations. There is, first of all, the psychological affect on attendants, and in a quiet turbine room abnormal noise indicating troubles are more easily heard. The very best geared machine has a slight rumble, even when new, and this rumble greatly increases as the gears get worn.

(3) **Better Ventilation of Engine Room.**—With the high speed alternator, the hot air discharged from the turbine can easily be conducted right outside the room, which causes fresh air to be continually drawn into the room, and, in the Durban summer climate, this is no mean advantage. The ordinary slow speed alternator, of the open type, is not usually designed for a closed system of ventilation.

As will be seen from a diagram of connections, there is installed a transformer bank capable of dealing with the whole of Hulett's load, being of a total capacity of 1,250 k.v.a. so that, should the low pressure machine be out of action, current can be obtained for the factory at low pressure, either from the E.H.T. supply or from the other turbine, which is, as was explained, built for 6,600 volts.

The switchgear for controlling this equipment is situated on the turbine floor parallel to the two turbo-alternators, the alternator panels being situated opposite their respective machines, thus giving the attendant full control over them.

The 6,600 volt gear comprises B.T.H. truck type panels arranged to control the Corporation main feeders, turbo-alternator and bus-bar coupling switch. The alternator is equipped with Merz-Price and overload protection together with a full range of recording instruments. The five transformer panels are of the sheet steel cubicle type, built up in the Corporation shops, and equipped with overload time-limit protection. The 500-volt gear is of the slate panel type with overhead bus-bars supplied by Messrs. The Metropolitan Vickers

Electrical Co. Ltd., and comprises two sections: the first controlling the low tension turbo-alternator and the five transformers. The L.T. alternator is also protected by Merz-Price and overload protection, and the transformer panels are fitted with the time limit overload protection. The Corporation main watt-hour meter is situated between this section and the second section controlling the nine main factory feeders. The field rheostats and cables are arranged in the basement directly under the switchgear. Synchronising gear is arranged so that the sets can be synchronised with the Corporation E.H.T. distribution system, or run direct on the factory load, the transformers acting as a tie between the E.H.T. and L.T. machines and for transferring load in either direction as may be required. The scheme of connections is also given.

The method of operation is ideally simple, and is worthy of a few words of description. It is obvious that the governing of the turbines is on an entirely different principle to that of turbines in modern stations. In an ordinary power plant generating current independently of any other source of supply, the first consideration is to keep the speed constant, and the amount of steam passing through the turbine has, therefore, to be controlled by governors, self-regulating, according to the speed. The load is the primary variable quantity, and the amount of steam passed is a function on the load. In this plant, however, the conditions are exactly reversed. The amount of steam required for heating purposes is the primary variable, and this steam must be used in its varying amounts up to the capacity of the turbines. The speed, on the other hand is a constant for both alternators are in parallel with a system of very much larger capacity than themselves, and so long as they remain in parallel with the mains, are forced to run at a speed corresponding to the periodicity of the main generating station. The factor which must be kept uniform is the pressure in the receiver which delivers exhaust steam to the factory, and at the present time this is fixed at 20 lbs. per sq. in. above atmosphere.

An automatic relay valve is, therefore, fitted on this receiver which as it rises and falls due to slight variation of pressure in the receiver admits less or more steam through the main steam pipe feeding both turbines.

The type of regulator employed is that known as the "Arca," and it functions through such small limits that unless the pressure gauge is scrutinized very carefully almost no variation may be noticed. Should the draw-off at times when demand for steam in the refinery is unusually high, be excessive, the turbine will not pass the necessary quantity of steam to keep the pressure in

the receiver up to normal, and in such circumstances another regulator operating a reducing valve is brought into action when the steam falls to about 18½ lbs.; this opens live steam from the high pressure range direct into the receiver, thus partly short-circuiting the turbines. In order that as little steam as possible should be short-circuited, for it is obvious that power is being wasted under such conditions, the attendants open by hand an overload valve on the turbines, which allows more steam to pass, though not under such efficient performance. As soon as the abnormal demand for steam falls off, this overload valve is closed, and the whole of the steam is again passed through the turbines under the conditions of maximum efficiency. In any further turbines which may be installed it will be arranged that the overload valve is brought automatically into action, so as to make the whole plant a little more automatic than it is at present.

Operation is extremely good and requires practically no action, except the occasionally opening and closing of the overload valves from the turbines, as explained. A bad short circuit on the system in the district on the feeders quite close to Hulett's tends to trip the generators, but this is of infrequent occurrence, and such trips have been minimized by a higher setting of the relays.

There is another occasion, and this happens every 24 hours, on which Attendants have to keep a lookout, and that is when the time signal is given at the main generating works by a reduction in supply pressure, of about 5 per cent. for 2 or 3 seconds at precisely 8 p.m. For the first two or three nights the plant was in operation a heavy interchange of current took place in the system through this drop in voltage but Attendants now stand by and lower the pressure on the two turbines for a few moments, and there has been no further trouble. An automatic arrangement could easily be put in to avoid this special attention if it were worth while, though, of course, it would entail a pilot wire or telephone wire between the two stations.

It may be very interesting to mention at this stage that the plant has given entire satisfaction since it was started up. The turbines have operated most successfully under the peculiar conditions existing, and the manufacturers are justified in claiming an intimate knowledge of the design of machines called to work under such unique circumstances.

In regard to the financial aspect of the proposition, it is satisfactory to record that this has been very favourable and is dealt with in detail later in the paper.

WEEK-END OFF SEASON OPERATION.

A very important feature of this collaboration between the manufacturer and power undertaking is that it relieves the manufacturer entirely of the responsibility of producing power. Without such a scheme provisions must be made for a power supply during the shut-down period for workshops, etc., and during the working season for boiler and other auxiliaries each week-end before steam is available. Further, while running independently a careful balance of steam and power requirements are essential if the waste of valuable heat to the atmosphere is to be avoided.

The interconnection with a large power supply system obviates all the above. The electricity undertaking is able to supply current for week-end overhauls, etc., at a lower rate than to other large consumers, and current is always available to the factory irrespective of factory steam requirements. When shutting down at week-ends the turbines are taken off load when steam for the factory becomes erratic, and are put on again, when starting up, when sufficient steam is available. Both after the machines are taken off load at the week-ends and before they are put on again, there is a period of about 4 or 5 hours when the factory requires a considerable amount of power for auxiliaries, and this power is drawn directly from the Corporation mains, and should, at any time during the running of the plant, the output fall below that required for the factory, due to a reduction in the amount of process steam, low steam pressure or any other cause, then the shortage is automatically drawn from the mains. Should a shut-down occur on the Corporation system then the outgoing feeder immediately trips on overload, and the machines are quickly brought under governor control without interruption to the factory supply. Originally a device was fitted to the Arca regulator which opened the main generator

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switches should the process steam demand practically cease, in which case excessive strains may be caused to the turbine by the machines motoring. This was found to be unsatisfactory and the valve is now set to pass sufficient steam to maintain a small load on the generators when the Arca regulator is in a fully closed position.

In the paper read before the South African Institute of Electrical Engineers appeared a very useful table giving the amount of electrical energy which could be obtained from a given quantity of steam (in this case 1,000 lbs.) at various initial pressures from 180 lbs. to the sq. in. to 900 lbs. to the sq. in. if the turbine prime mover were exhausting to a back pressure of 20 lbs. which is quite sufficient to supply steam for heating and evaporating purposes under the conditions in a sugar factory and most other heating and evaporating processes. The table is reproduced and also some curves based on this table.

At the time the paper was written the number of plants employing pressures exceeding 200 lbs. were comparatively few but great advances have been made in the use of steam at pressures far exceeding the old standard pressure of 180 lbs. to 200 lbs., and two or three years ago the matter of increasing the steam pressure at Hulett's refinery came under consideration but was not pursued on account of the depression in business which set in about that time. That such an investigation was on the face of it well worth while is evidenced by the fact that by increasing the steam pressure to say 800 lbs. to the sq. in. the number of Kilowatt-hours obtainable from 1,000 lbs. of steam, as will be seen from the table above referred to, is 50 Kilowatt-hours compared with 26 Kilowatt-hours obtainable from 1,000 lbs. at the present factory pressure of 200 lbs. to the sq. in. or, expressing it differently, a Kilowatt-hour can be obtained from 20 lbs. of steam at the higher pressure against 38.9 lbs. at the

lower pressure. The increase is vastly greater than if the turbine were exhausting into a normal vacuum of say 28½ inches.

At the higher pressure the turbines laid down at Hulett's factory would yield in a season of say 9 months per annum 23,000,000 units instead of the present number, viz., 12,000,000 units, and the surplus to the Corporation would be 17,500,000 units instead of 6,500,000 units. The profit would be increased from the present figure of £2,414 to £5,700 under the present costing system. Whether it would pay to scrap the present boilers and the turbines and instal at considerable expense plant suitable for the higher pressure was a point which would have been carefully investigated had the conditions of the industry not suffered a set-back, but there can be no doubt that in any new plant to be laid down in order to obtain by-product electricity from steam required primarily for heating purposes it would pay to adopt pressures of the order of 800 lbs. unless there were other countervailing considerations.

Since this plant has been at work with such excellent results to both parties to the agreement—the Company and the Town Council—other fields for the exploitation of the idea have not been overlooked and about two years ago it was decided to carefully examine the economics of such a proposition applied not to a sugar refinery but to a sugar factory in which sugar of good quality is made ready for the market from the sugar cane. Fortunately one of the largest, if not the largest, factories on the Natal sugar belt is situated within about 12 miles of the old Durban Borough boundary on the North Coast, and a report was presented to the Electricity Committee of the Durban Town Council in 1931 drawing attention to the enormous scope there was for the production of power as a by-product not only from this factory but from all factories both in the north and south coast which were producing at that time

393,000 tons of sugar per annum. From the mills within 50 miles of Durban producing about 250,000 tons it was shown that there was a possible surplus of electrical energy available of 54,000,000 Kilowatt-hours. It was also pointed out that one of the crying needs of the industry to overcome one great set-back to which it is continually liable, i.e., draught, was irrigation, but that in most cases the cost of pumping water was prohibitive, greatly owing to the height of the land on which sugar was grown above the river beds. There was, except in the very dry seasons, a sufficient quantity of water but it had to be pumped from 200 to 500 feet and at prevailing rates for power the cost was prohibitive. It was shown in the report made to the Town Council already referred to that if this surplus power available from the mills could be utilized, cheap electrical energy could be supplied and irrigation could be very extensively adopted. The Town Council, therefore, authorised the cost of a complete investigation into the engineering and economic features of a plant to be set up at a factory close to Durban already mentioned. This factory was particularly suitable for the introduction of such a plant, firstly because electricity was already extensively employed in the factory and the owners were keen on extending it where it could be shown to be of advantage; moreover, a large scheme of irrigation had just been started up and this was already showing good returns in increasing output of cane per acre. It is not the intention in this paper to go closely into all the various technical problems with which it was found the proposition bristled because these problems, being peculiar to the sugar industry, are not likely to be of any use in other parts of the country than in Natal. It may be necessary to say, however, that while the use of steam at high pressures yields an enormous output of electricity compared with use of steam at normal pressures other problems chiefly concerned with boiler operation must not be

overlooked. The first essential is an absolutely pure supply of feed water. At normal pressures, say 100 to 160 lbs. per sq. in., the highest pressure now employed in the sugar industry in Natal, pressures of from 80 to 100 ibs. being still quite common, there are no great practical difficulties in utilizing the condensed steam from heat and evaporating vessels as boiler feed. Though, of course, it is necessary to keep these vessels reasonably tight from leakage of the sugar juices into condensed steam ranges, a certain amount of impurity is of no great consequence provided that the water density in the boilers is kept within reasonable limits by the necessary amount of blowing down. There is usually a sufficient supply of reasonably good water to make up for this loss of water but with such a high pressure as say 800 lbs. to the sq. in. and a super-heat temperature of 700 deg. F. to 800 deg. F. the corrosion caused by impurities becomes serious and boilers cannot be blown down to any great extent because there is no sufficiently pure make-up water to be obtained without resorting to expensive purification. It may in fact be said that only pure distilled water is safe for feeding boilers working at the pressures and temperatures indicated.

METHODS OF OBTAINING PURE BOILER FEED WATER.

Leaving out the above considerations, the engineering, both electrical and mechanical, presented no particular problems but many schemes to obtain pure feed water were investigated. Boiler feed at the present time in most sugar factories consists of about 60 per cent. returned condensate and 40 per cent. make-up, and the first investigation was, therefore, to determine the nature of both these waters. It was found that there was practically a continuous small leak of sugar juices into the condensate which at times rose to considerable proportions, due to tube failures in the process plant, which are comparatively frequent owing

to the intensive corrosive action of the juices. The make-up is drawn from the river or from dams, both of which were unsuitable for high pressure boiler feed without treatment.

Chemical treatment for the pressure proposed was not considered suitable or advisable, so comparisons were made between the alternatives of complete distillation and de-aeration of all the feed and the use of a form of heat exchanger. Such a heat exchanger is a single effect evaporator constructed much on the lines of an ordinary condenser. The more or less impure water returning from the factory, together with the necessary amount of make-up, is completely evaporated by the heat in the steam from the turbine which is, of course, completely condensed and drawn off to the hot-well or direct to the feed pumps, thus providing an absolutely pure feed for the boilers, while the steam from the wated fed to the exchanger supplies the factory needs for evaporating and heating. The arrangement forms an analogy to the electrical and magnetic circuits of a one to one transformer. There is a transference of energy in the form of heat from one steam circuit to another, although physically there is no direct connection by means of pipes between the two. It is necessary that this heat exchanger shall be of such a form that it is easily cleaned because all the solids in the impure water which is evaporated must be removed when the accumulations on the surfaces begin to retard the flow of heat.

There is little to choose between these alternatives but both had perforce to be rejected on account of the cost, viz., nearly £40,000 for an output of 100,000 per hour. As practically the whole of the process of sugar making is the concentration of juices by the evaporation of the contained and added water, the next logical step would be the modification of the heat exchanger in which mill juices would be substituted for water. This apparatus,

which yields pure feed water, gives the maximum heat economy and is known as the pre-evaporator. It has been largely employed in the beet sugar industry where heat must be obtained from coal, and where it would appear that moderately high juice temperatures may be permitted with safety.

In the manufacture of cane sugar opinions vary somewhat as to the advisability of raising the juice temperature above about 220 degrees Fahrenheit owing to the possibility of deterioration by caramelisation of the sugar in the juices. The corresponding pressure (3lbs.) is insufficient for all factory purposes, particularly the vacuum pans. The pre-evaporator is not usually employed in the local factories under normal conditions, because its great advantage to the sugar Engineer—the saving of heat by the employing of the steam more economically —makes no appeal for the reason that with efficient working there is no inducement to save heat so long as there is sufficient bagasse available to furnish the heat without the pre-evaporator. A new plant, however, designed to operate in conjunction with a surplus power scheme would undoubtedly incorporate a pre-evaporator for the major portion of the factory evaporation, with perhaps a small heat exchanger, or direct reduction in pressure, for any quantities of steam required at an intermediate pressure for the vacuum pans and any other special factory requirements.

It is important to note that the economy secured from this apparatus would more than counterbalance the extra heat necessary to raise the temperature and pressure of the steam above the present standard, and also for the evaporation of the make-up.

A further method by which condensed water may be recovered for boiler feed, in addition to affecting material economies, is by employing the pre-evaporator principle for

partial factory requirements. For example, it is not considered advisable to use the condensate from juice heaters for extra high pressure boiler feed on account of the fact that any leakage will be a leakage of juice into the condensate, and to overcome this defect a single effect evaporator may be installed to evaporate portion of the juices, the vapour from which is used for supplying heat to the juice heaters. This is commonly known as a vapour cell.

With any device of the above nature there is a possibility of contamination of the condensate; but as this portion of the plant operates continuously at a fairly steady rate, and as the steam pressure is in excess of the juice pressure, there is little risk with a well constructed vessel, especially if precautions are taken to ensure that there are no juices present in the steam space after the week-end shutdown or an involuntary stoppage when there may be juice in the vessel without a steam supply.

All the above is of particular application to the sugar industry but the same problem of getting pure feed would probably be encountered in other industries such as soap making, chemical works, paper pulp works, etc., where surplus energy from a steam plant could be obtained and similar methods could then be used.

In addition to the major problem of ensuring a pure boiler feed, for which duty the vapour cell principle mentioned above was found to be the most suitable and economical for the particular factory investigated, it is necessary to determine the other essential items, such as steam pressure and temperature, capacity of units, bleeder heating of the condensate, type of furnaces, etc., and brief reference will be made to some of the other main factors to be considered in each case, as the conditions to be met differ materially from those which would apply to the main generating station plant.

STEAM PRESSURE AND TEMPERATURES

In considering the design of ordinary Power Stations steam pressure and temperature is fixed by such factors as price of coal, etc., whereas in surplus power plants the required condition of the steam exhausted from the turbine must be taken into account, the procedure being as follows:

Firstly, fix the pressure and temperature of the steam required for the factory; secondly, ascertain the efficiency of the turbine; thirdly, the initial steam temperature at which it is desired to operate (the maximum temperature with present day materials is 750—800 degrees Fahrenheit) and lastly, find the steam pressure which gives the correct initial superheat so that when the turbine has extracted the heat for its operation (depending upon its efficiency) the steam is delivered at the correct pressure and temperature to the process.

If, for example, dry saturated steam at 15 lbs. per sq. in. is required for process work, and a turbine on 79.4 per cent. is obtainable for the quantity of steam which will pass through the machine (say 100,000 lbs. per hour) and 750 degrees Fahrenheit is fixed as the maximum temperature then 600 per sq. in. will be the pressure which would have to be adopted. A pressure higher than 600 lbs. per. sq in. would give a lower initial superheat to the steam with the result that wet steam would be delivered to the factory, and this would mean that actually more steam would have to be generated by the boilers than is necessary for the process and probably require extra fuel. On the other hand, however, if a lower pressure were used then superheated steam would be passed to the factory, which is not only undesirable for the heating and evaporating plant, but electrical output is lost. A less efficient turbine would extract less heat from the steam passing through it, so that a higher initial steam

pressure would have to be employed, and a double loss would occur in reduced electrical output and higher cost of boiler and turbine plant.

BLEEDER HEATING.

It can be readily shown that, as in Power Station plants of usual design, a substantial increase in output and economy is possible by the inclusion of the feed heating using steam bled from the turbine. For the plant investigated the value of this increased output was £1,100 per annum and the capital charges and maintenance of additional plant and power £200 per annum. Notwithstanding this very favourable return it was considered inadvisable at this stage to include bleeding as this would involve the supply of highly pre-heated air to the furnace, the effects of which would be at present doubtful. Bleeding for feed water heating precludes the use of an economizer and highly pre-heated air would have to be employed to absorb the heat from the flue gases if the boilers were fed with high temperature feed, and the behaviour of the bagasse under these conditions is uncertain without further experiments. Furnace cooling by means of water walls is immediately suggested; and although this method is highly successful in coal fired boilers, it has not been attempted for bagasse firing owing to the nature of the fuel which is approximately half water and therefore requires a high temperature furnace to ensure complete combustion.

These aspects are touched on to indicate that these plants require careful study in advance to get the best results.

FINANCIAL.

However favourable the engineering features of a surplus heat power scheme may be, the whole success, in fact the only justifica-

tion for such an installation is the production of electricity more economically than from the main Power Station. While at the same time the Company in whose factory the plant is installed must obtain their supply at a figure lower than that which they could generate independently of the electricity supplier.

It is first necessary, therefore, to fix the value of the surplus current generated. Power station costs are divided into "standing" and "unit" charges, the former being rents, rates, capital charges, depreciation and fractions of the cost of fuel, oil and maintenance, the latter being composed almost entirely of fuel costs. No allowance is made here for transmission losses which will depend upon the relative positions of the main generating station, the surplus heat plant and the system load. It will be found that practically without exception no credit should be taken for standing charges. The output of electricity from the plant is entirely dependent upon the operation of the factory, over which the supply undertaking has no control, and while generally the output may be maintained there is no guarantee, in fact there is always the risk of a breakdown or reduction in output at a critical time. Should the industry be seasonal the factory may not be working at the time of the system peaks. The value of this surplus current is, therefore, equal to the unit cost, which is now about .18 pence in Durban, and even on such a low unit charge as this it will generally be found that a handsome return on capital invested in a surplus power plant can be shown. This will be evident when the total costs in the factory now supplying power in Durban, including:

(a) 10% on the capital invested;
(b) Operating and repair, wages and materials; and
(c) An allowance for supervision.

shows a good return both to the Company and to the Corporation.

The actual working results of the Hulett's plant for the year 1932 are given to illustrate the above. It must be pointed out, however, that this plant only operated six months during the year owing to the depressed condition of the sugar market, while under normal conditions the season lasts ten months. The difference between the cost to the Company and to the Council is due to the method of charging explained later, and also to a further allowance made to the factory for the coal they use in generating steam at a pressure of 200 lbs. per square inch instead of that necessary for factory heat only.

(a) The cost of 3,867,830 units to the Company was £1,264 or .079 pence per unit.

(b) The cost of obtaining 4,901,950 surplus units to the Corporation was £2,524 or .123 pence per unit.

(c) The profit to the Corporation (after allowing interest and depreciation and £531 for supervision) was £1,156 — 8½%.

Had the season been a normal one of ten months then the estimated costs would be:

(a) £1,486.

(b) £3,396.

(c) £2,414 — 17½%.

It will be noted that while the Corporation obtain a very reasonable return with only six months working, Messrs. Huletts also benefit considerably in that while they have had no capital outlay their total cost for current represents only 9¼% on the cost of the plant; so that Huletts are getting their electricity for less than what the capital charges **only** would

have been if they had put down the plant themselves independent of the Corporation as they originally proposed.

In the factory just mentioned the amount of electrical energy which can be obtained from the steam required for factory purposes, generated at 180 lbs. boiler pressure and passed to the process plant at 20 lbs. per square inch is about double the factory's electrical demand. At this moderate boiler pressure no elaborate feed treatment is called for, returned condensate and filtered river water being used, giving an exceedingly simple and economical lay-out.

In a sugar mill, however, a large amount of power is necessary for expressing the juice from the cane, and very little, if any, surplus current would be available for delivery to the supply mains, if the present standard pressure of about 160 lbs. were adhered to. To obtain surplus current, therefore, the pressure must be increased, and this entails the complications and expense of ensuring a pure boiler feed, as has been explained earlier in this paper.

In designing a new factory a very economical and satisfactory lay-out could be adopted, incorporating the pre-evaporator; but when this forms an addition to an existing factory then complications are introduced depending upon the design and capacity of the plant already installed.

For the above reasons capital expenditure necessary for recovering surplus energy from a sugar mill is much higher than for a refinery such as the one we have described and it was found in the sugar mill where the problem was investigated that the capital required was slightly less than £120,000. The output from this plant when the factory is working to its full estimated capacity is 32,200,000 units and the cost per unit is .14 pence. This surplus current would be delivered during the winter

months of May to November, while for the remainder of the year some 7,000,000 units will be consumed for irrigation and factory purposes. The improvement in yearly load factor on the main generating station should, therefore, be appreciable.

TARIFFS AGREEMENTS.

The successful operation of any surplus heat electric plant depends upon the active co-operation of the factory management, especially in the matter of maintaining the steam demand for the various processes as constant as possible. This is no easy matter in a factory, such as a sugar mill, where it is not generally the custom to give close consideration to the boiler house or even to the steam pressure. That effective control can be exercised has been conclusively proved in the plant at Huletts, and this must be attributed primarily to the financial inducements made to the Company by the method of charging, which gives the Company a direct interest in maintaining the output from the plant as high as possible.

The paper would be incomplete without details of this tariff which aims at:—

(a) Maximum output from the machines by control and regulation of process steam requirements and steam pressure;

(b) Economical electrical consumption in the factory to obtain maximum surplus output to the mains.

It was estimated that the Company would consume approximately half of the units generated, and at that time the value of surplus current was .2 pence to the Town Council per unit.

The agreement, therefore, provided that the cost of operation, including capital charges

and supervision, would be shared equally between the Company and the Council. For this the Company were entitled to one-half of the units generated free. Should, however, the Company consume less than its half share then the Council pays for the difference between the actual consumption and the half share at .2 pence per unit. If the Company exceeds its half share then it would pay for the excess units at the same rate. The proportion of the units generated which are consumed by the Company has fallen steadily from 49% to 44%. During 1932 this amounted to 576,000 units for which the Company were credited with £430.

CONCLUSION.

In conclusion the points which we think those in charge of large public electric supplies should bear in mind are:—

(1) That their system should be looked upon as capable, not only of supplying power, but of receiving power from any source provided the cost will show a saving on existing cost of supply and transmission.

(2) That process steam plants if properly designed to suit the condition are often capable of becoming such a source of cheap power.

(3) That plants for production of power should be owned and operated by the supply Company, the terms and financial arrangements being so drawn up as to yield a reasonable profit to both parties.

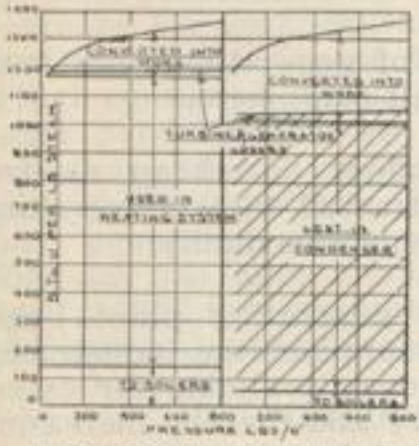
(4) That there are other substantial advantages apart from the direct financial benefit to the supply undertaking, which includes not only the profit during the running period but also the profit on the units supplied during the shut-down season. The supply undertaking may retain a large and

important consumer instead of losing the output and revenue should the consumer find it economical to generate its own requirements.

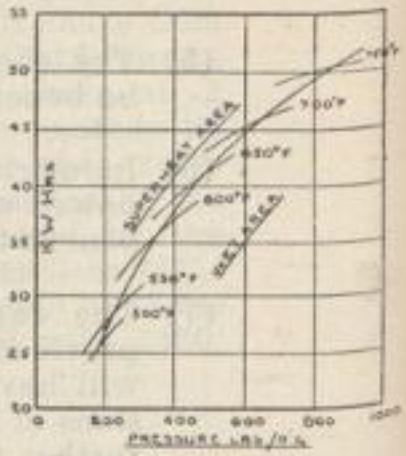
(5) The cheapening of generating costs must be beneficial to all consumers.

(6) Industries dependent on cheap electric power will be attracted with the resulting benefit to the whole community.

(7) The capital for generating plant being provided by the supplier, the industrialist will have this money available for extensions of his factory and thereby increasing further the demand for current.

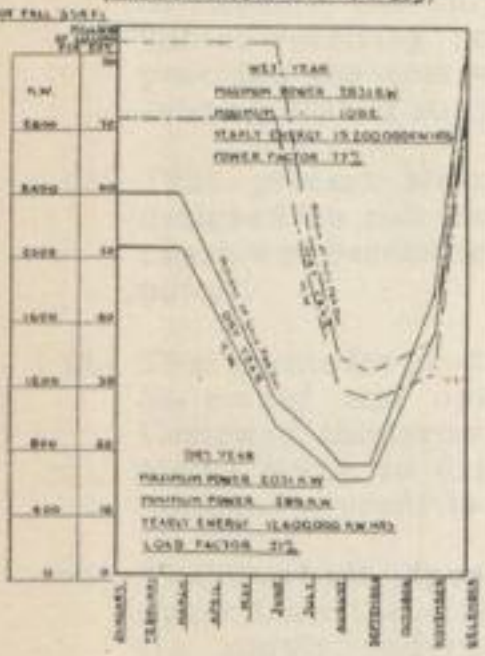


COMPARISON OF DISTRIBUTION OF HEAT PER LB. OF STEAM IN WASTE HEAT & CONDENSING POWER STATIONS PRESSURES & TEMPERATURES GIVING APPROX DRY STEAM EXHAUST TO 20 LBS BACK PRESS & CORRESPONDING INITIAL CONDITIONS FOR CONDENSING SETS TO 135 LBS ABS (28.2 VAC)



K.W. HRS PER 1000 LBS STEAM AT VARIOUS INITIAL PRESSURES AND TEMPERATURES TO 20 LBS BACK PRESS

CHART SHEWING DAILY MINIMUM FLOW EVERY MONTH DURING 1906 OF RIVER UMGENI AT HOWICK FALLS AND POWER AVAILABLE



A proposal was made that Mr. Roberts's paper should be taken as read and Mr. Roberts said he had no objection. There were just one or two things he would like to say on points that some friends had raised during the Convention, viz., that they did not think there was much outlet for such plant in the country outside Natal. There is tremendous scope for it in the Sugar Industry, and I think it is only a matter of time before steam will be universally used in the way we have indicated, because there is power there to be got practically for nothing on an expenditure in steam per K.W. hour, very little more than is now used in a power station. In expanding steam from 600 pounds down to 10 or 15 pounds, one can obtain a K.W. hour for about 17 pounds of steam so that you can readily imagine that in the sugar industry which may be employing 100,000 to 200,000 pounds of steam per hour, there is a tremendous amount of energy which can be generated and used, and it is, of course, not only the sugar industry, but any industry where there is a lot of heating or evaporating to do. Distilleries, he thought, should be interested.

Water power in this country was limited, the reason being that a good many rivers with falls are not reliable, becoming dry in the summer months, though there was a fair amount in the winter months. If this was used to supply a public Electric System, the fall could be connected with the Electric Plant, which would enable any energy available at

any time of the year to be used, making energy available which would be useless if it had to be depended upon for a specific job. There is one member who, as the result of conversation at the last meeting, has discovered in his own neighbourhood that there is some chance of using this system, and if his expectations are realised it is going to be a very fine thing for his concern, and if there is any discussion I hope he will give some idea of what his scheme is.

Mr. A. M. Jacobs (Electricity Supply Commission): Mr. Roberts might say a little more about the utilisation of the water. I understand you have so much impurity in the water.

Mr. Roberts: I don't think I have much to add to what I have said. I have suggested that it offers a very promising field for the utilisation of waste power, and that water falls which may not carry any water in the dry season, may be valuable if they can produce large power in the rainy season.

As to the use of the steam, it was well known that the product from which spirit is made has always a large liquid content of some percentage strength, and most of the water has to be evaporated, and the most economical way is by steam. Steam is generated in a boiler at a pressure of 100 lbs., and is employed in evaporation at a low pressure of 10 or 15 pounds, and the steam is usually wastefully expanded down to this low pressure. The higher the pressure you use, within certain

limits, the more profitable it is. If you are going to employ the steam for Power, I and Mr. Dawson have gone into some points and those who contemplate such a plant may find the hints given in this paper of value.

A member said a large amount of information was given in the paper which would be of tremendous use to those intending to utilise water power. He wanted to say that taking the Transvaal with its water power, the water unfortunately disappeared during the dry season. It would appear that in the paper there was a modification of the usual term of waste heat. It was usually understood that the remaining heat in a process would be waste. A more exact example of waste heat power might be found in the Johannesburg Gas Works, because a great deal of the heat in carbonization is recovered: it is recovered and used for the purpose of generating electric power. That plant was not running to its capacity—only 50%—but it was possible to use some of the waste heat from the Gas Works for generating Electric Power, but the Gas Works Manager, of course, does not like the idea of utilising his waste heat for the generation of electricity, which would be in competition with his Gas. There were Municipal Undertakings in South Africa where waste heat was being utilised. He understood in Umtata a useful scheme was in operation, and those who carried it to a successful conclusion were to be congratulated. He wished to thank Mr. Roberts for his paper, because there was much valuable information in it.

Mr. G. H. Swingler (Cape Town) thanked Mr. Roberts and Mr. Dawson for the hints given and the helpful way the paper was put together. At Cape Town they had had some experience in this way. The water from Table Mountain came down to the Molteno Reservoir, and was utilised at one time. They also went into the possibility of using the waste water

from the Stenbras Reservoir. There was quite a lot of power available there at the present time, but unfortunately, it was too far away. The amount of waste water would be reduced year by year. As the demand in Cape Town for water increased, so the opportunity for utilising the power produced would increase, and he had in mind that sooner or later the Stenbras Reservoir, where we have 20 million gallons a day, or more, coming to Cape Town, will give us quite a lot of power. The waste heat in Cape Town is no very big factor. Gas won't be extended in Cape Town and I am not looking for any waste heat from that source.

Mr. Rodwell (Johannesburg) said he would like to remark about the reference to the Gas Plant in Johannesburg, that personally he thought it was a wrong principle, because Electricity could supply almost every need that a Gas Plant can, and it was difficult with the generation of Gas and Electricity under the same Municipal control requiring as it does an unnecessary duplication of mains. It appeared wrong from a capital expenditure point of view.

Mr. E. F. Smith (Mossel Bay) wished to thank Mr. Roberts for some information that he got from that paper of his, and he thought he would be able to utilise it in quite a number of schemes. He had a certain amount of waste Circulating Water which was pumped from the sea, and some had to be run away, and he thought there was a possibility of utilising some of that to generate steam to some extent, for auxiliaries and so on. Also, he thought the idea could be adopted by a farmer who wanted power and was three miles away. This man had a permanent stream and it might be possible to utilise the stream for generating.

Mr. Hooper (Robertson) added his appreciation to that of other members of the value of Mr. Roberts's paper.

He had received much encouragement and valuable assistance from this paper, and from earlier conversations with Mr. Roberts on this subject, and it might be of interest to members to know that he had a plant extension proposal now before the Electricity Supply Commissioners to provide for a combined supply of electricity and process steam on a small scale and on similar lines to that described in the paper they had just heard read.

Briefly, he was contemplating the installation of a small turbo-alternator in the Municipal Power Station, the plant to be equipped with "pass-out" governing gear to provide a supply of steam at a low pressure of 25 lbs. per sq. in. for processing work in a Brandy Distillery.

Before going further, it would be of interest to members in charge of small stations to know that these engineering opportunities are sometimes quite unexpected and if grasped, may be developed profitably, in this instance, he was in conversation with one of the Directors of a local company in connection with the sale of current for motive power requirements, when it was suggested by way of a joke that if an electric motor could be used to distil brandy there would be plenty of business to be done, as an outcome of what was a casual remark he had made an offer to supply steam from the Municipal Power Station with the result that a Distillery had been built conveniently near to the Power Station to enable a supply of steam to be distributed.

The Distillery heating system was operated with steam at boiler pressure reduced through Bailey reducing valves to a pressure found to be satisfactory for the operation of the stills, with the idea that a profitable use of the steam demand could be effected following upon a more accurate knowledge of the steam conditions required for the process work.

It took a period of two years (or two seasons) to secure the necessary information of the minimum pressures at which the steam could be utilised. With the data secured there appeared to be three possibilities of utilisation with advantage to the Electrical Undertaking, one—a reciprocating engine generator arranged to exhaust against the required back pressure, two—a back pressure turbine generator, and three—a turbine generator arranged with "pass-out" valve gear; from the point of view of capital expenditure the second alternative showed the greatest advantage, but was unsuited for operation with the existing Power Station Plant. Consideration of the reciprocating engine plant was not pursued as it was felt that as the product dealt with was a profitable spirit and if complaint arose in regard to it, despite any assurance that could be given, there would be doubt as to the purity of the steam and possible contamination from the lubricant carried over with the exhaust steam.

The second alternative—the proposal to install a turbo generator fitted with valve gear to pass out steam from the lower stages was recommended.

It was found that the steam performance of some of the high speed turbines was very good, in fact equal to that attained by well known makes of reciprocating engines of equal size and as a point of particular interest to members in charge of the smaller undertakings he instanced his proposed schemes, which was really a very small project with an electrical output of 200 K.W. and a heating steam demand of approximately 3,000 lbs. per hour at 20 lbs. per sq. in. Had the proposal been ten times these dimensions there would have been no doubt of the possibilities. However, despite the very small size of the unit with a heating steam demand of 3,000 lbs. per hour, and an electrical demand of 100 K.W., it was possible to arrive at a steam consumption figure of little

more than 12½ lbs. of steam per K.W. over the heating steam supplied, making it possible in the smallest undertaking to introduce a means which would be of material help in developing a low rated domestic demand for electricity.

Concluding, and in particular regard to the "arca" regulating valves mentioned by Mr. Roberts in his paper, he would like to ask whether the effective regulation was actually maintained for a reasonable time under service conditions, and on the subject of higher initial pressures, whether Mr. Roberts would agree that proposals introducing high steam pressures called for very careful consideration of the factors of maintenance as well as the extra capital costs involved or the ultimate production cost may still be uneconomical.

Mr. Roberts replying to the discussion said he did not think water power fell within the scope of the paper. With regard to remarks about sugar in boiler feed water that was in reference to the necessity of avoiding contamination of the distillate and he gave a word of warning to anyone who might become interested in such an enterprise that distilling vessels must be steam and water tight, so that there must be no leakage of the liquor into the steam space where it would cause contamination, so it was, just as well if any such proposition came forward to raise this question and get the manufacturer to take some steps to see that the vessels are kept tight. With regard to Gas Works I should think that in his own interest, the Municipal Gas Manager should do all he can to reduce his costs so that he may be able to sell Gas at the lowest figure and there is no doubt that there is a large amount of surplus heat from a Gas Works. It is being employed on a very large scale at the steel works in Pretoria, a tremendous volume of heat and steam being obtained from the quenching of coke. Fortunately we escaped the incubus of a Gas System in Durban. There were many

attempts to introduce it, but we were always able to show that Electricity could do all that Gas claims to have done, and that was one great advantage that Durban has at the present time. With regard to the "Arca Regulators," the regulator is an extremely simple and reliable device for controlling steam or water by temperature or pressure, and because of the very excellent results it was employed in our surplus steam plant and I cannot remember hearing of any trouble since it was installed about 8 years ago. As to the capital expenditure on high pressure plant, it is of course a matter of economics.

The President moved a hearty vote of thanks to Messrs. Roberts and Dawson for their most excellent and able paper, the vote was carried with acclamation.

Paper by **Mr. Councillor J. D. LOW,** Chairman of City of Capetown Electricity Committee.

DEPRECIATION IN RELATION TO ELECTRICITY UNDERTAKINGS.

INTRODUCTORY.

When the subject of the paper was suggested to me as one that would arouse interest I must candidly confess to having had considerable doubt in my own mind as to whether that would really be so.

Of the importance of the subject I have not the least doubt, and it is with the object of reconciling the view of the engineers with that of the financial authorities that I have attempted the task.

It is given to few to present financial matters and figures to a general audience in an interesting fashion, and in order that too much time should not be taken up in detail it is proposed to discuss the question in a few general principles, and for those who desire to follow it up and apply them to their work to append graphs and forms showing such as would be suitable for that purpose.

It is also to be hoped that the subject may be thought worthy of some discussion on the part of both the Engineers and the Councillor Delegates because it is only by the interchange of opinion that we can arrive at conclusions that will ultimately bring us to a right and proper perspective in dealing with the various undertakings for which we are responsible.

In passing, it should be observed that the Provincial Ordinance governing the conduct of Municipalities in the Cape Province prescribes as one of the duties of the auditors to the Municipalities that they see that due provision has been made for the depreciation of assets liable to wastage or obsolescence. Doubtless, similar statutes in other Provinces in the Union of South Africa include provisions to the same effect.

A great deal has been written expressing many points of view on the need for making adequate provision for depreciation and on the methods which should be adopted in putting that need into effect, but notwithstanding that most writers are agreed as to the importance of the subject, it still happens all too frequently in trading concerns that the subject is improperly handled. It cannot be emphasised too strongly that unless such provision is made adequately and the methods adopted are suited to the different classes of assets of the undertaking, financial difficulties will inevitably be brought about sooner or later through failure to recognise the vital importance of the subject.

As an illustration of one of the many arguments against the need for making any special provision for depreciation in the case of the assets of Municipal Electrical Undertakings I would mention the well-known one to the effect that, because the interest and sinking fund charges are applied regularly, there is no need for the provision for depreciation also.

Now, if the interest and sinking fund charges are based on the useful life of the plant and provision made for extinguishing the whole of the capital outlay in that period there would not be so much to be said on the subject, although, even then, more frequent application to the money market for additional capital would be entailed than might be either necessary or desirable. But on the other hand one finds on enquiry that quite the reverse is the case and that the loans are based on repayments over a considerably extended period beyond what the engineer would deem to be the useful life of the plant, and hence the difference of opinion between the engineering and financial interests.

Now, in the Municipal Service your Undertakings are generally referred to as Trading Departments, and if this is so—I suppose most of you would actually prefer them to remain and be regarded as such—it is very much in your interests to see that at the outset provision is made for depreciation, based on fair and equitable rates, such as your experience and knowledge may determine. As to what these should be we shall at a later stage endeavour to determine, and for those faced with difficulty in forming an opinion we shall try to draw conclusions from what may be regarded as standard, authoritative and in some cases legislative views upon the question.

The business of the supply of electricity has one very striking characteristic as compared with many commercial businesses, namely, the

very high ratio of capital to turn-over. Practically every development in the direction of reducing the cost of electricity to consumers has been accomplished by the substitution of capital expenditure for running cost.

The question of adequate provision for depreciation is, therefore, of the greatest importance to an Electricity Supply Undertaking. Electricity has no monopoly either for lighting, heating or power, but must compete with other forms of energy, perhaps less convenient, but still available at an economic price. It is, therefore, important to avoid getting into a position such as that which has been reached by the railway companies, particularly in Great Britain and to some extent even in this country, where large amounts of capital have been expended and never adequately written off while serious competition has now to be faced from road transport.

I have heard engineering views upon the subject which more often than not lay blame upon those responsible for the financial side of things that due provision is not made for depreciation. As representing the other side I would venture to say that the question in the first instance undoubtedly lies in the hands of the engineer. He is primarily responsible for framing tariffs and from that point he should have in view the application of such rates of depreciation as will bring him out with a margin of safety. If he has omitted to deal with this factor, then when it becomes a matter of considering the financial side of affairs and the revenue returns provide nothing for the purpose I maintain strongly the engineer has failed in his duty because surely he should always have in mind the question of obsolescence and the annual wear and tear upon his machine.

If the financial man were to accept the position and to endeavour to cloak it by lack of application of the necessary depreciation,

merely because the engineer had omitted in the first instance to make due provision for it, then I should regard such a one as being likewise failing in his duty.

None know better than those I am addressing that whether the required sum is provided in the accounts or not, obsolescence and wear and tear upon the plant is going on all the time and that sooner or later other difficulties will have to be faced, such as costly repairs or the raising of additional capital at not always the most convenient time, because the position thereby created demands immediate remedy.

DEPRECIATION.

Definition.

The fact that the term "depreciation" has more than one meaning and that it has on this account been employed loosely has been responsible to a great extent for the misunderstanding that is so frequently met with. In the true commercial sense the term "depreciation" means the shrinkage in value of an asset from any cause during a given period, or in other words, it is the expired capital outlay on the assets during a given period, and in this paper the meaning of the term is confined strictly to this definition.

From the definition it will be clear that the provision made for depreciation extends only to the replacement of the cost of wasting assets already acquired and which are being wasted in the process of earning revenue. The provision is not for the purpose of covering the cost of future renewals, although it will be available to be applied to or towards that cost. Further, it will be seen from the definition that depreciation is not related in any way to market fluctuations in the value of similar wasting assets, and all such fluctuations must be dis-

regarded except in so far as they may indicate the desirability of revising earlier estimates of the ultimate residual value, if any, of the asset at the end of its useful life.

The annual provision for depreciation is sometimes looked upon as a provision for future renewals as though it had reference to the future. This is incorrect. The annual provision for depreciation relates solely to the past and is a replacement of capital outlay which has expired in the process of carrying on the undertaking and is as much an expenditure in the total cost of production as that of the wages of the operatives.

Looked at in another way depreciation is an inevitable loss which is incidental to the whole of certain assets (which themselves inevitably waste away) for the purpose of earning income and should, in consequence, be set off against such income as a working expense.

It is particularly important to note that depreciation, as defined above, takes place irrespective of the trading results of the undertaking.

Wasting Assets.

The assets of an electricity undertaking, like those of any industrial concern, consist of the land, power station and sub-station buildings, the generating and sub-station plant and equipment, leases, etc., used for the purpose of earning revenue, all of which have a limited life which in most cases of Municipal Undertakings in South Africa is far less than the period of the loans from which their cost was provided in the first place.

In the course of their use the value of these assets diminishes through causes described later in this paper until the stage is reached that they must be replaced, and if no provision

is made during the life of the assets for such replacement and the loan from which they have been purchased has not been repaid, the impossible position is reached that the total cost of the new and the old equipment represents a fictitious and exaggerated value compared with the assets, which must lead to serious financial difficulties. It is, therefore, obvious that provision must be made for the maintenance of the fixed assets of the undertaking of whatever nature the undertaking may be if it is to retain its permanent character.

LIFE OF PLANT.

Factors Affecting Life of Plant.

The physical life of a unit of plant is the period during which it can be retained in service and furnish the same character of service as that for which it was designed, while the useful life is the period during which it may be considered wise, on economic or public considerations, to retain the unit in service. In many instances the physical life and the useful life may be the same, but in the majority of cases the useful life is considerably less than the physical life and it is with the useful life, as defined above, that we are now concerned.

The life of the assets is affected by factors which are—

(a) internal or inherent in the plant itself and/or the extent to which it is used; and

(b) external, being dependent upon causes extraneous to the plant and equipment.

Of the internal factors bearing on the life of the assets that of wear and tear is the most important in the case of plant and machinery, while of the external forces obsolescence and

inadequacy have the greatest effect on plant, machinery and buildings, and in the case of leases effluxion of time is the principal consideration in the matter.

Wear and Tear.

The most important factor tending to limit the life of a plant unit is that which arises from time of service, exposure to the elements, and decay, namely, wear and tear. All elements and units in a plant commence to deteriorate immediately they are put into service, but this deterioration has no effect upon the service obtained from the plant while it is kept up to the required standard of operating efficiency through carrying out the necessary repairs.

The life of the plant is, so far as provision for depreciation is concerned, is, however, determined by the increase in the cost of maintaining the plant in proper working condition. The point must be reached at some time or other when for engineering and commercial reasons it must be replaced. It will be seen therefore, that the condition in which plant has been maintained by current repairs will affect the useful life of the plant. What that life will be can usually be determined to a reasonable degree of accuracy by the engineer from his own experience and observation of the operation of similar plants.

Obsolescence.

In financial quarters I have heard opinions advanced that the methods of generation and distribution have come to a stage where they may be considered as being more or less standardized.

On the other hand Engineers of good standing have told me that the progress and development in those methods have never been so rapid as in the last decade.

In my own experience I have known cases where it has paid a business to scrap a plant, in course of erection, in order to substitute a later development tending towards more economical means of production and that experience I understand is likewise not unknown in your own undertakings.

Such being the case it only indicates that it is unwise to take up too rigid an attitude in this regard and that one should rather be guided by those whose experience can show the position to be entirely opposite to that which may at first sight appear.

It is clear that the life of a unit of plant may be shortened by changes or improvements in similar plants giving an improved character of service and increased efficiency, for example, the growth of the undertaking may reach a point at which the old methods must give way to new, so involving making replacements on which considerable capital expenditure is incurred. An instance of this is the necessity which has arisen in many undertakings for the change-over from direct-current generation and/or distribution to the alternating-current system. Moveover, developments in the design of plant used in industrial undertakings are continuing to take place rapidly and there is no reason to suppose that developments in certain directions will not take place still more rapidly in the future. There must, therefore, always be some uncertainty attaching to any estimate made as to the limit of the life of a unit to be expected through the operation of the factor of obsolescence.

Inadequacy.

Another factor tending to shorten the lives of plant units is inadequacy, that is to say, the condition arising from the growth of the business and from the consequent necessity of replacing smaller units by larger ones. Several

causes may bring about the condition of inadequacy, one of which, in the case of Electricity Undertakings, may be due, for instance, to a change in financial policy such as a reduction in the tariff for the supply of electricity or the introduction of special rates to attract new classes of customers.

The condition of inadequacy may also be brought about through the fact that when establishing a new undertaking the plant installed has been of such a size as will produce a minimum of cost in annual operating expense for the business then in sight. Where, however, the demands for supply exceed the reasonable expectations of those responsible for the original design of the plant, or where the community grows more rapidly than was expected, the plant originally installed is liable to be found to be too small for the requirements and its useful life has been reduced through the fact of its inadequacy for the service then required of it.

These factors incidentally affect the scrap or salvage value of the plant.

The extent to which provision should be made for depreciation and the probable lives of the various units of plant and equipment are thus matters for careful consideration on the part of the engineer who must, in deciding, give consideration to a variety of conditions and circumstances bearing on the matter. While it is impossible to lay down any hard and fast rule for all plants under all circumstances, it is practicable in many instances to decide upon the probable life of plant in classes, for example, generating plant, transformers, buildings, etc., and to make provision for depreciation at the appropriate rates for the items under those headings, using the same estimated life for all items in each class, making exceptions, if deemed desirable, for individual items according to any special circumstances applying particularly to them only.

General.

From the foregoing considerations it will be seen that there is scope for a wide diversity of opinion as to the probable useful life of any asset, for, while a reasonably accurate estimate may be made of its life insofar as it is affected by internal factors, no one can pretend accurately to forecast the influence of external factors on the matter.

There do not appear to be any statutory rules in South Africa bearing on the question, so that it is one in which those concerned must use their discretion, a fact which doubtless results in considerable difference in the provision made for depreciation by different undertakings. For guidance, therefore, in deciding the point at issue it is desirable to consider the practice adopted where the subject has been thought deserving of definite rules being laid down, and of those which have recently been published, the most authoritative probably are those of the Electricity Commissioners (Great Britain) which are set out in Appendix I.

The appendix shows the **maximum** periods which are approved by the Electricity Commissioners for the repayments of loans in connection with electricity undertakings, and since the financial arrangements in force in Great Britain in this connection aim at the extinction of the loan during the estimated life of the asset the periods given in the right-hand column for those of the loans for different classes of assets indicate what, in the views of the Commissioners, are to be taken as the maximum useful lives of those assets.

Before leaving this subject it is of interest to note the views expressed by the Consulting Engineers to the City of Capetown in 1925, when reporting on the provision to be made for depreciation, an extract from whose report is as follows:—

"The discrepancy between the useful life of plant "as such and the life of the material used in its manu- "facture has been to the fore on several occasions "recently due to a combination of the above causes. For "example, the case of a London Municipal Undertaking "may be cited where generating sets installed in 1914 "and 1917 are now (1925) considered obsolete and are "to be replaced by larger and more economical units. "The capital expended on the first of these sets will not "be written off until 1932 and it will therefore be "necessary to continue to meet the payments due on "the outstanding loan until then or make some special "provision. The maximum period sanctioned by the "Electricity Commissioners for repayment of loans "contracted for plant and machinery is 20 years, for "transmission cables 40 years and for overhead lines 25 "years. These limits meet the case of depreciation which "is concerned mainly with the actual life of the material "but the period may be too long to represent the "economic life of generating plant. Indeed the indica- "tions are that in the smaller stations the discrepancy is "becoming rapidly wider. On the other hand, when "dealing with transmission, depreciation and obsolescence "may be regarded as synonymous terms because the "efficiency of transmission already approaches 100%. "Technical improvements in transmission lie mainly in "the direction of an increase of voltage to enable power "to be transmitted for greater distances and thus they "do not impair the utility of the older cables. The wider "significance of this comparison is in its bearing on the "present trend to link up rather than extend the larger "generating stations and take bulk supplies rather than "extend the smaller generating stations. For a given "capital expenditure, sinking fund payments for gen- "erating plant with useful life of possibly only 12 years "should be generally about three times as much as for "overhead lines and seven times as much as for cables. "The conclusion is therefore that an investment in inter- "connecting mains instead of in-generating plant, yields "a better return than the net revenue—after allowing "for the usual rates of loan repayments—indicates."

The following quotation from Accountancy and Business Management Vol. IV, Page 98, illustrating the point of view taken by leading

authorities in the United States of America, should also be noted particularly as showing the degree of importance which in that Country is placed upon the need for making adequate provision for depreciation on electrical plant and equipment due to the circumstances of its use and its liability to rapid obsolescence:—

"Electric light accounts differ from those of most "other undertakings in that the perishable nature of the "fixed assets renders it imperative that special attention "should be devoted to the subject of depreciation. It is "not merely sufficient that the working plant should be "fully maintained in a state of working efficiency out of "revenue, as the high speed at which the machinery is "run, combined with the fact that only the smallest "possible intervals of rest can be afforded to rectify "defects, very materially shortens the duration of the "life of these assets. Moreover, in connection with this "particular industry the advances of modern science are "so rapid that, in spite of this comparatively short time "of life, many parts of an electrical plant become "obsolete before they are worn out. For these reasons "a high rate of depreciation must be provided, and it is "now being realised that in most cases depreciation has "occurred at a more rapid rate than has been provided "for in the accounts.

"It is thought that a minimum safe provision against "depreciation of the actual expenditure, as a whole, "would be one equal to five per cent. on the total capital "expenditure. It may be added that five per cent. "allowance for depreciation on the entire cash invest-"ment is the minimum figure used by a prominent "American electrical engineer, who has made a careful "study of conditions in every part of the United States; "in the case of one ten million dollar plant he claims "that the annual depreciation rate should be nine per "cent."

Method of Providing for Depreciation.

Provided that the depreciation allowed is adequate, the detailed financial arrangements under which it is made is not usually a matter

of importance to the executive responsible for the operation of the undertaking. There are more or less commonly recognised rates applicable to the different types of plant, but if in total the overall depreciation is sufficient the Engineers would make allowance in their minds for the particular classes of assets they desired reduced in value while in actual fact the financial side might apply the amounts so set aside in other directions.

It is, of course, desirable to bring both parties into line and the very object of the paper is to endeavour to set up, if possible, through your Association, what might in ordinary circumstances be regarded as more or less standard rates. That is to say, the main consideration is that if plant has been installed at an initial capital outlay of £10,000 with a life of 20 years, at the end of which time it can be sold for £1,000, a sufficient sum of money must be set aside from revenue each year so that at the end of 20 years there will be £10,000 less £1,000, or £9,000 forthcoming with which to purchase a new asset to replace the original one or looking at it purely from the financial aspect, sufficient money must be set aside each year to a special fund to maintain the plant at its full capital value of £10,000.

The most desirable financial arrangement to meet depreciation is that in which the burden on the revenue of the undertaking is apportioned as equitably as possible over the several years of the useful life of the asset corresponding to the estimated amount of the expiry of the capital expenditure on it from time to time.

The principal methods commonly adopted for making provision for depreciation are:—

(1) The "fixed instalments" system.
(2) The "reducing balance" system.
(3) The "annuity" system.
(4) The "sinking fund" system.
(5) The "endowment policy" system.
(6) Periodic revaluation.

(1) Fixed Instalment System.

Under this system the whole useful life of the asset is estimated with due regard to all facts as well as future probabilities, and the capital outlay on the plant, less the estimated scrap value, is distributed to future revenue accounts in equal instalments over each year of that life period. This is also known as the "straight-line" method and is the simplest of all methods commonly used.

If, for example, the initial cost of an item of plant with an estimated life of 10 years is £100 with a scrap value of £10, the sum of £9 would be set aside each year to provide the sum of £100 less £10, or £90, during the life of the plant. The position at the end of each year under this system is shown in the following table, the figures in which are plotted in figure 1 of Appendix I. to show the characteristic features of this method.

End of Year.	Capital.	Depreciation = £9 per annum.	Total in Depreciation Fund.	Depreciated Value of Plant.
1	£100	£9	£9	£91
2	£100	£9	£18	£82
3	£100	£9	£27	£73
4	£100	£9	£36	£64
5	£100	£9	£45	£55
6	£100	£9	£54	£46
7	£100	£9	£63	£37
8	£100	£9	£72	£28
9	£100	£9	£81	£19
10	£100	£9	£90	£10

An objection which is sometimes advanced against this method is that money set aside in this way to meet expenditure on renewals may not be needed, perhaps, for a number of years, thereby embarrassing the utility with surplus money which is not being properly employed. In the case of most electricity undertakings,

however, considerable sums of money are constantly required for the replacement and extensions of the plant and equipment and there can be no objection to using the money so provided in purchasing such other and additional plant as may be required from time to time. If this policy is not adopted it would be necessary to invest the money reserved in this way and use it to earn interest. The interest may either be added to the fund or it may be credited to the general revenue account of the undertaking. If the first-mentioned arrangement is employed it is obvious that the amount needed to be set aside each year would be less than that arrived at by dividing the depreciated value of the plant by the number of years, and if interest at 5% per annum is earned on the amounts set aside for depreciation the figure of £9 per annum needed under the example quoted above can be reduced to approximately £7.35 per annum as follows:—(See also figure 2, Appendix I.).

End of Year.	Capital.	Depreciation Instalment.	Total on which Interest is earned.	Interest at 5% per annum.
1	£100	£7.35		
2	£100	£7.35	£7.35	£0.37
3	£100	£7.35	£14.7	£0.74
4	£100	£7.35	£22.05	£1.1
5	£100	£7.35	£29.40	£1.47
6	£100	£7.35	£36.75	£1.84
7	£100	£7.35	£44.10	£2.20
8	£100	£7.35	£51.45	£2.57
9	£100	£7.35	£58.8	£2.94
10	£100	£7.35	£66.15	£3.31
Total		£73.5		£16.54

Total amount accumulated, plus interest — £73.5 + £16.54 — £90.

Objection is sometimes taken to the principle of writing off the cost, less scrap value, in equal annual instalments on the ground that the cost of repairs becomes heavier as the plant becomes older, and therefore the provision for depreciation of plant should be greater in the earlier years and less in the later years.

(2) Reducing Balance Method.

In order to satisfy this objection the assets may be written down from year to year by deducting depreciation at a fixed rate per cent. upon the depreciated value of the plant at the end of each year, or in other words upon the balance standing to the debit of the depreciation account at the commencement of the year. Under this method the charges against revenue become less from year to year hence the method is often called the "Reducing Balance Method." Under this system if an item of plant costs £100 which is estimated to last 10 years and can be sold as scrap for approximately £10 at the end of that time it will be necessary to apply a rate of approximately 20% per annum to the reduced balance to provide the amount of £90 by which the plant has depreciated in 10 years, as follows:—(See also figure 3, Appendix I.).

End of Year. A.	Reduced Capital. B.	Depreciation at 20% per annum. C.	Amount set aside in Depreciation Fund. D.	Total Capital. B. + D.
0	£100	£—	£—	£100
1	£80	£20.0	£20	£100
2	£64	£16.0	£36	£100
3	£51.2	£12.8	£48.8	£100
4	£40.96	£10.24	£59.04	£100
5	£32.76	£8.2	£67.24	£100
6	£26.2	£6.56	£73.8	£100
7	£20.96	£5.24	£79.04	£100
8	£16.77	£4.19	£83.23	£100
9	£13.42	£3.35	£86.58	£100
10	£10.07	£2.68	£90 approx.	£100
Total		£90 (approx.).		

It will be seen that this method results in a relatively heavy charge in the early years and a very light one in the later years of the life of the asset.

(3) The Annuity System.

Under this system the asset is regarded as earning a fixed rate of interest and an amount is written off from the value of that asset each year which, after debiting the fixed rate per cent. against the diminishing value, will reduce the value of the asset to nil at the end of its useful life, that is to say, revenue is charged—under the head of depreciation—with equal annual sums sufficient to provide at the expiration of the estimated life of the asset, an amount equal to the original cost thereof plus interest on the capital for the time being remaining invested therein. An amount equal to that part of these annual sums which represents interest is credited, in annual diminishing amounts, to the revenue account, so that taking the difference between the amount debited for depreciation and the diminishing amount credited to revenue each year as interest the result is really to throw increasing annual burdens upon the revenue account as the asset gets nearer to the end of its life.

Using again the example of an item of plant costing £100 with a scrap value of £10 at the end of a useful life of 10 years, the position at the end of each year where this system of providing for depreciation is used is shown in the following table:—(See also figure 4, Appendix I.).

Year.	Expired Capital Outlay Charged to Revenue. A.	Diminished Value of Capital Outlay.	Interest on Diminishing Capital Outlay at 5% credited to Revenue. B.	Total Amount of Capital Outlay Repaid.	Actual Burden on Year. A.—B.
	£	£	£	£	£
1	12.155	92.845	5.000	7.155	7.155
2	12.155	85.332	4.642	14.668	7.513
3	12.155	77.444	4.267	22.556	7.888
4	12.155	69.161	3.872	30.839	8.283
5	12.155	60.464	3.458	39.536	8.697
6	12.155	51.332	3.023	48.668	9.132
7	12.155	41.743	2.566	58.257	9.589
8	12.155	31.675	2.087	68.325	10.068
9	12.155	21.104	1.584	78.896	10.571
10	12.155	10.004	1.055	89.996	11.100
Tls.£121.55			£31.554		£89.996 (say £90)

(4) The Sinking Fund System.

Under this system a fixed annual sum charged against revenue is invested in gilt-edged securities outside the undertaking where it earns compound interest, the amount of the annual sum of the interest being so arranged that the amount accumulated in the fund at the end of life of the asset is equal to the estimated value of the plant at that time. If, for example, the first cost of an item of plant with an estimated useful life of 10 years is £100 and it has a scrap value of £10, it will be necessary under this system to set aside annually the sum of £7.155 earning compound interest at 5% per annum to raise the sum of £90 at the end of the tenth year. The position, year by year, in this case is shown in the following table:—(See also figure 5, Appendix I.).

Year.	Expired Capital Outlay Charged to Revenue. (A)	Interest From Investments of (A) at 5%. (B)	Amount in Sinking Fund.	Actual Burden on Year. (A—B)
	£	£	£	£
1	7,155	—	7.155	7.155
2	7.155	0.358	14.668	7.513
3	7.155	0.733	22.556	7.888
4	7.155	1.128	30.839	8.283
5	7.155	1.542	39.536	8.697
6	7.155	1.977	48.668	9.132
7	7.155	2.434	58.257	9.589
8	7.155	2.913	68.325	10.068
9	7.155	3.416	78.896	10.571
10	7.155	3.945	89.996	11.100
Tls.	£71.55	£18.446		£89.996 (say £90)

It will be seen that by making the reserves for depreciation earn interest the annual burden on an undertaking is considerably less than in the case of the "straight-line" method, and also that the annual burden is the same for the "annuity" system as for the "sinking fund" method.

(5) The Endowment Policy System.

Under this system annual amounts taken from revenue, instead of being invested in gilt-edged securities as in the sinking fund system, are paid over by way of premium to an insurance company on a policy for the expiry of capital outlay during the estimated life of the assets.

(6) Revaluation.

Another method of providing for depreciation is to revalue the assets from time to time treating any diminution in value (after allowing for additions) as the realised depreciation for the year. Under this method, however, the

charges against revenue in successive years will be very unequal, since the gradual reduction in the market value of most articles has no correspondence with true depreciation as measured by the amount of use that has been had out of the asset during the period in question.

COMPARISON OF METHODS OF PROVIDING FOR DEPRECIATION.

As mentioned earlier, wide diversity of opinion is held on the question of the choice of the method of making provision for depreciation, and although there appears to be a general concensus of opinion that for electricity undertakings the "straight-line" method, taking everything into consideration, is the most equitable, and in any case is the simplest and most convenient method to apply, it may be of interest to consider the advantages and disadvantages of the other foregoing methods.

One of the principal advantages of the "straight-line" is its simplicity and the fact that money set aside under this arrangement is readily available for immediate re-investment in plant extensions or renewals as and when it is required. For this reason alone it is greatly to the advantage of a rapidly growing utility to adopt such a system.

Where the annuity method is employed the money could not readily be used for re-investment in this way, so that fresh capital would have to be raised to provide for renewals, thereby burdening the undertaking with the interest on the money borrowed.

The annuity method—the most scientific system when investment is not desired outside the business—is specially applicable to cases such as leases, where no additions are made to the asset during its life, or in the case of an undertaking which has been established in an

undeveloped area for which plant has been installed to meet anticipated future needs and is greatly in excess of present requirements. A typical example of this is the installation of a telephone service. This method is not generally used for depreciation of plant since on every occasion on which additions are made to the plant it becomes necessary to make further calculations and the matter is still further complicated by the fact that the plant sometimes yields a residual value at the expiration of its useful life.

The foregoing comments on the annuity system apply also to the sinking fund system.

The reducing balance method is best applicable in the case where the plant gives its maximum service at the commencement of its use, which service deteriorates rapidly with use. Typical examples of plant with this characteristic are storage batteries and road vehicles, in which continually decreasing quality of performance is characteristic of their lives. Further, it is almost essential under this system to revalue the assets from time to time to ensure the effectiveness of the rate utilised.

The endowment policy system has become increasingly popular since insurance companies have found it possible to give favourable terms, and although the interest return is lower than, for instance, under the sinking fund method, there is no risk of loss on realisation. This system is, however, more suitable for the case of a lease than for items of plant and machinery, etc.

The revaluation method should be applied only in the case of loose tools, and other plant which depreciates very rapidly, live stock and similar assets. As mentioned earlier, it may be necessary from time to time to have a revaluation throughout. For instance, it may be found that the life of the asset is different from

that which had been estimated in the first place, making it necessary to alter the rate of allowance for depreciation, but it is undesirable to adopt this system as the principal method of providing for depreciation.

Record of Depreciation.

It will be clear that on account of the direct bearing which adequate provision for depreciation has on the financial well-being of an Undertaking, it is essential that proper records of all transactions in the matter be kept in such manner as will enable the position in regard to the amount of depreciation and the unexpired portion of the capital outlay on the Undertaking to be readily ascertained at any time.

A properly developed system of accounting for unexpired capital outlay on plant and other wasting assets can be inaugurated much more easily than is generally supposed. It requires only the provision of a suitably designed accounting equipment which will be subsidiary to, and will not interfere with, the ordinary records of capital outlay contained in the financial books of an undertaking.

This subsidiary accounting equipment should provide a key to the real meaning and contents of the much condensed records in the financial books. It is not infrequently the custom to charge all outlay which cannot be debited to revenue at or about the time the payment is made to some head of capital outlay, where it more often than not remains unobserved and its details are lost to mind to be afterwards subjected, in company with a mass of other figures, to reduction, either by writing off some fixed percentage from the reducing balance of the account, or by writing off irregular sums out of surplus revenue, the amount often depending largely on the degree of prosperity or otherwise of the period. Under these conditions the accounting records relating

to capital outlay speedily become a confused mass of meaningless figures.

In place of such a neglectful treatment of the subject, continuous and systematic attention with the aid of suitable recording equipment introduce no difficulty. Provision in the equipment should be made for:—

(a) The regular observation and record of the behaviour of, and the changes in, each class of plant representing capital outlay.

(b) The regular use of suitable accounting equipment capable of enabling the results of such observation and record to be currently reflected in the annual accounts.

(c) The adoption of a settled and continuous financial policy under which each year's revenue account shall be charged with a regular measured sum, based on such observation and record, to answer capital outlay which has expired during the year.

Two essential requirements of a suitable subsidiary accounting equipment for keeping track of capital outlay as it expires year by year are first, that it shall be indefinitely expansible, so that it may continuously record, without any confusion, the outlay on any number of different classes of plant for any required number of years; and second, that it shall provide complete facilities for easily altering and adjusting the estimates of the useful life periods, and of the scrap values, of each class of plant.

Various systems differing only in detail have been devised to meet these requirements, one of which (*) is described as fully as space permits in Appendix III.

(*) Leake's Register of Industrial Plant for the Measurement of Depreciation.

Reserve Fund.

Hitherto no reference has been made to the desirability or otherwise of the establishment of a fund, called variously a renewals fund, reserve fund, betterment fund, etc., to provide means of meeting expenditure of an unusual nature on capital account, for the reason that it was felt to be beyond the scope of the paper.

So many considerations are involved in the establishment of such a fund that it ranks as a subject nearly, if not quite, as noteworthy both from the point of view of the diversity of opinions held on it and also from the actual bearing it has on the financial standing of the undertaking as that of providing for depreciation.

The need for a fund for this purpose has been recognised by the Cape Provincial Council by providing for it in the Standard Form of Accounts, prescribed by that body, to be adopted by Municipal Electricity Undertakings.

The point is mentioned merely to draw attention to the fact that allowance for depreciation is not necessarily sufficient in itself to avoid frequent application to the money market perhaps at times which are unavoidably disadvantageous to the Supply Authority for loans wherewith to finance renewals or extensions of the business.

In conclusion, had it not been for the kind co-operation and help of Messrs. H. A. Eastman, C. G. Downie of the Capetown Electricity Undertaking, it is more than likely this paper would not have been forthcoming. Their assistance made it possible and if the joint effort should in the future prove useful to any of you in your work the labour entailed will not have been deemed in vain.

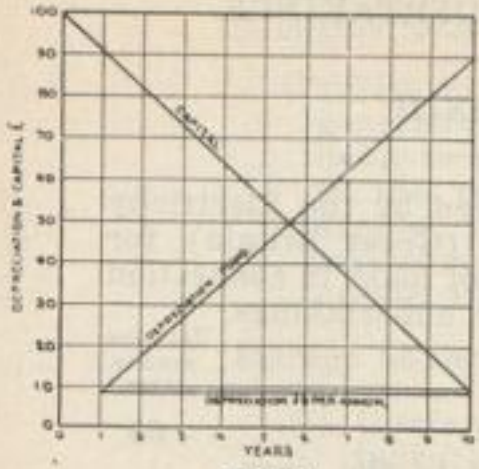


FIGURE 1
PROVISION FOR DEPRECIATION
STRAIGHT LINE METHOD

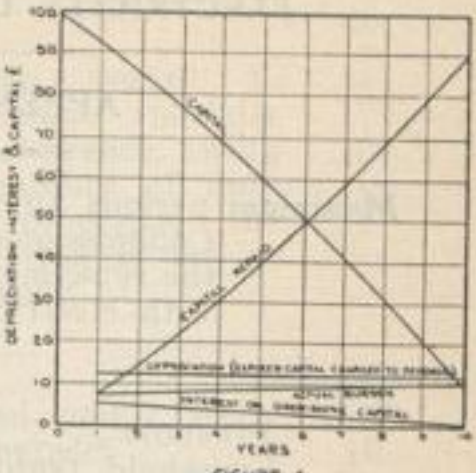


FIGURE 4
PROVISION FOR DEPRECIATION
ANNUITY METHOD

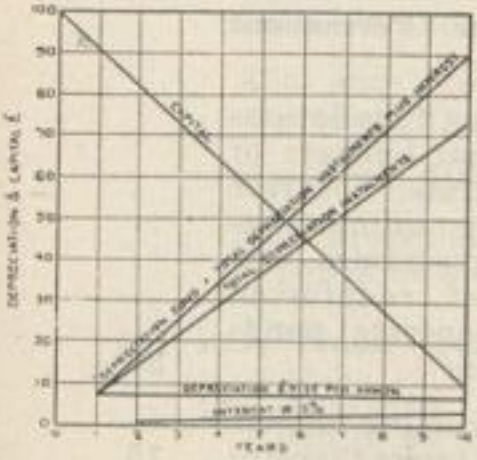


FIGURE 2
PROVISION FOR DEPRECIATION
STRAIGHT LINE METHOD
TAKING ADVANTAGE OF INTEREST

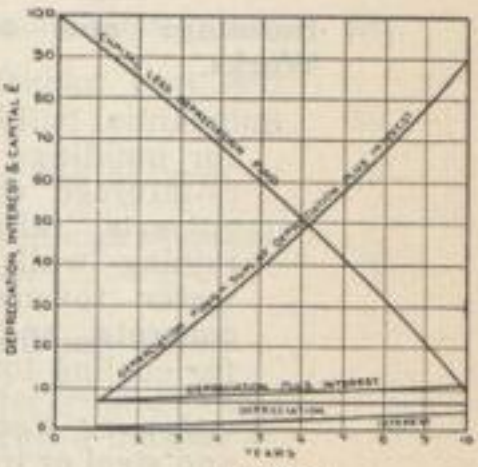


FIGURE 5
PROVISION FOR DEPRECIATION
SINKING FUND METHOD

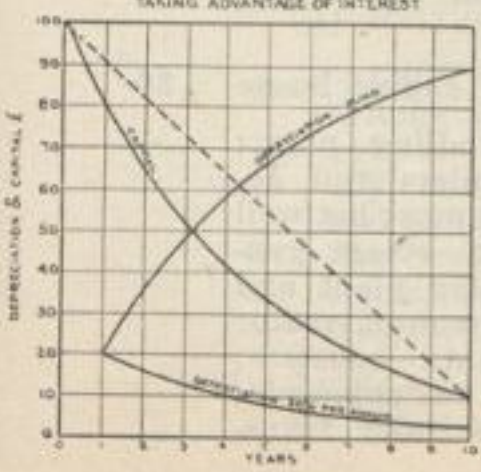


FIGURE 3
PROVISION FOR DEPRECIATION
REDUCING BALANCE METHOD

GRAPHICAL REPRESENTATIONS OF VARIOUS METHODS OF PROVIDING FOR DEPRECIATION.

DEPRECIATION IN RELATION TO ELECTRICITY UNDERTAKINGS.

APPENDIX II.

Maximum periods approved by the Electricity Commissioners (Great Britain) for the repayment of loans in connection with electricity undertakings.

	MAXIMUM PERIODS. YEARS.
(a) **Land.**	
Freehold	60
Leasehold (subject to the duration of the lease)	30
(b) **Buildings and other Permanent Works.**	
Substantial buildings, foundations for buildings, coal bunkers of re-inforced concrete, concrete culverts, railway sidings, retaining walls, reservoirs and water towers of re-inforced concrete, and concrete ponds for cooling towers	30
Wooden or steel cooling towers and steel or iron tanks therefor	15
(c) **Machinery and Plant** (including plant foundations).	
Overhead crane in engine house	30
Coal and ash handling plant; weighbridge; boilers and accessories; feed pumps; hot well tanks; pipework; steam generators, condensing plant and all accessories, motors, motor generators and boosters; switchgear and switchboards; rotary converters and trans-	

formers; internal combustion engines; cranes (other than engine house) 20

(Proviso:—With regard to generating plant, specially liable to obsolescence, owing to the probability of bulk supply or otherwise the maximum period is not to exceed 15 years).

Storage batteries—

	MAXIMUM PERIODS. YEARS.
(i) Guaranteed under Maintenance contract	10
(ii) If no guarantee	7
Portable and testing instruments	10
Ash and coal trucks (not self propelled)	10
Furniture, fittings and fixtures . .	10
Self propelled vehicles (steam, petrol or electric)	7

(d) **H.T. Trunk Transmission Mains.**

(1) Approved Underground Mains laid in an approved manner—

(i) If less than 11,000 volts . . 25

(ii) If 11,000 volts or more . . 40

(NOTE.—In cases where voltage is less than 33,000 however, the period is specially considered and regard is had to the possibility of the line eventually losing its characteristics as a main transmission line).

(2) Approved Overhead Lines erected in an approved manner 25

(e) **Mains and Services.**

Overhead lines (including supports); Underground mains, conduits, feeder pillars and boxes; House services	25
(f) **Meters**	10
(g) **Installations, etc., on Consumers' Premises.**	
(1) For Hire—	
(i) Wiring	10
(ii) Motors	10
(iii) Domestic and office appliances (i.e. cookers, radiators, irons, boiling rings)	7
(2) **For Hire Purchase** (for which special statutory powers are necessary).	

The same maximum periods apply as in the case of simple hiring but do not exceed the period within which purchase would normally be completed. Any sums received from consumers annually in excess of the loan instalments are required to be applied to the repayment of the loan.

APPENDIX III.

RECORD OF DEPRECIATION.

All outlays on original, renewal, and additional plant and equipment except the cost of current repairs are payments made on revenue to secure benefits extending to a date beyond the year of purchase. On this account they should not be charged direct to the revenue account for the year of purchase or any other one year.

They should, therefore, always be charged to capital outlay account except only the outlays for loose tools and other equipment subject to unusually rapid depreciation which must be treated separately for the reasons given later.

All such outlays made within each year and charged to capital outlay should be abstracted at the end of each year and distributed into a register of plant, by means of which the amount of depreciation will be measured and charged in total to each annual revenue account, the amount of depreciation being at the same time written off the capital outlay account in the financial books.

The outlay on loose tools, etc., should be recorded separately in a loose tools account in the financial book, apart from the capital outlay accounts, and the contents abstracted at the at the end of each year recorded in the register of plant, because the existing value at any time of these items can most satisfactorily be ascertained by an annual survey and inventory. All outlay for both renewal and repair of loose tools, etc., should therefore be charged through this account to the revenue account of the year in which it is incurred after adjusting the balance of the account to agree with the value of the stock on hand at the end of each year.

The plant register should, therefore, readily show if any part of the original cost of the plant still remains in the capital outlay account at the date on which it is scrapped or abandoned, and if so either this remaining balance must be written off by being included in the measured amount of depreciation to be computed at the end of the year or some other duly authorised árrangement must be made and noted in the register of plant by which the amount still remaining will be automatically written off over a number of years by being included in the depreciation amount for each of those years.

Plant Register.

The plant register, examples of sheets constituting which are included in this appendix, consists of:—

(a) Class Records.

(b) Class Summaries.

(c) Annual General Summary.

Details of the capital outlay, estimated scrap value, annual depreciation and unexpired capital outlay at the end of each year are shown in the Class Record.

Class Record.

One Class Record is used for each individual class of asset—or for such individual assets as may be deemed worthy of such treatment—and is given a class number to correspond to the reference number allocated to the class of asset in the schedule on which is recorded the rate for depreciation used by the undertaking for that class, but as will be seen each Class Record may consist of various sheets.

The example of a Class Record which follows has been prepared for a period of 25 years for the Boilers and Boiler Accessories of an Undertaking which is assumed to have been established in 1910. The useful life of this plant is assumed to be 15 years and the straight-line method of calculating depreciation has been adopted. The initial cost of this part of the plant is taken as £20,500 and it is assumed for depreciation purposes that at the end of its useful life it has a scrap value of £500.

This is indicated by the entry (£500 scrap value); (£20,500 useable value) for the year 1910 and similar entries are made for additional capital outlay which are made at later dates.

Where two amounts of additional capital outlay are not bracketed in this way it indicates that no scrap value is expected to attach to the plant at the end of its useful life.

The amount of depreciation allowed for the first year in the case of all additional capital outlay is calculated for one half the year on the assumption that it was in use for that period in each case.

The rate of depreciation is 100/15ths = 6.6% per annum and in determining the amount of this for each year it is calculated on the useable value of the plant, that is to say, on the capital outlay less the estimated scrap value.

For 1910, therefore, the amount of depreciation is one half of 6.6% of £20,000 — £666 13s. 4d., which sum is placed in red figures (indicating a deduction—other figures being in black) under the figure of capital outlay and the amount of the capital outlay reduced by this amount is brought down to be operated upon by the depreciation figure for the next year and so on.

In the example, the annual depreciation of this part of the total outlay on this class of plant amounting to £1,333 6s. 8d. is continued until 1918, during which year change is made in the estimates of the life and scrap value of the plant concerned. It is then decided that the scrap value of the plant after 10 years' service will be £2,500 and that it should be disposed of at that time. Up to the end of 1917 the plant has been depreciated for 7½ years at the rate corresponding to a life of 15 years and has then a depreciated value of £10,500. With a scrap value of £2,500 the unexpired re-estimated useable value of £8,000 must, therefore, be distributed over the next 2½ years to do which 2/5ths of this new unexpired value (2/5ths of £8,000 — £3,200) must be changed yearly.

ful records have not been kept previously, but such an analysis even of limited accuracy is of the greatest importance as compared with the alternative of complete absence of information.

The first allocations may, therefore, be only rough approximations but they will serve to enable the register to be started. This having been done it will develop and improve in its usefulness in forming one of the principal items of accounting equipment in maintaining the future finance of the undertaking on a sound basis.

CLASS RECORD.

Description of Asset: Boilers and Accessories. **Useful Life: 15 Years.** **Depreciation: 6.6% per annum.**

Class 3 (a).
Sheet 1A.

YEAR OF CAPITAL OUTLAY AND SUBSEQUENT ANNUAL DEPRECIATION DEDUCTED.

Depreciation Year.	1910 £	1911 £	1912 £	1913 £	1914 £	1915 £	1916 £	1917 £	1918 £	1919 £	1920 £	1921 £	1922 £	1923 £	1924 £	1925 £	1926 £	1927 £	1928 £	1929 £	1930 £	1931 £	1932 £	1933 £
1910	500 0 0 20,000 0 0 666 13 4																							
1911	19,833 6 8 1,333 6 8	6,000 0 0 200 0 0																						
1912	18,500 0 0 1,333 6 9	3,800 0 0 400 0 0	200 0 0 10,000 0 0 333 6 8																					
1913	17,166 13 4 1,333 6 8	5,400 0 0 400 0 0	9,866 13 4 666 13 4	2,000 0 0 66 13 4																				
1914	15,833 6 8 1,333 6 8	5,000 0 0 400 0 0	9,200 0 0 666 13 4	1,933 6 8 133 6 8	Nil	500 0 0 25,000 0 0 766 13 4																		
1915	14,500 0 0 1,333 6 8	4,600 0 0 400 0 0	8,533 6 8 666 13 4	1,800 0 0 133 6 8	—	24,733 6 8 1,533 6 8	1,000 0 0 35 6 8																	
1916	13,166 13 4 1,333 6 8	4,200 0 0 400 0 0	7,866 13 4 666 13 4	1,666 13 4 133 6 8	—	23,200 0 0 1,533 6 8	966 13 4 66 13 4	3,000 0 0 100 0 0																
1917	11,833 6 8 1,333 6 8	3,800 0 0 400 0 0	7,200 0 0 666 13 4	1,533 6 8 133 6 8	—	21,666 13 4	900 0 0	2,900 0 0	Nil															
1918	10,500 0 0 2/5ths 2,500 0 0 8,000 0 0 3,200 0 0	3,400 0 0 400 0 0	6,533 6 8 666 13 4	1,400 0 0 133 6 8	—	2/15ths 2,500 0 0 19,166 13 4 2,555 11 1	66 13 4	200 0 0																
1919	7,300 0 0 3,200 0 0	3,000 0 0 400 0 0	5,866 13 4 666 13 4	1,266 13 4 133 6 8	—	19,111 2 3 2,555 11 1	833 6 8 66 13 4	2,700 0 0 200 0 0	—	200 0 0 20,000 0 0 666 13 4														
1920	4,100 0 0 1,600 0 0	2,600 0 0 400 0 0	5,200 0 0 666 13 4	1,133 6 8 133 6 8	—	16,555 11 2 2,555 11 1	766 13 4 66 13 4	2,500 0 0 200 0 0	—	19,533 6 8 1,333 6 8	2,000 0 0 66 13 4													
1921	2,500 0 0	2,200 0 0 400 0 0	4,533 6 8 666 13 4	1,000 0 0 133 6 8	—	14,000 0 1 2,555 11 1	700 0 0 66 13 4	2,300 0 0 200 0 0	—	18,200 0 0 1,333 6 8	1,933 6 8 133 6 8	1,000 0 0 33 6 8												
1922	Nil	1,800 0 0 400 0 0	4,368 13 4 666 13 4	866 13 4 133 6 8	Nil	11,444 9 0 2,555 11 1	633 6 8 66 13 4	2,100 0 0 200 0 0	Nil —	16,866 13 4 1,333 6 8	1,800 0 0 133 6 8	966 13 4 66 13 4	300 0 0 3,000 0 0 100 0 0											
1923	—	1,400 0 0 400 0 0	4,200 0 0 666 13 4	733 6 8 133 6 8	—	8,888 17 11 2,555 11 1	566 13 4 66 13 4	1,900 0 0 200 0 0	—	15,533 6 8 1,333 6 8	1,666 13 4 133 6 8	900 0 0 66 13 4	3,200 0 0 200 0 0	1,500 0 0 50 0 0										
1924	—	1,000 0 0 400 0 0	4,033 6 8 666 13 4	600 0 0 133 6 8	—	6,333 6 10 2,555 11 1	500 0 0 66 13 4	1,700 0 0 200 0 0	—	14,200 0 0 1,333 6 8	1,533 6 8 133 6 8	833 6 8 66 13 4	3,000 0 0 200 0 0	1,450 0 0 100 0 0										
1925	—	600 0 0 400 0 0	3,866 13 4 666 13 4	466 13 4 133 6 8	—	3,777 15 9 1,277 15 7	433 6 8 66 13 4	1,500 0 0 200 0 0	—	12,866 13 4 1,333 6 8	1,400 0 0 133 6 8	766 13 4 66 13 4	2,300 0 0 4, etc., as indicated on Sheet 1A.	1,350 0 0, etc., as indicated on Sheet 1A.										
1926	—	200 0 0 200 0 0	3,800 0 0 666 13 4	333 6 8 133 6 8	—	2,500 0 2	366 13 4 66 13 4	1,300 0 0 200 0 0	—	11,533 6 8 1,333 6 8	1,266 13 4 133 6 8	700 0 0 66 13 4												
1927	—	—	333 6 8 333 6 8	200 0 0 133 6 8	—		300 0 0 66 13 4	1,100 0 0 200 0 0	—	10,200 0 0 1,333 6 8	1,133 6 8 133 6 8	633 6 8 66 13 4												
1928	—	—	200 0 0	66 13 4 66 13 4	—		233 6 8 66 13 4	900 0 0 200 0 0	—	8,866 13 4 1,333 6 8	1,000 0 0 133 6 8	566 13 4 66 13 4												
1929	—	—	—	—	—		166 13 4 66 13 4	700 0 0 200 0 0	—	7,533 6 8 1,333 6 8	866 13 4 133 6 8	500 0 0 66 13 4												
1930	—	—	—	—	—		100 0 0 66 13 4	500 0 0 200 0 0	—	6,200 0 0 1,333 6 8	733 6 8 133 6 8	433 6 8 66 13 4												
1931	—	—	—	—	—		33 6 8 33 6 8	300 0 0 200 0 0	—	4,866 13 4 1,333 6 8	600 0 0 133 6 8	366 13 4 66 13 4												
1932	—	—	—	—	—			100 0 0 100 0 0	—	3,533 6 8 1,333 6 8	466 13 4 133 6 8	300 0 0 66 13 4												
1933	—	—	—	—	—					2,200 0 0 1,333 6 8	333 6 8 133 6 8	233 6 8 66 13 4												
1934	—	—	—	—	—					866 13 4 666 13 4	200 0 0 133 6 8	166 13 4 66 13 4												
1935	—	—	—	—	—					200 0 0	66 13 4 66 13 4	100 0 0 66 13 4												
1936	—	—	—	—	—							33 6 8 33 6 8												

CLASS SUMMARY.

Class 3 (a)
Sheet 1.

Description of Assets. Boilers and Accessories.

Year.	Capital Outlay.	Depreciation.	Balance + or —
	£	£	£
1910 ..	20,500 0 0	666 13 4 +	19,833 6 8
	20,500 0 0	666 13 4	19,833 6 8
1911 ..	6,000 0 0	1,533 6 8 +	4,466 13 4
	26,500 0 0	2,200 0 0	24,300 0 0
1912 ..	10,200 0 0	2,066 13 4 +	8,133 6 8
	36,700 0 0	4,266 13 4	32,433 6 8
1913 ..	2,000 0 0	2,466 13 4 —	466 13 4
	38,700 0 0	6,733 6 8	31,966 13 4
1914 ..	Nil	2,533 6 8 —	2,533 6 8
	38,700 0 0	9,266 13 4	29,433 6 8
1915 ..	25,500 0 0	3,300 0 0 +	22,200 0 0
	64,200 0 0	12,566 13 4	51,633 6 8
1916 ..	1,000 0 0	4,100 0 0 —	3,100 0 0
	65,200 0 0	16,666 13 4	48,533 6 8
1917 ..	3,000 0 0	4,233 6 8 —	1,233 6 8
	68,200 0 0	20,900 0 0	47,300 0 0
1918 ..	Nil	7,222 4 5 —	7,222 4 5
	68,200 0 0	28,122 4 5	40,077 15 7
1919 ..	20,200 0 0	7,888 17 9 +	12,311 2 3
	88,400 0 0	36,011 2 2	52,388 17 10
1920 ..	2,000 0 0	7,022 4 5 —	5,022 4 5
	90,400 0 0	48,033 6 7	47,366 13 5
1921 ..	1,000 0 0	5,522 4 5 —	4,522 4 5
	91,400 0 0	48,555 11 0	42,844 9 0
1922 ..	3,300 0 0	5,655 11 1 —	2,355 11 1
	94,700 0 0	54,211 2 1	40,488 17 11
1923 ..	1,500 0 0	5,805 11 1 —	4,305 11 1
	96,200 0 0	60,016 13 2	36,183 6 10
1924 ..	etc.		

ANNUAL GENERAL SUMMARY.

YEAR 1910.

Description of Assets.	Capital Outlay.	Depreciation.			Balance + or —		
Boilers and Accessories ..	£ 20,500	£ 666	13	4 +	£ 19,833	6	8
Turbo Generators	500	1,000	0	0 —	500	0	0
Transformers ..	Nil	250	0	0 —	250	0	0
Batteries	200	100	0	0 +	100	0	0
Buildings	1,000	800	0	0 +	200	0	0
etc.	etc.	etc.			etc.		
TOTALS ..	22,200	2,816	13	4	19,383	6	8

YEAR 1911.

Description of Assets.	Capital Outlay.	Depreciation.			Balance + or —		
Boilers and Accessories ..	£ 26,500	£ 2,200	0	0 +	£ 24,30(	0	0
Turbo Generators	Nil	1,000	0	0 —	1,000	0	0
Transformers ..	200	260	0	0 —	60	0	0
Batteries	Nil	100	0	0 —	100	0	0
Buildings	1,000	820	0	0 +	180	0	0
etc.	etc.	etc.			etc.		
TOTALS ..	27,700	4,380	0	0	23,320	0	0

Similarly for other years.

APPENDIX IV.

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On account of Mr. Low's unavoidable absence, the paper was read by Mr. Withinshaw (Cape Town).

The President : This valuable paper is written by the Chairman of the Electricity Committee of one of the largest towns in South Africa. It is therefore of great assistance to Councillors, and I am sure we shall be glad to hear the views of Councillors with regard to this paper.

Rev. Lamont (Durban) said he very much appreciated the points raised in the paper. Speaking as a mere layman it seemed to him that they were dealing with a straight line: at one end was the consumer, in the middle the Electrical Supply Commission, and at the other end the expert Electrical Engineer. He thanked the gentleman who read the paper, and thought it would materially assist many Town Councillors.

Councillor Ericsen (Kimberley) said the paper required a good deal of consideration. It struck him it would be a very useful paper to place before their Municipal Auditors.

Mr. Mordy Lambe (East London) thought that the importance of the matter of provision for depreciation, both to Engineers and Councillors, would be readily realised by all, and particularly by Engineers. Adequate provision for depreciation was vital to the continued sound financial position of any electricity undertaking, it being understood, of course, that "depreciation" was to be taken as including renewals and obsolescence. A few years ago, through the efforts of their Association, the several Provincial Authorities in the Union met and drafted a standard form of Municipal Electricity Accounts, which form was adopted by all the Provinces and was now being followed. He felt, however, that the Provincial Authorities did not go as far as they should have done, in

that they did not stipulate the extent of the provision to be made in respect of depreciation, nor did they make provision for depreciation compulsory. He thought that in leaving these points undecided they fell short of reaching the logical goal.

The ideal system would, no doubt, be to eliminate the need for the making of special provision for depreciation by making the life of the loans raised for the purchase of plant and equipment coincide with the useful life of the plant. The difficulty lay, however, in accurately estimating the useful life of the plant and equipment. He felt sure that the Councillor Delegates present would not take exception to his saying that in most cases failure to make adequate provision for depreciation was due to that hoary old warrior "General Rate." In many cases the amount set aside for depreciation was that which was left after the electricity undertaking had had taken from it what was deemed by the Council to be sufficient to satisfy the old soldier to whom he had just referred. In his Presidential Address to the Association some years ago he had stated that "The policy so often pursued of requiring an electricity undertaking to make substantial contributions in aid of the general rate whilst leaving the legitimate requirements of the undertaking unprovided for was one which called for review at the earliest possible moment." The author of the paper then being discussed said that the Engineers were primarily responsible for the framing of tariffs. That statement was only partly true, because cases were not unknown in which strong opposition had been offered by Councillors to tariff reductions because of the fear that the electricity revenue might thereby be temporarily reduced, resulting in less being available as a contribution to the general rate.

Mr. J. Roberts (Durban) endorsed everything Mr. Lambe had just said on the question

of the adequacy of depreciation funds, as they were called. I think it is unfortunate such a term as "Depreciation" should be used because I should think renewal of plant is caused in 95% because of obsolescence, and if Engineers took more of a hand in this game they would have these things put on a basis which would more closely correspond to the actual circumstances of our business. I particularly endorse what he has said about the provincial auditor system which is a very elaborate one.

In Durban there is a plethora of auditing, the most trivial details being checked several times, but the provincial auditor appears to exercise no surveillance over such matters as adequacy of Depreciation Funds and has not, so far as I am aware, called attention to the fact that owing largely to the obligation placed upon the Tramways of making regular contributions to the rates of from 2 to 4 per cent. of their capital they have not made nearly sufficient contributions to their Depreciation and Obsolescence Funds and have not even written off the value of the old Horse Tramway System purchased by the Durban Town Council over thirty years ago, which still stands as an asset on the Balance Sheet at £120,000 so that any future system of transport, and such future system is urgently needed, will have to bear heavy standing charges, not only on its present Tramway System which is obsolete but of the old Horse Tramway System as well.

This contribution to the rates is also acting adversely in the extension of Electricity into outlying districts because the Municipal Auditor insists that Revenue should bear not only the capital charges on the plant expended, plus cost of production, but full 4 per cent. contribution to the Borough Funds as well and in thinly populated districts it is often very difficult to show a surplus of Revenue over Expenditure when this illegitimate though statutory allowance has to be made. If the Durban Under-

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taking had been relieved of all their contributions to the rates the Undertaking would have been Debt-free to-day and would have been unique, I should think, in the world.

In regard to the actual yearly allowances to write off plant at the end of its life, I think that we should all be guided by the scale of annual contributions laid down by the Electricity Commissioners of Great Britain and it should be illegal for any Undertaking to contribute anything at all to the rates until the proper allowance has been set aside to write off the plant.

Mr. D. Nelson (Paarl) said he felt those using Electricity should be the first to have the benefit of reduced price, before it went to the general public. It was not in every town that everybody was using Electricity. The result was that those who use Electricity are contributing to those who are not using Electricity. If they went into it, Electricity had already contributed much by giving light to the town at a reduced price, but some of the Councillors wished to carry on at a very low rate, and he felt if something went out from this Convention to give a hint to the Municipality, it would have a good effect. He thought as they had invited various bodies to the Convention, they might invite the Provincial Auditors.

Mr. F. Castle (Cape Town): This is certainly a very valuable paper, but I think Engineers would have liked to have seen more use of the term "obsolescence" because I look upon depreciation as rather a reflection in this Engineering age. For instance you buy a plant to-day and there are thousands of firms trying to improve on that plant, which will make it obsolescent. You are now changing over in many places from D.C. to A.C., not because the plants are worn out, but have become obsolete. I do feel that whatever you take, if it is anything which represents the present age, obso-

lescence is undoubtedly a prime factor. It is a glaring case that all manufacturers are trying to make what they have supplied, obsolete by making something more economical to put in their place.

Mr. L. L. Horrell (Pretoria): I wish to thank and congratulate the Author on a very excellent paper. This contribution to the proceedings of the Convention will assist us very materially in determining the lives of various items of plant. It is the useful life of the plant with which we are concerned in making provision for depreciation and not the physical life. It is the Engineer who works on the basis of his and his fellow Engineers' experience, who can best compute the life of an article. Improvements are continually being made and the Engineer is often faced with the fact that his plant is already obsolete. What to-day is a useful piece of apparatus, may in a few years appear to be the reverse, compared with apparatus then being marketed. If the Engineer knows what the useful life of the plant is, he should be able to face with less tripidation the question of replacement of plant by more efficient plant.

Mr. G. H. Swingler (Cape Town) did not intend to add much. The Chairman of the Finance Committee at Cape Town, whoever he be, is always out to grab as much revenue as possible. We want to reduce our Tariff, and at the same time the Council has spent money in other directions. The ratepayers clamour for improvements, but they don't want more rates. The Council wants £20,000 to £30,000, and they tell me the way to get it is to reduce the provision for obsolescence. What we are concerned with is the redemption of a capital over the useful life of a plant. I had for the last ten years a committee composed of Scotsmen, the best Committee I ever had. They were hard men and when you were making a profit they put it back into the business, in other words,

they created a Betterment Fund. We had a Sinking Fund, and this was augmented by Depreciation. Then we had more, and instead of giving it to the relief of rates, I advocated, seeing the cost of plant was so rediculously low, buying, and we got for £20,000 what usually cost £47,000. Their idea was to write down our loan when times were prosperous, and we got £350,000 into that in addition to the Sinking Fund which was established by virtue of the Provincial Authorities. He blamed lack of knowledge on the part of the Provincial Authorities for the position to-day. He thought the suggestion to invite the Provincial Auditors was an excellent one. It was false economy from the industrial point of view to have the rates for electricity higher than they could be and you cannot have adequate provision for obsolescence, and a high rate, and relief of rates. You are either having a questionable asset or a liability posterity. I think it is nothing else than being decent that you should leave the position as good as you found it. When you have a valuation of assets it should not be put at more than you can purchase at to-day, and with provision for depreciation. I have found we have to carry all the obsolescent stuff and I am as sorry for one friend from Paarl.

Mr. Low has treated the subject very thoroughly, and has done it at great inconvenience. He thought it might help to have something on record that the Engineers of the Council could point to as an indication of what should be done. Mr. Low asked me to say he he will reply to any queries which are raised through correspondence, and it will be in our Journal.

Mr. J. Roberts (Durban): As a matter of interest I would like to say that in Natal an ordinance was put through many years ago and it is a disability which Electrical Undertakings are suffering under. The ordinance

makes it compulsory for every Undertaking to contribute no less than 2% to 4% of its capital. This had been made legal. He wished steps could be taken to take it off the statute books, for some undertakings were not making sufficient contributions to depreciation funds because of this compulsory payment to the rates.

Mr. Baker (Town Clerk, Mafeking) said he was very interested in the proceedings. Being a financial paper, he would like it read at the Municipal Congress next week. No doubt, a good deal of discussion could take place on both sides.

Mr. G. H. Swingler (Cape Town): For the information of those who do not know, in Great Britain for the last few years, they have stipulated that a maximum of 1½% can be deducted from the Electricity Department on the net capital as a maximum, and then only when they have accumulated a reserve fund of 15%, and then only 1½%. That I think is a fair amount because we are told if we raised our money on the security of the town, we get it cheaper. Then I say, directly you have electricity, the value of properties rise. That has been acknowledged in the Cape by the fact that the Cape Provincial Authorities have allowed Cape Town to charge the added areas 10% more immediately they have water service, and a further 10% when they have electricity service. I think that we, as an electrical undertaking, should sell electricity at the lowest possible cost. I don't want to reflect on other sections of the Municipal Service, but I think we sweat and make money, and other people spend the money.

Mr. Withinshaw (Cape Town): For the benefit of those who do not know, I may say, there was added to the Cape Municipal area a few years ago a great tract of undeveloped land on the Flats. The people living there had, for a number of years, paid the same rates as the

remainder of the Municipality, and they objected and got the ear of the Provincial Authorities, and their rates were reduced to half the Municipal Rate, with the understanding that when water and electricity was brought to them, the rates should be increased.

Mr. A. T. Rodwell (Johannesburg): If the principle obtaining in Britain of only allowing 1½% on the net Capital was applied in Johannesburg, we should very quickly become an Undertaking with no liability whatever. That will be shown by last year, when we contributed to General Fund £135,000, I think it was. I think we should produce electricity and sell it at cost. Why should users of electricity have to relieve people who don't use electricity, and I think something on the lines suggested should go forward and every effort should be made to prevent, as far as possible, Municipal Authorities from taking so much from the Electricity Department. Our Municipality has agreed to a reduction of tariffs which releaves the community to the extent of £40,000.

Mr. Barnard (Potchefstroom): We don't allow anything to be taken from the Department. Any profit is passed on to the consumer. Then we have a depreciation fund apart from the Redemption Fund. The result is Potchefstroom compares favourably with any other town of similar size in the Union. In the Cape your ordinance is different from ours in the Transvaal, but we have no complaint about our Provincial Authorities. You must bear in mind that in any undertaking the whole of the ratepayers are liable. It was a surprise that in Durban they should have the old trams and horse tramways standing as an asset in the books. Surely some scheme could be devised. There was a difference between providing electricity and transporting passengers. We, in the Transvaal, have to bear in mind that the auditors are there to certify the correctness of our accounts or otherwise. In our case they

check our assets and certify that all our assets are in order, and the necessary provision has been made in each case. We encourage heads of Departments to fight for their interests, but the Council has to look after the interests of the whole town. He would like to say how much he enjoyed coming here.

Mr. Rodwell (Johannesburg): said the Auditors, on more than one occasion, pointed out that Electricity users were contributing heavily to the cost of transport energy in the form of Direct Current.

Mr. Barnard replying to a question of Mr. Mordy Lambe, said that his point of view was a matter of accounts. The Engineer had nothing to fear. He says it costs me so much to produce a unit. If the Council said they were going to loan them 4% ,and give it to General Revenue, it did not alter the position of the Engineer, as he must get credit for it. Council must decide what it is going to do with its money, but it did not alter the actual cost of production, and his books would show a higher cost. I don't say it's fair to the Engineer, but a man can do what he likes with his own. My argument is this: the Engineer prepares a scheme, provides the Electricity, and sells it at so much. Now, if the Council adds to that, that has nothing to do with the Engineer. It does not alter the Engineer's cost of production.

Mr. G. H. Swingler (Cape Town): The Council taxes one section of the community for the benefit of the other. Mr. Rodwell made £135,000. If the tariff was lower he would sell more. Any Engineer wants to increase his output and get his cost down. The best satisfaction we get is not our salary, but the good of our electricity. The Engineer will never get his prices down if the Councillors have not a proper perspective. It would be one of the best brakes on Municipal waste of money and expenditure on White Elephants, if they had to

go to the ratepayers every time for money they wanted. I consider direct taxation the best.

Mr. J. Roberts (Durban) did not think their friends from Potchefstroom really understood that this contribution to the borough rates increased the cost of production and made it necessary to charge a higher price for Electricity.

Mr. Withinshaw (Cape Town) could not let the statement go unchallenged that Engineers were only responsible for keeping down the cost of generating. Engineers were equally responsible for the low cost of the current consumed. It is as much their duty and to their credit as the cost of generating, and if the Councils were going to take away a large portion of their revenue then they cannot reduce the cost to the consumer, and it against the credit of the Engineers, because the fixing of the electricity tariff is a technical matter and the Councillors, as a whole, have very little knowledge. Arising out of the discussion he would like to move that:

"This Convention of Municipal Electrical Engineers and Town Councillor Delegates having considered the matter of provision for depreciation, renewals of Plant, and repayment of capital made by electrical and transport undertakings, is satisfied that in many cases sufficient allowances are not being made for these purposes, largely because of the growing practice of diverting surpluses made by these undertakings to the general rates; and in other cases these contributions to the rates are having the effect of keeping up the price of electricity so high as to prevent its free use to the development of electricity undertakings thereby preventing reductions in tariffs.

"As Provincial Auditors, for some reason, apparently acquiesce in this unsatisfactory

practice, the Convention resolves that the attention of—

(a) All Municipal Councils owning electricity and transport undertakings, and

(b) Their Honours the Administrators of all four Provinces,

should be drawn to the statutory regulations made in Great Britain, whereby the contributions to rates, made by the funds of a Municipal Electricity Undertaking must not exceed 1½ per cent. of the net outstanding loan balances, and this only after:

(a) All proper allowances have been made to restore the capital invested, such allowances being calculated on the economic life of each of the various sections of the plant.

(b) A reserve fund has been accumulated amounting to 15 per cent. of the loan debt, and a copy of the foregoing be therefore sent to the proper quarters."

Councillor Ericsen seconded.

The motion was carried unanimously.

The President: I am sure we are all very much indebted to Mr. Low for his paper. It is one of the most interesting papers that has come to this Convention, and I should like to ask Mr. Withinshaw to convey to Mr. Low our great thanks and also I would like to thank Mr. Withinshaw for so very kindly presenting the paper. I suggest that a record of these notes be sent to Mr. Withinshaw.

Mr. Withinshaw thanked the Convention for the way they had received Mr. Low's paper. It will be gratifying to him (Mr. Low), and I shall personally take the first opportunity, when I get back to town, to tell him about it.

"Broadcasting as it affects Municipal Electrical Undertakings from a Financial Aspect, and Conditions of Reception."

By W. MORTIMER MAIL, Town Engineer, Kokstad, East Griqualand.

In bringing this paper forward I wish to point out that it is intended principally for those areas that are situated some distance from the Broadcasting Stations, also to show that wireless sets are a source of revenue to the Municipal Power Stations.

The modern all electric set consumes from 60 to 100 Watts, and if this is used for 4 hours a day, uses from 7 to 12 units a month, so that if a number of sets are used in a town, this can be a useful addition to revenue, as this load can be charged for at lighting rates as most of it is used on the peak hours.

If partial H.T. main sets, or pure Battery sets are used, then the low tension batteries have to be charged, and that gives an indirect return to Power Station through wireless dealers or garages who use charging plants.

Unfortunately Broadcasting reception in South Africa, save in areas close to a Broadcasting Station, is very unsatisfactory, as owing to heavy static and fading, reception at distances over 50 miles or so is only good for a few months in the year, moreover for a number of listeners reception is only possible at night, unless very powerful sets are installed, and at night static is at its worst. To a certain extent these difficulties have been met by the Johannesburg Station operating on short wave of 49 metres, which in the district of East Griqualand in summer time is 80% satisfactory on 4 Valves

with a very great reduction in atmospherics, good reception on this wave being possible at most times when static on the longer wave (460 completely blankets reception). Johannesburg skips approximately at 6 to 7.30 p.m. on short waves for the rest of the evening, at the moment (March) and this effect will take place earlier each night as we go into winter, I would like to suggest that it would be a good move if the Broadcasting Company could be induced to instal short wave transmitting sets at Durban and Cape Town with an alternative wave length up near 80 metres for use at night (after Sunset) in the winter time. Amateur experience shows that this skip becomes far less acute as the wave length is increased. With three Stations, with alternative wave lengths in the 40 and 80 bands much greater use to listeners of their radio sets would be possible when Broadcasting on medium band, is impossible, due to fading and atmospherics. During heavy storms when it has been impossible to switch on the aerial, I have received on Johannesburg on the 49 metre wave on two foot inside aerial in the day time, and had very good reception. During the evening when atmospherics have been bad, I have listened in to Radio, Paris and Daventry, with good results on 3 Valves, but not nearly as good as we should get it from our own Broadcasting Company, who collect licences from us. Another improvement which would affect a great number of listeners would be another Transmitting Station at least 10 K.W. erected at Queenstown or thereabouts so as to serve East Griqualand, Transkei, Port Elizabeth, East London, and middle area of the Cape, or relay Broadcasting Stations erected in various parts of the country. If the service was improved in South Africa, I am certain that there would be a great increase in the number of licences taken out, as I know by the inquiries in my own district, that the public is getting more radio minded every day.

DIFFERENT FORMS OF INTERFERENCE AND REMEDIES FOR SAME.

Atmospherics and Fading.

Only cure to use a very powerful receiving set with inside aerial, and for fading use all the power available. Another cure:—Broadcasting Company to increase power of Station, and erect more transmitting Stations, and utilise the Short Waves.

Oscillating.

Due to some inexperienced person working a set with reaction. Try and discover culprit, and give him lessons on how to work a set.

Interference from Power Station.

All commutator machines to be filtered by having suitable condensers fitted and connected correctly as this is important.

Interference Due to Motors and all Electrical Appliances.

"Fitted with Make and Break and High Frequency Machines." To find out all users of interfering appliances, get them to fit suitable condensers, and also chokes if condensers are not sufficient.

Interference from Overhead Wires and Underground Cables.

This is due to wires partly earthed or faults in Street Lighting Brackets, and broken Insulators. Remedy:—Repairs to be effected.

Interference from Internal Combustion Engines.

Due to sparking plug and Make and Break. Suitable screen over plug and magneto or wire mesh screen over complete engine and earthed.

Interference from Tram Cars.

Due to worn-out trolley slippers, rollers and sparking badly, also due to bad earth

return of tramway system, and coming back to wireless set through earth.

In my opinion the Government should make it compulsory on everyone causing interference to desist, as this is possible, as has been proved in many parts of the Continent and in America.

In conclusion, I would like to move a resolution from this Association that, the Broadcasting Company be asked to improve the service to the outlying areas. Wireless to-day should be for the poor man and reception should be made possible from at least 2 Valves at Loud Speaker Strength. **(It is only in so far as Broadcasting reaches the multitude that wireless service and revenue can be built up).**

As this paper was prepared at the last moment, and was not included in the agenda for this Convention, it has necessarily had to be curtailed. Broadcasting is, however, in the opinion of the writer, one of the most important subjects affecting Municipal Electrical Engineers, and the general public to-day. It has not been possible to more than merely indicate simply and even vaguely some of the principal practical features affecting the problem of good Radio Service in this country. The writer, however, would welcome the opportunity of elaborating any of the points above referred to, to anyone interested.

The chief points that occur to one in viewing the problem as a whole are:—

Better Service. (More power and more Stations).

Eliminations of Static. (Use of Short Wave).

And the elimination of interference from various electrical machines (man made Static) by suitable electrical filters.

Every Municipal Engineer, should, I suggest, study particularly this last aspect of the matter. The time cannot be far off when man made Static will be made illegal and an offence, and the Municipal Engineers should be ready and able to give lead in any direction which will minimise this bugbear to the Town listener-in. The theory and practice of electrical interference filters is an interesting subject with a technique of its own. It is a side-line, but one which I think is going to become of increasing importance to every Power Station Engineer.

A visitor from England gave some technical information and also gave details of a special machine being developed for interference purposes.

Mr. G. H. Swingler (Cape Town): The kernel of the nut was the leading up to the establishment of a broadcasting station in the Eastern Province. With regard to the question of interference, I am glad to hear you have got over some of the trouble. Kokstad has brought forward this paper with a view to pressing for the establishment of a broadcasting station in the Eastern Province. Was that not really what Kokstad is after?

Mr. Mortimer Mail (Kokstad): The object is precisely what Mr. Swingler has said, to get a station in the Eastern Province. The main object is to improve broadcasting right throughout South Africa with another station possibly near Queenstown, and with Cape Town and Johannesburg we have a continuous service, instead of a few months in the year.

Mr. Campbell said the violet ray defied them with its interference. 90% of the trouble came from Hairdressers' Machines.

Mr. Chase Brown said they were all concerned. They had interference from flash lamps and sewing machine motors. He thought

they should get some legislation by which something could be done. The Municipality had no share in it. He had gone through his town and could say there was not a leak anywhere. If these appliances were fitted with condensers, we would be alright.

The President: Our experience shows that most interference originates from sources beyond our control.

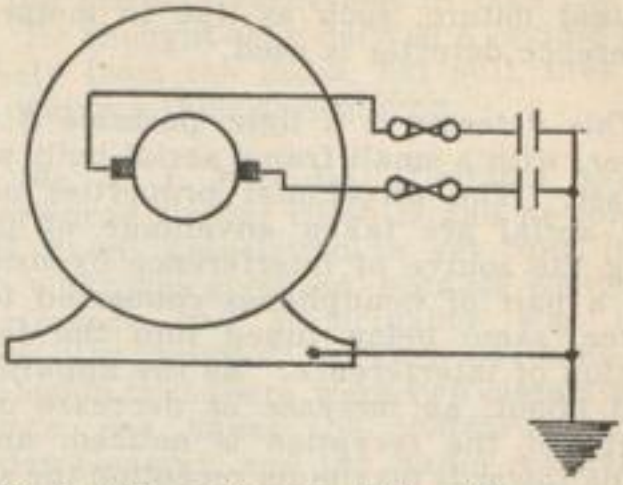
NOTES ON RADIO INTERFERENCE.

Mr. Horrell (Pretoria): With the increasing number of Radio receivers, complaints of interference of electrical disturbances are frequently made to the Pretoria Electric Supply Department.

The majority of these complaints on investigation, however, are generally found to be due to some cause in the complainant's premises. Causes of radio interference have been found to be due to loose connections on electrical fittings, such as switches and distribution boards, partially broken flexible leads, broken filaments in lamps, broken insulation on wire in pendant rods, low resistance of stove elements to earth, faulty lightning arrestors, defects in the radio receiver itself, and even to a thread of a spider's web making an intermittant contact between the prong of a lamp holder and its housing on a rod fitting.

Interference due to D.C. motors has been overcome, by the owner of the motor having the machine overhauled and cleaned, and if such did not give the required result, by placing suitable condensers in the circuit of the motor.

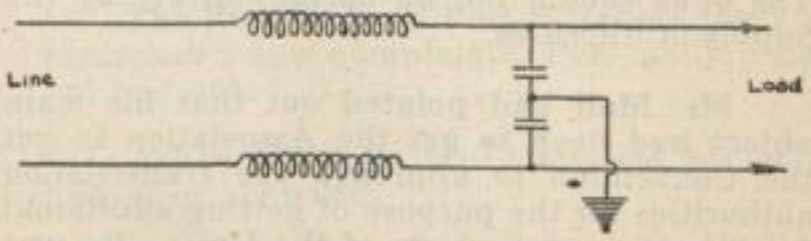
On a 5 H.P., 500 volt D.C. shunt motor, effective results were obtained, as shown in sketch.



Two 2 mfd. condensers (800 volt) connected in series across brushes with 2 amp. fuses in circuit. Mid-point of condensers connected to frame of motor and to earth apart from normal safety earth connection.

Sever causes of interference have also been located in the overhead distribution system, and these have been principally due to faulty section switches in which the contact blades had become burnt or corroded and also to house section fuses with loose connections. Loose connections on street lamp brackets were other great offenders in this respect.

Interference due to flicker controls on Railway crossings were suppressed by interposing a filter in the circuit. Satisfactory results were obtained after various trials of reducing interference, the sketch giving details of the filter which is mounted within a metal housing.



The chokes consist of 80 to 100 turns of 18 SWG. DCC. copper wire wound on presspahn

tubes 2in. in diameter, the capacity of the condensers being 2 microfarad each and tested to 800 volts D.C. For localising interference of a consistent nature, such as due to motors, an interference detector is used.

This detector is a light portable 3 valve receiver, with a small frame aerial built within the case. The directional properties of the frame aerial are taken advantage of in detecting the source of interference by listening in on a pair of headphones connected to the receiver, same being tuned into the loudest reception of interference. As the apparatus is moved about, an increase or decrease of the strength of the reception is noticed, and by working towards maximum reception the source of interference is localised.

Mr. Rodwell (Johannesburg) referred to the advantages of the use of Radio in making people stay at home, thereby using more electricity for light and other purposes. They had been approached in Johannesburg by the broadcasting authorities. We asked their Engineer to call and investigate the causes, and as a result it was found that a number of the troubles and complaints were due to small matters, such as, fuses, loose contacts, etc. There was interference from trollies of tram cars. It was an extremely difficult matter to persuade the user of current to furnish the wherewithal to put things right. He would like to know whether the radio firms could not help with preventive features in their apparatus. The onus should not be borne entirely by the Supply Authorities.

Mr. Mail had pointed out that his main object had been to get the Association to get the Convention to approach the transmission authorities for the purpose of getting additional facilities to certain parts of the Union. He was rather doubtful whether it was part of their work to do anything of that kind. It would be

rather going beyond their powers to approach these people for the purpose of getting certain facilities for certain areas. It would be better for the districts concerned to take the matter up. He thought they derived a certain amount of help from the radio, but still, they should not overstep their jurisdiction.

Mr. I. J. Nicholas (Umtata) said they experienced similar troubles and he joined the local Radio Association to get fully in touch with what was going on, because whatever the interference the Municipality was blamed. After nine months' working he came to the conclusion that there were two classes of interference, one under the control of the Post Master General, and the Radio Association in Umtata were approaching the Post Master General about it. The other point was what steps to take to prevent interference in the town and should they repudiate liability, or put things right.

Mr. L. B. Sparks (Pietersburg) agreed that if they took part in getting another station it might bring upon their shoulders duties which belong to other undertakings, such as the broadcasting company.

Mr. G. H. Swingler (Cape Town) : Having heard the discussion I would like to propose with regard to establishing a broadcasting station in the Eastern Province, that the matter be dropped as far as the Association is concerned.

The President: In Port Elizabeth there are remarkably few complaints. Personally, I have not had one.

Asked to reply, Mr. Mail said his object had been achieved.

Mr. L. B. Sparks (Pietersburg) : Considering the interference in small towns, I wonder

how it is possible to hear anything at all in Johannesburg. Why do they get reception in large towns. He thought probably the reason why they didn't get trouble at Durban was because they were under a station.

Mr. J. Roberts (Durban): One reason is that we are close to the station.

Mr. G. Swingler (Cape Town): We didn't get any trouble except from wireless enthusiasts who want timbuctoo, or somewhere.

Mr. Mortimer Mail: If they had another station it would improve the service right through South Africa.

Rev. Lamont (Durban) found conditions in Johannesburg were very bad, and Durban also.

Mr. G. H. Swingler: When at Muizenburg you can't get Cape Town, but you can get Johannesburg and sometimes Durban.

Mr. Swingler's motion, seconded by Mr. Sparks, that insofar as the establishment of a broadcasting station in the Eastern Province is concerned, the Association take no action, was carried unanimously.

"EARTHING."

Mr. L. L. Horrell (Pretoria) introduced for consideration and discussion the subject of "Earthing" and said the notes were prepared in the hope that a definite proposition would be laid down as to the manner in which "earth" connections should be made so as to reduce the risk to human life.

Notes on Earth Connections in Electrical Systems with Special Reference to the use of Water Mains for this Purpose.

By L. L. HORRELL, A.M.I.E.E.

These notes, prepared at very short notice, are intended to introduce the subject of Earth Connections in Electrical Systems in the hope that discussion will be invoked and result in definite principles being laid down regarding the manner in which the earth connection should be made so as to reduce the danger to human life of electric shock both under normal and abnormal circumstances.

In the first place it is important to realise the legal requirements regarding earthing which are contained in Regulation 34 (3), Chapter VI of the Factories Regulations reading as follows:—

"Earthing.

All accessible metallic portions of electrical plant or apparatus which though normally not forming part of an electrical circuit may become alive accidentally at a pressure exceeding low pressure to earth, shall be protected either by an insulating covering or shall be connected to earth by a conductor of adequate cross sectional area."

"Low Pressure" is defined as a pressure normally not exceeding 250 volts.

"Earthed" is defined as connected to the general mass of earth in such manner as will ensure at all times an immediate discharge of electrical energy without danger.

Furthermore, although not specially stated in the Factories Regulations, it is of course common practice to earth the low tension neutral point of all transformers in A.C. distribution systems with the object of limiting the potential between a live conductor and the ground and so reduce the danger to human life.

In each of the above cases, it is most important that the earth connection is connected in a thorough and proper manner to the general mass of earth. At transformer points, this should present no difficulty. In Pretoria the practice at transformer points, is to sink an earth plate about three feet square, fifteen feet into the ground. The plate is laid on a bed of coke. A four inch pipe is laid from the coke bed to the surface and periodically as much water as the bed will hold is poured down the pipe. In addition, the earth plate is effectively bonded to the nearest water main.

All poles for carrying the overhead distribution system are solidly connected to an earth wire which again is earthed at intervals of a quarter of a mile.

The question of effectively earthing metallic bodies which may accidently become alive, is a problem not so easily solved. It is obviously impracticable to sink an earth plate every time it is necessary to earth a metallic body, with the result that the universal practice of earthing to water mains has been evolved. In dry climates, however, such as is experienced in parts of South Africa during a large portion of the year, this method is open to criticism, in that it is possible for the system of water mains not to form a good electrical connection to the general mass of earth. The practice of using

flanged joints with rubber insertion in water mains, further prevents a good earth being obtained.

That people who should know better, have only a vague idea as to what constitutes an effective earth, was instanced in Pretoria recently, when an Installation Inspector discovered that an electric range had been "earthed" by connecting the range to a nail driven into the wall.

As this matter concerns every person or authority using distributing or generating electrical energy and is of such vital importance, it appears to me to warrant a thorough investigation. Accordingly, I propose that a summary of the discussions that take place here, as the result of these notes, be submitted to the Council of the South African Institute of Electrical Engineers, with the request that the Institute should assist, by appointing a Committee to investigate this problem. The aim of this Committee should be to formulate definite proposed regulations for submission to the Government Authorities concerned, with a view to incorporation in the Factory Regulations and also in the Mines and Works Regulations.

NOTES ON EARTH CONNECTIONS.

By L. L. HORRELL,
Discussion by JOHN ROBERTS.

I consider the Association is indebted to Mr. Horrell for bringing this important matter forward because the reliability and safety of a public electricity distribution system depends very largely on the proper manner in which electric circuits and appliances used in connection with electric circuits are grounded.

Whatever the absolute electric potential—if there is any such thing—of earth's sphere may be, we dwellers upon it call its potential

zero, and the potential of anything near it such as the air, the clouds, or other physical objects, is measured in terms of this zero potential. In early electric systems, the first of which was, of course, the wires used for electric telegraphs, the earth itself was generally used to complete the circuit made by a wire between the transmitting and receiving apparatus, and this gave quite satisfactory results with the primitive apparatus then in use but when heavy power and lighting circuits were employed it was found that the earth was by no means a perfect conductor, and when electricity came to be used for light and power, electric circuits were made entirely of metal conductors completely insulated from earth. As a consequence of this the potential of one or other side of the circuits varied in its relative potential to earth, depending upon the insulation of both wires and one part of the circuit which one day might be safe to handle—being at ground potential—might the following day be raised above earth to the full potential of the circuit owing to a fault on the other wire. Up to as recently as twenty years ago there was considerable difference of opinion as to the best practice in regard to the grounding of electric circuits. Some maintained that it was desirable to keep the insulation of both phases as high as possible but the practice of definitely earthing one side in as thorough a manner as possible began to grow, paying strict attention to the insulation of the other side of the circuit to avoid leakage or short circuits, and this has now become the universal practice. Many years ago in Durban the danger of a circuit of which one day one conductor may be safe and the next day may be alive was realised and so every low tension as well as high tension circuit was solidly grounded on one side and switches placed in the other side, thus ensuring that when a lamp or other appliance was switched off it was quite dead and safe to handle. As the town was served with a system of water pipes joined together by means of lead packed joints, so as

to give good conductivity throughout, the water piping system serving every premises was used without hesitation for grounding circuits. Probably due to the fact that, with the exception of the Tramways and a little power supply, current is distributed by alternating currents, there have been very few cases—and those quite minor ones—so far as I know, of any damage by electrolysis to the supply mains of the Corporation water system.

Regulations governing the insulation of wires and appliances on consumers circuits were drawn up with safety of consumers well in mind. For twenty or thirty years the use of switches and plugs, supported with flexible wires has been prohibited in bathrooms. The bath itself, if it was not connected metalically to the water pipes, had to be connected to the water supply pipes by means of a conductor of not less than 7/16 stranded copper wire so that it became impossible for the bath to become charged by a defective wire in its neighbourhood so that a person lying in the bath and touching the water tap could receive a very dangerous, if not fatal, shock. Such precautions as these coupled with active propaganda to educate consumers in the necessity for safety in the kitchen has, I am glad to say, been so successful that though eleven or twelve thousand Durban kitchens are completely electrified and irons, grills, toasters, etc., are employed by the tens of thousand there has never yet been a fatality to a consumer using an electrical appliance, not so far as I am aware a serious injury.

But when the mains were extended outside the Borough reaching as they do now to a distance of from 10 to 16 miles in three directions, the problem of satisfactory earthing in the absence of a network of water pipes serving every consumer became a serious problem which was given the closest study. In Durban and its surroundings, as in many other parts of

the country, houses and buildings were commonly roofed with corrugated iron, and in many cases the whole structure consisted of a wooden frame with both walls and roof covered with this material. In our early history numerous cases were experienced of a faulty wire, usually due to chafing on the edge of a tube—in contact with either the iron wall or the roof causing the whole building including down pipes and in some cases the iron fence surrounding a small garden to become charged up so that a person standing on the ground received a shock by touching either the fence or the wall of the house. As this class of house some years ago preponderated in the country districts over the brick dwelling house, this matter of proper grounding was even more important than within a Municipal area. The Department never pinned any faith to earth plates as a satisfactory ground and that this was well justified has been amply proved by tests we have taken. It is of course common knowledge that a steel pole buried four feet in the ground with a base plate of from two to three feet square can become charged up to a dangerous potential if an overhead wire becomes in metallic contact with it and it was considered that to use this common method of grounding was rather to increase the risk than reduce it as was brought home to the Department most drastically by an experience it had some years ago. This experience will be related as it demonstrates thoroughly how completely ineffective are even long lengths and large masses of buried metal as a ground for electric circuits.

An overhead service wire of which the insulation was in rather a poor condition, sagged until the live conductor touched the iron ridge of a roof of a house. The roof, in accordance with regulations, was connected in the prescribed manner with a Corporation water pipe and the water supply to this house from the main in the street was very lengthy, being 50 yards or more to the boundary and had a

branch crossing a lane to supply water to a tennis court on the property. How long the wire had been touching the roof and the insulation in this condition was not known, but supply was not interrupted to the premises and the main fuse did not blow. One morning a horse attached to a Baker's van visiting a house along the lane aforementioned. fell at a certain spot but was put on its feet again and no further notice taken as it was assumed that the horse had in some way stumbled. About an hour afterwards another horse led by a stable-boy proceeding along the lane to the racing stables. fell at the same spot and died immediately. It was then found—to make a long story short—that the leakage of current from the overhead wire touching the roof and connected to the water main had caused the pipe to assume a certain potential above the ground although it was supposed to be connected to the external system of water mains. but it was found—the premises being supplied through a meter—that the pipe joint from the service to the meter was not metal to metal as the flanges had been bolted up through a rubber gasket and the head of the bolt and the nut fitted with a yarn grummet so that the whole of the water service system amounting to perhaps 200 feet though buried in the ground did not cause sufficient current flow to blow the fuse and remained at a sufficiently high potential to kill a horse, which—by the way—was valued at £1,000, and had to be paid for by the Town Council.

For it's out of the borough distribution, therefore, the Department gave up all hope of trying to obtain satisfactory ground on consumers premises by buried earth plates and "seized the bull by the horns" and employed the grounded side of the electric circuit, being the neutral wire of the three-wire distribution, as a means of grounding on roofs, baths, etc., of consumers premises. Theoretically, of course, this system is open to objections and the practice is prohibited by British regulations, but so

far no practical disadvantages have been found in this method. The neutral wire is grounded to an earth plate at each transforming point and the neutral wire is solidly connected to each pole if these are of metal and the section of this neutral wire is equal to the other conductors. Every consumer is required to instal an earth plate connected to his roof which is also connected as described with the ground conductor of the supply mains, the idea of this being to establish as large a number of grounds as possible without any idea that one single earth plate is of any benefit to the consumer on whose premises it is buried. On unusually long circuits it is, of course, possible, if the circuit is unbalanced on either side that the potential of the neutral wire may vary considerably from its neutral pressure at the supply end of the circuit, but such difference of pressure has never so far as I know caused any trouble. Other Engineers will, of course, use their own judgment as to whether they will probably be interested in this description of the manner in which the Durban Electrical Department dealt with the earthing problem in their particular conditions.

Mr. A. R. Metelerkamp (Salisbury): The question of earthing was not a solution to the problem of eliminating fatal accidents by electrocution.

There is in existence, a system of earth leakage protection which has been used on the Continent for the past nine years, and is now compulsory on nine Undertakings in Germany.

Protective Gear was installed in the "leading in" wires to the consumer, on the principle of Earth Leakage Protection.

The protective gear incorporated a trip coil which operated and cut off the current from the building, in the event of the leakage current exceeding 15 mille-amperes.

It has been stated that if the current through the Human body exceeds 60 mille-amperes, the shock to the system may be fatal, and anything exceeding 150 mille-amperes, was always fatal.

These protective switches were obtainable in two, three, or four pole, combined with or without thermal overload protection. The cost of the two pole protective device, without overload protection was 35/-. He stated that he had installed one of these Automatic Isolating Switches in his own house.

He referred to a publication entitled: " ARTIFICIAL EARTHING," by T. C. Gilbert, which fully describes the system, and was well worth reading, and hoped that Artificial Earthing would be fully investigated before the Government amended the Mines and Works Regulations with regard to Earthing.

He further stated that the publication contained a very encouraging preface by the President of the London Institution of Electrical Engineers.

Mr. Swingler was very pleased to hear about the new device. If it could be embodied in an overhead system, it would be the ideal system.

Mr. L. B. Sparks (Pietersburg) described how in earthing he had thought at his place of drilling holes in the granite, and putting wires through, pouring lead into the holes and caulking the wires into the holes.

The discussion was postponed until the next morning, and the Convention adjourned until 9.30 a.m., April 7th, 1933.

Delegates attended the Metro Theatre in the evening at the invitation of the City Council.

FRIDAY, APRIL 7th, 1933.

The Convention resumed its proceedings at 9.30 a.m., with the President (Mr. L. L. Bickell) in the Chair, there being 33 Members, 18 Delegates and 10 Visitors in attendance.

Discussion resumed on "Earthing."

The President invited Mr. Clutterbuck, Chief Inspector of Factories (Pretoria) to address the Convention.

Mr. Clutterbuck: I have no considered contribution to make to the discussion on Earthing but I should like to describe an accident which recently occurred in a Municipal Swimming Bath and which may be of interest in this connection.

While a young lady was in the bath, for some reason or other she caught hold of the end of a pipe entering a little below the surface of the water and received a shock which caused her death. The investigation into this accident disclosed that the pipe had become alive owing to a breakdown caused by lightning.

Adjoining the bath was a pump house containing a motor driven directly connected centrifugal pump with the necessary switchgear.

The instruments on the switchboard were earthed by means of a common bare copper wire carried down and attached to one of the holding down bolts on the motor bedplate forming a metallic connection through the pump and piping to the bath.

A flash of lightning burnt out a coil in the meter on the switchboard causing its casing to become alive and the current passed through

the pump and its connections to the water in the bath.

This accident emphasises the necessity for some thought and consideration when a decision has to be made regarding the most efficient means of earthing any particular piece of apparatus.

Many qualified men would consider the arrangements made in this case satisfactory but unfortunately the pipe which caused the accident had been painted with a thick coat of bitumen which served as insulation.

There is a regulation dealing with earthing but it is vague and unsatisfactory. It needs amplifying and amending. The amendment of this and other regulations will be undertaken very shortly and the Association will be consulted as in former years.

Another recent accident will serve to direct your attention to an electrical hazard which is not fully recognised. While playing on the roof of a house a child was electrocuted by coming into contact with the bare neutral of a 3-phase, 4-wire lighting system, which had become alive without-of-balance current.

Although a discussion on Electrical Accidents is not included in your Official Agenda I am glad to be afforded an opportunity of saying a few words on the subject.

My remarks will be confined to a rough analysis of accidents which have recently occurred and in the majority of cases the method of prevention will be obvious.

As you know, the passing of the Factories (Amendment) Act of 1931 brought the supervision of all machinery and electrical apparatus other than that used on Mines or in connection with mining, under the supervision of the

Labour Department and a separate section dealing with machinery was added to the existing Factories Act.

The particulars I am able to give you therefore refer to the years 1931 and 1932 and do not include those accidents which occurred on mines or on the Victoria Falls Power Company's system.

In 1931 there were 16 accidents, eleven of which were fatal. In 1932 there was a gratifying reduction and out of a total of six accidents there were two fatalities.

Of these 22 accidents, 21 were on overhead lines and poles. No less than 5 children were killed and one injured through coming into contact with bare house service lines on roofs.

Further analysis shews following classification:—

	Killed.	Injured.
Contact with uninsulated wires and apparatus on roofs	6	1
Working on overhead lines and poles	3	7
Contact with wires accidentally displaced	3	—
Contact with wires accidentally alive	1	—
Handling electrical apparatus . . .	—	1

With one exception all the fatalities occurred on L.T. lines, that is, 250 volts and under.

It will be seen from these figures that notwithstanding the increased use of H.T. apparatus and transmission lines, the simple lighting system and house service connection is still the most prolific source of accident and the

cause of the largest number of deaths due to the use of electricity.

The fact that so many fatalities occurred to innocent children and persons who were ignorant of the risks involved should serve to impress upon Municipal Electrical Engineers the necessity of doing everything in their power to prevent such accidents.

We cannot prevent children climbing on to roofs and we cannot stop householders from employing labourers to paint their roofs, therefore the remedy lies in the provision of protection in the form of insulated lines.

You all know that the Regulation which requires house service connections to be made with approved insulated wire, is so far only applied to new installations. I would, however, urge Engineers, in the interests of safety to substitute insulated for bare wiring as quickly as finances will permit and opportunity offers.

When one realises that at least six lives would have been saved during the last two years, if the insulation of all house service lines had been made compulsory, one is inclined to consider whether the decision to give non-retrospective effect to the Regulation concerned should not be reversed.

In the case of accidents which occur while repair or replacements are being made at poles, it is regrettable to find that most of these can be traced to some form of carelessness or negligence on the part of the person carrying out the work.

In many instances men receive shocks from a system which could have been deadened without causing the slightest inconvenience. Ladders are used which are either too long, too short, or unstable. Difficult and dangerous positions are approached by ladder when the

job could have been done from a tower wagon without any risk.

In pole accidents, more frequently than not, the injuries caused by the fall are more severe than those due to actual contact with a live conductor. Life belts are generally supplied but after the accident these are usually found in the tool box.

While admittedly an Electrical Engineer cannot be expected to follow a workman from pole to pole, he is responsible in the first place for providing suitable appliances for carrying out the work in the safest possible manner, and for issuing clear and definite instructions to the men concerned. If these initial precautions are taken and combined with close supervision, the number of accidents on line work would be considerably reduced.

In conclusion I would appeal to Municipal Electrical Engineers to develop what may be called a Safety First Complex. Regulations have their uses and if a contravention occurs it is followed by a prosecution. Prosecutions are unsatisfactory from all points of view, I hate them myself, they interfere with the harmonious relationship which should exist between Engineers and Inspectors and do not benefit anyone.

Mr. Clutterbuck: While I am on my feet may I be allowed to digress a little and say a few words to our young Engineers. There are many young Engineers who are in charge of plants by virtue of what is called an endorsed certificate which entitles the holder to take charge of one particular plant only, I should like to advise them not to be satisfied with that certificate, but to take the full examination. Many young men do not realise the handicap they are placing upon themselves by relying on that certificate alone, and I strongly recommend them to go through the whole course, so that

when an opportunity for improvement in position comes they will be prepared to take it.

Mr. G. H. Swingler (Cape Town) said with reference to the girl being killed by coming in contact with the neutral, he had the 3-phase, 4-wire system and never used bare wire for the neutral because he maintained it became a danger. They were doing their best to get rid of bare copper wire but they never used bare wire for the neutral. When doing a job they might as well have a standard system and not have bare wire. He noticed some people used the short length and joined up. He did not worry about that either from the point of safety there must be insulated wire from the pole right into the house, all four wires or two wires.

Mr. W. D. Ross (Potchefstroom) said they had an accident. They did not carry insulated wire from the pole to the house, but left it within four feet or so. In this case a youngster went on the roof which was higher than the pole, and as he walked down he held the wire and slipped until he must have come to the bare wire. This showed the real necessity as pointed out by Mr. Swingler of carrying uninsulated wire from the pole direct into the building.

Mr. T. E. Ericson (Kimberley): Kimberley has not got a single bare connection in the whole of the town. The few connections overhead were insulated. 95% of the service connections are underground and that is why they had been free from accident. I think this should be carried out throughout the Union.

Mr. Rodwell (Johannesburg): At the moment we have no overhead service connections, they are all underground. Due to the adverse atmospheric conditions at Johannesburg it was felt necessary to do this, but to-day with the various protective devices, that question does not arise to the same extent. While

I prefer the underground connections the cost in many cases is high.

Mr. L. L. Horrell (Pretoria) thought they should thank Mr. Clutterbuck for his remarks which he considered most valuable. Mr. Clutterbuck had cleared up points which have been open to criticism for some time.

With regard to the proposition he had just put forward, he thought this question of earthing should be gone into very seriously and a resolution be taken. Perhaps it would be stronger if it came from a bigger body. I propose we shall send a resolution down to the Institute of Engineers asking if they will take it up and appoint two members of our own Association to form a Committee with them and go right into this suggestion and put forward a resolution to the proper authorities and from what Mr. Clutterbuck said, I have no doubt it will be passed and sent to the proper quarter. I therefore suggest that the gist of this information be forwarded to the Committee for them to go into the matter.

Mr. Rodwell: I understood Mr. Clutterbuck to say that they proposed to amend these regulations and I take it the Government Department will send copies to all bodies for their perusal so that suggestions may be received not only from this body and the South African Institute of Engineers, but others also. The certificated Engineers are a powerful body. It is desirable to have the consensus of opinion of the Engineers of South Africa, and I suggest that the Department prepare their proposed alterations and amendments then sumbit them to the Associations throughout South Africa for suggestions.

Mr. Clutterbuck: The three institutions mentioned will certainly be consulted.

Mr. Mordy Lambe (East London) asked if their Association would be consulted because

it appeared to him that there was evidence of the Association developing a marked inferiority complex in such matters. He did not think that the Association should agree to any other body representing them in this matter.

Mr. Swingler: My view is that we should treat all uninsulated wire as dangerous and all conductors, whether insulated or not. Notwithstanding the fact that we put up insulated wire we nevertheless advise our consumers against them as dangerous. The task if inspecting on 35,000 consumers is a big job and the best thing to do is to buy the best wire available. That is the best remedy.

The use of A.M.E. Wire was agreed to be the Government Engineers for a limited period and that period expired at the end of this year. It was brought up in the Council that morning, and I was asked to collect information before October of this year, and to submit a draft report to the Council to forward to the Government Mining Engineer, and I shall be glad to have, if you agree to this proposal, as much information from those who use it as possible, and I suggest you cut down a portion of the first installation you have done so that it may be sent to the Government Engineer to test and to form his own conclusions.

CONSIDERATION AND DISCUSSION ON "COAL RAILAGE CHARGES."

Introduced by:
The President, L. F. BICKELL, Esq.,
Port Elizabeth.

Mr. Bickell said he introduced the subject at the request of the City Council. Considerable surprise was expressed by members when they learned that 75% of the total cost of the coal delivered at the Power Station was in respect of Railage. In asking him to bring this before the Convention, the Council also instructed the Town Clerk to place it on the agenda for the Municipal Congress. While no immediate result may occur from this, his opinion was that the only way to get relief was to keep knocking at the door. Government carried to Cape Town for export for 12s. A charge of 20s. 11d. per ton for a truck of coal for internal consumption in power station and industry, was entirely unwarranted. He would ask the Secretary to read a letter from the Town Clerk of Fort Beaufort, relating to Oil Freight Charges.

Municipal Council Office,
Fort Beaufort, C.P.,
18th March, 1933.

L. F. BICKELL, Esq.,
President, Assen of Mun. Elec. Engrs.,
P.O. Box 369,
Port Elizabeth.

Sir,

I am instructed by my Council to ask your Conference to take up the question of Freightage on Crude Fuel Oil, both in tank cars and drums. It is felt, in the case of tank cars fully loaded and where no tranship is required, the high charges made by the Railways Administration is not warranted to transport a heavy grade oil under practically similar conditions

as illuminating or more highly inflammable petroleum oils. Our last tank of crude fuel oil cost £8 16s. 5d. per ton of 2,240lbs. landed at Siding, of which the railage ex Durban at Sea Competitive rates, comprise 48% of the total cost.

My Council would appreciate any assistance on the part of your Conference to obtain some reduction on the charges for freightage from the Railway Administration which would reflect in a direct benefit to the consumers of electricity supplied by Municipalities who depend on crude fuel oil for their motive power.

I trust that you will have an opportunity of discussing this question at your Conference.

My Council regrets that it is unable to send a delegate to the Conference.

Yours faithfully,
— BEZUIDENHOUT,
Acting Town Clerk.

A member asked the Convention to take up freightage on fuel oil in drums. The high charges by the Railway Administration were not justified on heavy oils. The railage ex Durban comprised 48% of the total cost. They would appreciate assistance in getting this charge reduced.

Mr. L. B. Sparks (Pietersburg) was sorry this request in regard to charges on crude oil had been made. They must realise that steam driven power stations had to fight against crude oil motive power and he thought it was a very grave point He thought the experience of a good many engineers was that they had to reduce their tariffs in order to compete with crude oil engines and to hold the field. He therefore thought they should deal with this carefully. He would rather concentrate on their own products, and try to reduce the freight on coal.

Mr. Swingler said he would like to move that there be a rate of five pounds a ton on crude oil. It was a double edged weapon, this crude oil. We have our own coal. He thought they should go very carefully into this and would like to propose that the railage be reduced by half on carriage of coal, and the carriage of crude oil be £5 per ton.

Mr. J. Roberts (Durban): I certainly think every opportunity should be seized to press our views in regard to the differentiation between the railage on coal for industrial purposes, and that for export; I think there is nothing to do but to keep on knocking at the door, and that the Council should write some letter or pass some resolution to forward to the Railways on the matter.

Mr. Rodwell (Johannesburg): I am particularly interested in the reduction of railage on coal. It is questionable if we will get any reduction in the charges but the Government may, by reason of strong representations, refrain from increasing charges.

Mr G. H. Swingler (Cape Town): We should not take "no." We could bring coal to Durban and then to the Cape at less than 14s. a long ton. The Railways then decided they could do it economically, and that continued until 1918, when they squeezed a little more out of us until we had to pay 20s. 11d. for a short ton of coal. They saw Mr. Moore on one occasion without success. There is a new General Manager now and another Minister of Railways. I suggest we write and don't take "no." Keep hammering away. If we could get coal like Mr. Rodwell at 10s. or 11s. per ton we would not grumble. People at the coast feel it badly I suggest we take a resolution and send it to the Municipalities to get the members of parliament to take it to the Minister as soon as parliament assembles.

Mr. Sparks: I would like to support Mr. Swingler's proposal because it would give the Councils a favourable view of the deliberations of this Association and give them an indication that we work in their interest. I have pleasure in seconding.

Mr. J. Roberts (Durban): Many years ago Durban started a campaign against high railway rates and produced a little pamphlet which stressed the necessity of cheap power for industries, etc. He suggested that that kind of propaganda would be more likely to be successful.

Mr. Mordy Lambe (East London) thought that it would be a good thing if some definite expression of the Association's views was sent forward to the forthcoming convention of the Municipal Association.

Mr. Swingler suggested sending a memo to each Council on this question of coal rates, and after that we ask them to get in touch with their members of parliament to join a deputation later, to meet the Minister or General Manager, with a view to getting a reduction on coal freight for local consumption.

Mr. Roberts said it would be interesting to know how much per unit of electricity was paid on railage. It might be as much as 1/5th of a penny

The President said he had a schedule of prices from Mr. Lambe.

Mr. Swingler: Mr. Roberts is about right. About 80 to 85% of a farthing went on railage.

Mr. Thomson (Bloemfontein) thought the Engineers discussing this had as the main object the reducing of their costs. They must also realise that the Railway had got to be run at as great a profit as possible. The revenue of

the railways was going down. They must not think that the only thing on which the charges were increased was coal. Up-country, what they paid was different from the people at the coast. He was going to take the other side because they had to put up-country for everything, even on requisites for ordinary life, yet they were going to reduce charges on coal for the benefit of the coal centres.

Councillor Ericson (Kimberley) thought they should go forward with unanimous action in trying to get a reduction on coal. Kimberley paid just the same as Cape Town, so Cape Town was getting the railage from Kimberley to Cape Town for nothing. He considered the coal charges too high, and he thought the Engineers and Manufacturers should take it up with the Minister. (Cries of dissent).

Mr. Rodwell: Councillors would have to advice their Engineers, but I don't think it would help to recommend that Engineers take the matter up. The Councils are representatives of the ratepayers. Engineers are the servants. I say we must take a broad view of this and in spite of Mr. Thomson's remarks, I heartily agree with the suggestions of getting the support of the Councils and any other authorities that can help us in this matter. Generally speaking, the rates on coal are far too high.

On Mr. Swingler's motion being put, it was carried unanimously.

CONTROL OF STOVE CIRCUITS.

The President announced that the Sub-Committee appointed to consider this matter had framed a recommendation with regard to circuit control on stoves and he would ask the Secretary to read that recommendation.

The Secretary: "The Sub-Committee recommends that each sub-circuit on stoves be separately fused and that where an appliance outlet is fitted it must be of a National Standard 3-pin, 15 ampere type, approved by the authority, and controlled by a switch of similar capacity."

Mr. Roberts stated that he did not like to see switches on stove plugs at all.

Councillor Ericsen asked who was the "local authority," the Council or the Electrical Engineer? Could not the Association get down to it and say definitely what plug should be used?

Mr. L. L. Horrell asked who was going to draw up the specification for this plug.

The President said the 5 amp. plug would be too small. There was nothing on the British Standard Specification between 5 and 15 amps. There was another specification for American and still another for Canadian stoves.

Mr. L. L. Horrell: Surely you are not going to have different specifications.

The President: We can't make American Manufacturers supply plugs to British Standard Specifications.

Mr. Horrell: Why not?

Mr. Swingler said the Hot Spot Kettles took 2 K.W. loaded. They thought from a mechanical point of view that it was better to have something in hand, that was why they fixed on 15 amps. He said a demonstration in 1929 with a switch as against a plug, was made, and it was proved conclusively that it was much weaker and a much less satisfactory means of breaking the circuit than the plug. I consider, quite frankly, that the Canadian people

developed the business in this country, and I would not condemn a Canadian or American type of plug if it was sufficiently robust to stand the work. As soon as one asks a manufacturer to alter his specification in any way, up goes the price.

Mr. Robinson (Manufacturers' Representative): The question of adopting one standard plug was discussed at length by the Committee yesterday, and I thought it was agreed that it would be a definite hardship in the case of Canadian and American manufacturers, to insist on them using the British plug. If they could bring the number of plugs down to two or three, it would be well. Now there were about 30. It would be better to use two or three plugs than 30. While I think standardisation on one would be the ideal, I agree on the other hand that two is better than 30.

Mr. J. Roberts (Durban): With a 15 amp. fuse there would be great risk of blowing the main fuse. He thought the switch was a relic of old days when pulling out the plug sometimes caused a flash over with D.C.

The President: I want to make it clear that we do not interfere with Engineers. This is our recommendation. You can still please yourself.

Mr. L. L. Horrell moved as an amendment that the switch be done away with.

Mr. G. H. Swingler: We don't allow 5 amps. now in large rooms. 5 amps. is not robust enough. Competition is so keen among manufacturers that they give nothing to spare.

Mr. G. G. Ewer (Pietermaritzburg) agreed with Mr. Swingler. They did not allow less than 15 amps. in Maritzburg.

Mr. Roberts thought it better to have a separate plug board in the kitchen for these appliances.

Mr. Ewer: In that case rather cut out the plug on the stove.

The Sub-Committees recommendation, as amended by Mr. Horrell, WITHOUT SWITCH, was agreed to.

Mr. Swingler introduced for consideration and discussion " Model Regulations."

The President: These regulations which have been kindly put forward by Mr. Swingler are intended, I understand, as model regulations. I am afraid it would be quite impossible to go through them item by item.

Mr. Swingler: The only reason I put these forward was that we were framing regulations in collaboration with the Electricity Commission, and as these were being prepared, I thought we might be short of matter for discussion, and I suggested that we should send a copy of our draft regulations, as they will form some basis for discussion, but having regard to the amount of discussion which has taken place, and the fact that it is 10 o'clock now, the purpose I had in view has apparently been served. Still, if any member has any remarks to make, perhaps he will let me have them. I shall be glad to have any observations.

Mr. L. L. Horrell wished to thank Mr. Swingler for the work in regard to this. Model regulations such as these had long been required, and he would like to suggest, as the time was late, that any suggestions, members would like to make, they should put them in writing and send them to Mr. Swingler.

Mr. A. T. Rodwell associated himself with the remarks of Mr. Horrell. Were the regulations to be Government Regulations?

Mr. Swingler: No, purely domestic.

This suggestion was agreed to.

The President, on behalf of the Convention, thanked Mr. Swingler for what he had done.

The resolution with regard to the Bank Account was formally confirmed.

Councillor Ericsen, on behalf of the Mayor and Council of Kimberley, extended thanks for the invitation to be present. He considered it a great education. He also expressed thanks for the very great hospitality and kindness extended to himself during his visit, and also wished the President a very successful year of Office.

The President said the Convention would end to-morrow, and wished to extend his thanks to those who were going away that day. and to express the great pleasure their visit had given, and to thank them for their assistance.

Mr. J. Roberts: I would also like to express my great appreciation of the way in which you have presided at this Convention. I also wish you every success in your forthcoming year of Office. He hoped to be in Salisbury next year, but if not, he expressed his best wishes for the meeting there.

Mr. Robinson thanked the Convention for the opportunity of entering into its deliberations. He was sure benefit would accrue to all of them.

Councillor Elsworth (Salisbury) said he would go back to his Council and tell them that

although unfortunately it was mostly technical matters that were discussed, it was well worth the expense of sending Councillors and their Engineers to this Convention.

The President asked those leaving to leave with the Secretary the number of Proceedings they required.

Mr. L. L. Horrell said that much depended on the sale of the Proceedings. Many, if not most of the Councils, ordered as many copies as there were Councillors.

Councillor Elsworth said some speakers did not give their names. He threw out the suggestion that there might be included in the agenda a list of the names of members, delegates and visitors. Of course, members coming year by year got to know each other, but the Council's delegates kept changing.

Mr. J. Roberts thought they could adopt the rotary custom and have little badges with their names and the towns they came from. It would be a great advantage, particularly in view of the number of new delegates who attended.

Mr. Rodwell said last year the amount received for the Proceedings did not cover the the cost of production. The proceedings were an asset of considerable value and is necessary that the sales be maintained.

A letter was read from an Engineer stating that he had attended the last two meetings at his own expense, and many Engineers paid for additional copies of the Proceedings rather than explain that the Council won't pay for them.

The President desired to thank all who contributed in such an excellent manner by their services in time and transport to the

entertainment of the ladies accompanying members. (Applause). He proposed a hearty vote of thanks to the various Clubs who had extended to them the privilege of full membership during their stay.

Councillor Ericsen wished to join with the President's remarks, Mrs. Bickell, who had done so much to make their stay in this place so pleasant.

Councillor Hookham (Johannesburg) said he had found the debates, which took place on the various matters, very interesting indeed. He had the pleasure of attending the Convention at Pretoria 18 months ago, and I think that it is essential that Councils, as a whole, should take a great interest in the proceedings. He would like to extend thanks and congratulate the President on having achieved that high position.

The Convention adjourned until 10 o'clock, Saturday morning.

In the afternoon a Tug Trip round the Bay, by kind permission of the Assistant Manager, to view Harbour Construction Work.

In the evening Members and Delegates proceeded to Schoenmakers Kop, via Marine Drive.

SATURDAY, APRIL 8th, 1933.

The Convention resumed its proceedings at 10 a.m., with the President (Mr. L. F. Bickell) in the Chair. There being present 17 Members, 8 Delegates and 7 Visitors.

The President said he knew a lot of them were in a hurry to get away. At the meeting of the Council the other morning, a letter was

submitted by the S.A. Electric Lamp Association, which he would ask the Secretary to read.

The Secretary read the letter which ran as follows:—

29th March, 1933.
4431/E.R.J.S./DR.

L. L. HORRELL, Esq.,
Municipal Electrical Engineer,
City Council,
P.O. Box 423, Pretoria.

Dear Sir,

I have been instructed by the Members of the South African Electric Lamp Association to ask you, in your capacity as President of the Association of Municipal Electrical Engineers, if you would initiate conversations at the forthcoming Convention of that body at Port Elizabeth with the object of stabilising declared voltages sent out by Central Power Stations, somewhat on the lines adopted overseas, the essential goal to be the prevention of too wide a divergence between the declared voltages and the voltages actually prevailing at consumers terminals.

Your Members are no doubt aware that Manufacturers throughout the world have during a number of years been endeavouring to work closely to Standard Specifications in the manufacture of lamps.

The object of these specifications, notable amongst which is British Standards Institution Specification, No. 161, 1932, is to produce a product giving the consumers a guaranteed number of hours life at the highest possible efficiency in regard to light output and current consumption.

The B.S.I. Specification, which has been adopted in nearly every country in the world, is based on the declared voltage remaining constant within fairly narrow limits, it being impossible to obtain a really high efficiency unless a strict constant in regard to declared voltage is laid down.

We know that one of the primary considerations of your Association is to give service to its consumers, and feel that this matter is worthy of your kind consideration with the idea of improving the conditions which exist to-day in this country, and thus assist Manufacturers of all Electrical Commodities to maintain a high standard of quality which must result in greater benefit to consumers of electricity, and in fact the Electrical Industry as a whole.

A copy of this letter is being sent to Mr. Bickell, of Port Elizabeth, as the incoming President of the Association of Municipal Electrical Engineers.

Yours Faithfully,

E. R. J. SMITH.

The President. The next business concerned the question of the registration of wiring contractors and the licensing of wiremen, to which he had alluded in his opening speech.

Mr. Macaulay moved that the report of the Committee which had gone into the matter should be referred to the Electricity Supply Commission for them to deal with.

The motion was agreed to.

The President said that ended the business of the Convention. There were one or two votes of thanks to move. He called upon Mr. Thomson.

Mr. Thomson said all good things came to an end some time or other and he thought the members of the Council all regretted that they had reached the closing stages of this meeting. Before they parted he would like to move a very hearty vote of thanks to the City Council of Port Elizabeth for their most magnificent and generous treatment of the members of the Convention. (Applause). They all realise that it was not just what they saw on the surface that constituted the work, but a great amount of labour had been entailed in arranging all the organisation for this function and he could only say that as far as the City Council was concerned they had done it in a manner which took second place to no other place in the Union. They had catered for the members and delegates' entertainment and amusement and there had not been one dull day during their visit here.

He would like to personally thank the President for they way in which he had carried out the duties of his office. He thought the manner in which he had conducted the meetings left nothing to be desired. If he said what he thought of Port Elizabeth and its Council, he would probably be occupied for the whole of the morning, but it could be realised that they had a most magnificent time and would look forward to the next conference to take place in this centre. (Applause).

The President proposed a vote of thanks to the Press for giving them such fine reports of the proceedings. He would like to propose a vote of thanks to Mr. Cohen for the very excellent arrangements he had made for them. Also to Mr. R. L. Weir [redacted] and for their very great kindness in forming themselves into a committee and laying themselves out to help in every way, both in the entertainment of delegates and in providing transport. They had carried out the work admirably. He wished to propose a vote of thanks to General Motors and

the Ford Company for supplying quite a number of cars—he thought 14—for transport, and for kindness in showing them, and taking so much trouble to show them round their factories. He also wished to include the Eastern Province Cement Company and Messrs. Mobbs.

Mr. Macaulay moved a vote of thanks to the President for the very excellent manner in which he had handled the proceedings of the Convention. (Applause).

The President was afraid he could not say much in reply. He did his best. (Applause).

Mr. Barnard said one of the principal features in the functions has been the manner in which the President's better half, Mrs. Bickell, had assisted him, and on behalf of the delegates present he wished to say how much they appreciated the efforts of Mrs. Bickell in entertaining, not only the ladies, but many of the gentlemen. He felt they should pass a special vote of thanks to Mrs. Bickell for her work in entertaining the delegates. (Applause).

Mr. Bottomley said he had been asked on behalf of the Secretary for Public Works, who regretted inability to be present, how very much he appreciated the invitation. Speaking for himself, Mr. Bottomley said that although he had taken no part in the discussion, he was sure from the papers read and the full discussion, that the holding of this annual function was quite justified. As a representative of a Government Department which was directly connected with every electrical enterprise in the country, he must say he appreciated very much the opportunity of meeting personally the electrical Engineers, because to him they were only known previously by correspondence, and it was nice to know them individually. He thought he was safe in saying that the relations which exist between the Public Works Depart-

ment and the Municipalities and their Electrical Undertakings were of the best, and he hoped they would continue to be so. Mr. Clutterbuck had asked to be associated with those few remarks, and he thanked them very much for the hospitality that had been extended to them and trusted the President would have a very happy year of Office.

Mr. Withinshaw and the delegated from Rhodesia also expressed their appreciation of the generous hospitality shown them, Councillor Elsworth particularly referring to the Mayor of Port Elizabeth and the President of the Convention. He assured them that when they came to Rhodesia next year they would be at the entrance to receive them. As a layman he had received a considerable amount of enlightenment during the Convention.

Mr. L. L. Horrell reminded members of a little function to be held in the lounge at 11 a.m., to present Mrs. Bickell with a small token of their appreciation of the work done by her, and he hoped all the members still remaining would be present.

Mr. Frank Castle speaking as a foundation member of the Association said the Convention had been an outstanding success, and he thought some of the success was due to the fact that they had been housed in one building, which furnished better opportunities of becoming acquainted.

The President thanked those who had spoken. Referring to the delegates he said they had taken no small part in the Convention. All the discussions had been conducted most aimably. He also wanted to thank in particular those of the delegates and others who had contributed in no small way to the success of the Convention in preparing the papers put before the Convention. As there was no further business, he declared the Convention closed. (Applause).