PROCEEDINGS of the 32nd CONVENTION

OF THE

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

(FOUNDED 1915)

HELD AT

CAPE TOWN

15th to 18th APRIL, 1958

VERRIGTINGS van die 32ste KONVENSIE

VAN DIE

VERENIGING VAN MUNISIPALE ELEKTRISITEITS-ONDERNEMINGS VAN SUIDELIKE AFRIKA

(GESTIG 1915)

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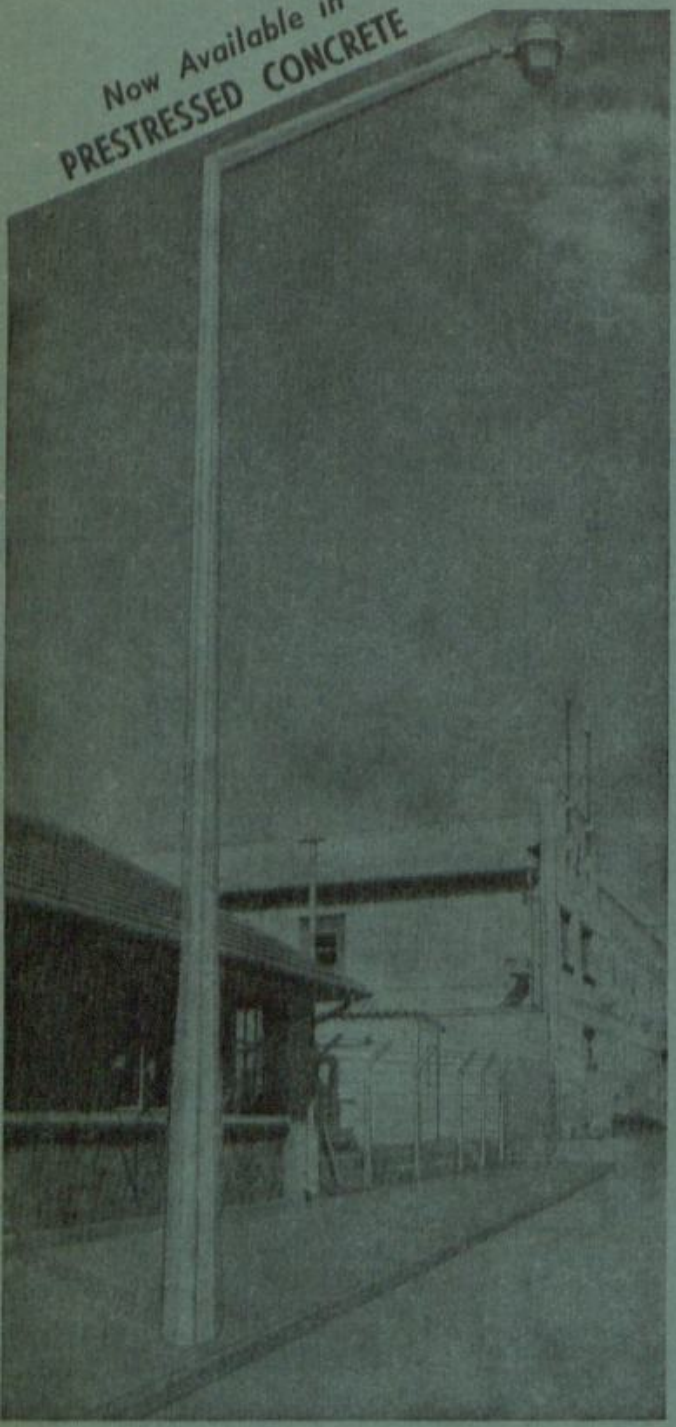

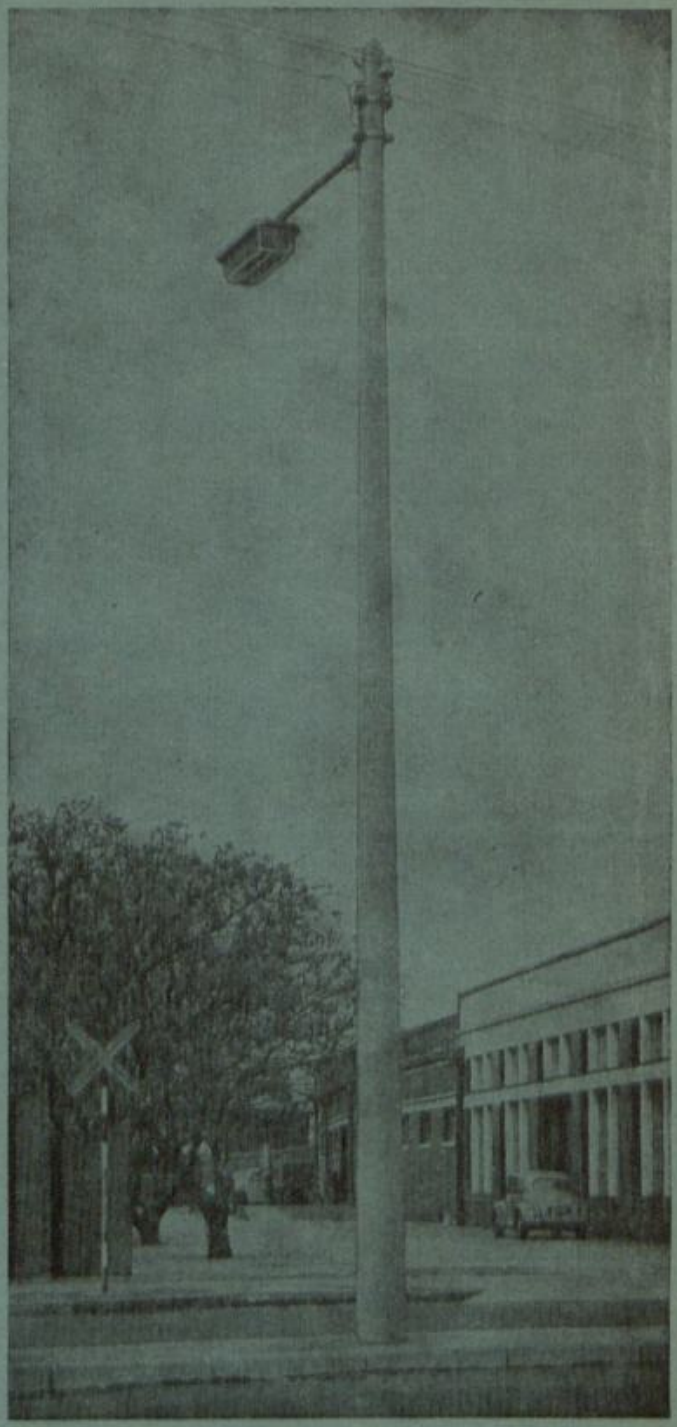

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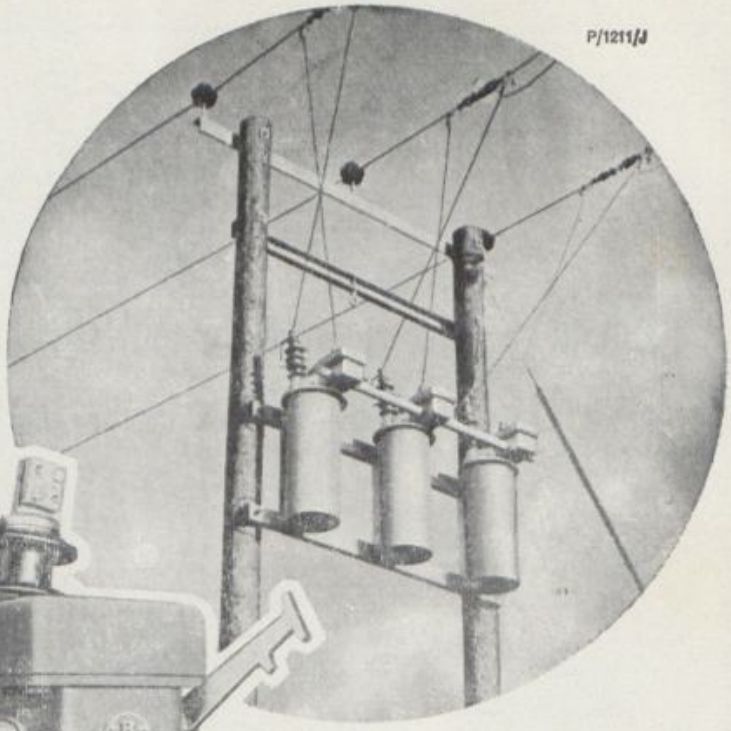

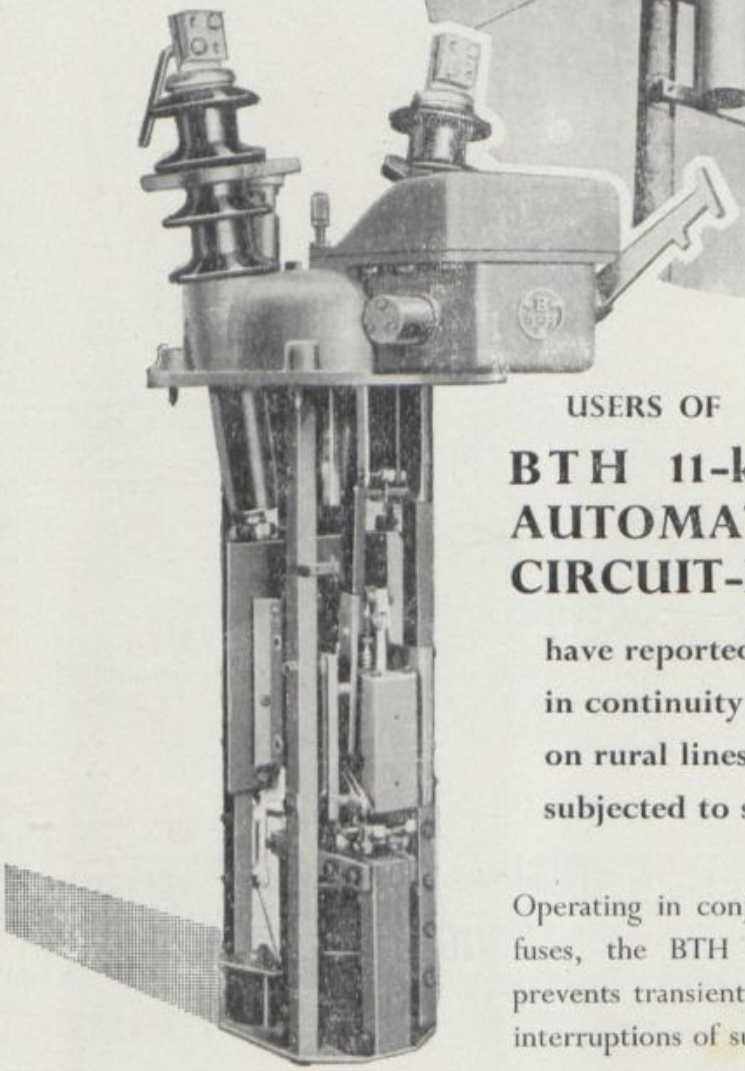

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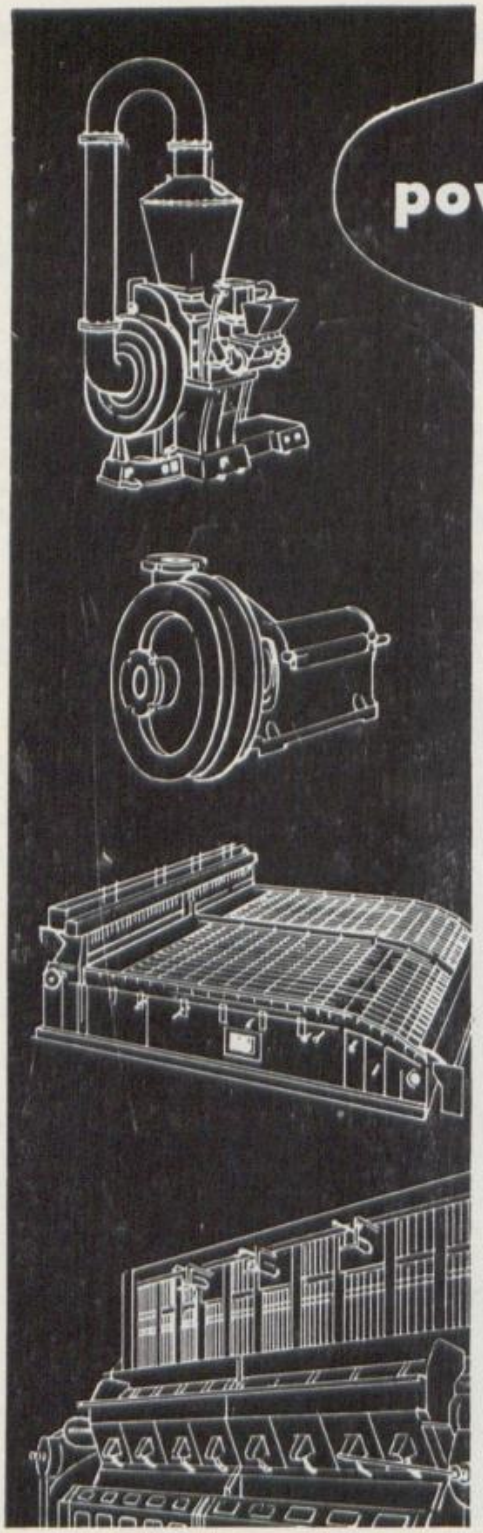

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1936-37	A. Rodwell, Johannesburg	E. Poole
1937-38	J. H. Gyles, Durban°	E. Poole
1938-39	H. A. Eastman, Cape Town	E. Poole
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1944-45	A. Rodwell, Johannesburg	L. L. Horrell, Jan., 1941
1945-46	J. S. Clinton, Salisbury	L. L. Horrell
	J. W. Phillips, Bulawayo	L. L. Horrell to Nov., 1945
1946-47	G. J. Muller, Bloemfontein	A. T. Taylor, Dec., 1945
1947-48	C. Kinsman, Durban	A. T. Taylor
1948-49	A. Foden, East London	A. T. Taylor
1949-50	D. A. Bradley, Port Elizabeth	A. T. Taylor
1950-51	C. R. Hallé, Pietermartizburg	A. T. Taylor
1951-52	J. C. Downey, Springs	A. T. Taylor
1952-53	A. R. Sibson, Bulawayo	A. T. Taylor
1953-54	J. C. Fraser, Johannesburg	A. T. Taylor
1954-55	G. J. Muller, Bloemfontein	A. T. Taylor
1955-56	D. J. Hugo, Pretoria	A. T. Taylor to 30th June, 1955
1956-57	J. E. Mitchell, Salisbury	Arthur Tingey, Ewing & Co., 1st July, 1955. Davidson & Ewing (Pty.) Ltd. 1st July, 1956.
1957-58	J. L. van der Walt, Krugersdorp	Davidson & Ewing (Pty.) Ltd.

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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.
1931-32	T. Millar, F. C. D. Mann, G. H. Swingler, A. Rodwell.
1945-34	T. Millar, J. H. Gyles, G. H. Swingler, A. Rodwell.
1934-35	T. Millar, J. H. Gyles, G. H. Swingler, A. Rodwell.

NOTE.—At the Thirteenth Convention the Rules and Constitution were amended to permit of Councils becoming members of the Association and to be represented on the Executive Council by two Councillor Members, hence the new layout of members of the Executive.

Councillor/Raadslid:	*Alternate Councillors/Alternatiewe Raadslede:*	*Engineers/Ingenieurs:*
	1935-36:	G. H. Swingler, Cape Town
T. P. Gray, Johannesburg	H. W. Dely, Pretoria	J. H. Gyles, Durban
J. McLean, Port Elizabeth		T. Millar, Harrismith
		E. A. Behrens, Port Elizabeth
	1936-37:	G. H. Swingler, Cape Town
H. Middlebrook, Durban	F. Morrell, Cape Town	T. Jagger, Ladysmith
T. P. Gray, Johannesburg	J. McLean, Port Elizabeth	E. A. Behrens, Port Elizabeth
		G. M. Pirie, Bloemfontein
	1937-38:	L. L. Horrell, Pretoria
H. G. Capell, Durban	H. Middlebrook, Durban	J. S. Clinton, Salisbury
W. James, Cape Town	L. Hofmeyr, Stellenbosch	A. O. Harvey, Springs
		G. M. Pirie, Bloemfontein

	1938-39 :	
E. Spilkin, Umtata	G. C. Starkey, East London	D. J. Hugo, Pretoria
W. James, Cape Town	W. Fowkes, Cape Town	J. S. Clinton, Salisbury
		A. Q. Harvey, Springs
		G. M. Pirie, Bloemfontein
	1939-44 :	D. J. Hugo, Pretoria
E. Spilkin, Umtata	G. C. Starkey, East London	C. Kinsman, Durban
C. Olley, Salisbury	W. Fowkes, Cape Town	A. Q. Harvey, Springs
		G. M. Pirie, Bloemfontein
		W. N. Powell, Bloemfontein
	1944-45 :	D. J. Hugo, Pretoria
H. H. Verity, Johannesburg	H. E. Gearing, Cape Town	C. Kinsman, Durban
C. Olley, Salisbury	R. M. Thomas, Durban	J. C. Fraser, Johannesburg
		G. R. E. Wright, Benoni
	1945-46 :	D. J. Hugo, Pretoria
J. Ohlsen, Bulawayo	M. Jaffray, Salisbury	C. Kinsman, Durban
J. W. du Plessis, Bloemfontein	E. Boylan, M.P.C., Johannesburg	J. C. Fraser, Johannesburg
		G. R. E. Wright, Benoni
P. J. C. du Plessis, M.P.C., (Bloemfontein)	1946-47 :	D. J. Hugo, Pretoria
	A. Immink, Johannesburg	J. C. Fraser, Johannesburg
Major J. Raftery, J.P., M.P.C., (Durban)	A. Z. Berman, Cape Town	J. C. Downey, Springs
		D. A. Bradley, Port Elizabeth
	1947-48 :	D. J. Hugo, Pretoria
Major J. Raftery, J.P., M.P.C. (Durban)	J. M. Preller, Pretoria	J. C. Fraser, Johannesburg
	C. G. Thompson, Johannesburg	J. C. Downey, Springs
E. H. Tiddy, East London		H. A. Eastman, Cape Town
	1948-49 :	D. J. Hugo, Pretoria
E. H. Tiddy, East London	C. G. Thompson, Johannesburg	J. C. Fraser, Johannesburg
J. C. K. Erasmus, J.P., Port Elizabeth	J. Johnston, Durban	J. C. Downey, Springs
		H. A. Eastman, Cape Town.
	1949-50 :	J. C. Fraser, Johannesburg
J. C. K. Erasmus, J.P., Port Elizabeth	W. F. du Plessis, Bloemfontein	J. C. Downey, Springs
	S. H. Millar, Bulawayo	H. A. Eastman, Cape Town
C. E. (Sax) Young, Pietermaritzburg		G. J. Muller, Bloemfontein
		A. R. Sibson, Bulawayo
		J. L. van der Walt, Krugersdorp

NOTE.—At the Twenty-Fourth Convention the Rules and Constitution were amended to permit of eight Councillor Members being elected to the Executive and that these Councillor Members shall be the Councillors of those towns whose Engineer Members (other than the two Past Presidents) have been elected to the Executive Council.

As a result of this amendment the undermentioned constituted the Executive Council :—

Councils/Rade : 1950-51 :		*Engineers/Ingenieurs :*
Pietermaritzburg	Councillor C. E. Young	C. R. Hallé
Springs	Councillor L. P. Davies	J. C. Downey
Bulawayo	Councillor J. J. Wrathall	A. R. Sibson
Bloemfontein	Councillor W. F. du Plessis	G. J. Muller
Cape Town	Councillor J. Muller	H. A. Eastman
Durban	Councillor G. Hayward	C. Kinsman
Krugersdorp	Councillor E. B. Neill	J. L. van der Walt
Johannesburg	Councillor L. M. Weiner	J. C. Fraser
		D. A. Bradley
		A. Foden

Councils/Rade : 1951-52 :		*Engineers/Ingenieurs :*
Springs	Councillor L. P. Davies	J. C. Downey
Bulawayo	Councillor C. M. Newman	A. R. Sibson
East London	Councillor F. T. Fox	A. Foden
Johannesburg	Councillor L. M. Weiner	J. C. Fraser
Pretoria	Councillor C. W. Sinclair	D. J. Hugo
Cape Town	Councillor I. W. O. Billingham	C. G. Downie
Durban	Councillor E. E. Cheek	C. Kinsman
Krugersdorp	Councillor H. Pannall	J. L. van der Walt
		C. R. Hallé
		D. A. Bradley

Councils/Rade : 1952-53 :		*Engineers/Ingenieurs :*
Bulawayo	Councillor T. W. Gubb	A. R. Sibson
Bloemfontein	Councillor E. B. Altona	G. J. Muller
Cape Town	Councillor A. E. Keen	C. G. Downie
Durban	Councillor H. L. Richardson	C. Kinsman
Johannesburg	Councillor H. W. Harrison	J. C. Fraser
Krugersdorp	Councillor M. C. Dames	J. L. van der Walt
Port Elizabeth	Councillor L. Dubb	D. A. Bradley
Salisbury	Alderman Morton Jaffray	J. E. Mitchell
		C. R. Hallé
		J. C. Downey

Councils/Rade : 1953-54 :		*Engineers/Ingenieurs :*
Johannesburg	Councillor H. W. Harrison	J. C. Fraser
Bloemfontein	Councillor G. A. Fichardt	G. J. Muller
Port Elizabth	Councillor A. Markman	D. A. Bradley
Cape Town	Councillor A. F. Keen	C. G. Downie
Durban	Councillor H. L. Richardson	C. Kinsman
Salisbury	Alderman A. Morton Jaffray	J. E. Mitchell
Krugersdorp	Councillor M. C. Dames	J. L. van der Walt
Pretoria	Councillor C. E. Acton	D. J. Hugo
		J. C. Downey
		A. R. Sibson

Councils/Rade : 1954-55 :		*Engineers/Ingenieurs :*
Bloemfontein	Councillor F. J. C. Castelyn	G. J. Muller
Cape Town	Councillor P. D. Santilhano	C. G. Downie
Krugersdorp	Councillor M. C. Dames	J. L. van der Walt
Port Elizabeth	Councillor A. Markmam	D. A. Bradley
Pretoria	Councillor C. E. Acton	D. J. Hugo
Pietermaritzburg	Councillor C. E. K. Young	C. R. Hallé
Salisbury	Alderman A. Morton Jaffray	J. E. Mitchell
Springs	Councillor L. P. Davies	J. C. Downie
		A. R. Sibson
		J. C. Fraser

Councils/Rade : 1955-56 :		*Engineers/Ingenieurs :*
Pretoria	Councillor P. G. E. Blignaut	D. J. Hugo
Salisbury	Alderman A. Morton Jaffray	J. E. Mitchell
Johannesburg	Councillor D. J. Marais	R. W. Kane
Cape Town	Councillor P. D. Santilhano	C. G. Downie
Pietermaritzburg	Councillor C. E. K. Young	C. R. Hallé
Germiston	Councillor H. Boneschans	C. Lombard
Krugersdorp	Councillor P. J. Jonker	J. L. van der Walt
Springs	Councillor L. P. Davies	J. C. Downey
Bloemfontein (Co-opted)	Councillor F. J. C. Castelyn	G. J. Muller
		A. R. Sibson

Councils/Rade : 1956-57 :		*Engineers/Ingenieurs :*
Salisbury	Alderman A. Morton Jaffray	J. E. Mitchell
Krugersdorp	Councillor P. W. Marais	J. L. van der Walt
Johannesburg	Councillor D. J. Marais	R. W. Kane
Cape Town	Councillor P. D. Santilhano	C. G. Downie
Bulawayo	Councillor S. H. Millar	A. R. Sibson
Germiston	Councillor de Bruyn	C. Lombard
Durban	Councillor J. McIntyre	R. M. O. Simpson
Springs	Councillor L. P. Davies	J. C. Downey
Bloemfontein (Co-opted)	Councillor F. J. C. Castelyn	G. J. Muller
		D. J. Hugo

Councils/Rade : 1957-58 :		*Engineers/Ingenieurs :*
Krugersdorp	Councillor M. C. Dames	J. L. van der Walt
Cape Town	Councillor W. J. Peters	C. G. Downie
Salisbury	Alderman Morton Jaffray	J. E. Mitchell
Pretoria	Councillor P. G. E. Blignaut	D. J. Hugo
Johannesburg	Councillor D. J. Marais	R. W. Kane
Bulawayo	Councillor S. H. Millar	A. R. Sibson
Durban	Councillor J. McIntyre	R. M. O. Simpson
Springs	Councillor L. P. Davies	J. C. Downey
Bloemfontein	Councillor F. J. C. Castelyn	G. J. Muller
East London	Councillor A. W. Louw	P. A. Giles

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

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Boksburg, Tvl., Town Council, P.O. Box 215.
Brandfort, O.F.S., Municipality, P.O. Box 13.
Bulawayo, S.R., City Council, P.O. Box 591.
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Ceres, C.P., Municipality, P.O. Box 44.

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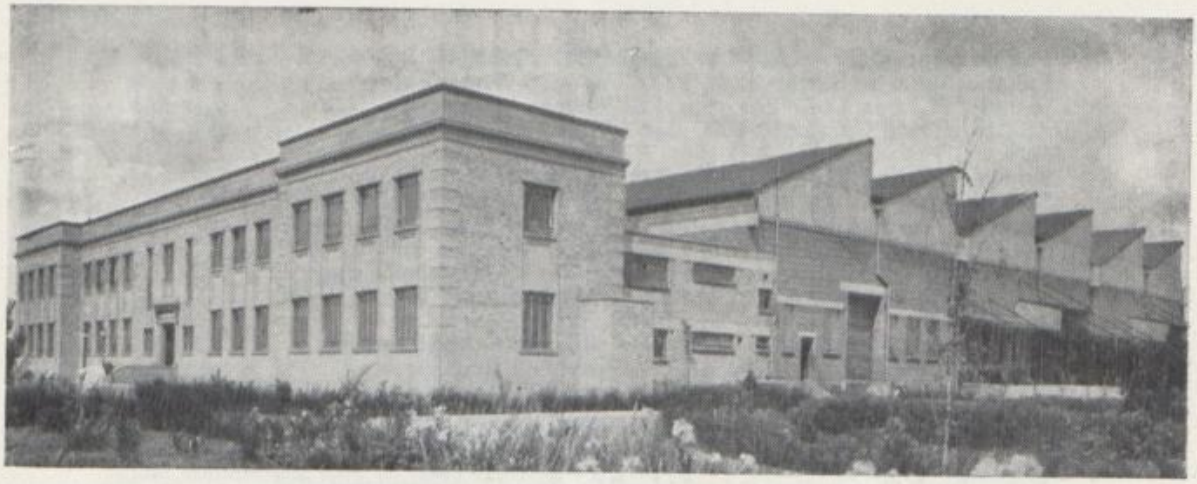

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CONSTITUTION.

1. DEFINITIONS.

In this Constitution unless the context otherwise indicates—

(i) "Association" means the Association of Municipal Electricity Undertakings of Southern Africa referred to in this Constitution;

(ii) "Convention" means the Convention of the Association referred to in clause 10;

(iii) "councillor representative" means the voting member of the council or board of a member undertaking representing such member undertaking;

(iv) "Executive Council" means the Executive qualifications are set out in cluase 7; and 17;

(v) "member" and "membership" shall not include affiliates, but shall include all the classes of membership for which the qualifications are set out in clause 7;

(vi) "undertaking" shall mean a local authority carrying on an electricity supply undertaking.

2. REVOCATION OF PREVIOUS CONSTITUTIONS AND DATE OF EFFECT OF THIS CONSTITUTION.

(1) The provisions of any constitution of the Association previous to this constitution are repealed, and this constitution, as from time to time amended, shall be the sole constitution of the Association: Provided that this provision shall not affect the validity of anything done or any decision or action taken in terms of any provision of any such previous constitution.

(2) This constitution shall take effect from the date of adoption by the Convention.

3 FORMATION AND NAME OF THE ASSOCIATION.

(1) There shall be, and is hereby constituted, in accordance with this constitution, a voluntary association with perpetual succession, to be styled the "Association of Municipal Electricity Undertakings of Southern Africa."

(2) The Association shall be capable, in its own name, independently of its members, of suing and being sued, and of purchasing or otherwise acquiring, holding and managing movable and immovable property, or any interest or

KONSTITUSIE.

1. WOORDOMSKRYWING.

Tensy uit die samehang anders blyk, beteken in hierdie konstitusie:—

(i) „Konvensie" die Konvensie van die Vereniging waarna verwys word in klousule 10;

(ii) „lid" en „lidmaatskap" sal nie geaffilieerdes insluit nie maar sal al die klasse van lidmaatskap waarvoor die kwalifikasies in klousule 7 uiteengesit word, insluit;

(iii) „onderneming" 'n plaaslike bestuur wat besigheid dryf as 'n onderneming vir die verskaffing van elektrisiteit;

(iv) „raadslid-verteenwoordiger" die raadslid of bestuurslid van 'n onderneming, welke onderneming lid is van die Vereniging en welke raadslid of bestuurslid sodanige onderneming verteenwoordig en die stem uitoefen namens sodanige onderneming;

(v) „Uitvoerende Raad" die Uitvoerende Raad waarna verwys word in klousules 14, 15, 16 en 17;

(vi) „Vereniging" die Vereniging van Munisipale Elektrisiteitsondernemings van Suidelike Afrika waarna verwys word in hierdie konstitusie.

2. HERROEPING VAN VORIGE KONSTITUSIES EN DATUM VAN IN WERKING TREDING VAN HIERDIE KONSTITUSIE.

(1) Die bepalings van enige konstitusie van die Vereniging van krag voor hierdie konstitusie, word herroep, en hierdie konstitusie, soos van tyd tot tyd gewysig, sal die enigste konstitusie van die Vereniging wees: Met dien verstande dat hierdie bepaling nie afbreuk sal doen nie aan die geldigheid van enigiets gedoen of enige besluit geneem ooreenkomstig enige bepaling van enige sodanige vorige konstitusie.

(2) Hierdie konstitusie sal in werking tree vanaf die datum van die aanname daarvan deur die Konvensie.

3. VORMING EN NAAM VAN DIE VERENIGING.

(1) Daar sal wees, en word hierby gestig, ooreenkomstig hierdie konstitusie, 'n vrywillige vereniging met ewigdurende opvolging, wat genoem sal word „Die Vereniging van Munisipale Elektrisiteitsondernemings van Suidelike Afrika".

(2) Die Vereniging sal bevoeg wees om, in sy eie naam en onafhanklik van sy lede, te dagvaar en gedagvaar te word, en om roerende goedere of enige vaste eiendom of enige belang daarin of reg ten opsigte daarvan te koop of andersins te verkry en om oor sodanige roerende

right therein, and of disposing of such property whether by sale, lease, or otherwise.

4. OBJECTS OF THE ASSOCIATION.

The object of the Association is not the acquisition of gain. The objects of the Association shall be—

(i) To promote the interest of undertakings;

(ii) To bring together municipal councillors, electrical engineers and all persons interested in the advancement and development of undertakings; to promote wider contact and exchange of views;

(iii) To arrange and hold annual conventions for the reading of papers, the discussion of subjects appertaining to undertakings, and to make recommendations on matters requiring common action.

(iv) To form branches of undertakings geographically so situated that they have common and peculiar interests;

(v) To take such action as may be lawful and expedient for the protection and extension of the rights and interests of undertakings.

5. PROPRIETARY RIGHTS OF MEMBERS AND LIMITATION OF LIABILITY.

(1) No member or affiliate shall, be virtue of such membership or affiliation, have any proprietary right, title or claim to, or interest in, any of the property of the Association.

(2) The liability of any member or affiliate of the Association for any obligation of the Association shall be limited to the annual contribution payable by such member or affiliate.

6. MEMBERS AND AFFILIATES.

(1) The membership of the Association shall consist of undertakings and natural persons. All members of the Association as at the date of the adoption of this constitution shall remain members of the Association in terms of this constitution.

(2) The membership of natural persons shall be classified as follows:—

(i) honorary members;
(ii) engineer members;
(iii) associate members;
(iv) associates;
(v) technical associates.

(3) The Executive Council may admit as affiliates such commercial or industrial undertakings as it may deem fit. Such affiliates shall be entitled to be represented at Convention by such number of representatives as may be fixed by the Executive Council, but such representatives shall not be entitled to vote.

goedere of vaste eiendom te beskik deur verkoop, verhuur, of andersins.

4. DOELSTELLINGS VAN DIE VERENIGING.

Die Vereniging beoog geen winsbejag nie. Die doelstellings van die Vereniging sal wees:—

(i) Om die belange van ondernemings te bevorder;
(ii) Om munisipale raadslede, elektrotegniese ingenieurs en alle persone met belang in die bevordering en ontwikkeling van ondernemings, bymekaar te bring; om wyer kennismaking en wisseling van beskouings te bevorder;
(iii) Om jaarliks konvensies te reël en te hou vir die lewering van verhandelinge, die bespreking van onderwerpe wat betrekking het tot ondernemings en om aanbevelings te maak oor sake wat gemeenskaplike optrede verg;
(iv) Om takke te vorm van ondernemings geografies so geleë dat hulle gemeenskaplike en besondere belange het;
(v) Om sodanige wettige stappe te doen as wat raadsaam is vir die beskerming en uitbreiding van die regte en belange van ondernemings.

5. EIENDOMSREG VAN LEDE EN BEPERKING VAN AANSPREEKLIKHEID.

(1) Geen lid of geaffilieerde sal, omrede van sy lidmaatskap of geaffilieerde lidmaatskap, enige eiendomsreg, titel of eis ten opsigte van, of belang in, enige eiendom van die Vereniging verkry nie.

(2) Die aanspreeklikheid van enige lid of geaffilieerde van die Vereniging vir enige verbintenis van die Vereniging sal beperk wees tot die jaarlikse bydrae betaalbaar deur sodanige lid of geaffilieerde.

6. LEDE EN GEAFFILIEERDES.

(1) Die lidmaatskap van die Vereniging sal bestaan uit ondernemings en natuurlike persone. Alle lede van die Vereniging ten tye van die aanname van hierdie konstitusie sal lede van die Vereniging bly ooreenkomstig hierdie konstitusie.

(2) Die lidmaatskap van natuurlike persone word soos volg ingedeel:—

(i) ere-lede;
(ii) ingenieur-lede;
(iii) verbonde lede;
(iv) geassosieerdes;
(v) tegniese geassosieerdes.

(3) Die Uitvoerende Raad kan sodanige handels- of nywerheidsondernemings as geaffilieerdes toelaat as wat hy passend mag beskou. Sodanige geaffilieerdes sal geregtig wees om by die Konvensie verteenwoordig te wees deur 'n sodanige getal verteenwoordigers as die Uitvoerende Raad mag vasstel, maar sodanige verteenwoordigers sal nie geregtig wees om te stem nie.

7. QUALIFICATIONS OF MEMBERS.

(1) To qualify for membership as an undertaking, the local authority carrying on an electricity supply undertaking, shall have as manager of the undertaking a chief engineer or other person on the permanent staff of such local authority, who shall have such experience and hold such qualifications as may be acceptable to the Executive Council and who is himself an engineer member or an associate.

(2) The membership qualifications for natural persons shall be:—

(i) *Honorary Members:* shall be distinguished persons who are, or have been, intimately connected with municipal electricity undertakings, whom the Association desires to honour for outstanding services in connection therewith.

(ii) *An Engineer Member:* shall be a chief engineer in charge of the member undertaking of a local authority, who has such experience and holds such qualifications as may be acceptable to the Executive Council: Provided that where such an undertaking has sales over 25,000,000 units per annum, the deputy chief engineer may, with the approval of the Executive Council, be admitted to the status of an engineer member. Such deputy chief engineer thus admitted may deputise for the chief engineer at a meeting of the Executive Council where the chief engineer is a member of the Executive Council.

(iii) *Associate Members:*

(a) Where an engineer member ceases to hold a qualifying position, he may apply to the Executive Council for transfer to associate membership.

(b) The engineer in charge of an authorised electricity undertaking, other than an undertaking as defined in clause 1, engaged in the supply of electricity in the area of jurisdiction of a local authority, may also be admitted to the status of associate member.

(iv) *Associates:* Where a member undertaking does not employ a person in charge who has the experience and qualifications acceptable to the Executive Council for engineer membership, such person in charge may be admitted to the status of associate.

7. KWALIFIKASIES VAN LEDE.

(1) On te kwalifiseer vir lidmaatskap as 'n onderneming, moet die plaaslike bestuur wat besigheid drywe as 'n onderneming vir die verskaffing van elektrisiteit, as bestuurder van die onderneming 'n hoofingenieur of ander persoon op sy permanente personeel hê, wat sodanige ondervinding het en sodanige kwalifikasies besit as wat vir die Uitvoerende Raad aanvaarbaar mag wees en wat self 'n ingenieur-lid of geassosieerde is.

(2) Die volgende sal die kwalifikasies vir lidmaatskap van natuurlike persone wees:—

(i) *Ere-lede:* sal persone wees wat hulleself onderskei het en wat in noue verband staan of gestaan het met munisipale elektrisiteitsondernemings en aan wie die Vereniging wens om eer te betuig vir uitstaande dienste in verband daarmee.

(ii) *'n Ingenieur-lid:* sal wees die hoofingenieur in bevel van 'n onderneming wat lid is van die Vereniging, waar sodanige hoofingenieur sodanige ondervinding het en sulke kwalifikasies besit as wat aanvaarbaar mag wees vir die Uitvoerende Raad: Met dien verstande dat waar 'n onderneming meer as 25,000,000 eenhede per jaar verkoop, die adjunk-hoofingenieur, met die goedkeuring van die Uitvoerende Raad, toegelaat mag word tot die status van 'n ingenieur-lid. Sodanige adjunk-hoofingenieur aldus toegelaat kan waarneem vir die hoofingenieur by 'n vergadering van die Uitvoerende Raad waar die hoofingenieur 'n lid is van die Uitvoerende Raad.

(iii) *Verbonde Lede:*

(a) Waar 'n ingenieur-lid ophou om 'n kwalifiserende betrekking te beklee, kan hy aan die Uitvoerende Raad aansoek doen om oorplasing tot verbonde lidmaatskap;

(b) Die ingenieur in bevel van 'n gemagtigde elektrisiteitsonderneming, ander as 'n onderneming soos omskrywe in klousule 1, besig met die verskaffing van elektrisiteit in die gebied van 'n plaaslike bestuur, mag ook toegelaat word tot die status van verbonde lid.

(iv) *Geassosieerdes:* waar 'n onderneming met lidmaatskap van die Vereniging nie 'n persoon in bevel in diens het wat beskik oor ondervinding en kwalifikasies aanvaarbaar vir die Uitvoerende Raad vir ingenieur-lidmaatskap nie, dan mag sodanige persoon in bevel toegelaat word tot die status van geassosieerde.

(v) *Technical Associates:* One assistant engineer on the permanent staff of a member undertaking may be admitted to the status of technical associate.

(3) Persons who were designated "associates" prior to the adoption of this Constitution, shall henceforth be designated "associate members".

8. ADMISSION AS MEMBERS OR AFFILIATES.

(1) Applications for admission as members, excluding honorary members, or affiliates shall be in such form and contain such particulars as the Executive Council may prescribe.

(2) The right to admit members and affiliates, but not honorary members, shall be vested in the Executive Council.

(3) Honorary members shall be elected by the Convention on the recommendation of the Executive Council.

9. MEMBERSHIP CONTRIBUTIONS.

(1) Membership contributions shall be due and payable annually on the first day of March of each year.

(2) Honorary members shall not be required to pay membership contributions.

(3) Member undertakings shall pay membership contributions on the following scale:—

Quantity of Electricity sold by the member undertakings per annum.	Membership Contribution per annum. (Guineas.)
Up to ¼ m. kW. hours sold	6
Over ¼ m. to ½ m. kW. hours sold	8
Over ½ m. to 1 m. kW. hours sold	10
Over 1 m. to 5 m. kW. hours sold	12
Over 5 m. to 25 m. kW. hours sold	14
Over 25 m. to 125 m. kW. hours sold	16
Over 125 m. to 500 m. kW. hours sold	20
Over 500 m. to 1000 m. kW. hours sold	25
Over 1000 m. kW. hours sold	30

(4) Engineer members, associates and technical associates shall not be required to pay membership contributions, but associate members as defined in clause 7 (2) (iii) (a) shall pay two guineas and associate members as defined in clause 7 (2) (iii) (b), five guineas per annum membership contribution.

(5) Members and affiliates shall pay membership contributions for the whole year in which they are admitted as contribution paying members. They shall, however, be entitled to receive a copy of the Proceedings of the Convention or any other publication issued by the Association during such year.

(v) *Tegniese Geassosieerdes:* een assistent-ingenieur op die permanente personeel van 'n onderneming met lidmaatskap kan toegelaat word tot die status van tegniese geassosieerde.

(3) Persone wat voor die aanname van hierdie konstitusie „geassosieerdes" genoem is, sal voortaan bekend staan as „verbonde lede".

8. TOELATING AS LEDE OF GEAFFILIEERDES.

(1) Aansoeke om toelating as lede, uitgeslote ere-lede, of geaffilieerdes sal in sodanige vorm wees en sal sodanige besonderhede bevat as wat die Uitvoerende Raad mag voorskrywe.

(2) Die Uitvoerende Raad sal die bevoegdheid hê om lede en geaffilieerdes toe te laat, maar nie om ere-lede toe te laat nie.

(3) Ere-lede sal deur die Konvensie verkies word op aanbeveling van die Uitvoerende Raad.

9. LIDMAATSKAP-BYDRAES.

(1) Lidmaatskap-bydraes sal jaarliks op die eerste dag van Maart van elke jaar verskuldig en betaalbaar wees.

(2) Dit sal nie van ere-lede vereis word om lidmaatskap-bydraes te betaal nie.

(3) Ondernemings wat lede is sal lidmaatskap-bydraes betaal ooreenkomstig die volgende skaal:—

Hoeveelheid elekrisiteit verkoop per jaar deur die onderneming wat lid is.	Lidmaatskap-bydraes per jaar. (Ghienies.)
Op tot ¼ m. kW. ure verkoop	6
Meer as ¼ m. tot ½ m. kW. ure verkoop	8
Meer as ½ m. tot 1 m. kW. ure verkoop	10
Meer as 1 m. tot 5 m. kW. ure verkoop	12
Meer as 5 m. tot 25 m. kW. ure verkoop	14
Meer as 25 m. tot 125 m. kW. ure verkoop	16
Meer as 125 m. tot 500 m. kW. ure verkoop	20
Meer as 500 m. tot 1000 m. kW. ure verkoop	25
Meer as 1000 m. kW. ure verkoop	30

(4) Ingenieur-lede, geassosieerdes en tegniese geassosieerdes hoef nie lidmaatskap-bydraes te betaal nie, maar verbonde lede, soos omskrywe in klousule 7 (2) (iii) (a) moet twee ghienies per jaar betaal en verbonde lede, soos omskrywe in klousule 7 (2) (iii) (b), moet vyf ghienies per jaar lidmaatskap-bydraes betaal.

(5) Lede en geaffilieerdes moet lidmaatskap-bydraes betaal vir die hele jaar waarin hulle toegelaat is as bydrae-betalende lede. Hulle sal egter geregtig wees om 'n afskrif van die verrigtinge van die Konvensie, of van enige ander publikasie uitgereik deur die Vereniging gedurende sodanige jaar, te ontvang.

(6) No member or affiliate whose membership contribution is more than six months in arrear shall be entitled to attend any meeting of the Convention or of the Executive Council or of any of its committees or to receive any publication of the Association.

(7) Any member or affiliate whose membership contribution is outstanding at the time of Convention in respect of the previous year shall forfeit his membership, and the Executive Council may remove his name from the register of members. Such member shall, nevertheless, be liable for arrear contributions up to and including the year of his removal from the register.

(8) Affiliates shall on the 1st day of March of each year pay such contributions as the Executive Council may determine.

10. CONVENTION.

(1) The Association, except where in the opinion of members there are exceptional circumstances, shall hold an Annual Convention of members.

(2) The Executive Council may invite visitors to Convention.

(3) The venue of Convention shall be as determined by the Convention, provided that, where special circumstances dictate otherwise the Executive Council may determine the venue.

(4) The Convention shall deal with such matters as are on its agenda. Any member shall be entitled to place a motion on the agenda. A motion to be placed on the agenda shall be submitted to the Secretary/Treasurer not less than two months before the date of Convention and shall fall within the objects of the Association.

(5) The Convention may decide on any matter affecting the Association, save matters delegated by this constitution to the Executive Council.

11. VOTING BY MEMBERS AT CONVENTION.

(1) Each member undertaking shall be entitled to two representatives with voting rights at Convention. One such representative shall be a member of the Council or Board of the member undertaking duly appointed as such by the undertaking. The other such representative shall be the engineer or associate in charge of the member undertaking.

(2) Subject to the requirements of clause 12 (5), Honorary Members have voting rights at Convention.

(6) Geen lid of geaffilieerde wie se lidmaatskap-bydraes meer as ses maande agterstallig is, sal geregtig wees om enige vergadering van die Konvensie of van die Uitvoerende Raad of van enigeen van sy komitees by te woon nie of om enige publikasie van die Vereniging te ontvang nie.

(7) Enige lid of geaffilieerde wie se lidmaatskap-bydrae uitstaande is ten tye van die Konvensie ten opsigte van die vorige jaar sal sy lidmaatskap verbeur, en die Uitvoerende Raad kan sy naam verwyder van die register van lede. Sodanige lid sal nietemin aanspreeklik wees, vir agterstallige bydraes tot en insluitende die jaar van sy verwydering van die register.

(8) Geaffilieerdes moet op die eerste dag van Maart van elke jaar sodanige bydrae betaal as wat die Uitvoerende Raad mag vasstel.

10. KONVENSIE.

(1) Tensy daar na die mening van die lede buitengewone omstandighede heers, moet die Vereniging 'n jaarlikse Konvensie van lede hou.

(2) Die Uitvoerende Raad kan besoekers uitnooi na die Konvensie.

(3) Die vergaderplek van die Konvensie sal wees soos vasgestel deur die Konvensie, met die voorbehoud, egter, dat waar spesiale omstandighede andersins aandui, die Uitvoerende Raad die vergaderplek mag bepaal.

(4) Die Konvensie handel met sodanige sake as wat op sy agenda verskyn. Enige lid sal geregtig wees om 'n voorstel op die agenda te plaas. 'n Voorstel bedoel vir plasing op die agenda sal aan die Sekretaris/Tesourier voorgelê word ten minste twee maande voor die datum van die Konvensie en moet binne die bestek van die doelstellings van die Vereniging val.

(5) Die Konvensie kan oor enige saak wat die Vereniging raak, besluit, behalwe sake deur hierdie konstitusie aan die Uitvoerende Raad gedelegeer.

11. STEM DEUR LEDE BY DIE KONVENSIE.

(1) Elke onderneming wat lid is van die Vereniging sal geregtig wees op twee verteenwoordigers met stemreg by die Konvensie. Een sodanige verteenwoordiger sal 'n lid wees van die Raad of Bestuur van die onderneming met lidmaatskap behoorlik aangestel as verteenwoordiger deur die onderneming. Die ander verteenwoordiger sal die ingenieur of geassosieerde in bevel van die onderneming met lidmaatskap wees.

(2) Onderworpe aan die bepalings van klousule 12 (5), sal ere-lede stemreg hé by die Konvensie.

12. PROCEDURE AT CONVENTION.

(1) The President of the Association shall take the chair at the Convention, or, in his absence, the Vice-President. In the absence of both the President and the Vice-President the Convention may elect a member of the Executive Council as chairman, or should no member of the Executive Council be present, any other member. The decision of the chairman of the Convention on any point of order or question of procedure shall be final.

(2) Fifteen representatives of member undertakings duly appointed with voting rights shall form a quorum.

(3) Save as provided in sub-clause (5), each decision of Convention shall be by majority vote of those present and entitled to vote.

(4) Voting shall be by show of hands, save when Convention decides that the voting on a matter shall be by ballot or by secret ballot.

(5) A representative at Convention of a member undertaking may move that a matter be decided by sectional voting as between the council/board representatives and the engineers/associates in charge of member undertakings.

If such motion is seconded, and fifteen or more representatives of member undertakings indicate that they are in favour of the matter under consideration being decided by sectional vote, then the chairman of the Convention shall call for a sectional vote, whereupon each of the sections defined above shall vote separately on the motion.

Unless a majority shall be obtained in both sections the motion shall be lost.

(6) In the event of an equality of votes on any motion, the motion shall be deemed to be lost.

(7) The Convention shall be open to the public, and the press shall be invited to the Convention and shall be given full particulars as far as may be conveniently arranged: Provided that the Convention may decide to discuss any matter before it in committee whereupon only members and representatives of member undertakings shall be entitled to be present: Provided further that the Convention may in such event, in its absolute discretion, permit any other person to be present.

13. THE PRESIDENT AND VICE-PRESIDENT.

The Convention shall each year elect a President of the Association and a Vice-President, who shall be engineer members representing member undertakings.

12. PROSEDURE BY DIE KONVENSIE.

(1) Die President van die Vereniging sal as voorsitter optree by die Konvensie, of, in sy afwesigheid, die Vise-president. In die afwesigheid van beide die President en die Vise-president, kan die Konvensie 'n lid van die Uitvoerende Raad as voorsitter kies, of, indien daar geen lid van die Uitvoerende Raad teenwoordig is nie, dan enige ander lid. Die besluit van die voorsitter van die Konvensie op enige punt van orde of vraagstuk van prosedure sal finaal wees.

(2) Vyftien verteenwoordigers van ondernemings met lidmaatskap, welke verteenwoordigers behoorlik as verteenwoordigers benoem is met stemreg, sal 'n kworum vorm.

(3) Behalwe soos bepaal in sub-klousule (5), sal elke besluit van die Konvensie geskied by meerderheidstem van die persone teenwoordig en geregtig om te stem.

(4) Stemming sal geskied deur opsteek van hande, behalwe wanneer die Konvensie besluit dat die stemming oor 'n besondere saak by stembriefies of by geheime stemming met stembriefies sal geskied.

(5) 'n Verteenwoordiger by die Konvensie van 'n onderneming met lidmaatskap kan voorstel dat daar oor 'n saak besluit word by deelstemming met die raadslid-verteenwoordigers as een afdeling en die ingenieurs/geassosieerders in bevel van ondernemings met lidmaatskap as ander afdeling.

Indien sodanige voorstel gesekondeer word, en vyftien of meer verteenwoordigers van ondernemings met lidmaatskap aandui dat hulle ten gunste daarvan is dat die saak onder bespreking besluit word by deelstemming, dan sal die voorsitter van die Konvensie vra vir 'n deelstemming, waarna elkeen van die twee afdelings soos hierbo omskrywe apart oor die saak sal stem.

Tensy 'n meerderheid verkry word in albei afdelings, word die voorstel nie aangeneem nie.

(6) In die geval van 'n staking van stemme op enige voorstel, sal die voorstel as verwerp beskou word.

(7) Die Konvensie is vir die publiek toeganklik, en die pers sal na die konvensie uitgenooi word en sal volle besonderhede ontvang sover as wat dit gerieflik gereël kan word: Met dien verstande dat die Konvensie kan besluit om enige saak wat voor hom dien in komitee te bespreek waarna slegs lede, en verteenwoordigers van ondernemings wat lede is, geregtig sal wees om teenwoordig te wees: Met dien verstande verder dat die Konvensie by sodanige geleentheid, in sy absolute diskresie, enige ander persoon mag toelaat om teenwoordig te wees.

13. DIE PRESIDENT EN DIE VISE-PRESIDENT.

Die Konvensie sal elke jaar 'n President en 'n Vise-president van die Vereniging verkies en hulle sal albei ingenieur-lede wees wat ondernemings met lidmaatskap verteenwordig.

14. EXECUTIVE COUNCIL.

(1) The following shall be members of the Executive Council of the Association:—

(i) The President;

(ii) The Vice-President;

(iii) The two Past Presidents who held office immediately prior to the period of office of the President;

(iv) The chairmen for the time being of duly constituted regional branches of the Association.

(v) Six engineer members other than those already mentioned who shall be elected annually by the Convention;

(vi) The 10 councillor representatives of the undertakings whose engineer members are members of the Executive Council in terms of the aforegoing.

(2) The engineer members referred to in (v) of sub-clause (1) shall be elected to give effect to the following rule, namely, that in respect of each of the territories listed hereunder there shall serve on the Executive Council at least one councillor representative and one engineer member representing a member undertaking or member undertakings situated in such territory:—

List of Territories:

Cape Province.
Federation of Rhodesia and Nyasaland.
Natal.
Orange Free State.
Transvaal.

15. PERIOD OF OFFICE OF EXECUTIVE COUNCIL: CASUAL VACANCIES: CO-OPTION.

(1) The President, Vice-President and elected members of the Executive Council shall hold office until at the next Convention a President, Vice-President and additional members are elected. The chairmen for the time being of duly constituted regional branches shall automatically remain in office as members of the Executive Council, but the one Past President who is no longer one of the two immediate Past Presidents shall retire.

(2) Should a vacancy occur during the year in the membership of the Executive Council, the Executive Council shall be empowered to fill such vacancy.

(3) The Executive Council may, if it considers that the objects of the Association will thereby be advanced, co-opt any person to serve on the Executive Council for a special purpose. Such person's membership, if not previously terminated by the Executive Council, shall terminate at the first ensuing Convention; but he may again be co-opted.

14. UITVOERENDE RAAD.

(1) Die volgende sal lede wees van die Uitvoerende Raad van die Vereniging:—

(i) Die President;

(ii) Die Vise-president;

(iii) Die twee voormalige presidente wat hierdie amp beklee het onmiddellik voor die ampstermyn van die President;

(iv) Die voorsitters vir die oomblik van behoorlik gekonstitueerde streektakke van die Vereniging.

(v) Ses ingenieur-lede anders as die persone alreeds genoem, welke ses ingenieur-lede jaarliks deur die Konvensie verkies sal word;

(vi) Die tien raadslid-verteenwoordigers van die ondernemings wie se ingenieur-lede lede van die Uitvoerende Raad is ooreenkomstig die voorafgaande bepalings.

(2) Die ingenieur-lede na wie verwys word in (v) van sub-klousule (1) sal verkies word om uitvoering te gee aan die volgende reël, naamlik, dat ten opsigte van elkeen van die gebiede hieronder genoem daar op die Uitvoerende Raad sal dien ten minste een raadslid-verteenwoordiger en een ingenieur-lid verteenwoordigende 'n onderneming of ondernemings met lidmaatskap geleë in sodanige gebied:—

Lys van Gebiede:

Kaapprovinsie.
Federasie van Rhodesië en Njassaland.
Natal.
Oranje-Vrystaat.
Transvaal.

15. AMPSTERMYN VAN DIE UITVOERENDE RAAD: TOEVALLIGE VAKATURES: KOOPTASIE.

(1) Die President, Vise-president en verkose lede van die Uitvoerende Raad sal hulle ampte beklee totdat by die volgende Konvensie 'n president, vise-president en bykomstige lede verkies is. Die voorsitters vir die oomblik van behoorlik gekonstitueerde streektakke sal outomaties hulle ampte behou as lede van die Uitvoerende Raad, maar die een voormalige president wat nie langer een van die twee onmiddellik voormalige presidente is nie, sal aftree.

(2) Indien daar vakatures gedurende die jaar in die lidmaatskap van die Uitvoerende Raad ontstaan, sal die Uitvoerende Raad bevoeg wees om sodanige vakatures te vul.

(3) Die Uitvoerende Raad kan, indien hy van mening is dat die doelstellings van die Vereniging daardeur bevorder sal word, enige persoon koöpteer om op die Uitvoerende Raad te dien vir 'n spesiale doel. Sodanige persoon se lidmaatskap van die Uitvoerende Raad, indien nie vooraf beëindig deur die Uitvoerende Raad nie, sal eindig by die eersvolgende Konvensie; maar hy kan weer gekoöpteer word.

16. DUTIES AND POWERS OF THE EXECUTIVE COUNCIL.

The affairs of the Association shall be managed by the Executive Council in terms of this constitution and the decisions of the Convention. The Executive Council shall be empowered to carry out the objects of the Association and in particular to exercise the following powers on behalf of the Association, such powers being in addition to the powers already hereinbefore assigned to the Executive Council:—

(a) To receive, administer and apply the monies and other property of the Association, and to invest monies not immediately required by the Association, and to vary or realise any investments.

(b) To enter into any contract on behalf of the Association and to institute, or cause to be instituted, conduct, or cause to be conducted, defend, or cause to be defended, settle or abandon any legal proceedings by or against the Association.

(c) To authorise signature of any document on behalf of the Association: Provided that all documents involving the finances of the Association shall be signed by the Secretary/Treasurer and by at least one member of the Executive Council authorised thereto either generally or specifically by the Executive Council.

(d) To appoint such standing or *ad hoc* committees of members of the Executive Council as it may determine and determine their terms of reference and powers.

(e) To regulate its meetings and the meetings of its standing or *ad hoc* committees.

(f) To appoint and dismiss officials, the appointment being in no case subject to a longer period of notice of termination than one year.

(g) To pay travelling costs and subsistence allowances to any person where it deems it necessary to do so in the interests of the Association.

17. MEETINGS AND PROCEDURE OF THE EXECUTIVE COUNCIL.

(1) The Executive Council shall meet as often as the business of the Association may require, but at least one meeting per year shall be held at a suitable time between Conventions.

(2) Eight members shall constitute a quorum at a meeting of the Executive Council.

16. PLIGTE EN BEVOEGDHEDE VAN DIE UITVOERENDE RAAD.

Die sake van die Vereniging sal bestuur word deur die Uitvoerende Raad ooreenkomstig hierdie konstitusie en die besluite van die Konvensie. Die Uitvoerende Raad sal gemagtig wees om die doelstellings van die Vereniging uit te voer en sal in besonder die volgende bevoegdhede namens die Vereniging uitoefen, sodanige bevoegdhede synde bykomstig tot die bevoegdhede reeds hiervoor aan die Uitvoerende Raad toegewys:—

(a) Om die gelde en ander eiendom van die Vereniging te ontvang, te administreer en aan te wend en om gelde wat nie onmiddellik benodig word deur die Vereniging nie, te belê en om sodanige beleggings te wysig of tot geld te maak.

(b) Om enige kontrak namens die Vereniging te sluit en om enige regsgeding namens die Vereniging in te stel, of te laat instel, te voer of te laat voer, of te skik of te laat vaar, asook om enige regsgeding teen die Vereniging te verweer of te skik.

(c) Om ondertekening van enige dokument namens die Vereniging te magtig: Met dien verstande dat alle dokumente waarby die finansies van die Vereniging betrokke is deur die Sekretaris/Tesourier onderteken sal word, asook deur ten minste een lid van die Uitvoerende Raad daartoe gemagtig deur die Uitvoerende Raad of in die algemeen of in besonder.

(d) Om sodanige staande of *ad hoc* komitees van lede van die Uitvoerende Raad aan te stel as wat die Uitvoerende Raad mag bepaal en om hulle verwysingsterme en bevoegdhede te bepaal.

(e) Om sy eie vergaderings en die vergaderings van sy staande of *ad hoc* komitees te reël.

(f) Om amptenare aan te stel en te ontslaan, mits die aanstelling in geen geval onderworpe sal wees aan 'n langer periode van kennisgewing van beëindiging van dienste as een jaar nie.

(g) Om reiskoste en onderhoudstoelae aan enige persoon te betaal, waar die Uitvoerende Raad dit nodig beskou in die belang van die Vereniging.

17. VERGADERINGS EN PROSEDURE VAN DIE UITVOERENDE RAAD.

(1) Die Uitvoerende Raad sal so dikwels as wat die besigheid van die Vereniging dit mag vereis, vergader; maar ten minste een vergadering per jaar sal gehou word te geleë tyd tussen Konvensies.

(2) Agt lede sal 'n kworum vorm by 'n vergadering van die Uitvoerende Raad.

(3) The President shall preside at meetings of the Executive Council, and, in his absence, the Vice-President. When they are both absent, the Executive Council shall elect a chairman for the meeting from its members.

18. FINANCIAL YEAR OF THE ASSOCIATION.

The Financial Year of the Association shall commence on 1st March of each year.

19. SECRETARY/TREASURER.

(1) The Executive Council shall appoint a Secretary/Treasurer who shall be the chief official of the Association. His services shall be terminable by not more than one year's notice by the Executive Council. Any vacancy in this position shall be filled by the Executive Council.

(2) The Executive Council shall determine the remuneration and duties of the Secretary/Treasurer whose duties shall include the keeping of a register of members and affiliates of the Association, the keeping of the accounts of the Association, the editing of the Association's news letters, the undertaking of the headquarters organisation of Conventions, the secretarial work connected with the Convention, the Executive Council and the committees, and the annual presentation to the Convention of the Report and Balance Sheet of the Association for the preceding year.

20 HONORARY LEGAL ADVISER.

The Executive Council may from time to time appoint an Honorary Legal Adviser to the Association.

21. PUBLICITY.

The Executive Council may authorise the President with the Secretary/Treasurer to make such statements to the press as the President and the Secretary/Treasurer may consider to be in the interest of the Association or of undertakings generally.

22. REGIONAL BRANCHES.

(1) The Executive Council may authorise the formation of a regional branch of the Association on an application signed by the representatives of at least three member undertakings. Such application shall state the circumstances which make the formation of the proposed regional branch desirable and shall indicate what undertakings should fall in the region. Such undertakings shall constitute the regional branch as may be approved by the Executive Council, and no undertaking shall be added to the branch without the approval of the Executive Council.

(3) Die President sal as voorsitter optree by vergaderings van die Uitvoerende Raad, en, in sy afwesigheid, die Vise-president. Indien hulle albei afwesig is, moet die Uitvoerende Raad uit sy lede 'n voorsitter vir die vergadering kies.

18. FINANSIELE JAAR VAN DIE VERENIGING.

Die finansiële jaar van die Vereniging sal begin op 1 Maart van elke jaar.

19. SEKRETARIS/TESOURIER.

(1) Die Uitvoerende Raad sal 'n Sekretaris/Tesourier aanstel en hy sal die hoofamptenaar van die Vereniging wees. Beëindiging van sy dienste deur die Uitvoerende Raad sal nie aan langer as een jaar kennisgewing deur die Uitvoerende Raad onderworpe wees nie. Enige vakatures in hierdie amp sal deur die Uitvoerende Raad gevul word.

(2) Die Uitvoerende Raad sal die besoldiging en pligte van die Sekretaris/Tesourier bepaal en sy pligte sal insluit die hou van 'n register van lede en geaffilieerdes van die Vereniging. Hy sal die rekenpligtige amptenaar van die Vereniging wees; hy sal die redakteur van die Vereniging se nuusbriewe wees, die hoofkwartiere organisasie van Konvensies waarneem, asook die sekretariële werk verbonde aan Konvensies, die Uitvoerende Raad en die komitees, en sy pligte sal insluit die jaarlikse voorlegging aan die Konvensie van die verslag en balansstaat van die Vereniging vir die voorgaande jaar.

20. ERE-REGSADVISEUR.

Die Uitvoerende Raad kan van tyd tot tyd 'n ere-regsadviseur van die Vereniging aanstel.

21. PUBLISITEIT.

Die Uitvoerende Raad kan die President tesame met die Sekretaris/Tesourier magtig om sodanige verklarings aan die pers te maak as hulle mag meen in die belang van die Vereniging en van ondernemings in die algemeen sal wees.

22. STREEKTAKKE.

(1) Die Uitvoerende Raad kan goedkeuring verleen vir die stigting van 'n streektak van die Vereniging op aansoek onderteken deur die verteenwoordigers van ten minste drie ondernemings met lidmaatskap van die Vereniging. Sodanige aansoek sal die omstandighede uiteensit wat die stigting van die voorgestelde streektak wenslik maak en sal aandui watter ondernemings binne die streek sal resorteer. Sodanige ondernemings sal die streektak vorm as wat goedgekeur mag word deur die Uitvoerende Raad, en geen onderneming sal tot die streektak toegevoeg word sonder die goedkeuring van die Uitvoerende Raad nie.

(2) Each regional branch may draft its own branch constitution and rules of procedure, but a copy of the branch constitution and rules shall be lodged with the Secretary/Treasurer within three months of the date of the authority to form such regional branch. The branch constitution and rules of procedure shall require the approval of the Executive Council.

(3) The minutes of the meetings of regional branches shall be sent regularly to the Secretary/Treasurer, and he may use any extracts from such minutes as he may deem fit for publication in any document or publication issued by the Association.

(4) No regional branch may bind the Association in contract without the written approval of the Executive Council first had and obtained.

(5) Notwithstanding anything in this clause contained, the quorum for regional branch meetings shall be five: Provided that representatives of at least five member undertakings are present.

23. DISSOLUTION OF THE ASSOCIATION.

(1) The Association may be dissolved if at least two-thirds of those entitled to vote at Convention vote in favour of such dissolution by postal ballot.

(2) No motion for the dissolution of the Association shall be considered unless all member undertakings were advised thereof at least three months prior to the consideration of the motion.

(3) Upon dissolution of the Association, the Executive Council shall be empowered to determine the terms and conditions of dissolution and the manner in which the assets of the Association shall be disposed of.

24. AMENDMENT OF CONSTITUTION.

(1) This constitution may be amended by decision of the Convention and after the Executive Council has reported to the Convention on the proposed amendment.

(2) The proposal for amendment of the Constitution must be contained in the agenda of the Convention and, unless proposed by the Executive Council, must be received in writing by the Secretary/Treasurer at least three months prior to the Convention.

(2) Elke streektak kan sy eie takkonstitusie en reëls van prosedure opstel, maar 'n afskrif van die takkonstitusie en reëls moet by die Sekretaris/Tesourier ingedien word binne drie maande vanaf die datum van die goedkeuring om sodanige streektak te vorm. Die takkonstitusie en reëls van prosedure moet deur die Uitvoerende Raad goedgekeur word.

(3) Die notule van die vergaderings van streektakke moet gereeld aan die Sekretaris/Tesourier gestuur word en hy kan sodanige uittreksels uit die notule haal as wat hy mag goeddink vir bekendmaking in enige dokument of publikasie uitgereik deur die Vereniging.

(4) Geen streektak kan die Vereniging kontraktueel bind sonder die voorafgaande geskrewe goedkeuring van die Uitvoerende Raad nie.

(5) Nieteenstaande enigiets in hierdie klousule bevat, sal die kworum vir vergaderings van streektakke vyf wees: Met dien verstande dat verteenwoordigers van ten minste vyf ondernemings wat lede van die Vereniging is, teenwoordig is.

23. ONTBINDING VAN DIE VERENIGING.

(1) Die Vereniging kan ontbind word indien ten minste twee-derdes van diegene wat geregtig is om te stem by die Konvensie, ten gunste van sodanige ontbinding stem by stembrief gestuur deur die pos.

(2) Geen voorstel vir die ontbinding van die Vereniging sal oorweeg word nie tensy alle ondernemings wat lede is ten minste drie maande voor die oorweging van die voorstel daarvan in kennis gestel is.

(3) By ontbinding van die Vereniging, sal die Uitvoerende Raad gemagtig wees om die voorwaardes van ontbinding te bepaal asook die manier waarop daar oor die bates van die Vereniging beskik sal word.

24. WYSIGING VAN DIE KONSTITUSIE.

(1) Hierdie konstitusie kan gewysig word by besluit van die Konvensie en nadat die Uitvoerende Raad aan die Konvensie verslag gedoen het oor die voorgestelde wysiging.

(2) 'n Voorstel vir die wysiging van die konstitusie moet vervat word in die agenda van die Konvensie en, tensy voorgestel deur die Uitvoerende Raad, moet dit op skrif ontvang word deur die Sekretaris/Tesourier ten minste drie maande voor die Konvensie.

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

MEMBERS AND DELEGATES ATTENDING THE 32nd CONVENTION
LEDE EN AFGEVAARDIGDES — 32ste KONVENSIE

COUNCIL AND ENGINEER MEMBERS
RAADS EN INGENIEURSLEDE

ALBERTON :
Odendaal, M. W.
BENONI :
Korsman, Cr. N. C.
Lees, D.
BETHAL :
Kirberger, M. N.
BETHLEHEM :
Smuts, Cr. B.
Fisher, K. M.
BLOEMFONTEIN :
Castelyn, Cr. F. J. C.
Muller, G. J.
BOKSBURG :
Kramer, Cr. I.
Von Oppell, H.D.O.
BRAKPAN :
Roux, Cr. P. F.
Vergottini, P. L.
BRITS :
de Wit, Cr. T.
Potgieter, P. F.
BULAWAYO :
Philips, Cr. J. W.
Sibson, A. R.
BURGERSDORP :
Rautenbach, G. F.
CAPE TOWN :
Peters, Cr. W. J.
Downie, C. G.
CRADOCK :
Williams, Cr. D.
Rossler, A.
DE AAR :
Macques, J. A.
DURBAN :
McIntyre, Cr. I.
Simpson, R. M. O.
EAST LONDON :
Louw, Cr. A. W.
Giles, P. A.
EDENVALE :
van der Merwe, Cr. J. F. L.
Bailey, R. V.
ERMELO :
van Zyl, Cr. P. J.
Joubert, J.
ESTCOURT :
Eriksen, J. G. F.
FORT BEAUFORT :
Verschoor, D. R.
GATOOMA :
Grandin, P. C.
GEORGE :
Dreyer, H. C.
GERMISTON :
De Bruyn, Cr. P.
Lombard, C.
GRAAF-REINET :
Schaftenaar, G. A. H.
HARRISMITH :
Hellman, Cr.
Pompe van Meerdervoort, J. L. K.
HEIDELBERG :
Rautenbach, Cr. P. H. R.
Joslin, H. C.
JOHANNESBURG :
Marais, Cr. D. J.
Kane, R. W.
KEMPTON PARK :
Jacobs, Cr. B. F.
Futcher, L.
KIMBERLEY :
Myburgh, Cr. J. L.
Mathews, J. A.
KLERKSDORP :
Gericke, J. M.
KROONSTAD :
Rossler, W.
KRUGERSDORP :
Dames, Cr. M. C.
Van der Walt, J. L.
LADYSMITH :
Hailstone, Cr. R.
LIVINGSTONE :
Beesley, W.
LOUIS TRICHARDT :
Barnard, Cr. F. A.
Lotter, G. A.
MAFEKING :
Cronje, Cr. Dr. S. C.
Jones, G. E. H.
MIDDELBURG, Cape :
Haig-Smith, D.
MIDDELBURG, Transvaal :
van Heerden, W. J. B.
MOSSEL BAY :
Lewis, L.
NDOLA :
McGibbon, J.
ODENDAALSRUS :
Brown, D. C.
PAARL :
Knott-Craig, Cr. J. F.
Relihan, H. J.
PARYS :
Pretorius, D. R.
PIETERMARITZBURG :
Pierce, Cr. R. L.
Waddy, J. C.
PIETERSBURG :
Bekker, Col. A. J.
Inglis, J. I.
PORT ELIZABETH :
Chaplin, Cr. E. L.
Nobbs, D. Murray.
POSTMASBURG :
Huysamen, Cr. G. A.
Broden, Cr. N. C.

POTCHEFSTROOM :
van Eeden, Cr. K. N.
Barnard, F. J. W.
POTGIETERSRUST :
Ross, J. W.
PRETORIA :
Blignaut, Cr. P. G. C.
Hugo, D. J.
Wilson, J.
QUEENSTOWN :
Chemaly, Cr. J. H.
Barratt, V. E. O.
RANDFONTEIN :
Pretorius, Cr. P.
Cherry, J. R.
RIVERSDALE :
Adams, C. H.
ROBERTSON :
de Jong, Cr. J. E. N.
De Villiers, S.
ROODEPOORT-MARAISBURG :
Hugo, Cr. H. J.
Brown, D. D.
RUSTENBURG :
Meintjes, P. A.
SALISBURY :
Divaris, Cr. D.
Tanner, Cr. H. D.
Jaffray, Alderman M.
Mitchell, J. E.
SOMERSET WEST :
Mackay, Cr. R. C.
Erasmus, H. A.
SPRINGS :
Davies, Cr. L. P.
Murray, Cr. A. S.
Downey, J. C.
STANDERTON :
Van der Merwe, Cr. L. J.
Heunis, G. B.
STELLENBOSCH :
Lategan, J. F.
STRAND, THE
Sims, C. N.
UITENHAGE :
Calder, Cr. D. G.
Dawson, J. D.
UMTATA :
Nelson, Cr. C. W.
Paull, R. A.
UMTALI :
Mussett, Cr. B. H.
Turner, H. T.
UPINGTON :
Basson, Cr. N. S.
Muller, Cr. H. M. S.
Psotta, K. U.
VEREENIGING :
Oliver, Cr. R. W.
Turnbull, A. F.
VIRGINIA :
Hobbs, I. L.
Gibbs, Cr. K. D.
VRYHEID :
van Rensburg, Cr. S. J.
Rush, W.
WARMBATHS :
Prinsloo, Cr. D.
Harvey, A. Q.
WELKOM :
Meyer, Cr. W. F.
Barton, R. W.
WELLINGTON :
Joubert, Cr. P. G.
Aalbers, G.
WESTONARIA :
Bentel, Cr. M.
Dreyer, L.
WINDHOEK :
Dixon, Cr. F. H. C.
Bellingan, G. F.
WITBANK :
De Villiers, E E.
WORCESTER :
Geldenhuys, Cr. J. P.
Theron, W.

OTHER MEMBERS/ANDER LEDE :

D. A. Bradley (Hon. Member)
J. S. Clinton (Associate Member)
D. R. J. Conradie (Associate Member)
H. A. Eastman (Hon. Member)
J. C. Fraser (Hon. Member)
W. H. Milton (Hon. Member)
H. M. S. Muller (Associate Member)
Major S. G. Redman (Hon. Member)
G. C. Theron (Associate Member)
J. D. Hattingh (Engineer Member)
J. T. Williams (Associate Member)
Alderman, Morton Jaffray (Hon. Member)

A.M.E.U. OFFICIALS/V.M.E.O. AMPTENARE :

A. P. Burger (Hon. Legal Adviser)
Miss Y. M. Grant and Mrs. D. M. Gow (Cape Town City Council).
R. G. Ewing (Representing the Secretaries)
Mrs. H. G. Simms (Convention Proceedings Clerk)

DELEGATES/AFGEVAARDIGDES :

GOVERNMENT DEPARTMENTS AND PUBLIC UTILITY UNDERTAKINGS
GOEVERNEMENTS DEPARTEMENTE EN PUBLIEKE UTILITEITSONDERNEMINGS

G. R. Blake, Department of Posts and Telegraphs, General Post Office.
J. P. Brand, Electricity Supply Commission, Cape Western Undertaking.
C. R. Burton, Electricity Supply Commission, Cape Northern Undertaking.
E. Dalton, South West African Administration (Inspector of Factories, Engineering).
G. D. G. Davidson, Electricity Supply Commission, Cape Western Undertaking.

J. J. de Haas, Public Works Department.
C. W. H. du Toit, South African Bureau of Standards.
C. W. Everett, Electricity Supply Commision (Cape Western Undertaking).
Dr. T. J. Hugo, Council for Scientific & Industrial Research.
A. Jackson, Cape Provincial Administration.
W. L. King, South African Railways.
A. W. Lineker, Rand Water Board.
G. J. Malan, Chief Inspector of Factories, Department of Labour, and Electrical Wiremen's Registration Board.
I. R. Minnaar, Electricity Supply Commission, Cape Western Undertaking.
F. Prins, South African Bureau of Standards.
J. E. Shaw, Department of Labour.
Prof. A. Heydorn, Electricity Control Board.

OTHER REPRESENTATIVES/ANDER VERTEENWOORDIGERS :

I. H. M. Drewett, South African Institution of Certificated Engineers.
Dr. H. D. Einhorn, South African Institute of Electrical Engineers.
Dr. P. N. Lategan, Transvaal Coal Owners' Association.
R. W. Lord, S.A. Cable Makers Association, S.A.
S. Revow, Electrical Contractors Association, S.A.
J. White, South African Institutjon of Mechanical Engineers.

VISITORS/BESOEKERS :

W. J. B. Slater, Acting Administrator for the Cape Province.
Col. J. W. O. Billingham, Mayor of Cape Town.
J. H. Bester, Ventersdorp Municipality.
P. W. Cave, Cable Makers Association, London.
H. A. Durr, Peri-Urban Areas Health Board, Pretoria.
B. B. Evans, Cable Makers Association, London.
R. Guelke, University of Cape Town.
Prof. A. Heydorn, Faculty of Engineering, University of Stellenbosch.
C. S. Marx, South African Federated Chamber of Industries.
S. A. Rowe, United Kingdom Trade Commisjoner.
H. Wood, Electricity Department, Cape Town.
J. White, Cape Town.

AFFILIATES/VERBOUDES :

African Explosives & Chemical Industries Ltd.	W. J. Maxwell.
Aberdare Cables (Africa) Ltd.	C. von Lindern, G. Mcl. Yuill.
Aberdare Construction Co. of S.A. (Pty.) Ltd.	T. D. Pratt.
Adams, Symes & Partners	K. Adams
African Cables, Ltd.	J. Berry, G. Yates.
The Aluminium Co. of S.A. (Pty.) Ltd.	E. B. Martin.
Arthur Trevor Williams (Pty.) Ltd.	J. T. Williams, J. A. Barnett.
Aycliffe Cables Ltd.	C. Rist, R. Bell.
Aluminium Co. of Africa.	Boyd.
Sir Alexander Gibb & Partners (Africa).	P. Samuel.
Asea Electric (Pty.) Ltd.	P. Rottier, F. Frank, J. S. Woosley.
Babcock & Wilcox of Africa Ltd.	H. M. Carlin, J. C. Callie, L. F. Johns.
British General Electric Co. Ltd.	L. Chuck, H. S. Turner, W. Hill.
British Insulated Calendars Cables S.A. (Pty.) Ltd.	A. L. Sanders, A. W. Allen, E. R. Welch.
British Thamson-Houston Co. S.A. (Pty.) Ltd.	L. G. Axe, I. E. Botha.
A. M. Burgun (Pty.) Ltd.	G. Gerber.
Caltex (Africa) Ltd.	E. F. Partridge, E. M. Arnot.
Chloride Electrical Storage Co. S.A. (Pty.) Ltd	A. C. Tilley.
C. M. B. Engineering Co. (Pty.) Ltd.	F. W. de Zeeuw.
Construction Electric Co. (Pty.) Ltd.	R. C. Jordan.
Contactor (Pty.) Ltd.	D. E. Raubenheimer, D. A. Anderson.
Cooper & de Beer (Pty.) Ltd.	C. L. de Beer.
Davidson & Co. (Africa) (Pty.) Ltd.	W. C. Massie.
Dowson & Dobson, Ltd.	W. D. Hutty.
Enfield Cables (S.A.) (Pty) Ltd.	D. R. Domisse, A. E. Torrance.
English Electric Co. (S.A.) Ltd.	G. V. Jackson, H. Prins.
Falks Electrical Supplies (S.A.) (Pty.) Ltd.	R. C. Viviers, G. Aitcheson.
First Electric Corporation of S.A. Ltd.	H. Boyd-Brown, C. A. Visser.

F. W. J. Electrical Industries	G. R. Hajn.
George Kent (S.A.) (Pty.) Ltd.	G. H. Troop.
E. K. Green & Son S.A. (Pty.) Ltd.	A. W. Bulless.
Henleys S.A. Telegraph Works Co. Ltd.	R. W. Lord.
Hopkinsons S.A. (Pty.) Ltd.	E. C. Enfield, W. G. van Aswegen.
James Howden & Co. (Pty.) Ltd.	E. P. Rodger, A. MacDonald.
International Combustion Africa Ltd.	Q. R. Nothard.
John Thompson (S.A.) (Pty.) Ltd.	J. Bout, C. Broers, P. H. Stirzaker.
Johnson & Phillips (S.A.) (Pty.) Ltd.	E. W. Dixon, N. Lennox-Trewren.
R. T. Jones.	R. T. Jones.
John Brown Land Boilers (Africa) (Pty.) Ltd.	G. E. Chambers.
G. H. Langler & Co. Ltd.	G. H. Boyle, M. Gray.
G. H. Marais.	G. H. Marais.
Harold Marthinusen & Co. (Pty.) Ltd.	G. Roeske.
Merz & McLellan	T. R. J. Bishop, S. G. Redman, C. E. R. Langford, H. H. Jagger.
Metropolitan Vickers (S.A.) (Pty.) Ltd.	S. McCracken, J. Monks, W. H. Eastman.
C. A. Parsons & Co. S.A. (Pty.) Ltd.	H. M. Rochester, F. W. Gardner.
C. A. Parsons (Rhodesia) Ltd.	I. S. L. Clunas.
Reunert & Lenz, Ltd.	H. B. Willis. J. H. Todd.
A. Reyrolle & Co., Ltd.	W. J. Gibbons, C. A. Stephens, C. R. J. Pilcher.
Rice & Diethelm, Ltd.	T. F. Suttie, J. O. Hunt.
S. A. General Electric Co. Ltd.	F. P. Kuttel, L. New, F. Duke.
S. A. Philips (Pty.) Ltd.	Dr. J. C. R. Heydenrych, D. H. Pieksma.
Samuel Osborn (S.A.) Ltd.	H. Snow, R. E. Harden.
Scottish Cables (S.A.) Ltd.	D. G. Sutherland, A. C. Grant.
Selby Engineers/Wright Anderson	K. M. Johnston.
Siemens Bros. British (Pty.) Ltd.	E. B. Sidney, A. G. Norris.
Standard Telephones & Cables, Ltd.	T. R. Johnson.
Stamcor (Pty.) Ltd.	J. M. Taylor.
Stewarts & Lloyds of S.A. Ltd.	T. A. Robinson, B. I. Harris.
Superconcrete Pipes S.A. Ltd.	P. H. Levick.
Simplex Electric Co. (S.A.) Ltd.	J. A. Morrison, A. K. Dean.
Union Steel Corporation S.A. Ltd.	J. T. Oosthuizen, T. N. D. Griffin.
M. Wegener & Co. (Pty.) Ltd.	M. Wegener.
Wilson & Herd (Pty.) Ltd.	W. N. Herd.
Yorkshire Transformers S. A. (Pty.) Ltd.	A. Singer.

LADIES/DAMES :

Adams, Mrs. C. H.
Anderson, Mrs. D. A.
Aspinall, Mrs. H. T.
Axe, Mrs. L. G.
Bout, Mrs. J.
Bekker, Mrs. A. J.
Bailey, Mrs. R. V.
Barnard, Mrs. F. A.
Barnard, Mrs. F. J. W.
Barnett, Mrs. J. A.
Barratt, Mrs. V. E. O.
Basson, Mrs. N. S.
Bates, Mrs. R. J.
Bell, Mrs. R.
Bishop, Mrs. T. R. J.
Blake, Mrs. G. R.
Boyd-Brown, Mrs. H.
Boyle, Mrs. G. H.
Bradley, Mrs. D. A.
Brand, Mrs. J. P.
Brown, Mrs. D. C.
Bulless, Mrs. A. W.
Burton, Mrs. C. R.
Baxter, Mrs. J. D. C.
Botha, Mrs. I. E.
Broers, Mrs. C.
Callie, Mrs. J. C.
Carlin, Mrs. H. M.
Castelyn, Mrs. F. J. C.
Cherry, Mrs. J. R.
Chuck, Mrs. L.
Clinton, Mrs. J. S.
Clunas, Mrs. I. S. L.
Conradie, Mrs. D. J. R.
Cottier, Mrs. J.
Cronje, Mrs. S. C.
Dames, Mrs. M. C.
Davidson, Mrs. G. D. G.
Davies, Mrs. L. P.
Dawson, Mrs. J. D.
de Beer, Mrs. C. L.
de Villiers, Mrs. S.
de Villiers, Mrs. E. E.
Dixon, Mrs. E. W.
Dixon, Mrs. F. H. C.
Doughty, Mrs. H.
Downey, Mrs. J. C.
Drewett, Mrs. I. H. M.
Dreyer, Mrs. H. C.
du Toit, Mrs. C. W. H.
de Villiers, Mrs. C.
Eastman, Mrs. H. A.
Eastman, Mrs. W. H.
Enfield, Mrs. E. C.
Erikson, Mrs. J. G. F.
Everett, Mrs. C. W.
Fisher, Mrs. K. M.
Fraser, Mrs. J. C.
Futcher, Mrs. L.
Gardner, Mrs. F. W.
Gericke, Mrs. J. M.
Gibbons, Mrs. W. J.
Gibbs, Mrs. K. D.
Giles, Mrs. P. A.
Grant, Mrs. A. C.
Gray, Mrs. M.
Guelke, Mrs. R.
Haig-Smith, Mrs. D.
Harris, Mrs. B. I.
Hattingh, Mrs. J. W.
Heunis, Mrs. G. B.
Heydenrych, Mrs. J. C. R.
Hobbs, Mrs. I. L.
Hutty, Mrs. W. D.
Inglis, Mrs. J. I.
Jackson, Mrs. G. V.
Jagger, Mrs. H. H.
Johnson, Mrs. T. R.
Johnston, Mrs. K. M.
Kane, Mrs. R. W.
King, Mrs. W. L.
Kirberger, Mrs. M. N.
Langford, Mrs. C. E. R.
Lategan, Mrs. J. F.

Lees, Mrs. D.
Levick, Mrs. P. H.
Lewis, Mrs. L.
Lombard, Mrs. C.
Lord, Mrs. R. W.
Lotter, Mrs. G. A.
Louw, Mrs. A. W.
Marais, Mrs. D. J.
Marais, Mrs. G. H.
Mathews, Mrs. J. A.
McCracren, Mrs. S.
Meyer, Mrs. W. F.
Milton, Mrs. W. H.
Minnaar, Mrs. I. R.
Monks, Mrs. J.
Muller, Mrs. H. M. S.
Muller, Mrs. G. J.
Murray, Mrs. A. S.
Nelson, Mrs. C. W.
Nobbs, Mrs. D. Murray
Norris, Mrs. A. G.
Nothard, Mrs. Q. R.
Odendaal, Mrs. M. W.
Oliver, Mrs. R. W.
Paull, Mrs. R. A.
Pieksma, Mrs. D. H.
Pilcher, Mrs. C. R. J.
Potgieter, Mrs. N. A.
Pompe van Meerdervoort, Mrs. J. L. K.
Pratt, Mrs. T. D.
Pretorius, Mrs. D. R.
Prins, Mrs. F.
Revow, Mrs. S.
Rafferty, Mrs. T. H.
Rautenbach, Mrs. P. H. R.
Rist, Mrs. C.
Robinson, Mrs. T. A.
Ross, Mrs. J. W.
Rossler, Mrs. A.
Rossler, Mrs. W.
Rush, Mrs. W.
Rowe, Mrs. S. A.
Samuel, Mrs. P.
Sharp, Mrs. V.
Schaftenaar, Mrs. G. A. H.
Simpson, Mrs. R. M. O. and the two Misses Simpson
Sims, Mrs. C. N. and Miss Sims
Smith, Mrs. L. Denbigh
Solomon, Mrs. I.
Stevens, Mrs. F.
Sutherland, Mrs. D. G.
Setzer, Mrs.
Singer, Mrs. A.
Stirzaker, Mrs. P. H.
Theron, Mrs. W. C.
Toop, Mrs. G. H.
Torrance, Mrs. A. E.
Turnbull, Mrs. A. F.
Turner, Mrs. H. S.
van Aswegen, Mrs. W. G.
van der Merwe, Mrs. J. F. L.
van der Merwe, Mrs. L. J.
van Zyl, Mrs. P. J.
Vergottini, Mrs. P. L.
Verschoor, Mrs. D. R.
Visser, Mrs. C. A.
Viviers, Mrs. R. C.
von Oppell, Mrs. H. D.O.
Welch, Mrs. E. R.
Williams, Mrs. J. T.
Wilson, Mrs. J.
Yates, Mrs. G.

THE ASSOCIATION OF MUNICIPAL
ELECTRICITY UNDERTAKINGS
OF SOUTHERN AFRICA

AGENDA AND PROGRAMME

32ND ANNUAL CONVENTION

TO BE HELD AT THE

CIVIC CENTRE
CAMPS BAY

FROM THE

15TH TO 18TH APRIL, 1958

AGENDA FOR THE ANNUAL GENERAL MEETING

1. Election of President.
2. Venue of next Convention.
3. Election of Vice-President.
4. Amendments to Constitution as proposed by the Executive Council.
5. Election of Executive Council, Sub-Committees and Representatives.
6. Annual Report of Secretaries.
7. Appointment of Auditors.
8. Presidential Address.
9. Reports of Sub-Committees and Representatives.
   - (i) Electrical Wiremen's Registration Board.
   - (ii) South African Bureau of Standards.
   - (iii) Coal Allocation Committee.
   - (iv) Safety Precautions Committee.
   - (v) Tariffs Survey Committee.
   - (vi) Recommendations Committee for New Electrical Commodities.
   - (vii) Papers.
   - (viii) Technical Staff and Man Power.
   - (ix) Rights of Supply—Industrial Consumers.
   - (x) S.A.I.E.E. Committee—Code of Practice for Sub-Stations.
10. General.

DIE VERENIGING VAN MUNISIPALE
ELEKTRISITEITSONDERNEMINGS
VIR SUIDELIKE AFRIKA

AGENDA EN PROGRAM

VIR DIE

32STE JAARLIKSE KONVENSIE

WAT GEHOU SAL WORD IN DIE

BURGERSENTRUM
KAMPSBAAI

VANAF

15 TOT 18 APRIL 1958

AGENDA VIR DIE ALGEMENE JAARVERGADERING

1. Verkiesing van President.
2. Vergaderplek vir volgende Konvensie.
3. Verkiesing van Onder-President.
4. Wysigings van die Grondwet soos dit deur die Uitvoerende Raad voorgestel is.
5. Verkiesing van die Uitvoerende Raad, Onder-Komitees en Verteenwoordigers.
6. Jaarverslag van die Sekretarisse.
7. Aanstelling van die Ouditeure.
8. Presidentsrede.
9. Verslae van Onder-komitees en Verteenwoordigers.
   - (i) Raad vir Registrasie van Draadwerkers.
   - (ii) Suid Afrikaanse Buro vir Standaarde.
   - (iii) Komitee vir die Toekenning van Steenkool.
   - (iv) Komitee vir Veiligheidsmaatreëls.
   - (v) Komitee van Ondersoek na Elektrisiteitstariewe.
   - (vi) Komitee vir die Aanbevelings oor Nuwe Elektriese Toerustings.
   - (vii) Verhandelinge.
   - (viii) Tegniese Personeel en Mannekrag.
   - (ix) Regte van Voorsiening — Industriële Verbruikers.
   - (x) S.A.I.E.I. Komitee—Kode van Gebruik by Sub-Stasies.
10. Algemeen.

RETIRING OFFICERS

President : J. L. VAN DER WALT, Krugersdorp.

Vice-President : C. G. DOWNIE, Cape Town.

Immediate Past Presidents : J. E. MITCHELL, Salisbury; D. J. HUGO, Pretoria.

Engineer Members : R. W. KANE, Johannesburg; C. J. MULLER, Bloemfontein; A. R. SIBSON, Bulawayo; P. A. GILES, East London; R. M. O. SIMPSON, Durban; J. C. DOWNEY, Springs.

Cities or Town represented : Krugersdorp, Cape Town, Salisbury, Pretoria, Johannesburg, Bulawayo, Bloemfontein, East London, Durban, Springs.

NOTE.—The Town or City is elected and not the individual Councillor.

AFTREDENDE AMPSDRAERS

President : J. L. VAN DER WALT, Krugersdorp.

Onder-president : C. G. DOWNIE, Cape Town.

Oud-presidente : J. E. MITCHELL, Salisbury; D. J. HUGO, Pretoria.

Ingenieurslede : R. W. KANE, Johannesburg; C. J. MULLER, Bloemfontein; A. R. SIBSON, Bulawayo; P. A. GILES, East London; R. M. O. SIMPSON, Durban; J. C. DOWNEY Springs.

Stede of Dorpe Verteenwoordig : Krugersdorp, Kaapstad, Salisbury, Pretoria, Johannesburg, Bulawayo, Bloemfontein, Oos Londen, Durban, Springs.

L.W.—Die Stad of Dorp word verkies en nie individuele Raadslede nie.

MEMBERS OF SUB-COMMITTEES AND REPRESENTATIVES

SUB-COMMITTEES :

Papers :

J. L. Van Der WALT (President); C. G. DOWNIE (Vice-President) J. E. MITCHELL (Past President).

Tariffs Survey :

R. W. KANE (Convenor), C. G. DOWNIE, A. R. SIBSON, J. C. DOWNEY (with co-opted members).

Finance :

R. W. KANE (Convenor), J. C. DOWNEY.

Recommendations Committee for New Electrical Commodities :

J. C. DOWNEY, D. J. HUGO (Alternate).

Technical Staff and Man Power :

J. L. VAN DER WALT (Convenor), R. M. O. SIMPSON, A. R. SIBSON, P. A. GILES, J. C. DOWNEY, H. T. ASPINALL (Co-opted).

Rights of Supply—Industrial Consumers :

C. LOMBARD (Convenor), D. J. HUGO, J. C. DOWNEY, P. A. GILES.

REPRESENTATIVES :

Electrical Wiremen's Registration Board : R. W. Kane.

Coal Allocation Committee : D. J. Hugo; R. W. Kane, Alternate.

Safety Precautions Committee : J. C. Fraser; J. C. Downey, Alternate.

S. A. Bureau of Standards : J. C. Downey, C. Lombard (Alternate).

S.A.I.E.E. Committee — Code of Practice for Sub-Stations : J. L. Van Der Walt.

LEDE VAN ONDER-KOMITEES EN VERTEENWOORDIGERS.

ONDER-KOMITEES :

Referate :

J. L. Van Der WALT, President; C. G. DOWNIE, Onder-president; J. E. MITCHELL, Oud-president.

Komitee van Ondersoek na Elektrisiteitstariewe :

R. W. KANE (Belêer), C. G. DOWNIE, A. R. SIBSON, J. C. DOWNEY met gekoöpteerde lede.

Finansieële Komitee :

R. W. KANE (Belêer), J. C. DOWNEY.

Komitee vir Aanbevelings oor Nuwe Elektriese Toerusting :

J. C. DOWNEY, D. J. HUGO (Alt.).

Tegniese Personeel en Mannekrag :

J. L. VAN DER WALT (Belêer), R. M. O. SIMPSON, A. R. SIBSON, P. A. GILES, J. C. DOWNEY, H. T. ASPINALL (Gekoöpteer).

Regte van Voorsiening—Randse Industrieële Verbruikers :

C. LOMBARD, Belêer; D. J. HUGO, J. C. DOWNEY, P. A. GILES.

VERTEENWOORDIGERS :

Registrasieraad vir Elektriese Draadwerkers : R. W. Kane.

Komitee vir die Toekenning van Steenkool : D. J. Hugo; R. W. Kane, Alt.

Komitee vir Veiligheidsmaatreëls : J. C. Fraser; J. C. Downey, Alt.

Suid Afrikaanse Buro vir Standaarde : J. C. Downey, C. Lombard (Alt.).

S.A.I.E.I. Komitee — Kode van Gebruik by Sub-Stasie : J. L. Van Der Walt.

PROGRAMME :

MONDAY, 14th APRIL, 1958.

9.30 a.m. — 4.30 p.m. — Meeting of Executive Council.

6.00 p.m. — 10.00 p.m. — Civic Welcome and Cocktail Party at City Hall.

TUESDAY, 15th APRIL, 1958.

8.45 a.m.—Registration.

9.30 a.m.—Welcome by His Worship the Mayor of Cape Town, Colonel J. W. O. Billingham.

Official opening of the Convention by His Honour the Administrator for the Cape Province, the Hon. P. J. Olivier.

Election of President.

Venue of next Convention.

Election of Vice-President.

10.30 a.m.—Refreshment Interval.

11.00 a.m.—Official Photograph.

11.30 a.m.—Presentations (Past Presidents' Medals and Certificates).

11.45 a.m.—Election of Office Bearers.

12.15 p.m.—Presidential Address.

1.00 p.m.—Luncheon Adjournment.

2.30 p.m.—Paper: "Gas Pressure and Oil Filled Cables" by P. W. Cave and film and slides.

3.30 p.m.—Refreshment Interval.

4.00 p.m.—Discussion on Mr. Cave's paper.

5.30 p.m.—Adjournment.

8.00 p.m.—Entertainment.

WEDNESDAY, 16th APRIL, 1958.

8.30 a.m.—Meeting of Executive Council.

9.30 a.m.—Convention resumes.

Communications from Council.

Annual Report of Secretaries.

Appointment of Auditors.

10.30 a.m.—Refreshment Interval.

11.00 a.m.—Paper: "Synthetic Rubber and Thermoplastic Cables" by B. B. Evans with film and slides followed by discussion if time permits.

12.00 p.m.—Luncheon Adjournment.

1.45 p.m.—Motor Trip to Paarl and visit K.W.V. Winery. Return via Helshoogte and Stellenbosch.

8.15 p.m.—Members' Forum.

10.00 p.m.—Refreshments and Adjournment.

THURSDAY, 17th APRIL, 1958.

8.30 a.m.—Meeting of Executive Council.

9.30 a.m.—Convention resumes.

Communications from Council.

Discussion on Messrs. B. B. Evans' and P. W. Cave's Papers.

PROGRAM

MAANDAG, 14 APRIL, 1958.

9.30 vm.— 4.30 nm.—Vergadering van die Uitvoerende Raad.

6.00 nm.—10.00 nm.—Burgerlike Verwelkoming en Skemerkelkpartytjie in Stadsaal.

DINSDAG, 15 APRIL, 1958.

8.45 vm.—Registrasie.

9.30 vm.—Verwelkoming deur Sy Edelagbare die Burgemeester van Kaapstad, Kolonel J. W. O. Billingham.

Amptelike opening van die Konvensie deur Sy Edele die Administrateur van die Kaapprovinsie, Mnr. P. J. Olivier.

Kiesing van die President.

Vergaderplek van die volgende Konvensie.

Kiesing van die Onder-President.

10.30 vm.—Pouse. Verversings.

11.00 vm.—Amptelike Foto.

11.30 vm.—Presentasie van Erepennings en Sertifikate aan Oud-Presidente.

11.45 vm.—Verkiesing van Ampsdraers.

12.15 nm.—Rede van die President.

1.00 nm.—Verdaging vir Middagete.

2.30 nm.—Referaat: „Gasdrukking en Oliegevulde Kabels" deur P. W. Cave. (Met behulp van Films en Strokies).

3.30 nm.—Pouse. Verversings.

4.00 nm.—Bespreking: Mnr. Cave se referaat.

5.30 nm.—Verdaging van Konvensie.

8.00 nm.—Onthaal.

WOENSDAG, 16 APRIL, 1958.

8.30 vm.—Vergadering van die Uitvoerende Raad.

9.30 vm.—Konvensie-werksaamhede word hervat. Aankondigings van die Uitvoerende Raad.

Jaarverslag van die Sekretarisse.

Aanstelling van Ouditeure.

10.30 vm.—Pouse. Verversings.

11.00 vm.—Referaat: „Sintetiese Rubber en Termoplastiese Kabels" deur B. B. Evans (Met behlp van films en strokies). Indien daar tyd is sal 'n bespreking oor die referaat geskied.

12.00 nm.—Verdaging vir Middagete.

1.45 nm.—Motortoer na Paarl en besoek aan K.W.V. Wynkelders. Terugtog oor Helshoogte en Stellenbosch.

8.15 nm.—Ledeforum.

10.00 nm.—Verversings en Verdaging.

DONDERDAG, 17 APRIL, 1958.

8.30 vm.—Vergadering van die Uitvoerende Raad.

9.30 vm.—Konvensie-werksaamhede word hervat

Aankondigings van die Uitvoerende Raad.

Bespreking van Mnre. B. B. Evans en P. W. Cave se referate.

10.30 a.m.—Refreshment Interval.

11.00 a.m.—Paper: "The Design and Economics of Township Reticulation by Low Voltage Overhead Mains" by H. Wood (Cape Town).
Discussion on Mr. Wood's paper.
Further discussion on previous papers and/or continuation of Members' Forum.

12.45 p.m.—Luncheon Adjournment.

2.30 p.m.—Convention resumes.
Amentments to Constitution proposed by Executive Council.
Reports of Sub-Committees and discussion thereon.

4.30 p.m.—Adjournment.

8.30 p.m.—Convention Ball at Weizmann Hall, Regent Road, Sea Point.

FRIDAY, 18th APRIL, 1958.

8.30 a.m.—Meeting of Executive Council.

9.30 a.m.—Convention resumes.
Communications from Council.
General.

10.30 a.m.—Refreshment Interal.

11.00 a.m.—Closing Session.

LADIES' PROGRAMME:

MONDAY, 14th APRIL, 1958.

6.00 p.m. — 10.00 p.m. — Civic Welcome and Cocktail Party at City Hall, Cape Town.

TUESDAY, 15th APRIL, 1958.

9.30 a.m.—Assemble for Official Opening of Convention.

10.30 a.m.—Refreshments.

11.00 a.m.—Official Photograph.

11.30 a.m.—Presentation of Past Presidents' Medals and Certificates.

Afternoon—Motor Trip via Hout Bay and Chapman's Peak to Muizenberg for Tea. Return via Constantia and De Waal Drive.

WEDNESDAY, 16th APRIL, 1958.

Morning — Free.

1.45 p.m.—Motor Trip to Paarl and Visit to K.W.V. Winery. Return via Helshoogte and Stellenbosch.

THURSDAY, 17th APRIL, 1958.

Morning — Tea with Mayoress at Kirstenbosch.

Afternoon—Free.

8.30 p.m.—Convention Ball at Weizmann Hall, Regent Road, Sea Point.

FRIDAY, 18th APRIL, 1958.

10.30 a.m.—Assemble for refreshments and closing session of Convention.

10.30 vm.—Pouse. Verversings.

11.00 vm.—Referaat: „Die Ontwerp en Ekonomie van Bolugse Laagspanningskraglyne vir Dorpsgebiede" deur H. Wood (Kaapstad).
Bespreking van Mnr. Wood se referaat.
Besprekings verder van vorige referate en/of hervatting van Ledeforum.

12.45 nm.—Verdaging vir Middagete.

2.30 nm.—Konvensie-werksaamhede word hervat.
Wysiging van Grondwet, soos dit deur die Uitvoerende Raad voorgestel is.
Verslae en bespreking van verslae van Onderkomitees.

4.30 nm.—Verdaging.

8.30 nm.—Konvensiedans te Weizmannsaal, Regentpad, Seepunt.

VRYDAG, 18 APRIL, 1958.

8.30 vm.—Vergadering van die Uitvoerende Raad.

9.30 vm.—Konvensie-werksaamhede word hervat.
Aankondigings van Uitvoerende Raad.
Algemeen.

10.30 vm.—Pouse. Verversings.

11.00 vm.—Konvensie word afgesluit.

PROGRAM VIR DAMES:

MAANDAG, 14 APRIL, 1958.

6.00 nm. — 10.00 nm.—Burgerlike Verwelkoming en Skemerkelkpartytjie in die Stadsaal, Kaapstad.

DINSDAG, 15 APRIL, 1958.

9.30 vm.—Vergader vir die amptelike opening van die Konvensie.

10.30 vm.—Verversings.

11.00 vm.—Amptelike Foto.

11.30 vm.—Presentasie van Erepennings en Sertifikate aan Oud-Presidente.

Middag —Motortoer oor Houtbaai en „Chapman's Peak" na Muizenberg vir tee.
Terug oor Constantia en De Waalrylaan.

WOENSDAG, 16 APRIL,; 1958.

Oggend —Geen reëlings.

1.45 nm.—Motortoer na Paarl en besoek aan K.W.V. Wynkelders. Terug oor Helshoogte en Stellenbosch.

DONDERDAG, 17 APRIL, 1958.

Oggend —Burgemeestersvrou se teepartytjie—Kirstenbosch.

Middag —Geen reëlings.

8.30 nm.—Konvensiedans te Weizmannsaal, Regentpad, Seepunt.

VRYDAG, 18 APRIL, 1958.

10.30 vm.—Vergader vir verversings en die sluiting van die Konvensie.

OFFICIAL PHOTO/AMTELIKE FOTO 1958

The Thirty-Second Convention of the Association was opened in the Civic Centre, Camps Bay, Cape Town, by Mr. W. B. J. Slater, acting Administrator of the Cape Province, at 9.30 a.m. on Tuesday 14th April, 1958.

Attendance at the Convention was as follows:— 75 Councils represented by 54 Councillors and 74 Engineers; 4 Hon. Members (not representing Councils or Affiliates); 5 Associates; 1 Engineer Member; 23 other Representatives of Government Departments, Public Utilities and other bodies; 107 Affiliates' Representatives; 12 Visitors; 159 Ladies; 5 A.M.E.U. Officials;—a total of 444 persons.

PROCEEDINGS
VERRIGTINGS

THE PRESIDENT: (Mr. J. L. van der Walt, Krugersdorp): Goeie more dames en here. Ek is baie bly om weer so 'n goeie opkoms vir ons konvensie hier te sien en ek vertrou dat u almal 'n baie aangename konvensie sal he. Dit is baie aangenaam vir ons om weer hier in Kaapstad, ons moederstad, met sy natuurskone omgewing te vergader.

I think that you must all agree with me that there is only one old Cape Town, which I would like to refer to as our beautiful old Cape, and we are indeed privileged to gather here for our Thirty-Second Convention. I wish to welcome you all to our Convention, and in particular our honoured guests, Mr. Slater, the Provincial Secretary, and His Worship the Mayor, Councillor Colonel Billingham. We esteem it a great honour that they are with us today.

I will now call upon the Mayor, His Worship Clr. Col. Billingham, to welcome you all to this Convention and to introduce to you the Provincial Secretary, Mr. Slater. His Worship the Mayor. (Applause).

HIS WORSHIP THE MAYOR OF CAPE TOWN: Mr. President, Mr. Slater, Ladies and Gentlemen: On looking above me this morning I see the reason for the quotation that God made man just a little lower than the angels. (Laughter).

Ladies and Gentlemen, as Mayor of this City, it gives me the greatest of pleasure to welcome the delegates and the visitors to your Convention.

This, I understand, is your Thirty-Second Annual Convention, and I want to point out to you that of all the conferences and conventions I have attended, I think this particular one, the Municipal Electricity Undertakings is the most jovial. What time you finished last night, I am not quite sure . . . or whether you actually finished in the City Hall or somewhere else, but it was evidently a very, very fine party! Now I am rather puzzled as to why this conference should have such jollifications attached to its conventions. It almost makes you think that there is very little work done. I think that is not true, and I think it must be that the officials of the Electrical Undertakings have such an easy "cushy" job that they can afford to smile and make life easy. Now look at our friend Chris; he smiles and gets all he wants from his Electricity Committee (Laughter) and so why shouldn't he enjoy himself and be happy? Of course Chris is a bit of a notability, you know. He is always chewing something. I don't know whether it is spearmint or biltong, or whether it is twist tobacco. Perhaps when he gets into the Chair he will tell us what it is that he does chew.

I understand that this is the fourth occasion that this Convention has been held in Cape Town and it is just a pity that during this Convention we are not able to show you the start of an atomic power station, but by the time that it comes round to your visit to Cape Town again, I think we may be in a position to show you either the completed work or the start of an atomic power station. It seems fairly obvious that that power station must emanate from the Cape Province, due to reasons of which you are well aware.

I mentioned that the jollifications attached to this convention were notable, but I do want to draw your attention to the one in Bulawayo where our friend Sibson put on the Gay Nineties—you remember? When the delegates couldn't even recognise each other from the proceedings that went on, and there were other occasions of the same nature. These things are always to the good, because it shows that even in the midst of work there is a great deal of pleasure.

It is a very nice omen for us to find that this Conference is being held in this new Civic Centre—something that has been developed since your last visit here, and we do think that the surroundings of this area, as you can see by entering the building, are such that it must be very pleasant, and give you a very fine feeling to be able to get the sea breeze all the time, even while your Convention is on. We do hope that many large Conventions will be held in this very fine hall. We think the venue is a delightful one and that you will enjoy not only your very large Agenda, but you will enjoy also your sojourn in this particular part of Cape Town.

Now I hope the accommodation generally is up to your requirements, and that it suits your particular needs. I think it does. And that you will be delighted with your stay here.

Now at this particular moment I cannot help but refer to the extreme loss that this City and Province has suffered in the death of His Honour the Administrator of the Cape, Mr. P. J. Olivier. I do want to mention it because the late Administrator was a great friend of most of us. He did a fine job of work and I do believe that your Convention, before it closes, will pass a motion of regret to his widow and family.

I also have great pleasure in welcoming Mr. Slater to this Convention. If this is his first introduction to the Electrical Undertakings, then I want to assure him that he is in for a good time—that is if he follows it up properly.

At the same time, in case you do sort of get out of hand a little bit, I want to issue a note of warning, that should you find an excessive number of traffic constables round the hall, or should you find them outside the Weizmann Hall on Thursday night, after all, we are looking for revenue, and here's a good chance to get it. (Laughter).

May I throw out a warning to the ladies from the Diamond City?

A city usually grows according to its Electrical Undertaking. Strange it may be, but it is a fact, because as your electricity grows, you know that your city is growing. And may I mention the case as far as Cape Town is concerned? The units increased from 546,000,000 in 1951 to 744,000,000 in 1957. Now that shows the type of growth that is going on in this city, and the demand has grown from 139,000 KW in 1951 to 212,000 KW in 1957.

Talking about kilowatts, we have a particular councillor who discusses matters of electricity in Council and he calls kilowatts KWV. (Laughter). When I asked him what it was all about he said, "Well, what's the difference? They both give you shocks." (Laughter).

Further, during the same period, our population for all races has increased from 577,000 persons to 709,000 which shows that the consumption of electricity is tied up completely with the increase in the city's growth. At this stage, I also want to tell you that the development which is going on in the new foreshore scheme and reclaimed ground, is amazing. The cost of the ground, most of it is a quarter of a million pounds an acre (but you don't buy an acre of course!) necessitates skyscrapers

to make the thing pay. We are watching, therefore, some gigantic skyscrapers going up on the foreshore. One going up there now will be 22 storeys high, and as you know is built on caissons. All this will require a large amount of electricity, so that the city in the next seven years, I have pleasure in saying, will grow on a much faster scale than it has done in the past 12 years.

Our consumers have increased in number from 77,500 in 1951 to 95,000 in 1957. This has necessitated the building of a new power station at Athlone, a coloured township named after the late Earl of Athlone, an early Governor-General of the Cape. The power station site is adjoining our sewerage disposal works, where the effluent will be used for cooling purposes.

I did hope that the power station that is now being built would have been an atomic one, because some years ago we were told by a visiting chief of the British Electrical Undertakings, that it would be at least 25 years before any atomic power station would be seen in this country, and I think he is entirely wrong. I think that the growth of atomic power, which is too costly at the moment, is such that within probably 15 years we should see the start, or the consideration, of atomic power stations in this country. It may be for the good, I hope it will. At this stage let me tell you something that I don't want to go into detail about. Very shortly I shall be launching something that is intended to acquaint engineers and scientists with the workings of atomic power. At the moment we have very little means of training atomic scientists. Before long, however, probably within the next few weeks, I hope to make an announcement concerning the training of engineers in the Cape; at present engineers have to go overseas to learn about atomic work. It is going to be a gigantic undertaking, and it is going to add a tremendous amount of impetus to the electrical undertaking generally. As I said, I don't want to go too far into it at the moment. I merely want to give you something to think about, something to make you talk a little, and perhaps when the time comes we'll be able to tell you all about it.

I want to tell you how pleased I am that your Association was able to accept the City's hospitality, and to tell you also that we hope all delegates will enjoy their stay in the city. We hope that the weather we have "switched on" for you will be such that it will make your stay here a real pleasure.

I know that your Agenda is a heavy one, and that you do not have too much time to discuss it, so I will not keep you much longer, except to say that I do hope that, when your Convention is completed, you will all return to your respective cities and towns believeing, and having assured yourselves, that it is one of the largest, one of the best, and one of the most enjoyable conventions that this undertaking has yet seen.

Thank you. (Applause).

Mr. President, Ladies and Gentlemen, I now have much pleasure in introducing Mr. Slater, who will officially open this Convention.

Mr. SLATER: Mr. President, Mr. Mayor, Ladies and Gentlemen,

I am conscious of the honour the Association has conferred on me by your invitation to open this Convention and for the opportunity of addressing you briefly.

It is a pleasure to welcome to the Cape, members and delegates from all parts of the Union and South West Africa, and particularly to welcome those who have travelled from beyond our national borders, from the Federation of Rhodesia and Nyasaland, to attend this Southern African Convention. I understand that the date of the Convention was advanced this year, but I do not know whether the reason for this was to ensure good weather at the Cape, whether it was to show our northern neighbours what a South African general election is like, or whether it was to demonstrate an immunity from political partiality in the conduct of engineering affairs! In any event, I trust that you will have good weather and that you will enjoy the relaxation of the pleasant surroundings of Camps Bay, and the hospitality of the City of Cape Town, as some relief from the very high tension to which the systems of your engineer members are subject.

The original Cape settlements were farming settlements, and farming continues to be the largest industry in the Cape Province. There is, I believe, some affinity between the farmer and the engineer. Farmers apply knowledge to the efficient use of land and bring forth the fruits of the earth. Engineers apply knowledge to the efficient use of the material resources of mankind and bring forth the fruits of our modern technological society. The rôle of electricity supply undertakings in this society cannot often be emphasised. The provision of adequate and efficient supplies of electric power is an essential requirement, indeed a catalyst in that reaction between manpower and machinery which creates a modern urban industrial society. It is a tribute to electricity supply engineers that urban communities so casually accept the ready and reliable availability of electric power at the mere operation of a switch at any time of day or night.

Mr. President, the duties of the Provincial Administration include a close connection with the work of engineers. The Administration has its own Roads, Buildings and Hospitals Departments. In addition the engineering works of all local authorities are subject to a financial control which includes technical scrutiny. In the Cape Province the supply of electricity for public purposes in urban areas is regulated by the Electric Power Ordinance. The Administrator has, therefore, a number of duties in regard to municipal electricity supply undertakings. In the Cape Province some 125 local authorities operate electricity undertakings, and during 1957 loans for electricity works for 47 of these were authorised. The total amount of these loans was approximately £6¾ million, of which by far the largest item was some £4 million, for completion of the £7 million first stage of the new Athlone Power Station for the City of Cape Town. During the same period tariffs, regulations and amendments for 48 local authorities were approved and other matters concerning electricity supply undertakings were dealt with.

Looking back over the past year, this may well be regarded as one of significance in world history. It has witnessed the remarkable scientific and engineering achievement of the launching of artificial earth satellites. It has seen the use of nuclear energy and its acceptance as an established and almost as a conventional source of power. There have been the first signs of the feasibility of the controlled release of energy from such an abundant substance as hydrogen. These advances, and the tempo of these advances, may have some significance for the future development of Southern Africa. With our material resources and with our reserves of manpower, continued industrialisation is essential to our further development. The problem of transporting fuel to Cape Town may one day be solved by the establishment of a nuclear power station, fuelled with uranium from the mines of the Transvaal or perhaps with sea water from off the coast of Camps Bay. Alternatively, developments in the technique of long distance electric power transmission may prove that the transmission of electrical energy direct from our northern coalfields is an economic proposition.

The solution of the technical and economic problems in the application of new scientific knowledge to the domain of practical affairs is a function of engineers, and it is to engineers to whom we look for guidance in vesting the large amounts of capital required for the establishment and extension of electricity undertakings. Until such time as new methods can be recommended as practical and economic propositions, however, we must be content with the more conservative methods. Nevertheless, whatever the source of power, the reliable and efficient operation of electricity undertakings, on which modern urban communities are so depenent, remains the responsibility of the electricity supply engineer.

Because of this dependence, because of the relationship of a people's standard of living to their *per capita* consumption of power, and because the utilisation of our national resources depends on technological processes, it is necessary for our national well-being that we should have an adequate supply of trained scientific and technical manpower. It is, however, no less essential to the well-being of our

peoples that fundamental education should receive proper attention. This is a matter with which the Administrator is particularly concerned and whilst the shortage of teachers is a problem parallel to that of the shortage of enginers, it is also one which precedes it. For it is during the years of secondary school education that the interest of youths may be attracted to technical and scientific vocations, and if we wish to encourage the supply of scientists, professional engineers, and technicians, it is, firstly, to the schools that one must turn, and secondly to the rewards which scientific and technical vocations offer to those who pursue them.

Die openbare belangstelling in die wetenskap en ingenieurs-wese is aangewakker deur die treffende prestasies van die afgelope jare. Hierdie prestasies het die verbeelding van die publiek aangegryp. Dit is tipies van hierdie nuwe openbare belangstelling dat daar onlangs in Wes-Kaapland 'n vereniging in die lewe geroep is om die stigting van 'n kernnavorsingsinstituut in hierdie gebied aan te moedig.

Fasiliteite vir navorsing en die studie van die geneeskunde word bevoordeel uit skenkings deur filantrope, maar dit is ironies dat vordering op die gebied van die ingenieurswese en die aanwending van wetenskaplike kennis vir produktiewe vreedsame doeleindes, in baie gevalle voorspruit uit navorsing vir militêre eerder as burgerlike doeleindes. Nietemin is die fasiliteite vir die opleiding van myningenieurs in hierdie land 'n voorbeeld van die voordele wat verkry word uit hulp van die nywerheid wat die nouste geraak word. Insgelyks kan die elektrotegniese nywerheid, met inbegrip van munisipale elektrisiteitvoorsieningsondernemings, die nuwe openbare belangstelling in ingenieurswese met voordeel eksploiteer. Die prikkeling van belangstelling vir die studie van natuurkunde op skool, en wesenlike hulp in die ontwikkeling van laboratoriums vir skole, tegniese kolleges en universiteitsfakulteite sal 'n belangrike bydrae deur die nywerheid wees wat sodoende hulp sal verleen vir die stappe wat deur die onderwysowerhede gedoen word om voldoende geriewe vir die opleiding van wetenskaplike en tegniese mannekrag beskikbaar te stel.

Hierdie geriewe moet beskikbaar gestel word en die nywerheid behoort, vir sy eie voordeel, behulpsaam te wees in die verskaffing daarvan. Maar blote belangstelling en geriewe is nie voldoende nie. Die wesenlike en ontasbare belonings, die besoldiging en stand of aansien wat uit wetenskaplike en tegniese beroepe verkry kan word, moet geensins minder aantreklik wees as dié van ander beroepe nie.

Mnr. die President, in hierdie verband is daar 'n saak wat, na ek verneem, 'n mate van besorgdheid by sekere van u ingenieurslede gewek het, en dit is naamlike die onlangse wysiging van die Kaapse Munisipale Ordonnansie. Ek verwys na die 1957-wysiging van artikel 69 van Ordonnansie 19 van 1951, waarby die stadsklerk as die hoof-administratiewe beampte van 'n munisipaliteit anngewys word. Dit wil voorkom of daar 'n verkeerde opvatting was dat hierdie wetgewing 'n verandering teweegbring in die verhouding tussen die stadsklerk en ander departementele hoofde in 'n munisipaliteit.

Ek meen dat daar op gewys moet word dat die wysiging waarby die stadsklerk as hoof-administratiewe beampte van 'n munisipaliteit aangewys word, noodsaaklik gemaak is bloot om redes verbonde aan die Nywerheidsversoeningswet.

Die onderlinge status van die verskillende departementele hoofde in 'n munisipaliteit word nie deur hierdie wysiging geraak nie en is nie in die Kaapprovinsie deur wetgewing vasgestel nie.

Die aangeleenthede wat u hier gaan bespreek, mnr. die President, is van belang vir die Provinsiale Administrasie en ek wil u graag 'n suksesvolle vergadering toewens. Ek is oortuig daarvan dat die geleenthede vir formele en informele bespreking wat lede en afgevaardigdes gedurende hierdie verrigtinge geniet, sal bydra tot die doeltreffende ontwikkeling en funksie van u ondernemings, en sal strek tot voordeel van die gemeenskappe wat u verteenwoordig.

Dit is met genoeë dat ek hierdie vergadering nou formeel geopen verklaar.
Gentlemen: I have great pleasure now in formally declaring your Convention open, and to wish you a very happy gathering

here in Cape Town, and also a most successful meeting. Thank you.

(Applause).

DIE PRESIDENT: Baie dankie Mnr. Slater vir u mooi en inspirerende woorde en vir die goeie wense vir hierdie Konvensie. Ons waardeer dit. U het onderwerpe aangehaal wat ons aandag, as ingenieurs, verg.

Thank you very much, Mr. Mayor, for your hearty welcome to Cape Town, I believe you have even gone so far as to lay on an inspection for engineers of this new type of Kilowatt, the KWV. We are very keen to inspect this in the right spirit.

Mr. Slater, Your Worship, Ladies and Gentlemen, before fulfilling my last task as your President, allow me to thank you very heartily and sincerely for the great honour you have bestowed upon me in electing me as your President for the past year. When you elected me, I realised the honour, the dignity, and the responsibilities of this post, and I could not understand how you could entrust that to me, but I thank you very much for that honour. I have endeavoured to do my best to maintain the standard and I trust that you have found that I have not allowed the dignity and the honour of the office to suffer.

My task would have been an impossible one were it not for the co-operation of every member of this Association and in particular the Executive and the Secretary, who have at all times been a council of wise men to fall back upon.

Ek wil net, voordat ek my laaste taak verrig aan u almal sê: baie, baie dankie vir die groot eer wat u aan my, en nie aan my allen nie, maar ook aan Krugersdorp, my dorp, gedoen het om my as u President vir die afgelope jaar te gehad het. Ek waardeer dit. My dorp, Krugersdorp, en my Raad, waardeer dit ook baie. Nogmaals, wil ek sê: baie, baie dankie.

Now I call for nominations for President.

Mr. D. J. HUGO (Pretoria): When I entered Municipal service nearly thirty years ago, I was told that there was only one Electricity Undertaking in Southern Africa, worth its salt, and that Undertaking, (and I am sorry to have to say it in the presence of His Worship), was the Durban Undertaking. (Laughter).

The City Electrical Engineer of Durban was then Mr. John Roberts who pioneered the development of the domestic load in this country. Mr. John Roberts, however, had an equally famous colleague in Mr. George Swingler, who was City Electrical Engineer of Cape Town. Under Mr. Swingler's direction the Cape Town Electricity Department was making great strides and endeavouring to overhaul Durban. Mr. Swingler had that rare gift, denied to so many of us, of being able to select the right man for the job. We had proof of that ability when we assembled here in 1838 and elected Mr. Horace Eastman as our President. Today it is my great pleasure and privilege to propose as President of this Association another member of the Swingler Kindergarten in the person of Mr. Chris Downie.

I think most of us first made Chris's acquaintance at the Durban Conference in 1947 when he read a paper to us on the Economics of Electricity Supply. Since then we have learnt to know him as an engineer of great ability, as a man of very high principles, and as a loyal friend with considerable personal charm.

Chris I think will be our first Rhodesian born President. He came to South Africa as a young man, and was educated at a famous Cape School—I won't mention the name because Chris likes you to ask him what tie he is wearing! He graduated at the University of Cape Town, and finished as the best student of his final year with a gold medal. He then proceeded overseas and served a graduate apprenticeship with Metropolitan-Vickers in Manchester. He returned to South Africa in 1927, when Mr. Swingler sought him out and made him join the Cape Town Electricity Department. He became City Electrical Engineer of Cape Town in 1951 and since then has rendered yeoman service to this Association.

Mr. President, I have great pleasure in formally proposing Mr. Chris Downie as our President for the ensuing year.

(Applause).

THE PRESIDENT: Thank you Mr. Hugo. A seconder for that proposal?

Clr. P. G. C. BLIGNAUT (Pretoria): Mr. President, I had the pleasure of attending a few conferences with Mr. Downie, and he always reminds me of electricity. He will remain silent until somebody touches the wrong spot. (Laughter). I think that Cape Town is really fortunate in having somebody of his calibre at the head of the Electricity Department.

Dit is vir my 'n voorreg, Mnr. die President, om die voorstel van Mnr. Hugo te sekondeer. Dankie. (Applause).

DIE PRESIDENT: Baie dankie, Mnr. Blignaut. Any further nominations? If not: I will now ask Mr. Slater to put the chains round Mr. Downie's neck.

(Mr. Downie was formally installed in the chair). (Applause).

Mr. C. DOWNIE (Cape Town): Mr. Slater, His Worship the Mayor, Ladies and Gentlemen: at moments such as this, words come with great difficulty. May I say that I appreciate very much the compliment that members of this Association have paid me today in electing me President for the ensuing year. I shall try to live up to the example which has been set to our Association by my predecessors. I hope that by the time my term of office expires, I shall have justified your choice of me as President. I mentioned that I would try to live up to the standard set by my predecessors, and in that connection I am thinking particularly of Johan van der Walt, whose term of office expired today. If I do as well as Johan has done, I shall satisfy you, and I shall also have achieved my object. I am saying this, gentlemen, because the tribute that is usually paid to a retiring president following a Valedictory Address by him, will not take place at this Convention. I just want to take this opportunity, therefore, of paying this special tribute to Mr. van der Walt for the very able manner in which he has carried out his duties as President during the past year. (Applause).

Ladies and Gentlemen: the next item on the Agenda is the venue of the next convention. May I invite somebody . . . Mr. Marais, of Johannesburg, has something to say.

Clr. D. J. MARAIS (Johannesburg): Mr. Slater, Your Worship the Mayor, Mr. President, I have had the pleasure of attending quite a few conferences in the last few years, and I have wondered why it has been such a long time before somebody suggested we should go to Johannesburg. When I look around the lovely beaches you have here, and the lovely weather, I am not surprised to see that we have taken a very, very long time to get round to Johannesburg. But I want to say, Mr. President, that my Council has asked me to extend a very sincere welcome to this Association to hold your next conference in Johannesburg. I can assure you that we are looking forward to repaying some of the wonderful hospitality which other centres have bestowed on delegates from Johannesburg. I assure you also that your stay there will be very happy, and if we can help it, a very comfortable one. We are certainly looking forward to seeing you there next year. (Applause).

THE PRESIDENT: Is that accepted. (Applause).

The next item, ladies and gentlemen is the election of the Vice-President for which I call for nominations.

Mr. J. C. DOWNEY (Springs): Mr. Slater, Mr. President, Your Worship the Mayor, Ladies and Gentlemen:

I should like this morning to nominate one as Vice-President of this Association with whom I have been associated in Municipal work for the past 30 years. It is not just the fact that we have known each other in municipal work for 30 years, but one, in which such a close association has rarely existed among engineers before. In the early days of our experience, we used to go touring round a town in South Africa, visiting various haunts during our inspection of various jobs, in the most unearthly hours during the night. It is said that you have got to live with a man to know him, but wives usually say "The longer I live with him the less I know about him." In this case, Mr. President, this individual we all know very well, and we all know the sterling qualities he has and the work

which he has done on our behalf. I won't delay but wish to tell you that the work he has done is extremely valuable to this Association. He has been a number of years on the Executive, and we have always leaned on him to fill the gaps when we have found that we needed somebody to step into the breach at very short notice.

Mr. President, it gives me very great pleasure in nominating Mr. T. W. Kane as Vice-President for the ensuing year 1958/59. (Applause).

Clr. MARAIS: Mr. President, it is with great pleasure that I second the nomination of Mr. Bobby Kane. I have been very fortunate, as Chairman of the Committee in Johannesburg which deals with electricity, to be associated with Mr. Kane, and I can tell you that he has built up a really wonderful reputation in Johannesburg in the Council, and that is something unusual because normally Councils look for something to say against their heads of departments. I can tell you this, that Bobby Kane has built up a really fine reputation. He is looking after a very large undertaking, and believe me, he is one of the most popular officials in Johannesburg.

Mr. President, it has also been my pleasure to know Mr. Kane as a man. I think that is very important, and I can tell you this, that I am certain when his time comes along to wear that chain, he will certainly fill that office with the dignity it deserves.

Thank you very much. (Applause).

THE PRESIDENT: Any further nominations? I have very great pleasure in inviting Mr. Kane to come up and join us at this table. (Applause).

Mr. R. W. KANE: Mr. President, Mr. Downey, and Clr. Marais, just a simple and grateful expression of thanks for the honour you have done Johannesburg and myself in electing me to office in your Association. I thank you all for what you have done. (Applause).

THE PRESIDENT: Ladies and Gentlemen: before we break for the tea interval, I have one or two announcements to make.

First of all, I regret to have to announce the death of Mr. J. H. Rogers, Municipal Electrical Engineer of Fort Beaufort, and Mr. J. A. West, who was an Associate Member from St. Michael's-on-Sea.

I would like you all to stand as a mark of respect for these two gentlemen.

Thank you.

Another announcement, ladies and gentlemen, is about the signing of the Register, which will be passed around among you. I hope all of you will make a point of signing your names, in the appropriate columns —as members, affiliates, visitors, or whatever your status at this Convention happens to be.

I have an apology from Mr. G. Dixon of Windhoek who has not been able to attend.

I also have pleasure in announceing that any visitor or engineer member who would like to do so, can inspect the installations of the Electricity Supply Commission while they are at the Cape. They can leave their names at the Enquiry Counter in the vestibule, when arrangements will be made for them to be shown around.

I also have to announce that the University of Cape Town are holding their Annual "At Home" and Graduation Ceremony on Friday from 3 p.m. to 5.30 p.m. Anybody wishing to attend these functions will be very welcome. Invitation cards are available at the enquiry counter, if any member would like to take advantage of this.

Another announcement, ladies and gentlemen, concerns the Springbok Radio Caltex Show that is being put on in this hall tonight. It is hoped that as many visitors and members as possible will come along. Tickets are available in the vestibule.

The doors won't open until 8.30, since the people running the show and the S.A.B.C. have to cary out certain tests to make sure that everything is laid on properly.

Regarding the Convention Ball that will take place in the Weizmann Hall on Thursday evening, tables for parties may be booked in the vestibule.

After the Refreshment Interval, ladies and gentlemen, the photograph will be taken outside the hall. The idea is that everybody should stand outside here so as to take advantage of the slope in the level of the ground. This might be a bit difficult, but we would like your co-operation in making it easy for the photographer.

I shall now call upon the Secretary to read further apologies.

THE SECRETARY: Mr. President we have a number of apologies this morning.

The Director of the Cape Technical College.

A telegram from Mr. Arthur Rodwell wishing us a very successful convention an enjoyable time and expressing his regrets that he cannot be with us.

Mr. Kinsman has written expressing his regrets and congratulating you, Mr. President, on your election to office.

The President of the Cape Town Chamber of Commerce.

Mr. L. Denby-Smith.

Mr. H. J. Gripper.

The representative for the United Kingdom Trade Commissioner for the Cape.

Prof. Straszacker.

Crompton Parkinson (S.A.) Ltd.

The Municipality of Kokstad.

W. T. Glover & Co., Ltd.

Metropolitan-Vickers Central Africa Ltd.

The Borough of Port Shepstone.

Mr. Edgar Poole.

The Municipality of Piet Retief.

The Town Council of Nigel.

The Transvaal Provincial Administration.

The Municipality of Walmer.

The Municipality of Winburg.

The O.F.S. Provincial Administration.

The Municipality of Middelburg, Tvl.

Dr. Hattingh.

The Municipality of Port Alfred.

The Southern Rhodesia Electricity Supply Commission.

The Municipality of Aliwal North.

The Secretary of the Department of Commerce and Industries, Union of South Africa.

The Chairman of the Industrial Development Corporation of South Africa.

The Provincial Secretary, Natal Administration.

The Town Council of Piet Retief.
Mr. A. Foden.

Mr. R. J. S. Wiley.

The British General Electric Co. of Central Africa Ltd.

The Borough of Estcort.

And best wishes are expressed for a successful Convention from Mr. James Baird, the partner of Messrs. Mertz & McLellan.

THE PRESIDENT: Thank you Mr. Ewing.

Another announcement is about the official photograph taken at the Convention at Margate last year.

Have all those who applied for photographs received them? If not will they please hand in their names, and if they have their receipts with them, the numbers of the receipts, at the Enquiry Counter.

Ladies and Gentlemen, we will now break for tea, which will be served in the Rotunda Hotel Ball Room, just across the way.

ADJOURNMENT FOR TEA.

On Resuming:

THE PRESIDENT: Ladies and Gentlemen, I have another sad announcement to make. This concerns the late Mr. J. H. Gyles, one of our Past Presidents, who passed away towards the end of last year. Mr. Gyles was for some years City Electrical Engineer of Durban. I omitted to mention this with the previous obituaries, and would ask you all to stand as a mark of respect to the late Mr. J. H. Gyles.

Thank you.

Another announcement concerns the ladies, and the trip to Muizenberg this afternoon, via Chapman's Peak. The buses that will pick up the ladies are due to leave

the Sea Point Pavilion at 2.30 this afternoon. They will then proceed from the Sea Point Pavilion to here, and pick up ladies waiting outside. I notice that there are only a few ladies left, but I wonder whether they would pass the news around to those who are not here, and whether the gentlement will remind their wives about this trip. It is a very beautiful drive round the mountain, via Hout Bay, Chapman's Peak, with tea at Muizenberg and then returning via Constantia Nek and de Waal Drive.

I want to remind you again about the Caltex Show this evening. There are still some tickets left and they will be held available until 3 p.m. this afternoon. Any tickets left over at 3 p.m. are going to be very easily disposed of, so that if you don't get a ticket by then you will have missed the bus for the show!

Ladies and Gentlement, I now have a very pleasant duty to perform, and that is to present certificates and medals to three of our Past Presidents.

They are Mr. Horace Eastman, Mr. Dirk Hugo and Mr. van der Walt.

I would ask Mr. Eastman to come up and receive his Certificate and his Medal.

Applause).

(Mr. HORACE EASTMAN received his tokens).

Mr. H. EASTMAN: Mr. President, Ladies and Gentlemen: I cannot tell you how pleased I am to receive this token for what service I have been able to render to the Association, particularly at the hands of one with whom I have been associated so closely in the Electricity Supply Industry for, I think, 21 years. My very heartiest congratulations to you, Mr. President, for your work, and on your accession to the Chair of this Association.

The importance of both farming and the supply of electricity in this country have been referred to this morning. When one combines these activities, I assure you, there is any amount of interest, and presumably good, I do wish this Association the greatest possible success in the future.

(Applause).

(Mr. DIRK HUGO received his tokens).

(Applause).

The PRESIDENT: I have great pleasure now in inviting Mr. van der Walt to come up and receive his certificate and medal.

(Mr. VAN DER WALT received his tokens).

(Applause).

The PRESIDENT: Ladies and Gentlemen, there are representatives of official bodies attending this Convention, and it is desired that we give them the opportunity to say the few words normally said by them on these occasions.

Mr. W. H. MILTON (ESCOM, Johannesburg):

I am here to express the regrets of Dr. Hattingh at his inability to make the journey down to attend the Convention, and at the same time to extend the best wishes of ESCOM to you, Mr. President, and those present here, for a very successful Conference.

Applause).

Mr. R. W. LINEKER (Johannesburg): On behalf of the Institute of Electrical Engineers, London, Mr. President, I wish you a very enjoyable and successful Convention.

(Applause).

Mr. W. L. KING (South African Railways, Johannesburg): On behalf of the Management of the Railways, Mr. President, I wish to congratulate you on your accession to the Chair, and wish you a very happy and successful year of office.

Applause).

Mr. H. M. DREWETT (Institute of Certificated Engineer): Mr. President, Ladies and Gentlemen: I would like to convey from the Institute hearty congratulations to you on your election and wish this Convention every success, and to you, sir, a very successful year of office.

(Applause).

Mr. H. T. ASPINALL (Wits Technical College, Johannesburg): I have been asked

Mr. President, to convey to you greetings, and wish you a very successful Conference.

J. J. de HAAS (Departement van Publieke Werke): Dames en here, die Direkteur van Publieke Werke wense vir 'n suksesvolle vergadering toe.

Mr. J. C. DOWNEY (Springs): Mr. President, on behalf of the South African Committee on Illumination, I wish to congratulate you on your election to the office of President, and wish you a very successful term of office, and a very happy Convention.

THE PRESIDENT: Gentlemen, the next item on the Agenda is the Election of Office Bearers, and in this connection I would like to mention that the Chairman of the Regional Branches that have been establshed, viz. Natal and the Eastern Province, automatically become members of the Executive. You must bear this in mind when you come to vote for members for the Executive. I now call for nominations.

I would also like to remind you of the special voting papers that we have produced for this election. The idea of this voting paper is to make the job easier for the scrutineers. You will be asked to write the names of those nominated according to the sequence in which they will be read out from here, then you will be asked to put a cross against the names of each of those whom you vote to be on the Executive.

Mr. Mitchell has just reminded me about the election of Chairmen of Regional Branches. We are going to provide for the Election of the Chairmen of these Regional Branches immediately after this election.

I now call for nominations for members of the Executive.

The following were duly proposed and seconded:-

P. A. Giles, East London.

Albert Rossler, Cradock.

Frank Stevens, Ladysmith.

G. J. Muller, Bloemfontein.

C. Lombard, Germiston.

A. R. Sibson, Bulawayo.

R. M. O. Simpson, Durban.

D. J. Hugo, Pretoria.

J. C. Downey, Springs.

THE PRESIDENT: Mr. Mitchell is still entitled to be on the Executive as a Past President. Two immediate Past Presidents remain on the Executive altogether the President and Vice-President plus Chairmen of Regional Branches. You have to vote for six Engineer members. We have nine nominations altogether. Are there any more nominations?

We have a new Constitution gentlemen, so I shall read the provision of the Constitution that governs the election of members of the Executive:—

> "Engineer members shall be elected to give effect to the following rule, viz. that in respect of each of the territories listed hereunder, there shall serve on the Executive Council at least one councillor; representative, and one engineer member representing a member undertaking/s situated in such territory."
>
> The list of Territories :—
>
> "Cape Province, Federation of Rhodesia and Nyasaland, Natal, Orange Free State, Transvaal."

We need one councillor representative and one engineer member for each of these territories, so that in putting your cross on the ballot paper would you please bear this in mind? And that must be having regard to Past Presidents. We have Mr. Mitchell of Salisbury, Rhodesia, and Mr. van der Walt, Krugersdorp, Transvaal. Then there is Mr. Bob Kane for the Transvaal, and myself for the Cape.

Now I will read out the names again, and would ask you to write them down on the voting papers in this order.

(The President then read out the list of nominations).

Please select six of these by putting a cross opposite their names in the column provided for this on the voting paper.

Bear in mind also the rule about Provincial representation.

The Free State and Natal are not represented at the present time. Mr. Muller is the only nominee from the Free State among the names which I have just read out.

Mr. Mitchell has just reminded me now that Mr. Muller automatically comes on to the Executive because he is the only nominee for the Free State. That means you must only put five crosses—or six including Mr. Muller.

I want to remind you, gentlemen, that the only people entitled to vote are engineer members, councillor members and honorary members.

We now come to the scrutineers. Would Mr. Milton of ESCOM and Mr. Wilson of Pretoria please undertake this duty?

The next item, gentlemen, is the presentation of my Presidential Address. I will ask the Vice-President, Mr. Bob Kane, to take my place while I deliver the Address.

PRESIDENTIAL ADDRESS

by

C. G. DOWNIE

To become President of this Association is a great honour indeed for a South African or Rhodesian Municipal Electrical Engineer and I appreciate very much therefore the compliment which you have paid me and the City of Cape Town today in having elected me to this office. I feel all the more honoured because of the fact that I have been considered worthy of occupying the same chair as did two of my predecessors who served Cape Town so well and who did so much good work for this Association in their time. I refer to the late George H. Swingler who was President in 1922 and to Horace Eastman who presided in 1938. We are very pleased to see that Mr. Eastman is with us at this Convention today.

As you all know, South Africa and the Rhodesias have undergone, since shortly after the beginning of the Second World War, a process of industrialisation at a rate which can only be described as phenomenal. This development could almost be likened to the Industrial Revolution that took place in Great Britain early in the 19th century and there is little doubt that if the present rate of progress is maintained Southern Africa in the not too distant future may become the main producing centre of the African continent. Increased industrialisation and production leads to higher standards of living, and if in these respects, Southern Africa with its vast potential of raw materials and agricultural products is to become as prosperous as some European countries and the U.S.A. it will in large measure be brought about by industrial development.

An essential pre-requisite for industrialisation is a cheap and adequate supply of electric power. The economic progress of any country has become so dependent upon the availability and use of electricity that to deny the one is to preclude the development of the other.

It is the object of this address to refer briefly to one or two aspects of the part played by municipal electrical undertakings over the past twenty years in promoting the economic development of Southern Africa and to their prospects for the future. These undertakings are concerned with the supply of electricity mainly within urban areas, in most of which a considerable degree of industrialisation has taken place since 1937. This has been followed by commercial development and the raising of standards of living which is to be found in the increasing use of electricity for domestic purposes. Close on two-thirds of the electricity produced and supplied by municipal electricity undertakings today is sold to domestic consumers.

According to figures published in the latest issue of the South African Municipal Year Book there are at present 153 municipal undertakings, of which 85 generate for themselves the electricity which they supply to their consumers, the remainder buying in bulk from the Electricity Supply Commission while retaining distribution and re sale in their own hands.

In keeping pace with the increasing demand for electricity municipal electrical

undertakings generated and sold approximately 3,250 million units in 1955 (which is the most recent year for which figures are available) as against 660 million in 1937 — a five-fold increase in less than twenty years. The aggregate demand for electricity over the same period increased from 205,000 kilowatts to 890,000 kilowatts.

If the amount of electricity sold by municipalities who buy power in bulk from the Electricity Supply Commission for distribution and resale is added to the figures just quoted the total amount of electricity sold in 1955 must be increased to 5.025 million units and the aggregate maximum demand to 1,315,000 kW. This again represents a five-fold increase during the last twenty years.

Assuming that over the period under consideration the cost of generating plant required averaged out at £40 per kilowatt, it will be seen that the increase in demand has necessitated capital expenditure on generating plant alone to the extent of some £30,000,000 or over £1½ million annually.

It is of even greater interest to have some idea of the amount likely to be spent on the plant and equipment that will be required to meet the demand for electricity during the next ten to fifteen years. To arrive at an estimate it can be assumed that the aggregate demand on municipal power stations in 1970 will be at least double what it was in 1955. This means that by 1970 a total of close on one million kilowatts of additional plant will have to be installed to meet the requirements of consumers supplied from municipal generating stations. Assuming that the cost of power stations in the future will not vary much from what they average today, namely £75 per kilowatt, the capital required over the next fifteen years will amount to a total of at least £75 million. I am inclined to think, however, that the foregoing estimate of growth in demand is on the conservative side and that £100 million would be nearer the total likely to be spent over the next fifteen years on augmenting the generating capacity of municipal electrical undertakings.

Some people may think that there will be difficulty in raising this amount of capital but, if one is to judge by past experience and bearing in mind what I said at the start of this address about the interdependence of supplies of electricity and the country's development and progress, one should not be pessimistic about the requisite amount of capital being forthcoming.

Another important aspect of municipal electrical undertakings is that of the raw materials required for the production of electricity. Most of the electricity produced today is generated in coal-burning power stations and it will be of interest to see how much coal was required for the 3,250 million units generated by municipalities in 1955. In this connection it is necessary to assume some figue for the amount of coal consumed per unit sent out from the power stations.

A reasonable figure would appear to be 1.36 lbs. which, for the amount of electricity produced for municipal coal-consuming power stations, gives a total of close on 2¼ million tons. This is approximately 18% of the total tonnage of coal burnt for the production of electricity throughout the Union (approximately 12 million tons) and 6.5% of all the coal requirements of the Union for that year, which are estimated to amount to a little over 33 million tons.

If the coal required by the Electricity Supply Commission to supply those municipal electrical undertakings buying in bulk is added to the figure just quoted, we find that electricity sold by municipal undertakings accounted for approximately 30% of the coal burnt for the production of electricity in the Union in 1955 and 11% of the country's total coal requirements for that year.

It is a well-known fact that, all other things being equal, an industry should be located as near as possible to the source of raw materials. It is unfortunate, therefore, that in South Africa the sources of raw material for the generation of electricity, namely the coal mines, are very localised. This localisation together

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with the vastness of the country makes it necessary to convey the raw material over great distances. The coastal undertakings at Port Elizabeth and Cape Town are particularly hard hit by the high railway freight charges which are thus incurred. For instance, in 1957 the Cape Town City Council paid just over £900,000 for coal, of which nearly £700,000, or 75% was for railage.

From an estimate of the average pit-head price of power station coal in 1955 and the average price per ton of coal bought by municipal undertakings for generation purposes, one arrives at a total of approximately £3,000,000 as having been paid by such undertakings for coal and that of this amount some £1,840,000, or approximately 60%, was paid to the South African Railways in transport charges alone.

The fact that coal is having to be transported to power stations situated a long way from the collieries has aroused a great deal of speculation on the possibility of Nuclear Power Stations taking the place, sooner or later, of existing distant power stations and of nuclear fuel being used instead of coal. This is entirely a matter of power supply economics in so far as we Municipal Electrical Engineers are concerned. So long as the South African Railways Administration can be relied upon to continue to transport the coal over those great distances, as they have managed to all along, except for a very "near miss" at the Cape during the winter of 1951, and provided that the delivered cost of coal does not increase much beyond what it costs today, producers of electricity situated far away from the coal mines can afford to wait the results of experience and development which will emerge from the establishment of nuclear power stations, all of which are, mainly, experimental in Britain and other countries which are not so fortunate as South Africa is in its vast resources of coal.

Sale of Electricity.

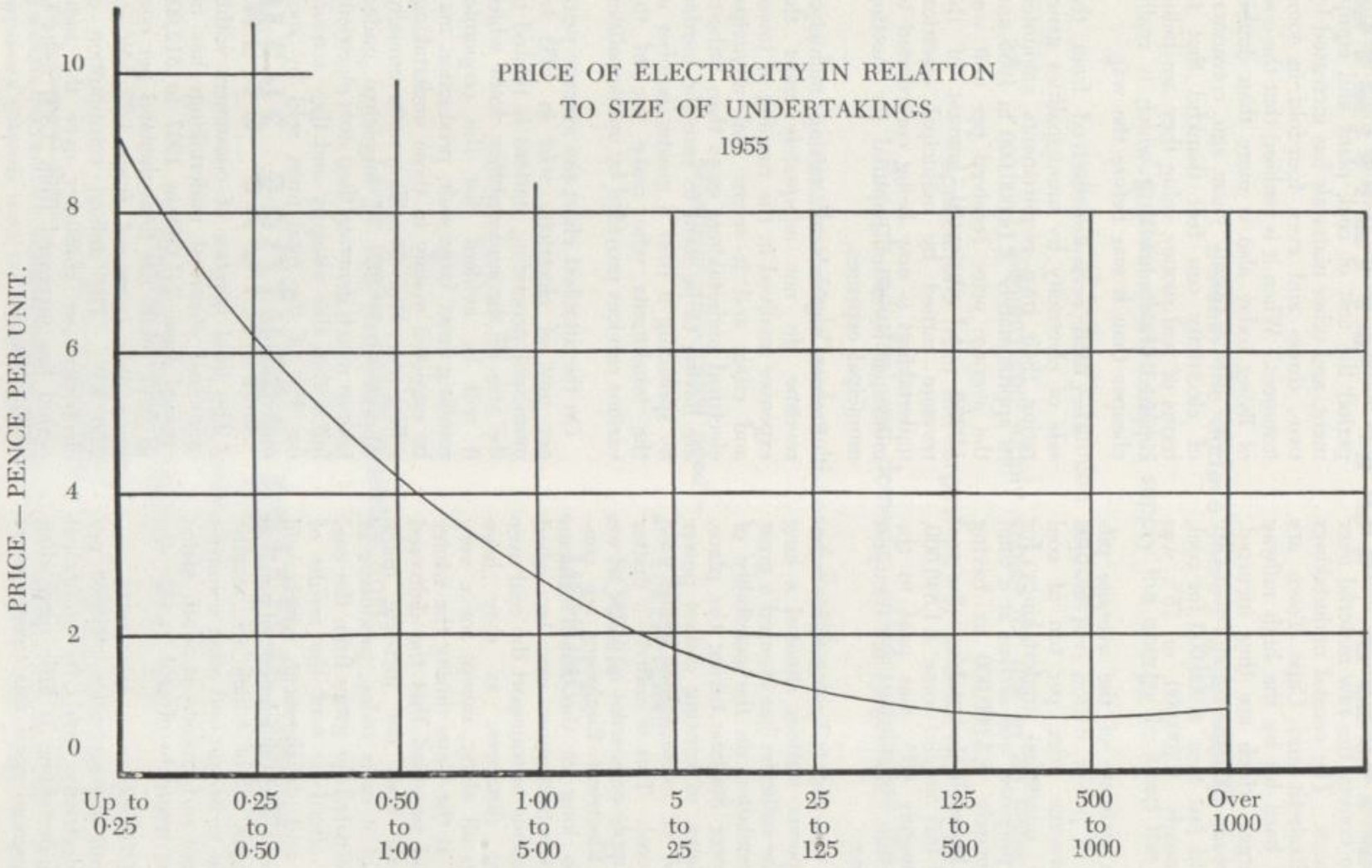
The overall average price charged per unit of electricity sold by municipal electrical undertakings is little more than what the average price was twenty years ago notwithstanding the fact that over this period the cost of coal, plant and equipment, and other materials has increased by two-, three- and even four-fold in some instances. When it is realised that the cost of living today also is more than double what is was twenty years ago, consumers of electricity can feel thankful that in terms of real money value they are being supplied with something which is really cheaper than it was before the war.

The total revenue received from the sale of electricity by municipalities generating their own requirements amounted to approximately £14,000,000 in 1955 and the average price received per unit was 1.036d. A substantial amount of the revenue earned by municipal electrical undertakings is now being contributed to municipal revenues required for meeting municipal expenses.

Present methods of raising municipal revenue do not adequately meet the expenses involved in the running of towns and cities and it seems that municipal electrical undertakings more than hitherto are having to be used to ease the burden by spreading it over a greater number of the inhabitants who make use of the various services provided by municipalities.

On the attached chart the average price per unit of electricity sold in 1955 by municipal generating stations is related to the size of the undertakings, from which it will be evident that the economies resulting from large-scale production may be expected mainly in those undertakings selling more than 25 million units annually. Approximately 25% of municipal undertakings which generate their own electricity fall within this category and they account for 95% of the total units sold by such undertakings.

The total number of consumers within municipal electrical undertakings has increased from 241,000 in 1937 to 512,000 in 1955, while the total demand per consumer has increased from 1.27 kW. to 2.56 kW. The annual consumption of electricity per consumer over the same period has increased from 3,800 units to 9,800 units.


PRICE OF ELECTRICITY IN RELATION
TO SIZE OF UNDERTAKINGS
1955
PRICE — PENCE PER UNIT.
10
8
6
4
2
0
Up to 0·25
0·25 to 0·50
0·50 to 1·00
1·00 to 5·00
5 to 25
25 to 125
125 to 500
500 to 1000
Over 1000
IN TERMS OF MILLIONS OF UNITS SOLD ANNUALLY.
SIZE OF UNDERTAKINGS

Although these figures are impressive, there is still much room for development, as a comparison with the figure for the potential total number of consumers of electricity (estimated at 1,095,000 in 1955) shows that only 47% of this number are actually consumers. This means that there are close on 600,000 families within the areas of supply of the municipal electrical undertakings who are not yet users of electricity. Again when one considers the amount of electricity consumed per head of population the scope for future development becomes all the more evident. Whereas the consumption per capita within the areas supplied by municipalities has risen from 310 units (in 1937) to 880 units (in 1955), these figures when compared with 1,529 for Britain (in 1956/57) and 3,393 units for the U.S.A. (in 1954) show how much more scope exists for the raising of standards of living through making greater use of electricity.

There seems to be a need not only for exploiting still further the advantages of the use of electricity particularly for domestic purposes, but also to devise ways and means by which these advantages may be put within the reach of more consumers, bearing in mind that the people concerned belong to the lower income groups.

Transmission and Distribution.

Earlier in this address I referred to the amount of money likely to be required by municipalities for additional generating plant to meet the increasing demand for electricity over the next 15 years. Although the construction of modern power stations includes a large proportion of structural and general civil engineering works, little of the larger items of plant is made in South Africa.

However, it is not sufficient merely to generate electricity, it is also necessary to transmit and distribute it via cables, overhead lines, transformers, swithboards, etc., to the various classes of consumer. A great deal of transmission and distribution plant is already being manufactured in this country, much of it under arrangement with prominent manufacturers overseas.

On the basis of the growth previously referred to, it is estimated that during the next fifteen years close on £100,000,000 worth of transmission and distribution plant and equipment of all types will be required to meet the increasing electrical demand within municipal areas of supply. A large proportion of this equipment will be manufactured in Southern Africa and municipal electrical undertakings can be said therefore to be supporters of South African industry and to form an important part of the industrial structure of the country.

Most of this plant and equipment will be purchased following the precribed procedure of calling for public tenders so that the figures quoted above will be of interest to prospective tenderers, many of whom are "affiliates" of this Association. Mention of this fact causes me to refer to recent experience in so far as Cape Town has been concerned in calling for public tenders. One finds repeatedly that several tenderers all quote the same price and that whereas, for example, the price quoted for a large transformer was a little over 16s. per kVA. in 1955, this was increased to 21s. per kVA. in 1957, i.e. by 30% when variations in materials indices and rates of pay would hardly seem to have justified any increase over that period. One finds also that whereas £9.3 per kW. was quoted for a turbo-alternator set in 1956, the same set, but for steam conditions not so arduous, is quoted at £15.5 per kW., i.e. an increase of over 60%, to another undertaking less than eighteen months later. Another example of present-day practice is to be found in the fact that a larger number of firms than usual are quoting the same price for electricity meters and that whereas these firms were previously confined to British manufacturers, Continental manufacturers are now joining them. This sort of thing, and I refer particularly to the policy of level price tendering, has, to say the least, become rather confusing and causes one to wonder whether there is any point in calling for tenders for certain classes of plant and equipment.

Technical Manpower for Future Development.

The success of South African municipal electrical undertakings in the past has been due largely to the ability and zeal of their engineers. The propects of future success should therefore also be gauged with reference to the prevalent *shortage* of engineers.

Without wishing in any way to minimise the contribution that non-graduate engineers have made and are making in the electricity supply industry, I feel that modern technological progress demands more and more that engineers should have a University training or its equivalent, and it is on the shortage of professional engineers that I would comment. In doing this I am mindful of the need for ensuring that engineers with a University training become available to fill posts requiring managerial, administrative and executive ability, which qualities spring from a University education and training.

Sir George Nelson in his recent Presidential Address to the Institution of Mechanical Engineers showed that although people in Britain were becoming increasingly conscious of the importance of science and technology there was still considerable scope for improviment as the total number of science and technology students was only about half the number of students in the other branches of learning.

The number of students of science and technology expressed as a percentage of the total number of students registered annually at British and South African Universities is shown in the table below.

It is evident from this table that the present plight of South Africa is worse than that of Britain, where the figure has risen from 26% in the year prior to the war to 35% in 1955. For South Africa the corresponding figures are 32% and 27%; that is to say relatively fewer students are taking science and technology courses, although the number of students of science and technology per million of population has risen from 269 in 1950 to 365 in 1956. The trend of these figures is encouraging but much remains to be done before we can reach the British figure for 1956 of 594 students per million of population.

It has been said that figures based on total population are not a fair reflection of the position and it is true, of course, that as far as South Africa is concerned the figures based on the European population only would present a much rosier picture. I can find no justification for this approach however. The non-Europeans have an important contribution to make to the economic life of this country but in the

Year	Students of Science and Technology as percentage of total Students.		Students of Sscience and Technology per Million of Population	
	British Universities	South African Universities	Britain	South Africa
1939	26.0	31.8	—	267
1945	32.0	26.9	—	275
1950	32.6	23.9	570	269
1954	33.8	25.5	547	301
1955	34.3	26.5	563	331
1956	34.8	27.2	594	365

meantime the burden of providing services for Europeans and non-Europeans falls on the former and any figures which do not include the non-Europeans are, to say the least, misleading.

Many reasons for the shortage of engineers have been put forward, but I am inclined to agree with the opinion expressed by Sir George Nelson that the apparent lack of interest displayed by modern youth in matters pertaining to pure and applied science may be laid at the door of that peculiar attitude of mind which relegates the engineer and technologist to a position of social inferiority in relation to those versed in the arts and the humanities.

I often wonder whether or not this shortage in South Africa may be due also to the way in which mathematics and and science are taught and presented in schools. Is the teaching of these subjects made interesting enough? Have the schools got the teachers who can do this?

The question of remuneration is also an important one, for although it is true that "money is not everything", too little of it when compared with what is earned in other occupations or professions can be very frustrating and this probably also has a considerable bearing on the shortage of engineers. It is pleasing to record, however, that some improvement has been made in this respect within the last two or three years but much leeway remains to be made up before inadequate remuneration will no longer be discouragement to entering the engineering profession.

I am strongly of the opinion that some sort of Government action is necessary to alleviate the present position and, although the recently appointed Commission of Enquiry into the method of Training for University Degrees is a step in the right direction, some good purpose would be served if an official enquiry were to be made into the shortage of engineers. After all, this is in the nature of a national problem and should be recognised and dealt with as such as soon as possible if this country is to progress and develop its vast industrial potential.

This is, of course, a short-term approach to the problem. As a long-term one I would suggest, among other things, extensive propaganda in the schools to bring home to South African youth that science and engineering technology have a romance of their own and that in these professions the urge to create, which is inherent in all of us, can find a fullness of expression.

I realise that there is much more that could be, and has been said, about the shortage of engineers in South Africa, but I feel that to do so in this present address would be to place too much emphasis on what must be regarded as one of the serious problems that municipal electrical undertakings, besides industry and commerce generally, have to face.

I hope that this address, though somewhat disjointed, has achieved some measure of success in bringing to your notice the part played by municipal electrical undertakings in the economy of Southern Africa. This has involved the quoting of figures, many of which, through lack of proper statistics, have had to be judiciously guessed or reasonably estimated. As engineers we are very much concerned with figures and statistics not only for keeping under constant supervision and control the manner in which our undertakings are being operated and managed, but also to give us some indication of what we have to recommend to our employers for meeting future development.

I am confident that the problem which the future may bring will be faced as resolutely and with as much resourcefulness as have those in the past and that those associated with municipal electrical undertakings may continue to enjoy that satisfaction which comes with the knowledge of a job well done.

Mr. R. W. KANE (Johannesburg): I understand the dark-eyed gentleman from Salisbury will propose the vote of thanks.

Mr. J. E. MITCHELL (Salisbury): Mr. Vice-President, Ladies and Gentlemen, in

proposing a vote of thanks to our President for his very interesting and very thought-provoking address, I would like to say first of all how pleased I am personally to see Mr. Downie in the Chair.

I think it is particularly apt that I should have the duty of proposing a vote of thanks for his Presidential address, because I am always willing to support a Salisbury product, and Chris, as you know, was born in Salisbury. Possibly being born so far from the sea made him so determined to spend the rest of his life so near to that medium. He even designs his power stations to be as near to the sea as possible. Table Bay couldn't be very much nearer, although I understand if the Town Planning people have their way, it will eventually find itself in the centre of the city.

He has not been quite as clever of course in regard to his next site at Athlone, which I understand from His Worship the Mayor, is near a sewage works, where the ozone will be a little different.

Now turning to his address, I would like to say at the outset that Mr. Downie has obviously got a lot of thoughts in the back of his mind and, unlike me, he doesn't feel like putting them forward in any way which might cause him to tread on people's corns. The position is that a Municipal Electricity Undertaking, unlike other Municipal or Government enterprises, is a commercial and business concern. I am particularly pleased to see Mr. Eastman here, because I remember that when Mr. Eastman made a speech on his retirement, and when thereby he had reached the stage where he could tread on as many corns as he liked with impunity, he actually stated that he considered with the frustrations he had had, committees should be more autonoumous. However, being a monopoly there has to be some kind of control, despite the fact that it is a commercial enterprise, and possibly a council is just as good a method as any other democratic form of control. Most democracies have some form of frustration for anybody who wants to go ahead very quickly, and it is not everybody of course who has a council which is understanding and will help the engineer. I think I might repeat the story I told at the Institution Dinner one year, about the M.O.H. who got up and said during his report that the death rate for the year was 10·4. And one councillor got up and said "How can the death rate be 10·4?" Another councillor got up before the M.O.H. could reply and said "Any silly man knows that. It means 10 are dead and four are on the point of dying."

It also means that if you are running an Electricity Undertaking not in the form of a normal business, but under the form of a municipal control, every thing is under the full glare of publicity. That is not always easy when one is carrying out certain transactions, possibly in regard to tenders to which I will refer later.

Mr. Downie gave you a resumé of the tremendous growth of the Electricity industry, and emphasised again that the industrial growth of a country is gauged by its electricity sales and that the greater use of electricity would improve the standard of living of the lower classes. This is axiomatic but how often must it be said before the general public will believe it?

There was of course a tremendous amount of meat in this address. There were quite a number of subjects; for instance he just casually mentioned that the rate funds of all the municipalities were benefitting greatly from all the municipal undertakings. That, of course, would make a day's debate in this Convention, if we got started. Mr. Downie did deal with the very vexed question of tendering, and I believe that there is so much in the matter, as to how much benefit there is by using public tendering and not negotiating that, with the President's permission, I will, at the Members' Forum on Wednesday evening, find enough time, I hope, possibly half way through, or some time during the evening, to put a question of that nature,

as to whether there is any benefit to municipalities or to the commercial fraternity in using the public tender method.

At the same time, our affiliates will then get a very good opportunity to tell us of their point of view in regard to, for instance, . . . Mr. Downie mentioned in the paper that he received something like 20 tenders for meters, even from British and Continental firms, all of the same value.

Mr. Downie did mention atomic power stations, and he said that this was entirely a matter of power supply economics insofar as we municipal electrical engineers are concerned. I would suggest that that is only half the problem, although Mr. Downie did deal with the other half in another part of his paper, viz. technical man power. From a first hand investigation of the Calder Hall Power Station, I was fully convinced that, without the necessary instrument mechanics and technicians to operate it, in common language, the "automation" goes "auto-hell." I was also not disappointed that Mr. Downie again mentioned this business of the training of engineers. It is one which has been raised at every Convention, and I think no apology is needed for it.

I was very tickled with the remark in a little book which was got out by the Association which is endeavouring to foster engineering training in South Africa, where it was said that the four most important things in your life were your birth, your death, the choice of your wife, and the choice of your vocation. It said that you had no choice in regard to your birth, you had very little choice in regard to your death, that you had a lot less choice in the picking of your wife than you were led to believe, but you could choose your own vocation, and I think that should actually be put to use in this country, and the interest in the work of engineering should be emphasised.

Now I think I have gone on long enough, but I would like to say how pleased I was to see Mr. Downie in the chair, after nine years in command at Cape Town, and to thank him for a very interesting and "full-of-meat" address.

Applause).

THE PRESIDENT: Thank you Mr. Mitchell.

Mr. MULLER: Mr. President, Ladies and Gentlemen, it affords me very real pleasure to support this vote of thanks to Mr. Downie, our president, for his Presidential Address, not only because they have treated us so very well in Cape Town, but we are quite green with envy when we look at the stage decorations.

Mr. Vice-President, I have known no less than three generations of engineers in Cape Town, although I am not 100 years old, so in spite of what His Worship the Mayor said about the very pleasant occupation we have, it does appear to be a rather wearing occupation. In my short span of life they have worn out three engineers in Cape Town!

In the past two or three weeks I have spent the time with a microscope going over the Annual Estimates, looking for odd pennies and one thing and another, and it is therefore very refreshing to use a telescope for a change and to see our industry as a whole, and to speak in millions rather than in ten pound lots. The amounts mentioned by Mr. Downie in his paper as likely to be required over the next 15 years odd, are really staggering when they are considered as a whole. A hundred millions is a very considerable sum of money. The councillors who will borrow this money will no doubt wonder how the interest and the redemption will be paid. As engineers we also have some worry in that respect, but I think as an engineer in charge of a generation undertaking it affords me more sleepless nights pondering the question of finding the staff to take care of these millions of pounds.

I was really going to elaborate on this subject at this Convention, but I think I can usefully spend a bit more time gathering ammunition, and I will reserve it for a little later.

Mr. Vice-President, with these few words, I would like again to second the vote of

thanks and to thank you for the opportunity of doing so.

Applause).

THE VICE-PRESIDENT: Ladies and Gentlemen, we have listened to a very interesting address by our President, and two proposals very ably made by Mr. Mitchell and Mr. Muller. Before I ask the President to resume his duties in the Chair, I would like to ask you to show your appreciation in the usual way.

(Applause).

Thank you.

(Mr. DOWNIE resumed the Chair).

THE PRESIDENT: Thank you very much gentlemen, for the way in which you received my address.

LUNCHEON ADJOURNMENT ON RESUMING:

THE PRESIDENT: My first duty, gentlemen, is the announcement of the names of those elected to serve on the Executive for the ensuing year. They are as follows:—

G. J. Muller, Bloemfontein.

P. A. Giles, East London.

J. C. Downey, Springs.

D. J. Hugo, Pretoria.

R. M. O. Simpson, Durban.

C. Lombard, Germiston.

(Applause).

Before continuing, I would like to take the opportunity of thanking the out-going Executive. I want to refer particularly to someone who has not been re-appointed, and that is Mr. A. R. Sibson, of Bulawayo.

Mr. Sibson has done sterling work as a member of the Executive, and those of us who have served on it know and appreciate what he has done. We shall miss him, and his wise counsel, but we look forward to seeing him at future conventions.

Now we come to the one and only item on the Agenda this afternoon, and that is the paper by Mr. P. W. Cave on "Developments in Gas Pressure and Oil Filled Cables."

Mr. Cave graduated at Bristol in 1921 and has been in the cable industry ever since. He is now a Consulting Engineer to the Power Cables Division of Messrs. British Insulated Callenders Cables Ltd. and is attending this Convention as a representative of the Cable Makers' Association.

At home he is a member of 28 committees and sub-committees dealing principally with mains cables. Apart from the Cable Makers' Association technical committees, he is on three of the joint C.E.A.—C.M.A. cables committees and represents the C.M.A. on no less than 12 British Standards Institution, Electrical Research Association, and Institution of Electrical Engineers Committees concerned with Power Cables for mains, for ships, and for mining.

He has participated as a United Kingdom delegate in both of the Commonwealth Conferences on cables held to date, in London, in 1953 and in Delhi, last year.

He was appointed leader of the U.K. Cables Delegation to the International Electro-Technical Committee meetings in Yugoslavia in 1953 and in Russia last year, and is due to attend the forthcoming meeting in Copenhagen next July in a similar capacity.

Following the Moscow conference last July he was elected one of a working party of four to draw up a new specification for High Voltage Gas Pressure Cables, and this will be the principal item to be discussed at Copenhagen this year.

With Mr. Evans, Mr. Cave also attends the meetings of the International Electro-Technical Commission Technical Committee No. 18 which deals with electrical installations on ships.

Gentlemen, I have great pleasure in calling upon Mr. Cave to come up and deliver his paper. (Applause).

Before presenting a synopsis of his paper, circulated in advance to members, Mr. Cave thanked the A.M.E.U. of Southern Africa on behalf of the Cable Makers' Association of Great Britain for the opportunity afforded for the presentation of the Paper to the Convention.

DEVELOPMENTS IN GAS PRESSURE AND OIL FILLED CABLES

Presented on behalf of the Cable Makers' Association

By P. W. CAVE, B.Sc., M.I.E.E., M.Amer. I.E.E.

INTRODUCTION.

Since the end of the war there have been considerable developments in all departments of High Voltage Cable design and manufacture stimulated by the intense competition between the various types and conditioned to a very large extent by the requirements of the principal home customer, viz. the C.E.A. and the Area Boards.

Many of the developments, notably the use of screened conductors, the abandonment of the double lead sheathed types and the evolution of corrosion resistant coverings are common to all types of cable and will be dealt with first. Then those developments which are peculiar to the various types will be dealt with separately, type by type.

These types can be classified according to the method adopted for ionization suppression, and there are two broad categories :—

a) Cables in which the insulation is kept fully impregnated and free from voids.

b) Cables in which voids in the insulation are filled with gas under pressure.

Included in (a) are Oil Filled Cables, Compression Cables, Flat Oil Filled Cables (Mollerhoj Type), Oil Pressure Pipe Type Cables.

Included in (b) are Gas Filled Cables, Gas Cushion Cables, Impregnated Pressure Cables.

TYPE APPROVAL PROCEDURE.

The procedure which will now be described in general terms has been evolved from many discussions and conferences between the C.M.A., the C.E.A. and the Area Boards, and is something which the C.M.A. would like to see adopted internationally, at least so far as the broad principles are concerned.

By this method a design of cable, together with all the accessories which will be used with it in the final installation, is subjected to a series of very searching type approval tests and, having passed these tests to the satisfaction of the ultimate purchaser, the design is approved for all future contracts. A system having received official approval in this way is not required to be submitted again to type tests but it is, of course, still necessary to ensure that manufacture for a contract produces cable and accessories which are not inferior to those manufactured and used for the type tests. This is achieved by adequate routine and sample tests.

It is not considered necessary to subject every conductor size in a particular range to the type testing procedure. Satisfactory results obtained on the one small size and one large size are sufficient to obtain approval for all the sizes between and including the two sizes tested.

Discussions are still in progress as to the necessity or otherwise of including the small size it being felt in some quarters that if the large size proves satisfactory all smaller sizes will also be satisfactory.

The type tests comprise the following eight items. For tests 1 to 4 inclusive a miniature system consisting of a short length of cable with accessories is erected in the testing laboratory.

1. A loading cycle test with superimposed voltage equal to 1·5 times working voltage (1·33 times working voltage in the case of 275 kV. systems). During this test the cable is heated to a maximum conductor temperature 5°C. in excess of the declared maximum working temperature of the conductor for a period of 6 hours, and then the cable is allowed to cool down naturally over a period of 18 hours. This cycle of heating and cooling is repeated at the rate of 5 cycles per week until 20 cycles have been completed.

   Throughout the test power factor measurements are taken at the value of the superimposed voltage immediately prior to the beginning of each

loading current period (i.e. "cold") and immediately prior to the end of the loading current period (i.e. "hot"), and on the results obtained the stability of the cable is judged.

2. As a further test of stability for cables for voltages of 132 kV. and upwards the cable is subjected to a temperature stability test carried out as an extension to the loading cycle test. At the conclusion of the twentieth cycle the cable is again heated to 5°C. above maximum working temperature, with superimposed voltage as before, and with the loading current held constant. Once the test temperature is reached temperature readings of the conductor sheath are taken every hour for at least six hours to ensure there is no progressive rise.

3. The cable system is subjected to a hot impulse test, that is to say the application of an impulse voltage to cable and accessories while the former is maintained at its maximum declared working temperature.

   The values of the applied voltage employing a nominal 1/50 wave are:

   For 33 kV. systems — 194 kV.
   66 kV. „ — 342 kV.
   132 kV. „ — 640 kV.
   275 kV. „ — 1050 kV.

   and the system must withstand ten positive and ten negative applications of voltage of the appropriate value without breakdown.

For the above tests a miniature system comprising cable, joint(s) and sealing ends is erected and the type approval forthcoming from a satisfactory result to all the tests applies to all the accessories used.

For the cable alone there are further tests which must be satisfied before type approval is obtained.

These are:—

4. Power factor—voltage test at ambient temperature and at ½, 1, 1½ and 2 times working voltage.

5. Bending test.

6. Thermal resistivity test to check the thermal resistivity of the insulation.

7. Mechanical test on the reinforcement.

8. Saline bath test for the corrosion resistant covering over the reinforcement.

The first three of these tests are so well known that it seems unnecessary to give details.

The mechanical test on the reinforcement consists simply of sealing the ends of a short sample of cable and applying an internal pressure equal to twice the maximum declared working pressure of the cable for a continuous period of 7 days and checking that, throughout the period, there is no leakage.

The saline bath test is in a category of its own, and will be described in a later section of this paper dealing with protective coverings.

MAXIMUM DIELECTRIC OPERATING STRESSES.

The period under review has seen a steady increase in the maximum dielectric stress employed in the designs of the various types of cable, as will be seen when each type is considered individually.

It is, of course, Tests 1, 2 and 3 of the type approval precedure which have been the principal controlling factor.

The impulse levels quoted in Test No. 3 are those prescribed by the C.E.A. and Area Boards, and do not necessarily apply to countries outside the United Kingdom.

For example, the I.E.C. Recommendations for oil filled and gas pressure cables, when they are issued, will almost certainly include much lower levels, except when the cable is short and connected direct to an overhead line, thus requiring a higher surge strength.

The I.E.C. do, in fact, recognise two classes of insulation for transmission line equipment, full insulation and reduced insulation, and these may be extended to cables and their accessories.

The following table gives a comparison between the surge levels required by the two bodies:

Nominal system voltage kV.	Impulse withstand voltage kV.		
	I.E.C.		C.E. & Area Boards
	Reduced Insulation	Full Insulation	
33	—	200	194
66	300	350	342
132	550	650	640
275	1050	—	1050

If it is assumed, purely for the purposes of urgument, that 1000 kV/cm is the maximum dielectric stress under impulse testing conditions which the insulation can withstand without breaking down, it is possible to calculate the basic maximum stress at normal working voltage upon which cables can be designed to ensure that they will stand up to the surge levels quoted.

The figure of 1000 kV/cm is, at this juncture in the paper, purely a talking figure—actual figures vary from type to type.

The maximum permissible stresses under normal working conditions calculated on this basis are approximately as follows:—

	I.E.C. Reduced Insulation	C.E. & Area Boards
33 kV.	—	100 kV/cm.
66 kV.	125 kV/cm.	110 kV/cm.
132 kV.	140 kV/cm.	120 kV/cm.
275 kV.	150 kV/cm.	150 kV/cm.

but these stresses cannot always be adopted for a number of reasons.

IMPULSE TESTING.

Since the war the amount of impulse voltage testing carried out in the various C.M.A. laboratories has increased considerably. When impulse testing was first introduced, and for many years after, it was the practice to test the cable sample at ambient temperature; in fact most of the levels given in the previous section were derived in the first place from tests made at ambient temperature on line insulation.

It was, however, generally agreed some four or five years ago that impulse testing at ambient temperature although convenient in the laboratory was not related to actual working conditions and it was eventually agreed that these tests should be carried out at the maximum declared operating temperature of the cable. At elevated temperatures the maximum withstand stress is lower than at ambient temperature, due mainly to the lower viscosity of the impregnant. The drop in stress is greater in some types than in others, and therefore the adoption of hot impulse testing, as it came to be called, meant that the test was more severe, but at the same time realistic.

All cables and accessories are now tested with impulse voltages with the cable at its maximum declared operating temperature which at present is 85°C. for all types up to and including 132 kV. and testing commences at the appropriate withstand level given in the table with ten positive and ten negative applications. Sometimes the test is extended to breakdown to give an indication of the margin of safety. In order that different tests can be truly comparable, the method of increasing the voltage has been standardized thus:—

With the loading current still maintained constant the test cores of the assembly are submitted to 10 successive negative, followed by 10 successive positive impulses, starting at the specified withstand voltage and increasing in 10 kV. steps for 33 kV. cables, 15 kV. steps for 66 kV. cables, 20 kV. for 132 kV. cables and 30 kV. for 275 kV. cables until failure occurs.

During the period under review there has been a considerable increase in the impulse stress required to breakdown the cable insulation and figures as high as 1050 kV/cm. have been obtained on modern 132 kV. cables designed to operate at a stress of 110 kV/cm.

CONDUCTORS.

Much of the improved performance under impulse testing conditions has been achieved by producing a smooth surface to the conductor, either by die-ing down or compacting and then screening with either carbon black or metallized paper tapes.

The introduction of shaped conductors for gas filled and oil filled cables for 33 kV. operation was only made possible by using died-down and screened conductors and for operating voltages of 132 kV. and higher the conductors of all types of cable are smoothed in this way.

Without die-ing down, compacting or screening the corrugated surface of standard conductors produce peaks of stress around the periphery which may be 10 to 25% higher than the stress calculated on the assumption of a smooth cylindrical surface, which is the customary practice. This variation in stress around the periphery also produces tangential stresses, and the combination of the two gives a lower dielectric strength than is obtained with a smooth surface.

Hollow conductors, as used for single core oil filled cables, are compacted by making the strand from preformed wires and then drawing the completed strand through a die. Compacting of shaped conductors is, of course, achieved by rolling.

The methods adopted for screening are described under the individual types.

INSULATING PAPER.

(a) *Material.*

There has been a steady improvement in paper quality and a general adoption of high impermeability and high density papers to obtain better electrical and mechanical properties.

(b) *Application.*

The high performance now required of the insulation and the heavy insulation necessary for the very high voltages has led to much improvement in the technique of paper lapping.

It is desirable, for example, to keep the paper insulation free from wrinkles and creases which although not having as much adverse effect on the electrical performance of the cable as might be imagined, do create an unfavourable impression when the cable is being dissected.

These defects can be avoided by careful control of the tension with which the papers are applied, by accurate grading of these tensions radially through the insulation, and by control of the moisture content of the paper at the time of lapping.

The last point is important because paper shrinks during drying; the percentage shrinkage is greater in the thickness than in the length. This results in the papers next to the conductor tightening, but further out they tend to slacken and produce a spongy insulation which leads to creasing and tearing of the papers when the cable is bent.

The practice has therefore been adopted of completely enclosing the paper lapping machine together with the paper cutting machine and the storage racks in a fully air conditioned enclosure, so that the whole process is carried out under constant conditions of temperature and humidity. This results in the papers applied to the cable having uniform moisture content, so that the shrinkage during drying can be compensated accurately by correct tensioning. The result is a dielectric completely free from wrinkles and creases. The process of paper lapping with pre-impregnated paper tapes also ensures a dielectric completely free from wrinkles and creases.

LEAD SHEATHS.

Development during the period under review has been steady, if not spectacular. All has been directed to the production of featureless pipes of uniform grain size. The alloys used for the various types of cable are explained by the different processes used in manufacture, and the different functions in service.

The oil filled cable for example, differs from other types in that the final drying and impregnation of the paper insulation takes place after lead sheathing. In service too, the oil filled cable sheath is subjected to lower internal pressure, albeit a wider range of pressures than the gas pressure types which are under a substantially constant pressure. The internal pressure in an oil filled cable varies with the contour of the route and with the load on the cable.

The alloy used by most oil filled cable manufacturers in the U.K. has for many years now been one containing 0·2% tin and 0·075% cadmium, and is known as ½C. Many alloys have been tried and some have been abandoned either because they did not suit the press being used for them, or because they exhibited undesirable features of grain growth during the drying and impregnating period which resulted in transverse cracking in service and led to numerous oil leaks.

In the early years oil leaks were troublesome due to longitudinal cracks caused mainly by oxide inclusives and indifferent temperature control during extrusion. In modern presses using modern extrusion techniques this type of trouble is happily rare, and this of course applies to all types of cable, not only oil filled.

For the diaphragm sheath of the compression cable it is necessary to use a material which will readily respond to changes in internal volume, and to the effect of the external gas pressure. Commercially unalloyed pure lead has been found to be the best for this type of duty.

For reinforced pressure retaining sheaths of all types of gas pressure cables the sheath is made from pure lead. Alloy E, or an alloy containing 0·1% tin, and the sheath thickness is derived from the formula

$tL = 0{\cdot}02D + 0{\cdot}055''$ where tL is the minimum thickness of sheath at any point in ins.

D is the diameter under sheath in ins.

ALUMINIUM SHEATHS.

The introduction of aluminium sheaths for mass impregnated cables which led to the production of Part 2 of B.S. 480-1954 has been extended to gas-pressure and oil filled cables. The sheath is applied either by die-ing down an oversize sheath until it is a reasonably close fit on the insulated core assembly, or by forming the sheath from aluminium strip folded round the cable and argon-arc welded to produce a continuous longitudinal gas and oil tight seam. The resulting sheath may be left plain or it may be corrugated in order to obtain increased flexibility. A corrugated aluminium sheathed cable can be bent to the same minimum bending radius as the corresponding lead sheathed type and with the same ease.

Aluminium sheathed cables, whether gas pressure or oil filled, do not require any reinforcement, being strong enough to withstand the internal gas or oil pressure. The sheath must, of course be protected from corrosion, and any of the corrosion resistant coverings described later in the paper can be used for this purpose.

REINFORCEMENT.

Broadly speaking there are three main types of reinforcement in use today.

For gas pressure cables operating with an internal pressure around the 200 lbs/sq. in. mark or even higher in exceptional circumstances, it is necessary to provide reinforcement to the lead (alloy) sheath to withstand both the longitudinal thrust tending to stretch the cable and also the hoop or circumferential stress tending to distend and ultimately burst the sheath.

There are two methods of achieving this dual object. One is to use reinforcement which deals separately with the longitudinal and circumferential stresses in the following manner:

A layer of impregnated cotton tape is first applied to the lead sheath to act as

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a cushion and protect the sheath from damage. This is followed by a layer of narrow metal strips applied with a long lay (longitudinal reinforcement). Over these strips are applied two or more layers of much wider tapes applied with a short lay (circumferential reinforcement).

An alternative method is to apply metal tapes in two or more layers at such an angle to the cable axis that the stress components parallel to the axis and at right angles to the axis are in the correct ratio of longitudinal to hoop stress. The theoretical angle of application to produce this result is 54°44′ and reinforcement applied at about this angle is known as compensated reinforcement and is used by several manufacturers.

In the oil filled cable, operating at much lower internal pressure than the gas pressure types, longitudinal reinforcement is not considered necessary and only circumferential tapes are applied as indicated in the section headed "Oil Filled Cables." Longitudinal reinforcement is also unnecessary in self-contained pressure cables and in flat oil filled cables.

The materials used for reinforcing tapes are steel (for 3 core cables only), 1% tin bronze, hard drawn copper, or ¾ hard brass.

The designs are all based on a 0·01% proof stress of 40,000 lbs. per sq. in. for all these materials and using a factor of safety of 2.

CORROSION RESISTANT COVERINGS.

The sheath and reinforcement of any cable, gas pressure or oil filled are vital components which must be protected from corrosion at all costs. For example, the incidence of corrosion to the reinforcement of a lead sheathed cable, or to the aluminium of an aluminium sheathed cable will almost certainy lead to progressive corrosion which will eventually weaken the reinforcement on aluminium sheath to a point where it will no longer contain the internal pressure in the cable. Bursting of the sheath will then take place and this could lead to electrical breakdown if the cable is not removed from service or the pressure maintained in some way.

In the early days, of oil filled cables particularly, the reinforcement of 3-core cables consisted of 10 mil steel tapes, and 16 mil brass or cadmium copper or tin bronze tapes were used for single core cables, and in either case they were protected by a second lead sheath which in turn was protected by the customary fibrous protection as used for solid type cables, e.g. two compounded papers, one compounded cotton and one compounded hessian overall. Nowadays this second lead sheath is almost never used and reliance is placed on a corrosion resistant covering of rubber or P.V.C. or a combination of the two.

It was in the development of suitable corrosion resistant coverings that the saline bath test referred to under item 8 of the type approval test schedule was and is extensively used.

The test consists essentially of immersing a sample of the completed cable in a ½% solution of brine. To simulate the handling which the cable may receive during installation the sample is subjected to the standard bending test before immersion.

(Development work is still in progress to evolve a satisfactory method of simulating the effects of dragging the cable along the bottom of a trench and of abrasion by sharp stones, but so far there has been no final agreement about this pre-treatment and no provision for it in the standard test).

A potential of 10 volts D.C. is applied across the covering under test, i.e. between the brine bath and the metal reinforcement (or sheath in the case of aluminium sheathed cables which do not need reinforcement but still have to be protected from corrosion) with the latter connected to the negative pole. The reason for this method of connection is to create osmotic pressure in the direction to drive the salt solution through any weak spots in the covering.

The leakage current is measured and then the brine bath is heated to a temperature of 75°C. which is approximately the maximum temperature which the covering will reach in service. This elevated

temperature is maintained for 5 hours and then the bath is allowed to cool naturally for 19 hours. This cycle of heating and cooling is repeated at the rate of 5 cycles per week until 100 cycles have been completed.

The leakage current is measured before the commencement of each heating cycle and for a covering to pass the test the leakage current at no stage must exceed the initial measurement by more than 10 micro amps.

As a result of many tests on different coverings by different manufacturers of the various types of pressure cables some measure of standardization has now been achieved, and the 'standard' covering is described in the B.E.B. Specification in the following terms :—

(a) Coating of waterproof compound.
(b) One lapping of cotton or P.V.C. tape.
(c) One complete double layer of rubber compound tapes applied to a minimum radial thickness of 0·040 inch.
(d) One lapping of cotton or P.V.C. tape.
(e) Coating of waterproof compound.
(f) One impregnated hessian tape.
(g) Coating of waterproof compound.
(h) One impregnated hessian tape.
(i) Coating of waterproof compound.

A layer of conducting material is incorporated in the serving over the non-fibrous layer to provide an electrode for the voltage test, which is applied at works and again on site after laying to check the integrity of the covering.

DEVELOPMENTS IN THE INDIVIDUAL TYPES OF CABLES.

Having dealt at some length with those development which are more or less common to all the different types of oil filled and gas pressure cables, some general notes on each individual type will now be given.

COMPRESSION CABLE.

General Description :

In the compression cable the insulation is subjected continuously to a pressure of about 200 lbs./sq. in. transmitted through an impermeable membrane which may be either a thin lead or polythene sheath. The membrane expands to accommodate compound expansion when the cable is warming up under load, and the external gas pressure ensures that the membrane will follow up the contraction of the compound when the cable subsequently cools down. Thus void formation is prevented.

The construction of a compression cable differs only in detail from that of a solid type cable. For a three core, the S.L. construction is preferred, and consists of a stranded conductor, of oval cross section insulated with paper tapes impregnated by the mass impregnation process, and then lead or polythene sheathed. The sheaths are then lightly reinforced with paper and metal tapes. The three cores are then laid up without any fillers and then are either enclosed in a reinforced lead sheath (self-contained type) or drawn into an already installed steel pipe (pipe type).

In the self-contained type the pressure retaining lead sheath is applied over the three laid up cores, is reinforced with metal tapes and served overall with a corrosion resistant protection as already described.

In the pipe type installation employing polythene diaphragm sheaths over the individual cores, the laying up process may be dispensed with, the three single cables being drawn into the pipe simultaneously.

If a self-contained single core construction is required, e.g. at termination, a circular pressure retaining sheath is extruded over a single oval lead sheathed core, the space between the oval core and the circular outer sheath providing the gas space.

Conductors.

The conductors are made of near oval sections more accurately described as a rectangle with semi-circular ends and for voltages of 132 kV. and above the conductors are screened with semi-conducting carbon black paper tapes. The number of tapes used varies with conductor size and voltage.

Insulation.

The practice is to use thin high density papers next to the conductor for a propor-

tion of the thickness and thicker tapes for the remainder.

Impregnant.

The compound used is a mixture of mineral oil and polyisobutylene.

Diaphragm (lead) Sheath.

This is composed of commercially pure lead, not an alloy, and is lightly reinforced to withstand sudden internal pressure transients due to violent load fluctuations. The reinforcement consists of non-ferrous tapes applied over a bedding of oiled paper.

Steel Pipe.

Hot finished seamless open hearth mild steel pipes of standard thickness are generally used and the internal diameter is chosen such that the cable occupies about 40% of the internal space. When laid in the ground no provision is made for expansion, the material being strong enough to withstand the compression stresses which are set up. The tubes are supplied in random lengths of up to 40 ft. with the ends swaged so that they can be welded together using a buttweld nipple joint which ensures the same internal diameter of joint as of tube, and prevents metal spikes from the arc welding being left inside the tube.

Protective Coating.

The usual protection for the steel pipe consists of a layer of loaded bitumen approximately 0·25" thick, the loading material being asbestos, quartz or sand. Recently the mechanical properties of the coating have been improved by incorporating glass fibre tapes with the construction.

When the protection is applied on site it is preferable to use a construction employing tapes which can be lapped on. To this end coatings are now being produced comprising butyl rubber tapes interleaved with layers of bitumen which possess both high electrical and mechanical strength.

The coatings are tested at various stages of the installation by applying a high D.C. voltage. A circular metal brush is moved along the pipe from one end to the other; any faults revealed are then repaired.

Reinforced Sheath of Self-contained Type.

The method of reinforcement and its protection from corrosion follows closely the practices adopted for Impregnated Pressure and Gas Filled cables, and is described under those headings.

Design Stresses and Operating Temperatures.

There has been little change during the period under review and the stresses employed in present day designs are :—

33 kV. — 80 kV/cm.
66 kV. — 85 kV/cm.
132 kV. — 110 kV/cm.

and the maximum conductor temperature is 85°C.

GAS CUSHION AND IMPREGNATED PRESSURE CABLE.

General Description.

In these types of cable the insulation is maintained under high gas pressure, usually nitrogen, at round about 200 lbs/sq. in. which is contained within the metal sheath of the cable and is therefore in contact with the insulation, as opposed to the Compression Cable where the diaphragm sheath keeps the gas out of contact with the insulation.

Also, unlike the compression cable, no external pressure is applied to the sheath to follow up changes in the compound volume during heat cycles. Voids in the insulation are filled with nitrogen under pressure and therefore do not ionize under working conditions.

Stranding, insulating and sheathing follow solid cable practice in broad outline and for three core cables the screened constuction is invariably used, not the S.L. type.

The pressure retaining sheath may be of lead alloy, in which case it must be reinforced and the reinforcement protected by a corrosion resistant serving; or it may be of aluminium, in which case no reinforcement is necessary but the corrosion resistant serving is still needed.

Conductors.

These are invariably circular in section, are made with standard strandings.

For cables of all voltages the conductor is screened by the application of metallized paper tapes.

Insulation.

The impregnant used is similar in both designs, being a blend of polyisobutylene and mineral oil. The Specification of a typical compound is :—

Specific Gravity 15·5°C.	0·918
Flash Point deg. C.	240
Pour Point deg C.	0·
Coefficient of Expansion/deg. C.	0·0007
Viscosity—centistokes 60°C.	450
Viscosity—centistokes 100°C.	64
Specific Inductive Capacity 150°C.	2·3
Dielectric Strength BSS. 148/1951	40 kV.
D.L.A. 100°C. (initial)	0·0005
D.L.A. 100°C. (aged)	0·0010

Ageing Test—Four litres of filtered air blown per minute through 300 grams of compound maintained at 125°C. for six hours.

Reinforcement.

For gas cushion cables a compensated reinforcement is used which combines the two stresses, longitudinal and circumferential but in the impregnated pressure cable it has always been the practice to have separate longitudinal and circumferential components.

Design Stresses and Operating Temperatures.

There has been little change during the period under review and the stresses employed in present day designs are :—

33 kV. — 85 kV/cm.
66 kV. — 93·5 kV/cm.
132 kV. — 100 kV/cm.

and the maximum conductor temperature has risen only 5°C. from 80°C. to 85°C.

OIL FILLED CABLES.

General Description.

The successful operation of this type of cable depends on maintaining a perfectly void-free dielectric under all ambient conditions, and under all conditions of load. This is achieved by impregnating the insulation with a thin oil, not unlike transformer oil, and providing reservoirs at strategic points along the route into which the additional volume, produced by expansion when the cable is under load, is forced and which return the oil to the cable system when the load is reduced and contraction takes place.

To facilitate the flow of oil along the cable towards these reservoirs and so keep the transient pressures to a practicable minimum, ducts are provided inside the cable.

In single core cables the duct is in the centre and the conductor is stranded round it, except in the short lengths of single core cable used for terminations when, as an alternative, the ducts are formed by grooves in the under side of the lead sheath. There are thus two forms of single core cable, viz. hollow conductor type and fluted lead type.

In three core cables the ducts are accommodated in the outer interstices between the insulated cores in the core assembly.

Conductors.

Three core and fluted lead single core cables have standard stranded conductors usually made from tinned wires to facilitate soldering during jointing.

Hollow conductors are designed specially to give the requisite area. The wires used are plain high conductivity copper stranded round the central steel duct in one or more layers with no gaps between the wires. Conductors for 132 kV. and above are died down and screened with either metalized papers or carbon black papers.

Insulation.

The modern practice is to use thin (3 to 3½ mil) high density papers next to the conductor for a proportion of the total insulation thickness and 5 to 5½ mil papers for the remainder.

Oil Saturant.

There has been a significant change in the type of oil used which has resulted in an economic saving and the overall cost of a system under certain conditions.

This is the introduction of what is at present known as "low viscosity" oil for the cable saturant. A comparison between this oil and the oil previously used is given in the following table :

Test	Normal Grade	Low Viscosity Grade
Flash Point, closed	295°F. (Minimum)	250°F. (Minimum)
Pour Point	−40°F. (Maximum	−50°F. (Maximum)
Viscosity @ 0°C.	110 centistokes (Maximum)	37 centistokes (Maximum)
20°C.	30-35 centistokes (Maximum)	14 centistokes (Maximum)
60°C.	6-7·5 centistokes (Maximum)	4 centistokes (Maximum)
Power Factor @ 850°C.	0·002 Maximum	0·002 Maximum

The important difference is the greatly reduced viscosity of the "low viscosity" oil at the lower end of the temperature scale. This enables much longer sections to be fed in those cases where the limitation in the length of a section is the maximum heating transient. These heating transients are produced at all points along a cable route by rapid fluctuations in the load causing a correspondingly rapid expansion or contraction rate of the oil, depending on whether the load is increasing or decreasing. The maximum heating transient occurs when full load is suddenly switched on to a cold cable and at a point remote from the feed point. Modern O.F. cables are designed to withstand a maximum transient pressure of 90 metres of oil (125 lbs/sq. in.) and the maximum heating transient plus the static pressure at any and every point along the route must not exceed this value. As the transient pressure is directly proportional to the viscosity of the oil at any temperature, it is obviously possible to have oil sections very much longer with the new low viscosity oil, and this can mean the elimination of stop joints or at any rate a reduction in the number of stop joints required along a route.

There are no disadvantages attending the adoption of this low viscosity oil. Being made from the same crude as the earlier type the two oils are perfectly miscible and there is therefore no difficulty or hazard if two cables impregnated respectively with the two different types of oil have to be joined together although appropriate allowances must be made when determining the oil feeding arrangements.

Apart from its general application for cables working under normal ambient conditions this low viscosity oil has a special application for cables which are required to be installed outdoors in air in certain parts of the world where they will be subjected to abnormally low ambient temperatures in winter.

In such circumstances a high viscosity oil could prove a serious handicap in the hydraulic design.

Lead Alloy Sheath.

As mentioned earlier the alloy generally used is ½C.

Reinforcement.

Circumferential reinforcement only is provided consisting of metal tapes applied in tandem with a gap between convolutions. The materials used are steel, tin-bronze or cadmium copper, the first-named being used only for three core cables.

Protection to Reinforcement.

The earlier cables were protected with a second lead sheath but now-a-days all cables are made with a single lead sheath with the standard corrosion-resistant protection over the reinforcement.

Design Stresses and Conductor Temperatures.

The following table gives a comparision of the figures used in 1945 and those in use today:

	33 kV.		66 kV.		132 kV.		275 kV.	
	1945	1957	1945	1957	1945	1957	1945	1957
Maximum Dielectric Stress or Insulation Thickness	* 0·16″	* 0·13″	75 kV/cm	80 kV/cm	85 kV/cm	110 kV/cm	—	130 kV/cm

During the same period maximum conductor temperatures have increased for all voltages from 75°C. to 85°C.

*The thickness of insulation on the conventional three core 33 kV. oil filled cable is a good deal greater than is required for purely electrical performance. In the smaller conductor sizes the additional thickness is necessary to enable ducts of adequate size to be accommodated in the filler spaces. It is a question of pure economics. If the thickness of insulation is reduced the size of duct is also reduced and since the resistance to oil flow increases as the inverse fourth power of the internal diameter of the duct, the length of oil section which can be fed from one point is drastically reduced in the same proportion. The present day figure of 0·13″ associated with the use of low viscosity oil gives oil sections of reasonable length.

The introduction of the ductless, fillerless oil filled cable dealt with in the next section has to some extent removed this limitation.

Ductless, Fillerless Shaped Conductor Oil Filled Cable.

This is a recent type which has been introduced for 33 kV. systems. As its name indicates there are no fillers and no steel ducts in the filler spaces. The filler spaces are in fact the ducts.

Shaped conductors are used because they provide more support to the sheath when the latter is composed of lead alloy (with reinforcement).

The protection over the aluminium or over the reinforcement of the lead sheathed variety is the standard corrosion-resistant protection used for all other types.

To prevent collapse of the lead sheath a positive pressure of about 25 lbs/sq. in. is maintained inside the sheath until the cable is installed, when the pressure is raised to the maximum possible having regard to the profile of the route.

In all other respects the cable is similar to a conventional three core oil filled cable.

Flat Oil Filled Cable (Mollerhoj Type).

This is a recent innovation so far as the C.M.A. is concerned. Originally developed in Denmark it has not yet been installed commercially in the United Kingdom, although lengths have been manufactured for the purposes of Type Approval and have satisfactorily passed the necessary tests.

In its construction three paper insulated and screened cores are laid side by side in flat formation and enclosed in a lead sheath having flat sides and semicircular ends.

After sheathing the cable is dried and impregnated with low viscosity oil using conventional oil filled cable manufacturing technique.

The lead sheath is reinforced by means of circumferential non-ferrous tapes and the flat sides with corrugated tin-bronze tapes which are tightly held in position by a lapping of hard drawn copper wire located in the grooves of the corrugation.

The combination of lead sheath and corrugated tapes acts as an elastic membrane which expands and contracts with increasing and decreasing conductor temperature and prevents void formation.

The cable can therefore be classed as a compression cable or as a self-compensating oil filled cable which does not require external oil feeding equipment.

It is ideally suited for long cable routes where intermediate feed points are impracticable, e.g. submarine crossings.

GAS FILLED CABLES.

General Description.

Gas filled cables differ from other types in one important direction; the insulation is composed of pre-impregnated papers and there is no further drying and impregnating process after the papers have been applied to the conductor.

The insulation is therefore to a degree cellular in construction containing spaces between the edges and convolutions of paper which are not filled with compound but, later, when the cable is gassed, by nitrogen at 200 lbs. per sq. in. or thereabouts.

Since the stress at which gas spaces ionize is not only a function of the gas pressure but also as an inverse function of the dimensions of the space, the papers are graded in thickness with thin papers (1¾ mils nominal) near the conductors, 2½ mils nominal further out in the wall of insulation and 4 with occasional 6 mils for the outer layers.

Conductors.

Three core 33 kV. and certain sizes of 66 kV. cables have always been manufactured with shaped conductors, while single core cables have died conductors. All conductors are screened with metallized paper.

In common with other types there has been considerable interest in the past two years in the use of aluminium conductors.

Insulation.

There has been no major change in the insulation since this type of cable was first introduced. In common with other types, there has been a steady improvement in paper quality and the adoption of high impermeability and high density papers.

Reinforcement.

Up to 1950 mild steel reinforcement was used on three core cables and brass on single core cables.

With the dropping of the second lead sheath the reinforcement was changed to 1% tin bronze for single core cables and it may be adopted on three core cables as well, in order to obtain a slightly improved current rating.

The tapes are applied at approximately the optimum angle on a single, double or treble start basis to limit individual tape widths to 2″ in order to maintain a satisfactory bending performance. For the same reason, the outer two layers of tapes which, before 1956, were applied with overlapping tapes are now applied with a gap.

Corrosion-Resistant Covering.

This now follows the practice of other types and uses a waterproof compound cotton tape under the 40 mil rubber layer. The tape applied immediately over the rubber layer is loaded with carbon to act as the outer electrode when testing the rubber sheath electrically.

Operating Stresses.

These have increased over the years from 1939 to 1957 as follows :—

33 kV. Cables—
From 54 kV/cm. to 75 kV/cm.

66 kV. Cables—
From 80 kV/cm. to 85 kV/cm.

132 kV. Cables—
From 85 kV/cm. to 100 kV/cm.

275 kV. Cables—
. . . . . 110 kV/cm.

Maximum Conductor Temperature.

Over the same period the maximum operating temperature of the conductor has increased from 80°C. to 85°C. except for the 275 kV. cable which at present is restricted to 80°C.

OIL PRESSURE PIPE TYPE CABLE SYSTEMS.

General.

During the past year the first cable system of this type has been installed in England and is now working.

This type of cable system consists essentially of a steel pipe line containing oil under pressure and enclosing the insulated conductors of the cable. It bears therefore a close resemblance to the Compression-Pipe type cable with oil substituted for nitrogen gas as the filling medium for the pipe.

Conductors.

These are composed of hard drawn copper wires. The use of hard drawn copper is necessary to provide adequate mechanical strength during installation when the cores are pulled into the pipe.

Insulation.

The insulation consists of high density paper impregnated with a straight mineral oil of medium viscosity.

After impregnation the insulated and screened cores are protected from dirt and moisture by intercalated layers of metal and plastic tapes. A skid wire is then applied overall. The cores are wound on despatch drums which are sealed with special covers of moisture impervious material and the enclosed space is maintained under gas pressure to exclude damp air.

Pipe Line.

As each section is completed a tow line is blown through it and then the pipe is cleaned, dried and charged with nitrogen under a positive pressure to exclude damp air. During installation of the cable a flow of nitrogen is maintained for the same reason.

Sections will vary in length. In this pioneer installation there were two sections measuring 1,360 yards and 1,140 yards respectively.

Operating Stress and Maximum Conductor Temperature.

The same figures are permissible as for the corresponding oil filled cable.

SUBMARINE CABLES.

No paper on development of high voltage cables since the war would be complete without a reference to one of the outstanding achievements of the period; the successful installation of a cable link between the British Columbia mainland and Vancouver Island comprising 138 kV. single core cables.

The gas filled design was adopted firstly, because it is capable of being operated in service without the use of auxiliary equipment at intermediate points along the route and secondly, because it is the only type which could be manufactured in one continuous length of the length required—16 miles. This length was necessary to avoid having under-sea joints in the cable. Another advantage of this type for this project is the relative ease with which such a long length can be charged with gas.

The following are a few of the main features of this installation.

Conductor.

This was a 0·35 sq. in. conductor stranded over a central duct and screened with three metallized paper tapes.

Insulation.

This comprised pre-impregnated paper tapes screened with copper tape.

Pressure Retaining Sheath.

This was composed of alloy E.

Reinforcement and Corrosion Resistant Protection.

Layers of tin coated bronze tapes were used protected by a waterproof compounded cotton tape followed by a proofed tape, a vulcanized rubber sheath and a further waterproof of compounded cotton tape Thus far the coverings were similar to land practice.

The cable however had to be heavily armoured to sustain the stresses and strains of installation and to provide adequate mechanical protection, so the construction proceeded with :—

(a) A layer of impregnated jute to serve as a bedding for

(b) A single layer of galvanised steel wires each of 0·25″ diameter.

followed by :

(c) A proofed tape, a waterproof compounded cotton tape and a compounded jute serving overall.

Operating Stress, Loading and Gas Pressure.

The cable is designed to operate at a maximum dielectric stress of 85 kV/cm. and the three-phase circuit is capable of transmitting 120 MVA at 138 kV.

The cable is designed to operate at an internal gas pressure value of 300 lbs/sq. in. This value of pressure was used in order to prevent ingress of water into the cable

structure in the case where it was damaged or severed by external means. The cable can withstand external pressure up to 500 lb/sq. in. without deformation with an internal gas pressure equal to that of the atmosphere. This feature is necessary as the cable is installed with atmospheric pressure inside the sheath and this condition exists until the terminations are completed. In addition in the case of damage the gas pressure is released for the repair work and the cable must withstand the external water pressure of 265 p.s.i.

CONCLUSION.

This paper is a factual statement which of necessity has had to be highly condensed in order that all the development work which has taken place during the period under review can be included in a paper of normal length.

It must be realised that each individual development has usually been the result of extensive research work which in many cases would well justify a paper to itself. Furthermore, no mention has been made of the development work on all the accessories which has proceeded on parallel lines.

A good deal of this development has been directed towards cables operating at higher and higher stresses and temperatures with obvious economic advantages to the user. This has been achieved without any sacrifice in reliability.

Mr. P. A. GILES (East London): I have very great pleasure in proposing a vote of thanks to Mr. Cave for his excellent paper which sets out very clearly the fundamentals of impregnated paper cable making and indicates in a very satisfactory manner the technique and research associated with the production of paper tape and suitable impregnants.

In my opinion the author is to be congratulated on the excellence of his subject matter and his presentation of it. Papers of this class, which contain a wealth of technically descriptive matter, will prove an authoritative reference in estimating and in specifications to those engineers engaged in this work, when the full paper is published in the proceedings. Students and various members of the departmental staffs can then spend a few very profitable hours reading through the paper, and the ultimate discussion, to gather the details of the recent development of power cables.

I was particularly interested in the comparatively rapid development of the use of pressure as a means of void control, which has resulted in the attainable standard of performance of cables being raised to a very high level, both as regards voltage and capacity for loads, and it is interesting to note that it is now possible to install the ideal cable, that is, the cable without joints using direct gas pressure for a distance of sixteen miles. Of course this cable must be laid in the sea. I don't suppose it would be possible to lay it on land. If it were so, it would be a very promising outlook for those people who are responsible for power cable installation.

Mr. Cave has indicated that the task of building a cable capable of sustaining high internal stresses is a matter involving many mechanical difficulties, and the patience and ingenuity required to be applied to the solutions of the practical problems involved is clearly evident. This Mr. Cave did not really explain fully in his description this afternoon, but those of us who have read the paper can see that there has been a great deal of very intricate and critical work involved in the manufacture of these cables.

From the technical angle, the inhibition or the suppression of local voids, or the gas pockets which form, besides preventing the weakening and the subsequent failing of the dielectric, and the subsequent ionisation and disruptive discharge in the void, permits the electric stress to be raised to a much higher value, as indicated in the paper, without endangering the performance of the cable. This is, I understand, a very old principle; the application of pressure so that when the cable expansion takes place the voids are under control at all times.

The resulting permissible increase in the maximum electric stress permits a reduction in the dielectric wall thickness as mentioned by Mr. Cave and consequently a smaller and lighter cable for a specified load is possible.

A further feature is that the decreased dielectric thickness reduces the thermal resistivity of the cable, and this of course allows an increased current loading. Also, a high maximum conductor temperature is possible, as the application of pressure to the dielectric controls the effect of the heat cycle brought about by the loading.

It is of value to note from the paper that pressurising the cable has now increased the surge withstand characteristics of cable insulation, thus improving the performance of the high voltage cable of the future.

I understand that there was some doubt about five years ago that the surge withstand characteristics may prove a limitation to the development of the high voltage cable.

The author has indicated that there is no practical alternative to the oil impregnated paper dielectric, and the fact that paper has been used for the insulation of cables from the early stages of their development is a tribute, not only to this durable material, but also to the pioneer cable makers who saw in the flexable paper insulated cable an important alternative to the rubber insulated cable which was first in the field for power transmissions and distribution in the 1890's.

The only change that I have been able to ascertain is that the original long fibre manila paper, which was selected on account of its good tearing resistance was superseded in 1940 by the all-wood papers and now cable impregnates are required to withstand deterioration and maintain reliable performance for periods of up to 40 years, which is a very onerous requirement. But Mr. Cave has indicated that the problem is well on the way to being solved.

The next major advance seems likely to have been an entirely new insulating material not already mentioned, but whatever that material may be, it must be economic in performance if it is to replace the now classic paper impregation for cables.

Mr. President, our thanks are due to the author for the work involved in the presentation of this paper.

Thank you. (Applause).

THE PRESIDENT: Thank you Mr. Giles. I will now call upon Mr. van der Walt to second the vote of thanks.

Mr. VAN DER WALT (Krugersdorp): Mr. President, Gentlemen, after listening to Mr. Cave's qualifications and abilities one would think anyone daring to discuss its contents or statements, or argue about it, would be kicking up a din where angels fear to tread. Obviously Mr. Cave has fared better in his scolastic career than a student who was wasting his father's money at university. His father had been expecting his final year results for many years, and a certain year when he was again writing his final, his father sent him a telegram and asked whether he had failed or passed. Back came the telegram: "Yes."

The father walked around with this telegram for a day or two and then sent him another telegram. "Yes, what?" A day after the reply came back. "Yes father."

Mr. Cave has stressed the Type Approvals Scheme of the Central Electricity Generating Board and Area Boards in Britain. Your Executive, (now speaking out of committee) has under consideration a standard form for general conditions of cable and one wonders if this could not be extended into something similar, a Type Approvals Scheme for your Association. I think it is worthy of consideration.

Mr. Cave, we have heard, is a member of the Committee No. 18 of the I.E.C. dealing in cables. One would expect that the recommendations issued by these Techical Committees would be followed by members of the I.E.C. I am disappointed to see that this is not the case, and that members of Mr. Cave's organisation are still following their own values, where standards would have been beneficial to all. I refer to impulse withstand voltages and dielectric stresses. Could Mr. Cave explain this diversion?

One is often at a loss, when specifying cables for voltages of 33 Kv and above, what operating dielectric stress to specify. One is afraid to specify a definite value, because it may exclude some modern developments which could be to the economic advantage of the consumer. On the

other hand, leaving it open, one absolutely dreads the adjudication of such a tender due to the number of alternatives that can be offered. Mr. Cave himself states that higher operating stress can be accepted without sacrificing reliability. Has Mr. Cave any definite opinion on a preferred operating dielectric stress level? Corrosion resistant coverings have come to the fore. I would like to have seen some recommended figure of minimum thickness of covering for various cables, various voltages under various conditions and I do not think it is impossible. It again makes the adjudication of tenders very difficult. While we, the engineers, would have to specify the cables, we have no clue as yet what to specify. The tenderers offer the various thicknesses and you have difficulty to adjudicate such a tender.

As a matter of interest, I may relate my experience with low tension cable near an electrified railway track, but at right angles to it. This cable used to last only six to seven months, and was then corroded through. The serving was the conventional jute serving. Electrolosis was suspected but could not be proved. The theory is now that before tarred roads were in existence the earth road in that area was stabilised with large quantities of salt. Soil samples subsequently gave ph values of as low as 2. My experience with aluminium cable is that it fails due to its not being flexible. Faults usually blow clear and service can be re-instated due to the good test, to fail again, usually 14 days or three weeks later, and at the odd hour of two to three in the morning due to condensation of moisture. This can be a nerve-wracking repetition.

We thank Mr. Cave, Mr. President, for his interesting disclosure in modern development of cable design and I have great pleasure in seconding Mr. Giles' vote of thanks. (Applause).

THE PRESIDENT: Thank you Mr. van der Walt. Gentlemen, we still have another ten minutes which should give one or two more an opportunity to contribute to the discussion.

I might say that I have suggested to Mr. Cave that he makes a note of the points raised during the discussion, and of the questions, and to reply to them at the end of the discussion.

Mr. R. M. O. SIMPSON (Durban): I would also like to join the proposer and seconder in thanking Mr. Cave very much indeed for his most interesting paper. Cables are undoubtedly playing an increasing part in all our undertakings particularly as they increase in size necessitating the use of higher voltages. In making my comments I do not propose to refer to the internal parts of the cable, but wish to ask Mr. Cave one or two questions regarding the protective covering.

That particular part of the cable is today assuming a very high place in the design of underground cables generally. Personally, from my point of view, gas and oil filled cables have certain advantages on account of their not suffering from the problems of migration of compound. The use of these particular types does more readily allow the use of unarmoured cables when a lead sheath is used, but it makes it more than ever imperative for the cables outer protective covering to be very durable and waterproof.

Manufacturers of late have paid much attention to protective coverings, but up to the present the integrity of this sheath covering has been limited to each length of cable between joints, so that you are still faced with the fact that once that cable is laid you cannot measure any deterioration. Quite frankly this aspect has stopped me from taking very much interest in aluminium, because of the ever present danger in a city, of some other Department eventually damaging this protective covering, it is almost certain that this will take place sooner or later. If there is no means of checking the overall integrity of the covering this trouble cannot be discovered before the cable suffers damage.

Have any steps been taken, or I should say I am interested to know what steps are under way, for the monitoring of the integrity of the sheath or covering over the full length of cable, it will of course be necessary for the joints themselves to be protected. Can Mr. Cave give any

information on this aspect of cable practice. When this facility is available I am sure it will certainly give impetus to the use of aluminium and plain steel as a reinforcing cover to lead.

With those few remarks I would like to thank Mr. Cave very much indeed for his most interesting paper. (Applause).

THE PRESIDENT: There is till time for another speaker gentlemen.

Mr. D. G. SUTHERLAND (Scottish Cables, Pitermaritzburg): Mr. President I appreciate that this paper is essentially a high voltage paper dealing with higher voltage cables, but there is one question which I should like to ask Mr. Cave if I can just go a little bit beyond the scope of the paper.

I would like to ask him his opinion as to the advisability or otherwise of introducing power factor tests for 11 Kv cables, and I would like to explain that in asking this question I do so because there appears to be a growing body of opinion in the Union which is advocating a power factor test for 11 Kv cables, either on a type test basis, while some sections of that body are even recommending a routine test. I feel that when this matter comes up for discussion and decision, the opinion of a man like Mr. Cave with his very wide experience would be very valuable.

THE PRESIDENT: Thank you Mr. Sutherland.

Any further discussion?

I intend to give more time to this later, gentlemen. Mr. Cave's paper is one that should give rise to question, and a great deal of discussion. Several people are on the point of considering tenders for high voltage cables, and they have to make up their minds about lead sheathing, aluminium sheathing, protective servings, and so on, and I think we engineers should take full advantage to learn as much as we can from the papers presented at this Convention by Messrs. Cave and Evans.

Before closing today's session, I have some announcements to make.

(There followed Convention Announcements).

CONVENTION ADJOURNED.

SECOND DAY

On Resuming:

THE PRESIDENT: Good morning, gentlemen. The first item on the Agenda this morning is "Communications from Council." I have pleasure in announcing in connection with the Regional Branches of our Association, that Mr. F. Stevens, of Ladysmith, has been elected Chairman for the Natal Branch, and that Mr. V. E. O. Barratt, of Queenstown, has been elected Chairman of the Eastern Province Branch. These two gentlemen automatically become members of our Executive. (Applause).

I have great pleasure in informing you also that the Executive this morning has decided to recommend to Convention that Messrs. Hallé, Foden, and Ewer become Honorary Members of our Association.

(Applause).

I take it that you all agree that these three gentlemen become Honorary Members of our Association.

(There followed Convention Announcements).

Concerning the Members' Forum in this hall this evening, we would like as many members and affiliates as possible to attend, not only men, but also the ladies.

I would like to mention that a regular attender of these Conventions, who has not been able to come along this year, has sent his greetings. I refer to Mr. B. Marchand, Manager of ESCOM's Witbank Undertaking. Mr. Marchand it not able to be present through illness and I think it would be quite a nice gesture if our Secretary were to convey our good wishes to him and at the same time express the hope that Mr. Marchand will have a speedy recovery. We look forward to seeing him next year at our Convention in Johannesburg.

Mr. Kane, who is the Convenor of the Tariff Survey Sub-Committee has just reminded me that copies of a report which have been put on the table in the vestibule are not official. This is a proposed report, and still has to be considered by the Sub-Committee.

Another announcement is on the subject of education and propaganda in schools on dangers inherent in electrical installations. Two booklets, which Mr. Jimmy Mitchell of Salisbury has brought, are being circularised. I don't know whether you have seen these, but I would ask you to be on the look-out for them.

Now we come to the Annual Report of the Secretary. I take it that you have seen and read this report? May I take it that the Report and the Financial Statement have been accepted.

AGREED.

ANNUAL REPORT OF THE SECRETARIES

To the President and Members of the Association.

Mr. President, Gentlemen,

It gives me great pleasure to submit to you your Annual Report together with the Revenue and Expenditure Account and Balance Sheet for the financial year ended 28th February, 1958.

Obituary :

I deeply regret having to record the passing during the year of Mr. J. H. Rodgers who was an Engineer Member of the Association and Municipal Electrical Engineer of Fort Beaufort.

Thirty-first Convention :

The 31st Convention of the Association was held in Margate from Tuesday the 7th May to Friday the 10th May, 1957. Delegates were welcomed to Margate by His Worship the Mayor of Margate, Clr. S. A. W. Herbert, and to the Convention by the Deputy Mayor of Krugersdorp, Clr. P. J. Marais.

The Convention was formally opened by the Administrator of Natal, the Hon. Mr. D. G. Shepstone, and an all time record of 485 members, delegates, representatives, officials, visitors, and ladies attended. Notwithstanding the fact that the Convention was held under different conditions from those which had pertained in any previous instance it was, we do believe, voted an unqualified success by all.

On behalf of the President, Members of the Association and all others who attended the Margate Convention, I wish to record sincere appreciation to His Worship the Mayor, the Borough Council and Officials of Margate for the welcome, great hospitality and assistance rendered in connection with the Convention and to members of the Margate Chamber of Commerce for their great assistance. To the Mayor and Town Council of Krugersdorp I also wish to record the appreciation of all for the co-operation and assistance rendered in connection with the Convention which, had circumstances been different, would have been held in Krugersdorp. I wish to place on record sincere thanks for the work done by the President in connection with the Margate Convention. His task was in many ways made more difficult by reason of the unusual conditions pertaining in this instance, and his great energy was largely responsible for the smooth running of the Convention. I would also like to pay tribute to the assistance rendered by Mrs. van der Walt.

The papers presented at the Convention were "Earth Leakage" by Mr. A. A. Middlecote of the S.A. Bureau of Standards and "Street Lighting" by Mr. J. C. Downie. Mr. Middlecote's most interesting paper was well received and that of Mr. Downie, presented with the courtesy and kind permission of the S.A. Institute of Electrical Engineers, proved of great practical interest to all sections of the community represented at the Convention.

Members' Forum, known for the first time by this wider title at the Margate Convention, led to much spontaneous and informative discussion. The first Certificates and Medals to be presented to Past Presidents and Honorary Members were handed to those present at Margate.

An amended Constitution of the Association was also adopted at the Convention. This for the first time grants official standing to Manufacturers, Consulting Engineers and others associated with the Electrical Industry, as Affiliates of the Association, and those falling within this group who had attended either the Salisbury or Margate Conventions were officially welcomed as such by the President at Margate. Certain other amendments to the constitution mainly adopted to bring it up to date were also included, and as a result of further consideration by the Executive Council, during the year, certain anomolies have subsequently been dealt with. They are embodied in a new document forwarded to Members with this report, and will be submitted for final adoption at the 32nd Convention. At this stage I would like to record the appreciation of all concerned for the assistance rendered in connection with the drafting of the new constitution by Mr. A. P. Burger, Hon. Legal Advisor to the Association.

Membership :

The following new Members were elected during the year ended 28th Feb., 1957 :

Councillor Members :
Riversdale Municipality.
Sasolburg Village Board of Management (Provisional).

Engineer Members :
R. A. Paul (Umtata).
J. L. K. Pompe van Meerdevoort (Harrismith).
D. C. Brown (Odendaalsrus).
L. Lewis (Mossel Bay).
J. Yodaiken (Que Que).
T. Benson (Matatiele).
F. J. W. Barnard (Potchefstroom).
R. N. Naisby (Welkom).
G. A. H. Schaftenaar (Graaff-Reinet).
J. Joubert (Ermelo).
G. F. Bellingan (Windhoek).

Associate :
A. B. McNamara (Komgha).

Technical Associate :
K. V. Psotta (Upington).

Associate Member :
H. P. Alexander.

The comparative figures of Membership for the year 1955/56 and 1956/57 :—

	1956/7	1957/8
Council	111	111
Engineer Members	98	103
Honorary Members	9	10
Associate Members	Nil	33
Associates	32	1
Technical Associates	Nil	1
Affiliates	Nil	79

Finance :

The Income and Expenditure Account for year under review, as well as the Balance Sheet as at 28th February, 1958, are attached hereto.

Last year, I reported that due to the uncertain effect of a number of factors upon the finances of the Association, it was impossible to indicate with any certainty what the trend would be over the next couple of years. One year later, the position is considerably clearer, and although the excess of income over expenditure of £1,009 reflected in the accounts before you is greater than should normally be anticipated in the future, I feel confident that the Association is again on a sound financial footing. The reasons for this year's surplus being as great as it is, are mainly the recovery of arrear subscriptions and somewhat lower Proceedings printing costs which cannot be anticipated every year. In addition, the amount absorbed by travelling and subsistance allowances in respect of the mid-year Executive Meeting will in all probability show a further increase from 1958 onwards.

On this occasion, once again, it is my pleasant duty to thank Messrs. R. W. Kane and J. C. Downey, for their assistance as members of the finance sub-committee. Mr. Kane's interest in the financial affairs of the Association and his willingness to be of assistance to us at all times is particularly appreciated. To the advertisers we extend, on behalf of the Association, appreciation for their continued support.

General :

The year end review has seen the preliminary steps in the formation of the first two Regional Branches of the Assciation, in the Eastern Cape, and Natal respectively, This development is, I feel, particularly important to the extension of the Association's activities and it is hoped that the lead given by the above mentioned areas will be followed elsewhere.

The Mid-year Executive meeting was held in Krugersdorp in November and this opportunity is taken of thanking the Mayor and Town Council of Krugersdorp for the hospitality extended to the Executive Council in 1956 and 1957.

On behalf of the Association appreciation is expressed to the various Sub-Committees and Representatives on other Committees for their work during the year. The importance of their work to our organisation cannot be over estimated.

Before concluding my report, I wish to point out that certain errors in respect of years specified appeared in the report and accounts as published last year.

Lastly, it is my pleasure to take this opportunity of thanking you, Mr. President, and all other Members of the Executive Council for the courtesy and assistance given to us throughout the past year.

To the Association and all Members we extend our best wishes for the year 1958/9.

R. G. EWING,
for DAVIDSON & EWING (Pty.), Ltd.
6th March, 1958. Secretaries.

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

BALANCE SHEET – 28th FEBRUARY, 1958

1957					1957			
	ACCUMULATED FUNDS:					PRESIDENTIAL BADGE		
3,283	Balance at 28th February, 1957	3,105 2 5			1	Nominal Valuation	1 0 0	
Dr. 178	*Add:* Excess of Income over Expenditure for the year ended 28th February, 1958	1,009 1 0			57	FURNITURE AND FITTINGS At cost less depreciation	51 4 0	
			4,114 3 5		3,176	INVESTMENTS Fixed Deposits and Savings Account at Building Societies including interest accrued.	2,605 2 5	
53	PROVISION FOR AGENTS' COMMISSION		124 17 6		788	DEBTORS	707 1 6	
1,179	CREDITORS		—		33	PAYMENTS IN ADVANCE	18 5 10	
772	1957 CONVENTION REPRESENTATION FEES PAID IN ADVANCE		—		10	DEPOSIT—Davidson & Ewing (Pty.) Ltd.	10 0 0	
—	INCOME RECEIVED IN ADVANCE		61 0 0		1,044	CASH AT BANK	907 7 2	
£5,109			£4,300 0 11		£5,109		£4,300 0 11	

NOTE.—There is a Contingent Liability in respect of unclaimed expenses amounting to approximately — — — £150 0 0

Davidson & Ewing (Pty.) Ltd.,

J. L. van der WALT, *President.*

Per R. G. EWING, *Secretaries.*

Report of the Auditors to the Members of the Association of Municipal Electricity Undertakings of Southern Africa:

We report that we have examined the Books, Accounts and Vouchers of the Association for the year ended 28th February, 1958 and have satisfied ourselves of the existence of the securities. Stocks of Medals for Past Presidents and Honorary Members to the value of £36 were on hand but not reflected in the books of the Association at 28th February, 1958. Subject to that remark in our opinion, the above Balance Sheet is properly drawn up so as to exhibit a true and fair view of the state of affairs of the Association as at 28th February, 1958, according to the best of our information and the explanations given to us and as shown by the books of the Association.

SAVORY & BRINK,
Auditors.

Johannesburg, 7th March, 1958.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 28th FEBRUARY, 1958.

1957			1957		
12	Audit Fees	12 12 0	992	Subscriptions (Councils and other)	1,705 16 0
11	Bank Charges	14 1 5	133	Interest on Fixed Deposits and Savings Account	109 3 5
4	Bad Debts—Sale of Proceedings	13 10 0	958	Subscriptions (Affiliates)	1,175 16 0
1,175	Convention Expenses	1,158 10 1	—	Proceedings—Schedule	309 6 4
—	Medals—Past Presidents and Honorary Members	72 8 4	—	Sundry Revenue	5 10 8
5	Insurance	6 3 0			
6	Depreciation—Furniture and Fittings	5 10 0			
138	Printing and Stationery	126 15 5			
55	Postages and Telegrams	67 5 7			
600	Secretarial Fees	600 0 0			
28	Telephone	27 10 0			
94	Executive Committee Expenses	170 7 0			
15	Subscriptions	15 0 0			
2	Sundry Expenses	6 18 0			
116	Proceedings	—			
Cr. 178	Excess of Income over Expenditure transferred to Accumulated Funds	1,009 1 0			
£2,083		£3,305 12 5	£2,083		£3,305 12 5

ASSOCIATION OF MUNICIPAL ELECTRICITY UNDERTAKINGS OF SOUTHERN AFRICA

SCHEDULE TO THE ACCOUNTS

PROCEEDINGS:			
Advertising—Gross		1,039 10 0	
Less: Underprovision for Agents' Commission 1957	7 18 1	132 15 7	
Provision for Agents' Commission 1958	124 17 6		
		906 14 5	
Add: Additional Revenue from 1957: Advertising not provided for		73 0 0	
		979 14 5	
Add: Sales		242 0 0	
		1,221 14 5	
Less: Cost of Printing	808 9 1	912 8 1	
Sales Commission	103 19 0		
		£309 6 4	

THE PRESIDENT: I now call upon Clr. Davies of Springs to propose the adoption of the Secretaries' Report.

Clr. L. P. DAVIES (Springs): Mr. President, and Gentlemen, it gives me much pleasure to move a vote of thanks to our secretary for his very fine report on the activities of our Association during the past year. The Report is very brief, but when you sit down and study it you will appreciate the amount of work that has been done.

As a councillor who has served on your Executive now for a number of years, I have known your problems and have watched your methods of tackling them, and have noted the results. For instance, last year the experiment of holding the Convention at Margate, the amendments to the Constitution and the various technical problems that were handled by the sub-committees. Our secretary, in my opinion, has been very modest. He has paid tribute to all and sundry for their contributions and assistance during the past year. I would like to endorse his remarks, but also add that the results have been due to team work of the highest order. I am not exaggerating when I say "of the highest order." Gentlemen, just consider for a moment, your Executive members are scattered all over Southern Africa from Cape Point to the Belgian Congo, and yet throughout the year the work has gone on just as if all were in one town.

Mr. President, we have one individual to thank. I know from experience that in any organisation if your Secretary is a passenger, then God help the rest of you!

I want now to pay tribute to Mr. Ewing. I remember when he started with us in 1956, at the Pretoria Convention. I think it was his first experience of Kilowatts and what-nots. I have watched him go on from Convention to Convention and I do not hesitate today to say that your Executive were very wise in their choice. Mr.

Ewing, in my opinion, is the ideal Secretary, and on your behalf gentlemen, I congratulate him on his report and for the results achieved during the past year.

I now formally move the adoption of the Secretaries' Reports. (Applause).

THE PRESIDENT: Thank you Mr. Davies. Before calling upon Mr. Louw of East London to second the adoption of the Reports, I would like to warn representatives of various organisations that I am going to call upon them to speak or give their reports. As we have time, we can spend it on those items.

I now call upon Mr. Louw to second the adoption of the Report of the Secretaries.

Clr. A. W. LOUW (East London): Mr. President, Gentlemen, this is the first opportunity that I have had of attending your convention, and when at East London, I received all the documents and agenda for this Convention, it became very clear to me that the man responsible for all that must be a very capable individual. Coming to this Convention here, seeing all the arrangements that were made here, reading the various reports which came through the Secretary's office, it was very evident to me that the Association must be complimented in having such a good official who attends to his duties so excellently.

To me it is a great pleasure and a privilege to be able, on behalf of the Convention, to say "Thank you" in seconding the Report of the Secretaries.

THE PRESIDENT: Thank you Mr. Louw. I wonder whether Mr. Jack Downey would like to say something about the S.A.N.C.I. Convention which was held in Cape Town last week? As you are probably aware, Mr. Downey was president of that Convention which was held last year at Margate, just before our own Convention.

In passing I would also mention that there are a number of flood-lighting installations in Cape Town that are well worth seeing.

Mr. J. C. DOWNEY (Springs): Thank you Mr. President. The Convention of the South African National Committee on Illumination took place last week, and the theme of the convention was floodlighting. Various lectures were held on the matter, and, in conformity with the theme, the local Action Committee worked on the question of providing practical demonstrations of floodlighting.

To you, Mr. President, we owe a great debt of gratitude for your co-operation and assistance to this Committee in providing floodlighting of numerous buildings; a bowling green, and a swimming bath.

I would commend a visit by the members of the A.M.E.U. to these various buildings. At Sea Point you have the Rotunda and this hall, floodlit by the City Electricity Department; you have the Sea Point Swimming Bath and, coming from town, your Bowling Green on the right hand side, and in the centre of town a number of buildings, including Electricity House, that have been floodlit.

For those that wish to visit these buildings I have a list of them and copies are available so that you can guide yourself round the town and visit the floodlighting of the various buildings.

I would commend you to do so because most of the smaller towns are anticipating floodlighting their Civic Centres and it gives some indications of what can be done to brighten up a town and civic centre, and at the same time what can be done for amenities at night in floodlighting bowling greens and swimming baths.

THE PRESIDENT: Thank you Mr. Downey.

The Electrical Wiremen and Registrations Board. There is a report, gentlemen, by the representative on this Board, Mr. Bob Kane, our Vice-President.

Perhaps he would be prepared to say a few words on it.

Mr. R. W. KANE (Johannesburg): Mr. President and Gentlemen, you all have copies of the report, and I doubt if you want me to enlarge on it at all.

I think it is quite possible that Mr. F. J. Malan the newly appointed Chief Inspector of Machinery (Factories) may wish to introduce himself to you all and perhaps finish off what I have left unsaid.

Thank you. (Applause).

REPORT OF ELECTRICAL WIREMEN'S REGISTRATION BOARD, 1957

Meetings:

Eleven ordinary meetings and one special meeting of the Board were held during 1957. Mr. R. N. F. Smit took the chair for the first three meetings and on his retirement, Mr. R. K. Frost presided for the next seven meetings. Mr. S. J. Malan was appointed Chief Inspector of Machinery (Factories) during the latter part of the year and was appointed chairman for the balance of the meetings.

Amendments:

During May, 1957, certain of the proposed amendments became law and provided for:

(a) The registration of apprentices who in terms of the Apprenticeship Act have passed the qualifying examinations before reaching the age of 20 years.

(b) The acceptance of Bantu trainees for practical experience in the areas controlled by supply authorities.

(c) The issue of certificates of limited scope.

(d) The issue of provisional certificates up to the number of four in six monthly periods and not necessarily successively.

The right to issue a certificate of limited scope will enable the Board to give special consideration to obvious cases of hardship in the determination of new areas and the effects of the determination on long established wiremen.

It is not anticipated that the balance of the proposed amendments submitted some years ago will be submitted by the Department of Labour to the Ministry during 1958.

Determination of areas:

No areas were determined during 1957 as it would appear that the Department was concerned about possible cases of hardship. However, with the amendments to the Act reported above, the following areas were submitted or resubmitted for determination:

Bethal, Brits, Caroline, Christiana, Ermelo, Louis Trichardt, Middelburg (Tvl), Wolmaranstad, Beaufort West, Burgersdorp, Calendon, Ceres, De Aar, Upington, Graaf Reinet, Kuruman, Moorreesburg, Mossel Bay, Riversdale, Somerset East, Swellendam, Umtata, Vryburg, Wolseley, Ladybrand, Odendaalsrus, Parys, Sasolburg, Senekal, Ventersburg, Virginia, Welkom, Escourt, Ladysmith, Stanger and Vryheid.

Examinations and Registration:

Four written examinations were held during the year, the number of notifications issued being 1,823, there were 974 candidates who wrote the examinations and 319 (32·8%) were successful.

There were ten practical examinations held with 475 entrants of whom 388 (81·7%) were successful.

In addition the Board granted oral examinations to 13 candidates. 512 applications for registration were considered by the Board, 490 were accepted and 387 registration certificates were issued. At the end of 1957, 6,843 wiremen were registered.

Notification in terms of Section 17 (2).

In terms of this section the holder of a certificate must notify the Board yearly of his residential address and whether he continues to practice as a wireman. Failure to comply with this section is a punishable offence and certificates are liable to cancellation. Only a relatively small percentage (approximately 25%) submits the required notification and it is difficult to enforce this provision.

When the Board considered amendments to the Act in 1956 it was decided to recommend the deletion of 17 (2). In the meantime, no steps are being taken to enforce compliance with this provision of the Act.

General.

I am indebted to the Board for the information provided in this report and for permission to submit it to Convention and in addition I am indeed grateful to the Assocation for again nominating me as their representative for a further period of three years.

R. W. KANE,
Representative.

THE PRESIDENT: Thank you Mr. Kane.

I will now call upon Mr. Hugo, our representative, on the Coal Allocation Committee, to say something on coal supplies.

Mr. D. J. HUGO (Pretoria): Mr. President I have pleasure in formally presenting the report of the Coal Allocation Committee. As you see it is short and to the point.

Things were critical at times last year due to abnormal weather conditions, but the Railways weathered the storm, and as far as your representatives on the Coal Allocation Committee know, no Undertaking went short of coal or was in serious difficulty.

I take the opportunity again of paying tribute to the Railways and to the Transvaal and Natal Coal Owners Associations for the ready assistance we have had from them at all times. (Applause).

REPORT OF COAL ALLOCATION COMMITTEE

Over the past twelve months the Coal Allocation Committee has met monthly in Johannesburg under the Chairmanship of Mr. W. J. Lamb. Your Association was represented at all the meetings. Usually both your representatives, Messrs. Kane and Hugo were present. Mr. Chris Downie, the official representative of the United Municipal Executive also attends and looks after the interests of Municipalities.

Due to abnormal weather conditions the Railway Administration passed through a critical period but nevertheless continued to meet the requirements of Municipal power stations with very little dislocation.

The Association can be grateful to the Coal Allocation Committee, the Railway Administration and the Representatives of the Coal Owners for the valued assistance and attention Municipalities receive from these bodies in the matter of coal supplies for power stations.

D. J. HUGO,
Representative.

THE PRESIDENT: Thank you Mr. Hugo.

Gentlemen, I am very pleased to see that we have attending the Convention this year (I have not seen him before at our Concentions) the Vice-Chairman and Chairman Elect of the Transvaal Coal Owners' Association. I refer to Dr. Lategan. I am sure that Dr. Lategan would like to take this opportunity of his presence at this Convention to say a few words to us about coal.

Dr. P. N. LATEGAN: Mr. President, and Gentlemen, I would like to congratulate Mr. Downie on his election as President, and would wish him a very successful year of office.

I thank you for the opportunity given me to express, on behelf of the Transvaal Coal Owners' Association, our deep appreciation of the way in which all your Electricity Undertakings have co-operated with us in supplying your requirements during the past seven years.

As you know, Mr. Downie, is on the Coal Allocation Committee. We have learned to know each other and we, by knowing each other, have realised the difficulties facing both parties. If there is time, I would like to say a few words on why we are supplying the type and grade of coal you are receiving today, and why it will be necessary in future to continue to supply this size and grading.

During the past seven years, factors such as transport and availability of various classes of coal over which the producer had little or no control, brought about a complete change in the size and grade of coal which the power stations were used to burning.

A growing tendency towards an unbalanced state of production between consumption and production of small coal vis-a-vis large coal came to a head in 1951 with the imposition of an embargo on the export of coal owing to a shortage of rail transport, meant that even less graded smalls were available since the availability of natural arisings in the firm of smalls is

entirely dependent on the production of large coal. While the embargo on the export of coal helped the inland consumer of large coal, it made the supply of "smalls" worse, and in order to prevent power stations closing down, the producer had to resort to crushing large coal in order to supplement the meagre availability of graded "smalls."

The power stations were then faced with the problem of burning a product different in size and grading from what they were accustomed to burn, a product which also differs from the fuel for which their stokers were designed. This meant de-rating their boiler capacity, especially that of the older types of boiler, and as the capacity was already inadequate to meet the growing demand for electricity, those in charge were placed in a very difficult position. However, as necessity is the mother of invention, proper wetting of soon proved that the degree to which the fines and changes in firing techniques boilers had to be derated was not quite as serious as was at first thought.

On the other hand, while duff coal was being dumped, the producer had to crush large coal in the face of increased mining costs as a result of decreased tonnage mined. Colliery outputs were curtailed to such an extent that severe rationing of coal supply to consumers had to be introduced, and here I must point out that while some consumers received less than 30% of their requirements, the power stations were supplied with their full burning rate.

Fortunately, as a result of the experience gained in burning crushed coal, the power stations found that they could burn, instead of crushed coal, duff in admixture with peas, a mixture which often has a calorific value higher than that of the grade of peas.

This practice has been so successful during the past two or three years, that "pea-duff" mixtures have now become standard power station fuel. The Collierier no longer produce graded peas, except in small quantities to meet the requirements of smaller municipal generating stations.

It may interest the Convention to know that Municipal Power Station coal requirements supplied by the Transvaal Coal Owners' Association, from 1950 to 1957, increased by 60% as against an increase of just under 13% over-all in colliery output. Now this is the point: as the power stations' requirements, or other users of small coal, increased by 69%, the collieries output only increased by 13%. This explains why it is necessary to continue substituting "pea-duff" mixture for graded peas in the form of natural arisings.

Once aigain, Mr. President, I thank you for your co-operation and congratulate you on the way you solved the difficulties which were at one time thought insurmountable.

THE PRESIDENT: Thank you Dr. Lategan. Gentlemen, coal is something which has taken up quite a lot of our thinking— we people who have had coal-powered power stations—over the last seven years, and it may be that there are one or two others present who would like to say something, or ask questions, and take advantage of Dr. Lategan's presence.

Are there any people present who would like to talk on the subject?

Mr. G. J. MULLER (Bloemfontein): Thank you Mr. President for the opportunity of a few words.

First of all I would like to say that we are extremely satisfied with our Coal Allocation Committee. We have had very little difficulty. On one occasion we ran short, but that was entirely our own fault! It is just as well to admit the truth once in a while.

We still find, however, that the policy of bulk despatches is causing quite a burden on our handling costs. One wonders if there is any prospect in the immediate future of ironing out despatches to a more even tenor, or will we still have to face 60 trucks occasionally, and then a week with very little. One can imagine that your labour costs are somewhat upset by such despatchse.

The other matter that I have been watching for some time is the removal of the levy on road transport. Is there any immediate prospect may I ask of the Railways catching up with the transport? Dr. Lategan is perhaps not the person to ask, it should be the Railways but he is so intimately connected with the question, that he may know whether there is any reasonable prospect of expecting this levy to be abolished as the Railways can cope with the transport that is now being undertaken by road transport?

Thank you Mr. President.

Mr. W. H. MILTON (Johannesburg): (Escom). Whilst I said I did not wish to speak on this subject, Mr. President, after hearing what Dr. Lategan has said I felt I could not remain silent. He has mentioned that with the application of wetting and burning techniques, this question of de-rating of boilers is not quite as serious as we had feared. A statement of that description is, of course acceptable, de-rating isn't as serious as we at first feared, but what we first feared was disaster! What we are actually faced with is serious de-rating, and I would like to support our President in his recommendations to his Council, that he should increase his boiler capacity by the addition of boilers to overcome the derating problem arising from the de-rating of the quality of coal.

I don't think we can say that that was a mistake made by our President; it was an essential move. The question of the mixtures that we are now called upon to burn in old boiler plants is still one of a very serious nature.

I have carried out studies myself, and it is quite apparent that if we could arrange for the sorting out of crushed coal into its pea quantity and duff, it would probably pay us to dump the duff at the sending end instead of paying for railage over long distances on the duff. The improved

facilities, and improved efficiences, might pay. The difficulty, of course, is to obtain a screening plant and to arrange for payments for the operation of that screening plant, because it is of no value to any individual user alone at the present time, but as a group it might pay us, especially as the duff could very probably be consumed in the local and Reef areas, where puverised fuel stations are being installed, capable of readily absorbing the duff. I don't think we can really discount to negligible proportion this question of de-rating of old boiler plants.

Insofar as new boiler plants are concerned of course, we can obtain them to operate quite as efficiently on the new coal mixtures with a high content of duff, as we could the older plants with peas. I think these are points we should bear in mind for quite a long time to come.

THE PRESIDENT: Thank you Mr. Milton.

I have to confess, gentlemen, that the proceedings went rather out of joint just now. Following Mr. Kane's talk on the Electrical Wiremen's Registration Board, I should have called upon Mr. F. J. Malan, the Chief Inspector for Factories (Machinery) to say a few words.

I wonder whether Mr. Malan would like to say something now.

Mr. F. J. MALAN: At this stage, Mr. President, I would just like to thank you very much for the opportunity of introducing myself. Mr. Bobby Kane pointed out that I was only appointed about six months ago with the result that I am still swimming—very hard, as a matter of fact. So at this stage, I would just like to say "Thank you very much indeed." I have no comments at all.

I will answer any questions if there are any.

Thank you very much. (Applause).

THE PRESIDENT: Thank you Mr. Malan.

We now come to the appointing of the Auditors. I suggest that we reappoint the existing Auditors, Messrs. Savory and Brink. (Agreed).

THE CONVENTION ADJOURNED FOR TEA

On Resuming:

THE PRESIDENT: Gentlemen, we now come to the paper to be presented by Mr. B. B. Evans on behalf of the Cable Makers Assocaition, London, on "Natural Rubber, Synthetic Rubber and Thermoplastics for Electric Cables."

Mr. Evans is a B.S.c. (First Class) from Birmingham University; he is a Fellow of the Royal Institute of Chemistry and of the Institution of the Rubber Industry of Great Britain. For the past 15 years he has been Chief Chemist to the Research Laboratories of Messrs. W. T. Henley. He is Chairman of the Rubber and Plastic Cables Research Committee of the Cable Makers Association and a member of the British and Standards Institution Committees concerned with specifications for rubber and PVC compounds for cables. He is a member of the joint CMA British Transport Commission Committee concerned with Railway Signal Cables. With Mr. Cave he is a member of the I.E.C. Committee concerned with cables for ships.

I now have pleasure in calling upon Mr. B. B. Evans to deliver his paper.

Mr. B. B. EVANS: Mr. President and Gentlemen, Mr. Cave mentioned yesterday that this is quite an occasion for us. For me it is probably even more so, for it is not often that a chemist has the opportunity of travelling some 10,000 miles to address a distinguished gathering of Electrical Engineers. Please do not get alarmed at the thought of being addressed by a Chemist. Some of the species are almost human, and myself—I have forgotten almost all my chemistry. Like Mr. Cave, I have no films, and as the full paper contains a number of illustrations, I propose to keep slides to a minimum.

NATURAL RUBBER, SYNTHETIC RUBBER AND THERMOPLASTICS FOR ELECTRIC CABLES

Presented on behalf of the Cable Makers Association

by

B. B. EVANS, B.Sc., F.R.I.C., F.I.R.I.

SECTION 1

GENERAL BACKGROUND

For many years prior to World War II. natural rubber had been a traditional cable making material. However even before the War man-made products were becoming available and this process was naturally speeded up by the War and particularly by the loss of Malaya. It is now obvious that a number of these have come to stay and the cable maker (to say nothing of the user) is often embarrassed by the number of materials available. No doubt each material will in due course find its correct place but in the meantime the situation is fluid and sometimes perplexing; the object of the present paper is to outline the properties of these various synthetic materials and to indicate the fields in which each is likely to be used.

The man-made products can be divided for practical purposes into rubber and thermoplastics. For the present purpose the "rubbers" will be defined as those materials which can be converted from the plastic to the elastic state by heating,

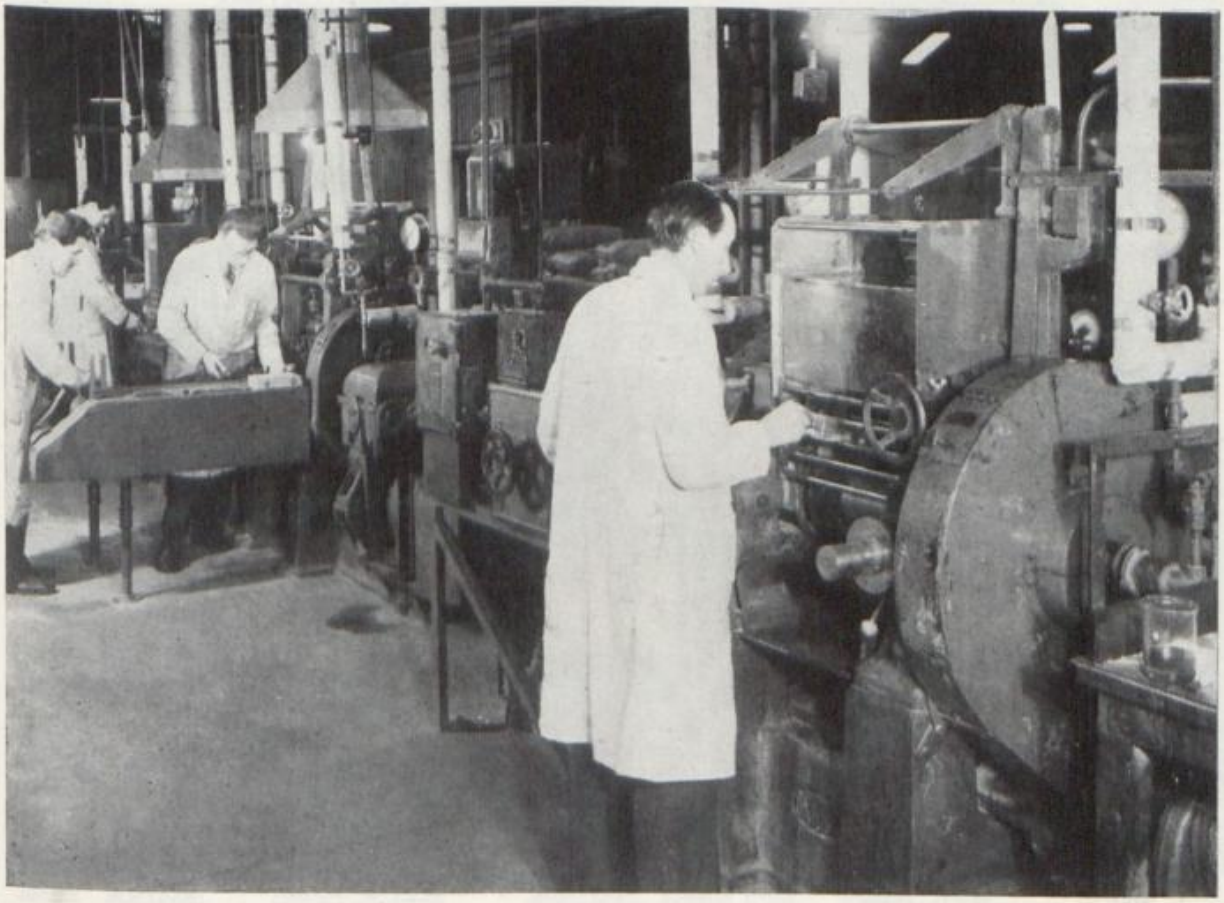


Fig. 2.

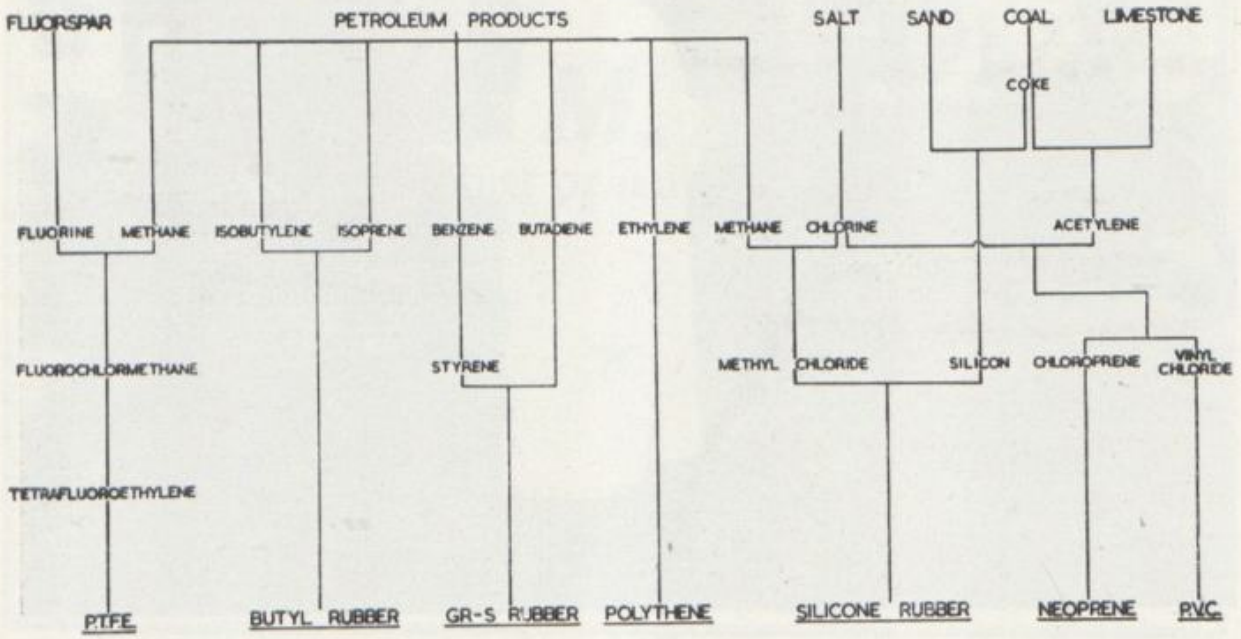
Table 1.

TRADE NAMES & CHEMICAL DESCRIPTION

SYNTHETIC RUBBERS & PLASTICS

TRADE NAMES	CHEMICAL DESCRIPTION
NEOPRENE	POLYCHLOROPRENE
BUTYL RUBBER	COPOLYMER OF ISOBUTYLENE & ISOPRENE
SILICONE RUBBER	POLYSILOXANE
G.R.S. TYPES (S.B.R.)	COPOLYMER OF BUTADIENE & STYRENE
P.V.C.	POLYVINYLCHLORIDE
POLYTHENE	POLYETHYLENE
P.T.F.E.	POLYTETRAFLUOROETHYLENE

Fig. 1. ROUTES TO SYNTHETIC RUBBER AND PLASTICS



usually but not necessarily, following admixture with sulphur. Those which cannot are to be regarded as thermoplastics. The rubbers are usually sub-divided into "special purpose" and "general purpose" types.

The man-made rubbers owe their rubbery nature to the fact that, like natural rubber they are long chain polymers built up from single molecules or monomers. However, the monomers which form the starting point for the synthetics are different from the monomer from which natural rubber is built in the tree and this accounts largely for the differences between the natural and synthetic rubbers.

The present paper is concerned only with the synthetic rubbers and plastics which have either become firmly established or are under serious consideration for cable making purposes. Their trade names and chemical description are given in Table I.

The chemical routes by which these are obtained are shown diagrammatically in Fig. 1 which stresses the importance of petroleum as a starting material.

The monomers are usually obtained from the petroleum base by the cracking process in which the complex hydrocarbons are broken down into simpler ones by being passed over appropriate catalysts at appropriate temperatures.

Before discussing the technical merits of natural rubber and the synthetics it may be of interest to glance rapidly at the sort of laboratories in which preliminary evaluation work of this sort is done. Fig. 2 shows mixing and calendering equipment by means of which various compounds can be made and calendered into sheet form for moulding, etc.

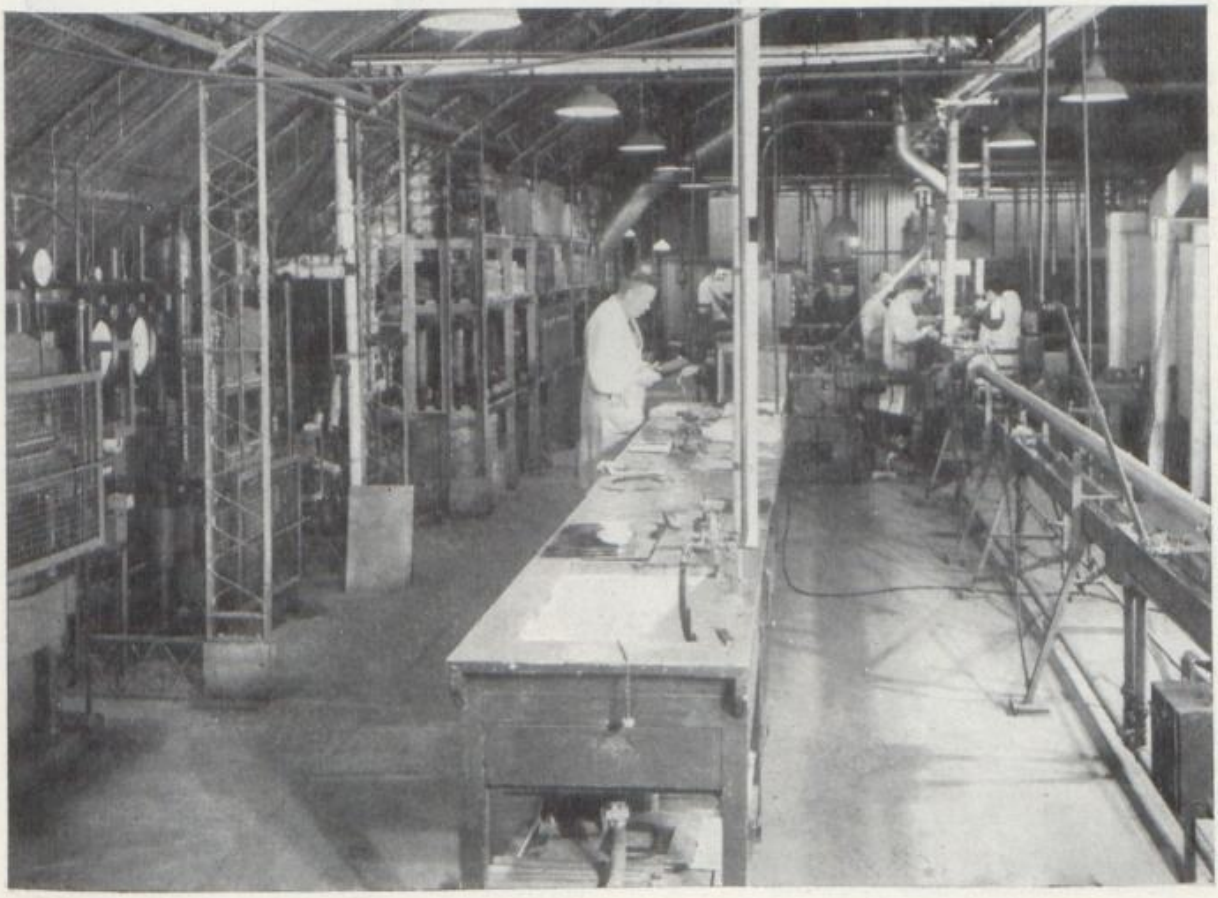


Fig. 3.

Fig. 3 shows another view of the same laboratory; on the left are presses in which samples in sheet form can be moulded from either vulcanisable rubbers or thermoplastics, while on the right is seen an extruder to which can be attached a model C.V. curing tube.

Much work is carried out on the effect of various elevated temperatures on rubbers and plastics and Fig. 4 shows a typical accelerated ageing oven.

The effect of accelerated ageing is often measured by the changes produced in physical properties, more particularly of the rubbers, and Fig. 5 shows a typical physical testing laboratory.

When many types of rubber compound are under mechanical stress and at the same time subjected to ozone, cracks may develop at right angles to the direction of stress. It is important that for some cable usages, e.g. high voltage, the compounds shall have high resistance to this form of deterioration. Figure 6 shows a typical apparatus for studying resistance to ozone of various materials and compounds. The ozone is produced by passage of air through an ozoniser and the concentration can be adjusted to any desired degree. The actual exposure to ozone is carried out in the small chamber indicated.

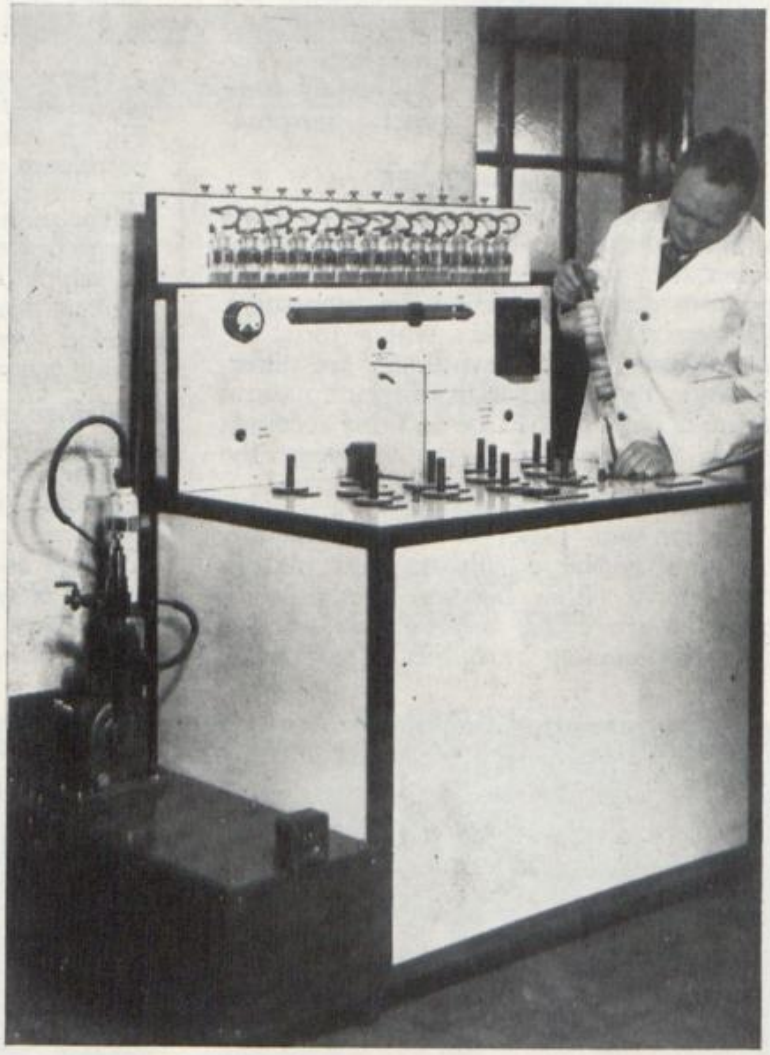


Fig. 4.

Members of the C.M.A. do not rely entirely on laboratory testing but try to simulate actual service conditions where possible. Fig. 7 shows exposure frames carrying various types of weather resisting cable which are undergoing prolonged exposure tests. The samples illustrated are undergoing exposure to the combined action of sunshine and moisture in the wettest part of the English Lake District; duplicates of these are undergoing exposure in Africa, India and Australia.

In addition to the large amount of evaluation work carried out in the laboratories of C.M.A. members, Joint Committees have been formed with nationalised users, such as the Central Electricity Authority, British Transport Commission and National Coal Board and with Government Departments such as the Ministry of Supply and Admiralty, through which properly organised practical trials of cables made with promising materials are carried out and reference will be made to these in Section three.

SECTION 2

TECHNICAL PROPERTIES OF NATURAL RUBBER, SYNTHETIC RUBBER AND PLASTICS.

In this section it is proposed to discuss results of what are basically laboratory evaluations carried out by the sort of means just outlined in Section 1.

The science and technology of natural rubber have reached an advanced state so that within the limits of the natural product and by making use of modern accelerators and antioxygens, it is possible to design a wide range of compounds with different amounts of rubber, and, therefore, different initial physical and electrical properties, but all having equal and high resistance to oxidation. This, together with the realisation that high insulation resistance has not the practical importance once attached to it, means that one can design various acceptable types of dielectric which will have adequate electrical and physical properties combined with a long life. This has been dealt with at more length in a previous C.M.A. publication (Modern Rubber Cable Technology 1954) and it is not felt necessary to say more about it at this stage. The important properties of the various synthetic rubbers and plastics relative to the properties of natural rubber compounds are summarised in Fig 8.

This immediately emphasises one important point, i.e. one cannot say in general terms that any particular material is better than natural rubber; improvement in one property is usually gained at the expense of another and it is necessary to be specific.

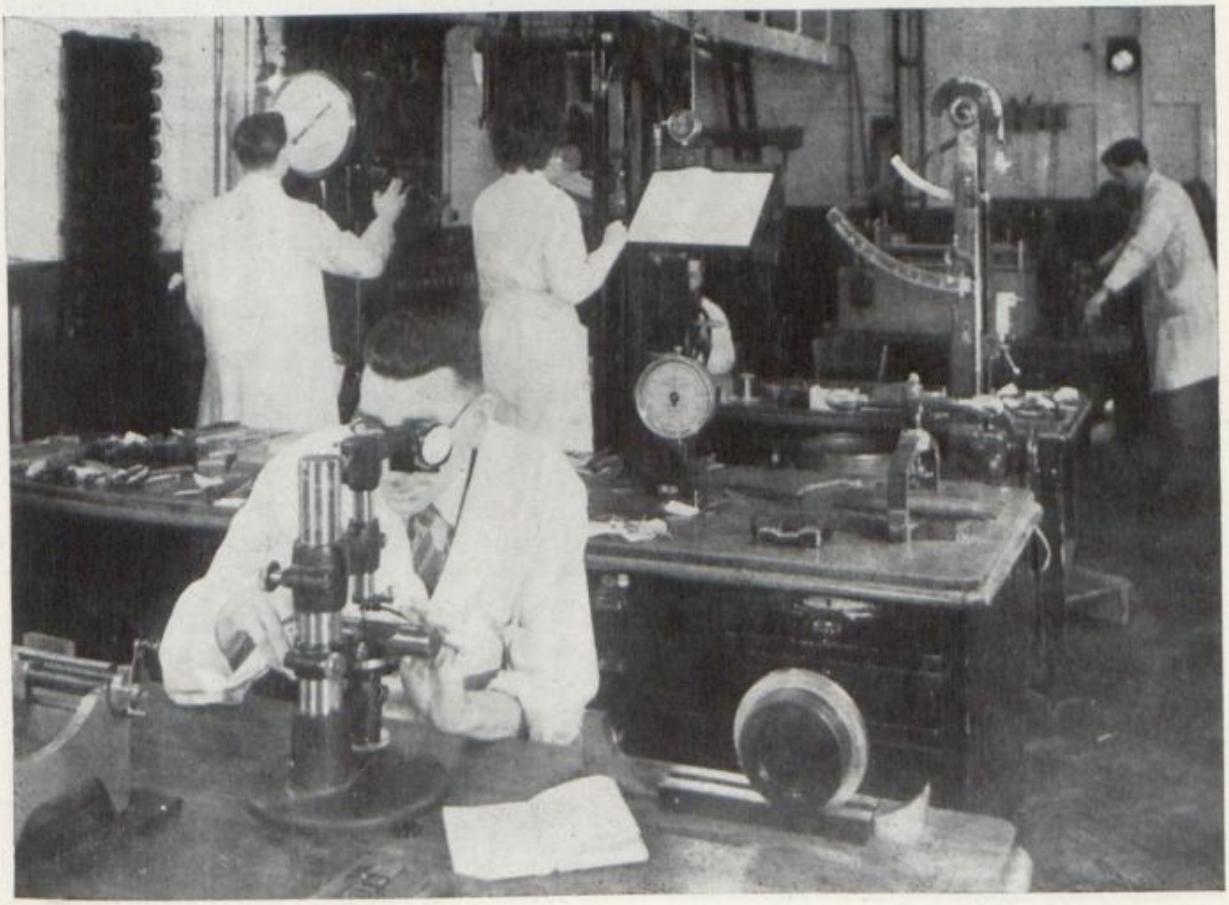


Fig. 5.

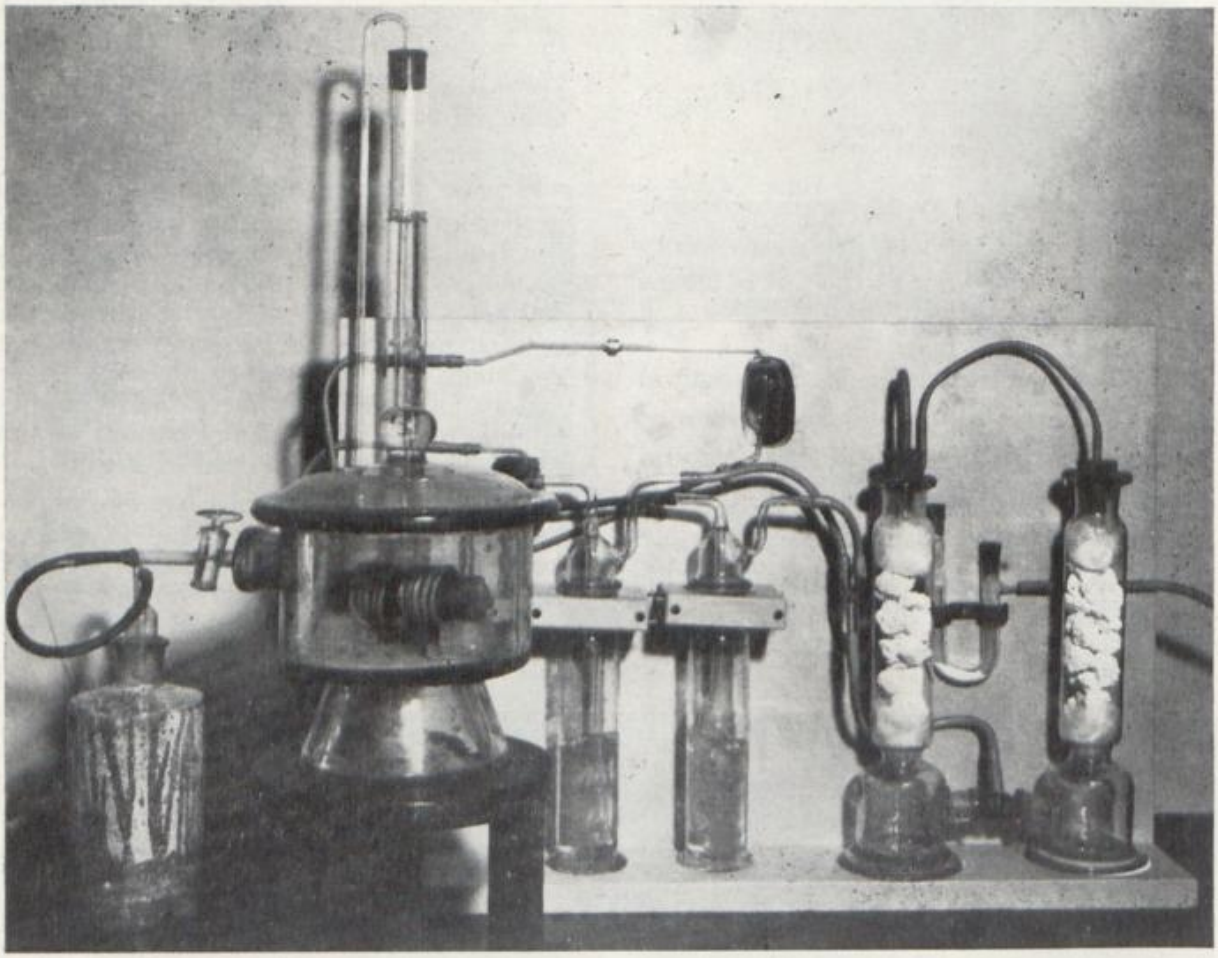


Fig. 6.

The following remarks will amplify this statement.

2.1 POLYCHLOROPRENE (Neoprene)

Whereas the monomer of natural rubber is isoprene or methyl butadiene

$$-H_2C-C(CH_3)=CH-CH_2-$$

that for neoprene is

$$-H_2C-C(Cl)=CH-CH_2-$$

chlorobutadiene and the product (polychloroprene/p.c.p.) contains about 35% chemically combined chlorine. Polychloroprene must be compounded and vulcanised in much the same way as natural rubber. The resulting compounds feel rather similar to natural rubber ones but as is now generally recognised neoprene compounds are better than natural rubber ones in resistance to fire, oil and weather. They are not so good as natural rubber in electrical properties but nevertheless, as will be clear from Section 3, neoprene compounds can be adapted. The statement that neoprene is more resistant to fire needs a little clarification. The usual criterion by which resistance to fire is judged is the tendency to self-extinguish when the source of ignition is removed. Chlorinated bodies in general are, of course, better than hydrocarbons owing to

the fact that when chlorinated bodies are destroyed they generate hydrochloric acid which in gaseous form will suppress flame. However, work carried out by members of the C.M.A. a few years ago showed that if a different criterion was adopted one would draw different conclusions. The particular case to which a brief reference may be made has been described in some detail elsewhere. (Cox, Macdonald and Teasdale, "Proceedings A.M.E.M.E." June, 1954, p. 435). Briefly the C.M.A. were asked to develop a telephone cable which would operate during and after a fire in a mine, the criterion being the length of time for which the cable would continue to convey speech at red heat. Cables were made with different materials, e.g. silicone rubber, glass, in various constructions and several of these had neoprene or p.v.c. sheaths, while others had natural rubber ones. Rather to our initial surprise we found that those cables in which chlorinated bodies such as neoprene and p.v.c. were used did not convey speech for nearly so long a time as did those in which the chlorinated bodies were absent, though of course from the point of view of not spreading a flame those made with the chlorinated bodies were the best. There seems little doubt that this difference in the behaviour of the cables arose from the fact that where chlorinated bodies were used the decomposition products were

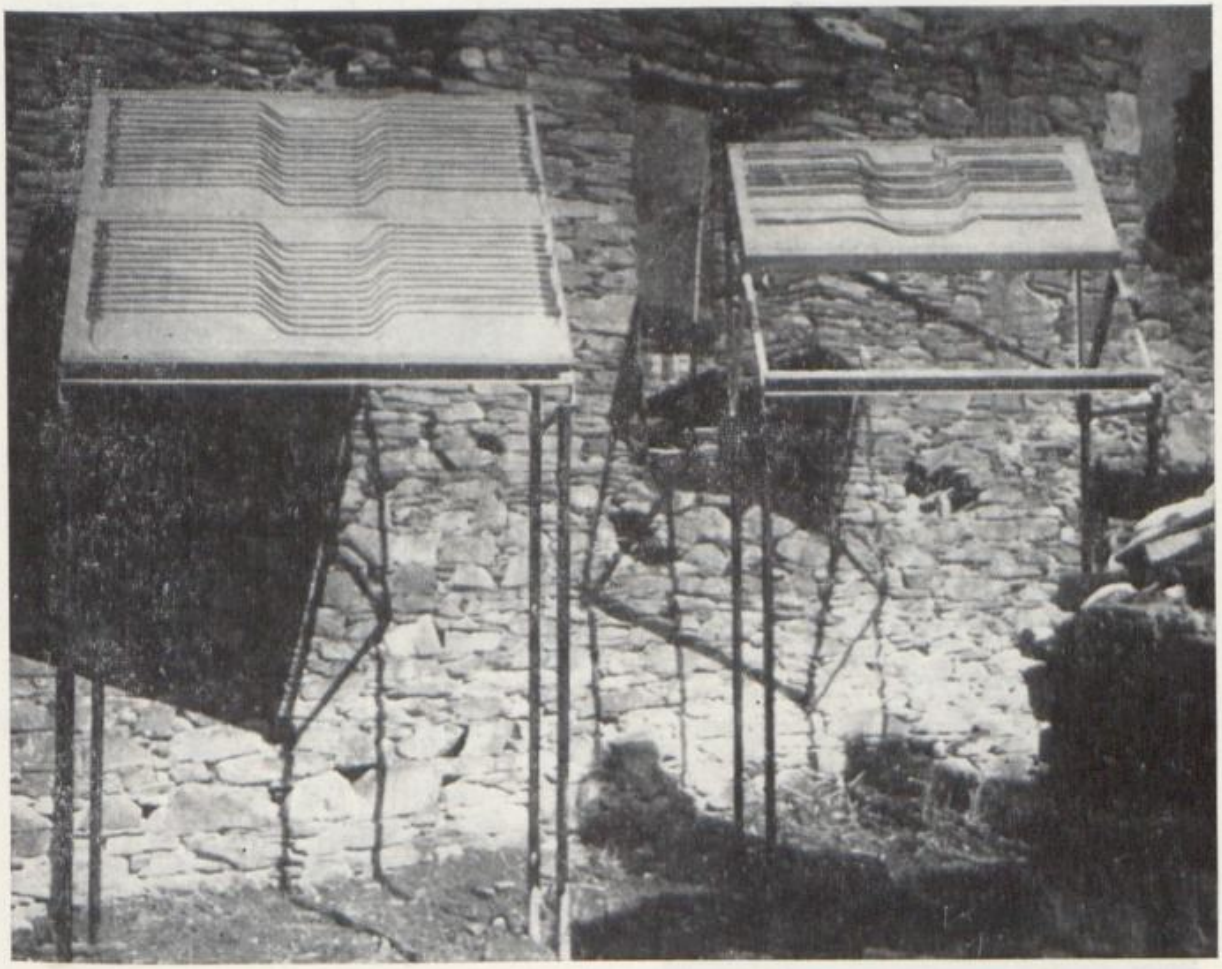


Fig. 7.

conducting while in the case of the natural rubber the decomposition products were still substantially of a hydrocarbon nature. This point is mentioned as a further illustration of the general principle that when one talks about one material being "better" than another the order of merit may well depend upon the particular criterion adopted.

Neoprene is more expensive than natural rubber and neoprene compounds are in general more expensive than natural rubber compounds of the same type.

2.2 BUTYL RUBBER.

Butyl rubber is a copolymer of isobutylene and isoprene containing about 1-4% of the latter. Polyisobutylene (P.I.B.) is what the chemist calls fully saturated, i.e. it is very unreactive chemically. One result of this is that it will not vulcanise and as it is not nearly so stiff as other thermoplastics it is of little use by itself. Therefore

PROPERTIES OF SYNTHETIC RUBBER & THERMOPLASTIC COMPOUNDS

COMPARED WITH NATURAL RUBBER COMPOUNDS

	ELECTRICAL PROPERTIES FOR WIRING SYSTEM CABLES	SUITABILITY FOR H.V.	PHYSICAL ROBUSTNESS	RESISTANCE TO HEAT	TENDENCY TO BECOME HARD AT LOW TEMPS.	RESISTANCE TO MOISTURE	SELF-EXTINGUISHING PROPERTIES	RESISTANCE TO OIL	RESISTANCE TO WEATHERING
NEOPRENE	−	−	=	=	−	−✓	++	++	++
BUTYL RUBBER	=	+	−✓	++	=	++	=	=	+
SILICONE RUBBER	=	O	−	+++	+++	O	+	=	O
BUTADIENE STYRENE RUBBER	=	=	−✓	=	=	+	=	=	=
P.V.C. GENERAL PURPOSE	=	−	+	+	−	+	++	++	++
P.V.C. HARD COMPOUND	=	−	+	+	−	+	++	++	++
P.V.C. HEAT RESISTING COMPOUND	=	−	=	++	−	+	+	++	O
STANDARD POLYTHENE	+++O	++	−✓	=	+	++	=	=	B +
EXPANDED POLYTHENE	+++O	−	−	−	+	+	=	=	O
FLAME RETARDANT POLYTHENE	=	=	=	=	=	+	++	+	B +
HIGH DENSITY POLYTHENE	+++O	=+	+	+	+	+	=	=	B +
IRRADIATED POLYTHENE	+++O	++?	+	++	+	+	=	+	O
P.T.F.E.	+++O	++O	++	++++	+	+	++	++	O

CODE

= NOT SUFFICIENTLY DIFFERENT FROM V.R. TO BE OF PRACTICAL IMPORTANCE.

−✓ NOT SO GOOD BUT ADEQUATE.

− SUFFICIENTLY WORSE TO BE OF PRACTICAL CONSEQUENCE IN SOME APPLICATIONS.

\+ SUFFICIENTLY BETTER TO BE OF PRACTICAL CONSEQUENCE IN SOME APPLICATIONS.

? STILL IN EXPERIMENTAL STAGE.

++, +++, ++++ } INCREASING SUPERIORITY OVER V.R.

O NOT RELEVANT.

B BLACK.

Fig. 8.

the object of copolymerising with the isobutylene a small amount of isoprene, which you will remember is the monomer of natural rubber, is to obtain a material having the potential merits of a very unreactive material but to offset the demerits due to its thermoplasticity.

Butyl rubber is again compounded and vulcanised in much the same way as natural rubber though the processing of the compounds is more troublesome. However, the vulcanised compound has the inherent properties of the raw material; thus, being based on a hydrocarbon the compounds have electrical properties of the same order as those of natural rubber. These are combined with the low chemical reactivity. One aspect of this is that Butyl compounds are much more resistant to oxidation than are natural rubber compounds. Figure 9 shows the relative resistance of typical natural rubber and Butyl rubber compounds to physical deterioration at 100°C.

From a good deal of experimental work it has been concluded that Butyl dielectrics are capable of operating indefinitely at temperatures of the order of 80-85°C. A second aspect of the low chemical reactivity is that appropriately formulated Butyl compounds have much greater resistance to ozone than have similar natural rubber compounds. An additional feature is that the method of preparation of the raw Butyl rubber is such that it is purer than natural rubber and hence it is

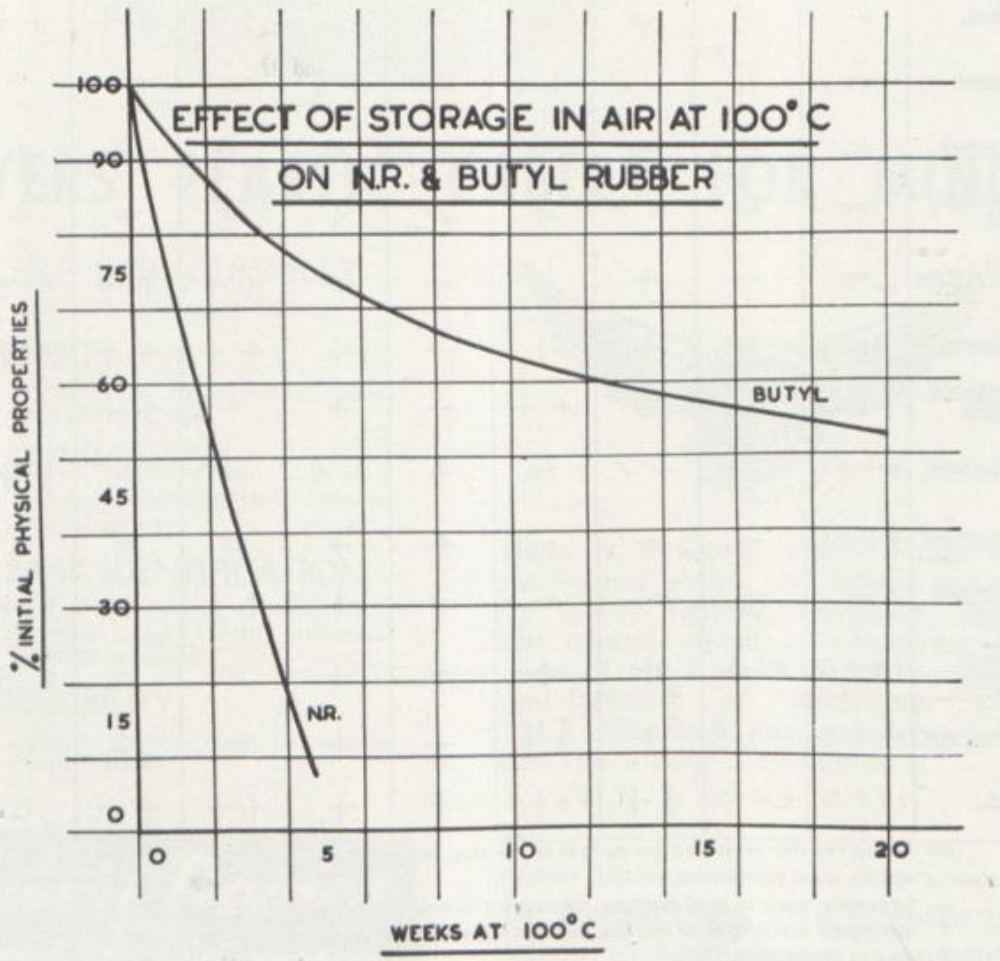


Fig. 9.

possible to produce Butyl rubber dielectrics having very low water absorption. As Butyl rubber has intentionally such a low amount of unsaturation it is not possible to build up the same amount of cross-linking as occurs during the vulcanisation of natural rubber. Hence vulcanised Butyl rubber dielectric compounds do not have the very elastic and rubbery feel usually associated with natural rubber and Butyl compounds are in fact less robust than natural rubber ones, though adequate for their purpose.

Experience to date on the weathering of Butyl rubber compounds indicates that incorrectly formulated compounds are probably no better than natural rubber ones, while correctly formulated ones are appreciably better than those based on natural rubber. Laboratory tests involving exposure to ultra-violet light have suggested that Butyl compounds are not as good as Neoprene compounds but Butyl rubber has not been available sufficiently long for a final verdict to be passed on this point.

2.3 SILICONE RUBBER.

Silicone rubber is unique in several aspects. Firstly, although it has to be compounded and vulcanised in order to convert it to an elastic material, the actual materials and technique for doing this are quite different from those for natural rubber. Quite strong chemical oxidising agents are incorporated in the unvulcanised silicone rubber compound. This is quite weak mechanically. It is therefore extruded on to the conductor and the covered conductor is then usually passed immediately through a vulcanising tube which gives the product sufficient initial vulcanisation to make it robust enough to withstand the subsequent manufacturing operations. If the silicone rubber is subsequently to be used at high temperatures it is then given an "after vulcanisation" which may consist of anything from 4-24 hours in circulating air at temperatures of the order of 200-250°C. during which time the aforementioned oxidising agent oxidises the material. Treatment of this sort meted out to natural rubber would, of course, completely destroy it. The second respect in which silicone rubber is unique is that instead of the backbone of the chain being composed of carbon-carbon linkages -C-C-C-C it has the silicone/oxygen linkage -Si-O-Si-O-Si-O- similar to that in quartz and it is this inorganic backbone which gives the material its exceptional resistance to heat.

From a good deal of laboratory work it has been concluded that silicone rubber can be used indefinitely at temperatures of the order of 150°C. and for short periods up to temperatures of the order of 200°C. Another property which follows from the fact that silicone rubber is half organic and half inorganic is the fact that when destroyed by fire it gives rise to scarcely any carbon formation. The residue left is very largely pure silica and the cable will function if not disturbed after a fire. In fact if two silicone insulated cores are twisted together and 500 volts applied between the two, the whole can then be placed in the hottest part of a Bunsen flame and the two cables will not break down even while in the flame itself. One property which could not have been obviously forecast from the chemical nature of silicone rubber is the fact that it retains its flexibility down to quite low temperatures of the order of −70°C. These exceptional properties are combined with electrical properties of the same order as those of natural rubber. The cost of silicone rubber is very much higher than that of natural rubber.

2.4 STYRENE/BUTADIENE RUBBER (S.B.R. or GR-S).

A truly man-made copy of natural rubber would consist of polymerised isoprene. However the monomer isoprene itself is relatively expensive. Rubbers have been made in the past from the somewhat cheaper but closely related butadiene but the 100% butadiene rubbers were rather intractable in the factory and a reasonably practical proposition was found to be in a copolymer of butadiene and styrene containing about 25% of styrene. The polymerisation is carried on in water emulsion and the final product as normally marketed is contaminated with small amounts of organic emulsifying agents which have

been used as emulsion stabilisers. For most purposes this does not matter but these same amounts of emulsifying agents cannot be tolerated in material intended for dielectric purpose. Therefore, for such purposes the product is specially washed and although the original intention was probably to produce merely an equivalent of natural rubber, the washing treatment gives a product which is rather purer than natural rubber, so that it is possible to produce from this specially washed material types of synthetic rubber compound which have lower water absorption than have natural rubber compounds. Again the degree of unsaturation is somewhat less with this type of rubber than with the natural product and in general, dielectric and sheathing compounds based on GR-S are somewhat less strong than similar compounds based on natural rubber. It cannot be said that this type of synthetic rubber has any outstanding merit over the natural product. It is to be regarded basically as a substantial equivalent which may be used as a step in stabilising or reducing the price of many types of rubber cables depending on the relative prices of natural and synthetic rubber.

2.5 POLYVINYLCHLORIDE (P.V.C.)

It is assumed to be fairly common knowledge that the p.v.c. polymer itself is a white powder. P.V.C. compounds are made by mixing the polymer with plasticiser(s), stabilisers and lubricants and heating the mass by appropriate means, e.g. in internal mixer, for periods of anything from 2 to 10 minutes at temperatures of the order of 150-170°C. when the whole mass gells and becomes rubber-like at the high temperatures. The properties of p.v.c. compounds can be varied at will within certain limits by the nature and amount of plasticiser. As practically all types share certain common properties the object of formulating special types of compound is to obtain one or more desirable characteristic, usually at the expense of some other properties. The properties common to all p.v.c. compounds are permittivity of between 4·0 and 6·0, power factor between 0·05 and 0·1, indicating adequate electrical properties for voltages up to about 6 kV. sufficient flexibility for static uses, rather better, and in some cases much better, resistance to prolonged heat than that of vulcanised rubber, better resistance to oils, weather, and chemicals generally, all combined with self-extinguishing properties. P.V.C. dielectric compounds are normally worse than rubber in their tendency to become stiff and brittle at temperatures round about 0°C. or a little lower.

It has just been stated that p.v.c. compounds have better resistance to weather than has vulcanised rubber but in fairness a further comment should be made on the weather resistance of p.v.c. Field trials carried out in India and Africa over a number of years have shown that black p.v.c. compounds do not show any superficial effects after quite severe exposure. However, reference has just been made to the fact that round about 0°C., or a little lower, conventional p.v.c. compounds will become quite stiff and brittle; weathering raises the temperature at which this happens. This effect will not be of importance in countries where cold weather is not experienced but it may be of importance in countries such as England. Thus a p.v.c. cable may be exposed out of doors under conditions where movement may take place due to wind, and after a few years the "cold crack" temperature of the compound may have risen to a point where such movement can cause cracking during winter months, and this is a point which has to be watched.

Broadly speaking, there are three types of p.v.c. compound.

2.5.1 GENERAL PURPOSE TYPE MADE WITH MONOMERIC PLASTICISERS.

These are usually designed to have adequate properties over the ambient temperatures normally encountered in temporate climates. One may have both sheathing and dielectric compounds and sheath compounds are usually rather softer than dielectric types. What are known as monomeric plasticisers are used in this type of compound and if one has two

compounds adjacent to each other with widely differing amounts of plasticiser, some migration of plasticiser will take place from the more highly plasticised compound to the less plasticised one.

It is for this reason that a v.r. insulated p.v.c. sheathed cable is not regarded as a particularly satisfactory type.

2.5.2 HARD GRADE TYPE MADE WITH MONOMERIC PLASTICISERS.

If compounds are formulated along the same lines as the general purpose types, but with less plasticiser, the so-called hard grade compounds are obtained. Their essential property is that if subjected to relatively high temperatures, e.g. those met in soldering, for a short time they show less tendency to flow than do the general purpose types, and this is useful for certain specialised purposes (see Section 3.6.2). The advantages gained at high temperatures are necessarily lost at the low ones because the general purpose types remain flexible at lower temperatures than do the hard grade types.

2.5.3 HEAT RESISTING TYPES MADE WITH POLYMERIC PLASTICISERS.

If used at temperatures of the order of 80 to 100°C. general purpose p.v.c. compounds become stiff and horn-like. This is not due to oxidation as with natural rubber but to volatilisation of plasticiser. By replacing the monomeric plasticisers by polymeric types, which are non-volatilo, it is possible to produce types of p.v.c. compound which retain their flexibility for very long periods at temperatures round about 100°C. and for quite useful periods at even higher temperatures. These are often described as "heat resisting"; for instance this type of compound will remain quite flexible after about 40 weeks at 130°C. whereas a convential type will become quite stiff and horn-like after only a few days at this temperature.

Migration of polymeric plasticisers is insignificant compared with that of the monomeric types.

The polymeric plasticisers are also leached from the compound less readily by solvents.

P.V.C. compounds are rather more expensive than rubber compounds (based on the present price of raw rubber) and the "polymeric plasticised" types are more expensive than the monomeric plasticised ones.

At temperatures of the order of 100°C. or above the "heat resisting" types are softer and more liable to plastic flow than is the "hard grade" general purpose type and it is important to bear this in mind in deciding what is meant by "heat resistance". If, for instance, there is a usage where the p.v.c. will be required to withstand a relatively high temperature locally for short periods with a minimum tendency to plastic flow, then a "hard grade" general purpose type will probably be better than a "heat resistant" type. On the other hand, if there is a usage where it is important that the p.v.c. shall retain its flexibility after relatively long periods at high temperatures then clearly the "heat resisting" types will be better than the "hard grade" general purpose. The limitations of heat resisting p.v.c. compounds should be appreciated. Firstly their insulation resistance at temperatures of the order of 100°C. is extremely low, and this will obviously limit their use. Secondly if the compounds are kept at 100°C. for some years the polymer itself will decompose; therefore it must not be assumed that in "heat resisting" p.v.c. we have a compound which can be used for each and every purpose involving high temperature. The technical properties and cost of heat resisting p.v.c. make it somewhat of a special purpose material.

2.6 POLYTHENE

2.6.1 STANDARD GRADES.

Polythene is obtained by the polymerisation of ethylene at pressures of about 1,500 atmospheres and is now a well established material. It is a very pure hydrocarbon, therefore the electrical properties and resistance to moisture are excellent but it has no self-extinguishing properties if once

ignited, but will melt and drip burning material. In its unpigmented or natural state polythene is particularly susceptible to photo-oxidation and is therefore unsuitable for exposure to sunlight. This can be corrected by the addition of about 2% of a good carbon black and experience to date indicates that polythene pigmented in this way has satisfactory resistance to weathering. Physically the material is not unlike a hard, high melting point wax, being not quite so robust as rubber. Unlike both rubber and p.v.c. and again somewhat resembling high melting point wax, it has a relatively sharp softening point at about 100°C. Although, as stated, the electrical properties of polythene are excellent, it does suffer deterioration if subjected to electrical discharges.

Polythene is appreciably more expensive than a rubber compound but this difference is to some extent offset by the fact that the former does not need the processing and vulcanisation needed by the latter.

2.6.2 EXPANDED POLYTHENE.

Certain organic compounds, usually very rich in combined nitrogen, decompose with evolution of gaseous products at temperatures of 100°C-200°C. which are the temperature limits within which polythene is extruded. If such organic compounds are mixed with polythene and the mixture extruded, one obtains an expanded polythene in which the cells are non-communicating. The extrusion conditions have to be controlled carefully but if this is done correctly it is possible to obtain almost an air spaced insulation with a very low permittivity.

2.6.3 FLAME RETARDANT POLYTHENE.

If chlorinated materials, e.g. chlorinated paraffin wax, and a material such as antimony oxide which at high temperatures will react with the chlorinated body, are mixed with polythene it is possible to produce compounds which are self-extinguishing. Naturally, many of the properties normally associated with polythene are sacrificed and many of the resultant properties of flame retardant polythene resemble those of p.v.c. However, it has a lower permittivity (about 3) than p.v.c. (4-6) and this combined with self-extinguishing properties makes it an unusual and relatively low cost material.

2.6.4 HIGH DENSITY POLYTHENE.

It has been pointed out that the standard grades of polythene soften at temperatures round about 100°C. Attempts have been made with some degree of success, to raise the melting point of the product by varying the conditions under which the ethylene is polymerised. Whereas the specific gravity of standard polythene does not exceed 0·93 the modified methods of polymerisation give a range of types with specific gravities between 0·93 to 0·96; hence the term "high density". All are improvements over the standard types in that they are somewhat tougher at normal temperatures and the softening point has been raised by some 10-20°C. depending upon the particular type. In one type, sometimes referred to as the Ziegler type, the polymerisation is catalysed by aluminium organometallic compounds and carried out at substantially atmospheric pressure. This type tends to be contaminated with catalyst residues which to some extent adversely affect the electrical properties as evidenced by the fact that whereas the power factor of a standard polythene is 0·0002 that of the Ziegler types is of the order of 0·001-0·002. Contamination with catalyst residues tends to make this type rather more liable to oxidation than is the standard material. Although the softening point of the "Non-Ziegler" high density polythene is some 10° higher than that of the standard types it is not as high as that of the Ziegler types. However, as the "Non-Ziegler" types are not contaminated with catalyst residues there is no loss in electrical characteristics, and no increased tendency to oxidation at a given temperature. Both the Ziegler and Non-Ziegler types of high density polythene are coming into production in Great Britain. The indications are that these types are likely to be more expensive than the standard types.

2.6.5 IRRADIATED POLYTHENE.

When polythene, either the standard or high density type is irradiated by any form of high energy particle, e.g. in a Van der Graaf accelerator, or high energy rays, e.g. from a nuclear or radio active source, the polythene becomes cross-linked in much the same way as rubber becomes cross-linked when it changes from the thermoplastic to the elastic condition during vulcanisation. The effect of this change in polythene is to give a material which takes on rubber-like properties above the softening point of the normal type of material, and if the polythene is sufficiently irradiated it will not melt below its decomposition point. In all other essential respects irradiated polythene resembles normal polythene so that we have a material which at first sight seems unique in that it appears to be one which could be used at temperatures of the order of 150°C. and upwards. Up to the present it has been found almost impossible to obtain any practical conditions of use which are sufficiently oxygen free to prevent oxidation and no means have yet been found of preventing comparatively rapid oxidation of irradiated polythene at high temperatures. Thus on the basis of experimental work it seems likely that the useful life of irradiated polythene is 3000-4000 hours at 100°C. about 1000 hours at 120°C. and about 500 hours at 140°C.

2.7 POLYTETRAFLUOROETHYLENE (P.T.F.E.)

Chemically speaking p.t.f.e. is polythene in which all the hydrogen atoms have been replaced by fluorine atoms and this change gives a material which from the user standpoint is technically outstanding. It combines all the excellent properties of polythene with extreme chemical inertness. It does not oxidise and so far as can be judged from laboratory tests can be used indefinitely at temperatures of about 250°C. Due to the high halogen content it is self-extinguishing. It does not melt but sinters at its transition temperature of 327°C. This property makes its fabrication extremely difficult. It cannot be normally extruded, but has to be compacted round the conductor, which is then passed slowly through a tube under pressure and heated to the transition temperature of p.t.f.e. when the particles sinter into a substantially homogeneous mass. For applying thinner wall insulations the process can be made somewhat less difficult by the use of a so-called "lubricated polymer". An alternative method of applying the material is to lap it as a tape (made from unsintered lubricated polymer) round the conductor and then heat the covered conductor to the transition temperature of the p.t.f.e. when again the material sinters so that the laps coallesce. At temperatures above about 250°C slight decomposition of the p.t.f.e. occurs with evolution of small quantities of harmful volatile fluorine compounds; this becomes more serious above the transition temperature of p.t.f.e.

All synthetic work involving fluorine is very expensive and the price of p.t.f.e. is of the order of £2 to £5 per lb. which naturally makes it a very special purpose material.

SECTION 3

TECHNICAL USE OF NATURAL RUBBER, SYNTHETIC RUBBER AND PLASTICS.

In the present section it is proposed to discuss the practical use made of the properties outlined in the previous section, in current cable making practice and usage in Great Britain. It has been pointed out that in general special purpose materials are more expensive than vulcanised rubber. They are therefore in general use only where their extra cost can be justified.

3.1 NATURAL RUBBER.

In Section 2 it was emphasised that studies have shown that equally satisfactory cable can be made with compounds containing quite wide variations in rubber content and as users quite correctly do not now attach the importance to very high insulation resistance that they used to, there has been no great technical difficulty in putting into effect the recommendations of the 1953 Commonwealth Conference that compounds having lower rubber

contents than those in common use hitherto be adopted. A new British Standard catering for a dielectric containing not less than 50% nor more than 60% by volume of rubber compared with the previous standard of 70-75% and for some reduction (though smaller) in the rubber content of the general purpose sheath is now in force.

3.2 POLYCHLOROPRENE (Neoprene, p.c.p.)

Polychloroprene has now been commercially available for a little over 20 years and its merits are now widely recognised. There seems little doubt that its use in Great Britain would have been greater but for the fact that it has been a dollar import and Du Pont's decision to erect a p.c.p. plant in Northern Ireland is a most interesting development. As Table III. implies that the electrical properties of p.c.p. are in some respects worse than those of rubber it may seem surprising that the first use of p.c.p. was in dielectrics. However, during the middle of the late 1930's a fair amount of prominence was given to developing fire resisting dielectrics. The "longitudinal" method of applying dielectrics was at that time in common use and so the extremely low insulation resistance of p.c.p. was overcome by making a composite dielectric in which the inner layer was vulcanised rubber and the outer vulcanised p.c.p. This was a novel construction introduced by the C.M.A. The dielectric has been recognised in B.S. 883 (Cable and Flexible Cords for Equipment of Ships) for a good many years and is now included in the new B.S. mentioned in Section 3.1. Its self-extinguishing properties compared with those of V.R. can be shown by a simple experiment illustrated in Figure 10. Lengths of V.R. core and F.R. core are twisted together for about 3" and then the remainder of the lengths separated; the flame from a Bunsen burner is allowed to impinge on the two lengths where they are twisted together. Both dielectrics become ignited, but whereas the V.R. insulation conveys flame along its length, the F.R. insulation does not.

Having a p.c.p. outer layer this composite dielectric is of course more oil resistant than an "all rubber" one and as it seems likely that its use will overcome troubles experienced from time to time with the "all rubber" dielectric due to accidental but unavoidable contact with lubricating or fuel oils, the composite dielectric has been adopted in a new type of railway signal cable being standardised by the British Transport Commission.

For many years outdoor low voltage cables for connection to rural buildings have had a standard V.R. dielectric with a braid and red lead compound finish and although such cables have given a reasonably long life the Central Electricity

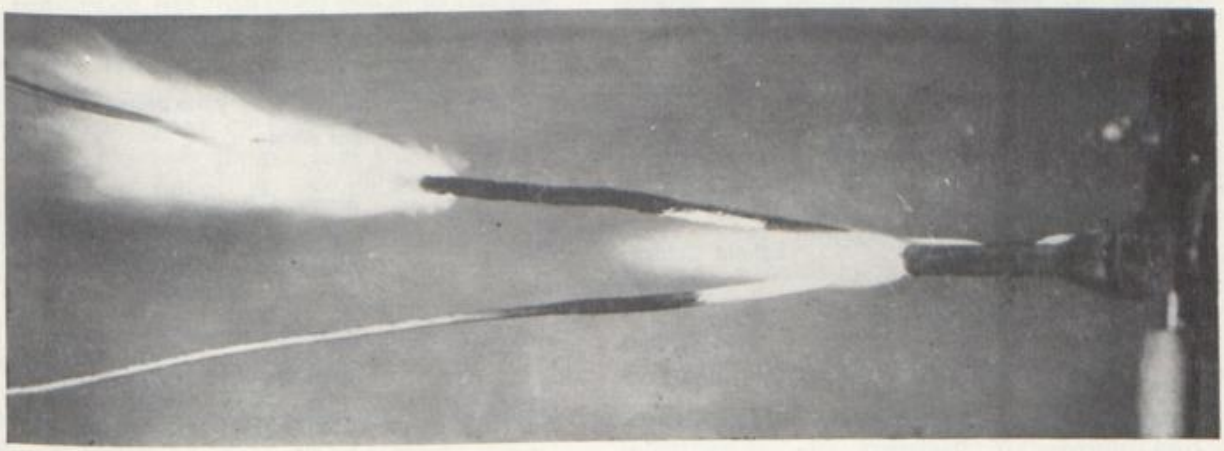


Fig. 10.

Authority are considering an all purpose cable having an inner layer of V.R. and an outer covering of p.c.p. the two being virtually vulcanised together and thus approximating to an enlarged composite construction. This is, of course, intended to take advantage of the extremely good weather resistance of p.c.p.

The self-extinguishing and oil-resisting properties of p.c.p. are also used in what are known as the Pren and Nypron range of aircraft cables. In the Pren range the construction of the single core cable is—conductor, glass braid followed by a relatively thin covering of p.c.p. We then have variations of this in which two or more cores may be laid up, glass braided and p.v.c. lacquered overall, or the laid up cores may be sheathed with p.c.p. However, it has been found that p.c.p. is attacked by modern so-called "ester based" lubricants and the "Nypren" range has been developed to overcome this, the essential feature being that the thickness of p.c.p. covering over the glass braided core is reduced by about 5 mils and replaced by a 5 mil sheath of Nylon.

It is about 20 years since the first experimental trailing cable having a p.c.p. sheath was made for practical trial in a mine but the use of p.c.p. heavy duty sheaths for this purpose is now universal, the reason being of course that if a local fire starts the cable will not spread the fire as was the case with natural rubber sheathed cables.

Reference has just been made to the use of a composite R/N dielectric by the British Transport Commission; this is naturally being accompanied by a p.c.p. sheath for types of cable used outdoors. The merits of p.c.p. for this type of application have, it is believed, been recognised and applied for some years by the South African Railways and Harbour Board.

In the new types of cable now coming into production for the British Admiralty (see Section 3.4) metal sheaths have been abandoned and replaced by p.c.p. the object being to save weight while maintaining oil and fire resistance.

Recognising the shortcomings of V.R. when exposed to the weather it has not been possible to recommend the use of unprotected rubber sheathed cables for prolonged static use out of doors and for certain purposes, e.g. farm wiring, attempts have been made to produce an "all purpose" cable by the use of a textile braid embedded in a rubber sheath, the whole wax compounded. While this is an improvement over the plain type it is not as good as a plain p.c.p. sheathed cable and there is now a trend to adopt a plain p.c.p. sheathed cable as an "all purpose" cable for the wiring of farm buildings.

3.3 BUTYL RUBBER.

Section 2.2 showed that the merits of Butyl compared with natural rubber were improved resistance to heat, ozone and moisture. The improved heat resistance may be utilised in two ways. Firstly, it gives a means of producing a cable having all the ease of installation merits of a V.R. cable but suitable for conductor temperatures in the region of 80-85°C. (or even higher for a short life) for which V.R. is unsuitable. Secondly, in the larger sizes it can be used to increase current ratings. This implies that for a given current rating a Butyl insulated cable can be smaller than one insulated with V.R. There is general agreement among British cable makers that current ratings for Butyl insulated cables can be based on conductor temperatures comparable with those for varnished cambric cables and although the prime cost of the former may be higher installation costs will be lower as there is no need for special end sealing. Varnished cambric cables are at present commonly used for ship wiring but there is every prospect of lively competition between varnished cambric and Butyl in this field. The use of Butyl rubber insulated cable for use on ships has been approved by Lloyds, subject to the dielectric compound complying with certain performance tests regarded as characteristic for heat and moisture resisting butyl compounds.

As Butyl rubber compounds are so good electrically, so resistant to ozone and capable of operating at temperatures of the

order of 80-85°C. it is natural that they should excite interest for what, in the rubber cable field, are regarded as high voltages, i.e. up to about 15 kV. Laboratory extended tests have suggested that their life would be at least that of the traditional impregnated paper cable and although once again the prime cost will be higher the overall cost of an installation might be lower, again due to the fact that special end sealing may not be necessary. Limited quantities of high voltage Butyl rubber insulated cable have been supplied.

The resistance of vulcanised rubber to moisture is not sufficient to enable manufacturers to recommend burying rubber cables in the ground. As Butyl rubber compounds can be formulated to have a very much lower water absorption, it may well be that the adoption of Butyl rubber will enable manufacturers to produce a non-metallic sheathed cable which can be recommended for burial in the ground. Field trials of such cable by a joint C.M.A./C.E.A. committee are in hand, while other field trials of Butyl insulated cables in wet situations are going on at two main line railway stations under the supervision of a joint C.M.A./B.T.C. committee.

3.4 SILICONE RUBBER.

The essential features of silicone rubber being its very good heat resistance combined with moisture resistance it is natural that silicone rubber cables have found applications in situations which are either permanently or spasmodically hot, i.e. brick kilns, flues, etc.

In close collaboration with the C.M.A., the British Admiralty have decided to abandon their traditional V.R. insulated cables and to change over to silicone rubber insulated cable for all cables, other than flexible, in H.M. Ships. The reasons for this are, firstly that temperatures in certain parts of the ship are liable to reach 70-80°C. or even higher with the result that even the best V.R. formulations perish and the cables have to be replaced every 9-10 years. In view of the extreme heat resistance of silicone rubber even at 150°C. there seems every reason for believing that at these lower temperatures the silicone rubber cables will last as long as the ship itself, so that the need for replacement will not arise. A second reason for their adoption is the fact already mentioned that if the insulation is destroyed by a fire the residue will still have some measure of insulating properties and the cable will continue to function temporarily.

In view of the increased temperatures encountered in aircraft, particularly near the engine, and the importance of maintaining service during a fire, silicone rubber naturally features in various contructions of cables used near the engine, usually in conjunction with glass fibres. One such construction (Glasil) has a silicone rubber insulated core followed by a layer of asbestos and a glass braid which is silicone varnished. For various reasons this is not an ideal construction, but recently a better aircraft cable has been introduced, (Tersil), having a silicone rubber insulated core, followed by a composite covering of Terylene and glass.

3.5 S.B.R. (GR-S).

The present British B.S. 7 specification allows up to one third of the natural rubber in general purpose sheaths to be replaced by GR-S. However, the facts that (1) it may be possible for compounds based on GR-S to compete economically with those based on natural rubber, and (2) the British Government is apparently willing to allow the import of the synthetic rubber, have stimulated interest in the material. Cable makers in the United Kingdom had good experience with GR-S during the War years so that it would not be a major development to changeover manufacture from natural rubber to synthetic rubber.

It is mentioned in Section 2 that the dielectric type of GR-S is a purer form of rubber than is the natural product; this, therefore, opens up the possibility of formulating GR-S dielectric compounds with lower water absorption than natural rubber ones and probably cheaper than Butyl; cables made with a dielectric of this type are included in the field trials referred to in Section 3.3.

3.6 P.V.C.

3.6.1 GENERAL PURPOSE TYPES (MONOMERIC PLASTICISED)

The use of p.v.c. insulated and p.v.c. insulated/p.v.c. sheathed cables for general purpose wiring is now so well established that only passing comment is necessary. The decision as to whether one uses v.r. or p.v.c. seems to depend largely on their relative price at any given time, plus personal preference of individual users. Reference has already been made to the stiffening of p.v.c. in cold weather and some contractors dislike the consequent difficulty of trimming ends. Other contractors report that when p.v.c. cables are pulled into conduit there is much more tendency for them to "bind" on each other than is the case with the conventional braided and compounded V.R., though this can be reduced by appropriate compound formulation. However the uses of p.v.c. are extending in other directions. Thus it is recognised that compounded textiles are not fundamentally resistant to moisture and there is a trend to replace compounded boddings and servings under and over armour with p.v.c. on account of the greater moisture resistance. When used in this way sheathing types of compound are preferred for the bedding as being softer and dielectric types as the serving over armour as being harder and therefore more resistant to damage. Extruded p.v.c. sheaths are also finding favour as anti-corrosion sheaths over metal sheathed cables.

For many years it has been the custom, where overhead power cables cross Post Office telephone lines, to insist that the power cables shall have sufficient electrical protection to avoid electrification of the Post Office telephone lines during momentary contact such as might occur if an overhead line breaks. Hitherto this protection has taken the form of impregnated paper tapes, cotton lapping and a braid saturated with red lead compound, but this complete covering has now been changed to p.v.c. it being specified that for voltages up to 660 the minimum thickness at any point shall be 30 mils while up to 11 kV. the minimum thickness at any point shall be 60 mils. It should be re-emphasized that these thicknesses are regarded as being sufficient to give the momentary protection and are not accepted as being any guide to the thicknesses for continuous operation at these voltages. In view of the electrical properties (Section 2.5) a common view in Great Britain is that p.v.c. may not be the most suitable insulation for voltages above about 6 kV.

Serious thought is being given to the use of p.v.c. insulated armoured cables for low voltage power cables as alternative to the present type of impregnated paper lead sheathed types. Practical trials under a joint C.M.A./C.E.A. Committee are in hand to evaluate p.v.c. as a material, though other considerations may well decide the issue (Section 4).

3.6.2 HARD GRADE (MONOMERIC PLASTICISERS).

The essential feature of this type compared with the general purpose type is that if it is heated for a short time at a high temperature, it shows less deformation. It was therefore developed specially for use on Post Office communication cables with the object of providing a compound with less tendency to flow away from the conductor if accidentally touched with a soldering iron during jointing in a crowded telephone cable terminal box. It has now been included as a special type of compound in B.S. 2746.

3.6.3 HEAT RESISTING (POLYMERIC PLASTICISED TYPES).

These types are used where retention of flexibility for relatively long periods at temperatures of the order of 80-130°C. are important. It so happens that the polymeric plasticisers used are not so readily leached out of compounds by solvents as are the monomeric types. One obvious type of usage therefore is for coil end flexibles, i.e. flexible leads from motors, which are attached to the windings and required to withstand the high temperature impregnation process given to the motor windings. Other types of use where

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their extra cost would, in theory, be justified are for electric blankets, wash boilers, etc.

Unlike monomeric plasticisers these polyester plasticisers do not migrate to any important extent. Hence their use in so-called "non-poisoning p.v.c." sheaths which are required over polythene cores for some types of usage.

P.V.C. compounds share many of the properties of p.c.p. compounds and it is not surprising that much thought is being given to the development of cables similar to the Pren or Nypren types but using p.v.c. instead of p.c.p. Such types (Nyvin) would have a thin nylon sheath over the p.v.c. which would prevent loss of plasticiser from (say) a hard grade compound made with a monomeric plasticer. At temperatures of the order of 90-100°C. such a compound would show less flow than would a "heat resisting" type and it is moot point whether, in the event of p.v.c. aircraft cables being used, these should be made with a conventional "hard grade" compound or with a "heat resisting" grade. The merits of bare p.v.c. versus bare p.c.p. for connection to rural buildings have been considered by a joint C.M.A./C.E.A. Committee. The C.M.A. recommendation is for p.c.p. (Section 3.2) owing to the fact that a rise in cold crack temperature which will occur with p.v.c. may become important in cold weather (Section 2.5).

3.7 POLYTHENE.

3.7.1 STANDARD GRADES.

The use of polythene for high frequency cables is well established and does not require any further comment. Over the past few years it has been used quite extensively for low voltage wiring types of cable. At one time there was some semi-technical propaganda on the general theme that the electrical properties of polythene were so much better than those of v.r. and p.v.c. that the dielectric thickness on low voltage house wiring cables could be very much reduced. However this sort of talk ignored the basic fact that thicknesses of insulation, whether of rubber, p.v.c. or polythene, adopted for low voltage wiring cables are not determined by the electrical properties of the material but by the thicknesses which are necessary to enable the core to withstand subsequent manufacturing processes in the factory followed by the usually rougher handling during installation, and still retain a good margin of safety. As polythene is if anything rather less robust than v.r. or p.v.c. the radial thicknesses of polythene should logically be certainly not less. However in the drawing up of B.S. 1557 for polythene insulated house wiring cables the thicknesses adopted were rather less than those in B.S. 2004 and B.S. 7 for p.v.c. and v.r. cables respectively. The excellent electrical and moisture resisting properties of polythene naturally suggest its use for buried cables and polythene insulated cables are undergoing field trials along with similar cables made with butyl rubber (3.3), GR-S (3.5) and p.v.c (3.6).

The excellent electrical properties and moisture resistance of polythene naturally indicates a use for high voltages and cables for voltages up to and including 11 kV. made with polythene dielectrics have been proposed, the radial thicknesses of dielectric being rather less than those for the traditional paper impregnated cable. It was mentioned in Section 2 that in spite of the excellent electrical properties of polythene the material was readily deteriorated under the influence of electrical discharge. Therefore in the manufacture of high voltage polythene cables great care has to be taken to ensure that the dielectric is void free. Reference has already been made to troubles arising from the comparatively low temperature at which polythene softens, i.e. not very much above 100°C. and this has a bearing on the behaviour of polythene insulated cable under short circuit or overload conditions.

3.7.2 EXPANDED POLYTHENE.

Expanded polythene is essentially a special low permittivity dielectric and its main use is for television down leads.

3.7.3 FLAME RETARDANT POLYTHENE.

In general and as indicated in Section 2.6.3 flame retardant polythene has no particular advantage over p.v.c. However it is somewhat unusual by reason of the fact that it is a self-extinguishing dielectric with a relatively low permittivity. This combination of properties makes it of interest for neon sign cables and B.S. 559 recognises the compound as an approved dielectric for this purpose.

3.7.4 HIGH DENSITY POLYTHENE

As the high density polythenes are in general slightly higher melting point versions of the standard samples they should in theory be suitable for all purposes for which the standard grades are used but should be somewhat safer in that they will not melt so readily under overload conditions. Work so far has indicated that the production of void free dielectrics with these types of polythene is rather more troublesome than with the standard types.

3.7.5 IRRADIATED POLYTHENE

Irradiated polythene does not melt but becomes elastic at high temperatures and, therefore, certainly overcomes any shortcomings of the standard grades due to their relatively low melting points. Thus a wire insulated with irradiated polythene can be soldered without melting the dielectric, whereas normal polythene will melt. Then it might seem that irradiated polythene would prove a serious competitor to impregnated paper, as unlike the non-irradiated standard types it will not melt at temperatures of the order of 120°C. In practice it would not be possible to exclude oxygen sufficiently to prevent oxidation of the material at this temperature and until suitable anti-oxidants have been found which are capable of giving protection for long periods at temperatures of this order, the practical advantages of irradiated polythene, leading to large scale use, appear to be rather problematical. However, irradiated polythene is a new material and it is probably unwise to be dogmatic.

3.8 P.T.F.E.

In view of the fact that p.t.f.e. costs between £2-£5 per lb., has a specific gravity of about 2·5 and is most difficult to fabricate, it will be understood that it must be regarded from the cable making and usage standpoints as a very special purpose material. Nevertheless temperatures are encountered particularly near the engine in modern aircraft which require a material having at least the technical properties of p.t.f.e. Certain quantities of p.t.f.e. extruded cable have been made for this purpose and although early types showed some defects, improved cables are now available. In addition to the use of p.t.f.e. for heat resistance, it is used as an insulation on cables in circumstances where resistance to a wide range of chemicals is important.

SECTION 4

PLASTICS VERSUS IMPREGNATED PAPER.

Finally a comment may be made on the possibility, as seen today, of some of the newer materials such as Butyl rubber, p.v.c. and polythene replacing impregnated paper for buried mains cables. At present no serious thought is in general being given to their use above about 11 kV. Reference has been made to the co-operative C.E.A./C.M.A. trials on non-metallic sheathed cables made with these materials; the basic object of these trials is to see whether the materials have sufficiently good moisture resistance. Even if this proves to be so no-one expects to get better results than are obtained with impregnated paper lead sheathed cables and the rubber like materials are of practical interest only i they give cheaper cable or an overall cheaper installation. None will do this unless the lead sheath can be omitted. Even without a lead sheath a p.v.c. armoured cable is the only type that would appear to offer the possibility of competing economically with impregnated paper lead sheathed cable, but as already indicated in Section 3.6.1 there is a body of opinion which inclines to the view that technically and economically p.v.c. is not very attractive for voltage above about 6 kV.

This body of opinion holds that above 6 kV. polythene or Butyl rubber is the

more logical choice. Compared with an impregnated paper lead sheathed cable a polythene insulated and sheathed cable is slightly cheaper only in small conductor sizes, with a Butyl rubber insulated p.c.p. sheathed type noticeably more costly on the whole range of sizes.

The design of plastic or rubber insulated cables as alternatives to impregnated paper insulated, lead sheathed cables for direct burial in the ground will of course be conditioned to some extent by the regulations in force at any given time. At the present time the regulations in Great Britain permit low voltage non-metallic sheathed cables to be buried direct in the ground providing they are armoured. It is understood that in the supply industry the phrase 'low voltage' in this context is being interpreted as embracing voltages up to 650 volts. Since the possibility of using p.v.c. cables underground in Great Britain is still the subject of extensive study between the C.M.A. and the C.E.A. it would be unwise to predict the outcome at this stage. It seems likely that the problem will be resolved in terms of comparative installed system costs, the hope of the Supply Authorities being that in view of the large amount of cable jointing involved in supplying electricity to housing estates it will be possible, quite apart from cable cost, to effect economics in the total cost of the installed joint.

SECTION 5

TRENDS IN SPECIFICATIONS.

All dielectric and sheathing compounds widely used in Great Britain are controlled by specifications, usually British Standards, and a comment on trends in specifications may be of interest.

Specifications can be of two general types. The first type consists essentially of two sections. In the first section a particular type of compound is defined by general composition clauses; the second section consists of specified tests and minimum performance requirements; these do not necessarily bear any direct relation to service conditions, their main function being to ensure that the specified type of compound has been used and properly manufactured. The second type of specification consists only of performance tests and requirements so framed that any "rubber" dielectric or sheath meeting the combination of requirements must necessarily be of satisfactory quality.

Hitherto, British specifications have been of the first type. The latest British specification is really a blend of both types as it controls the general purpose v.r. and fire resisting dielectrics by the first type of specification while using the second type for controlling the ozone resisting dielectric. While the first type of specification proved reasonably satisfactory so long as there was only one basic raw material available, i.e. natural rubber, it has proved restrictive and somewhat cumbersome with the advent of additional suitable materials such as the various types of synthetic rubber, and the C.M.A. is at present carrying out a large programme of experimental work with the object of framing a specification based purely on performance tests and requirements which will ensure a technically sound product while allowing the use of natural or synthetic rubber depending on variations in price and supply position. The British specification for p.v.c. compounds (B.S. 2746) approximates very closely to the second type of specification mentioned above.

The foregoing paper has outlined the types of synthetic rubbers and plastics now available for cable making purposes and the means whereby they are evaluated within the C.M.A. not only by laboratory tests but in carefully organised field trials with the co-operation of suitable users. It is evident that there are groups of materials better than natural rubber in various respects, e.g. resistance to weather, self-extinguishing properties, heat resistance, moisture resistance, and there is usually more than one material in each group. All the materials described are in use to varying degrees; in the foreseeable future the various materials in each group will compete with each other and the ascendancy of one over another will in the end be determined by a balance between technical properties and price.

THE PRESIDENT: Thank you very much, Mr. Evans.

I now call upon Mr. A. R. Sibson of Bulawayo, to propose a vote of thanks for Mr. Evans's paper.

Mr. A. R. SIBSON (Bulawayo): Mr. President, Gentlemen, it is with very great pleasure indeed that I rise to propose a vote of thanks to Mr. Evans for his very excellent paper.

The Association is very much in Mr. Evans' debt, and it is always a pleasure to us to welcome visitors, and particularly visitors so knowledgeable as he. When we add to that that our speaker has travelled some 6,000 miles to get here, and will have to travel a similar distance to get home, it is easy to imagine the debt which we owe him.

The paper itself has been of tremendous value and will add materially to our proceedings. It contains a mass of information regarding developments of very recent origin all in one place, which, as far as I know, is nowhere else so readily accessible.

I suppose it is one of the compensations of the tragedy of war that so many technical developments arise, and I think that a large proportion of the materials which we have been hearing about this morning would possibly not have been anywhere near so advanced as they are if it were not for the recent war with the military competition so introduced.

As far as the use of thermoplastics in this country is concerned I suppose that PVC, polythene and neoprene are the three with which more of us are familiar. PVC in particular, as the speaker said, has come into very common us, and there is no doubt that we in Africa can endorse what he says about the importance of colour. We ourselves have found, without any doubt at all, that the black colour is by far the most lasting.

I am glad that the speaker referred to the possibility of a British Standards Specification arising in the near future. There are standard specifications for the PVC material itself, but we have not as yet any quality standards for the finished product, and this will of course no doubt be an advantage when it can be obtained. I shall have a little more to say about the use of PVC for overhead service connections tomorrow when discussing the paper by Mr. Wood.

Turning for a moment to polythene: this material with its considerably improved dielectric qualities, is an attractive material for multi-core protective circuits, particularly when associated with long pilot cables, where it is possible for quite high transients to develop. Up to the moment, however, we have had some difficulty in obtaining polythene multi-cores with suitable identification marks on the cores. The question of colour is no doubt a chemical matter, but I do hope that, if it has not so far been done, it will not be long before we can obtain polythene cable with some sort of core identification.

A very brief reference at the end of the paper is made to the question of jointing, and here is one of the areas of activity where the themo-plastic is proving so valuable, and I think the time is coming when we shall be using more and more of these materials as di-electrics in joints. With all the advantages that they give a uniformity of jointing procedure by the employment of techniques that can be easily understood, and actually carried out by people of far less skill than has been customary with the orthodox type of jointing, a matter which, in this country, is most important.

Now, Mr. President, I won't keep you any longer but repeat again how very grateful we are to Mr. Evans for this remarkably fine paper, and for the great contribution that it will make to our proceedings. (Applause).

THE PRESIDENT: Thank you Mr. Sibson.

I now call upon Mr. Simpson of Durban to second the vote of thanks.

Mr. R. M. O. SIMPSON (Durban): Mr. Evans, Mr. President, and gentlemen, it gives me very great pleasure indeed to second the vote of thanks to Mr. Evans so very ably proposed by Mr. Sibson, for

his very instructive and useful paper. Today we hear much about plastic cable, and this paper will be of great interest, and also of very great benefit to us all, in showing how careful one must be in the selection of the type of plastic you must use in each particular case.

I know that the economics is probably the most important factor, but this paper certainly high-lights other points, and gives us a very wide source of information as to the characteristics of the various materials used. It is a little disturbing when we see how much reliance is being placed today on our world resources of petroleum, this raw material is constantly coming to the fore for so many purposes, and we rightly get a little worried as to whether there will be enough available for all the purposes to which we are putting it.

Mr. Sibson has covered many of the more important points one would like to raise in thanking a speaker for a paper of such a standard, so I will cut my remarks short as I know the time is limited this morning, and just raise one or two points that I would like to know more about and I hope that I will again have the chance of further questions at discussion time tomorrow.

There is a fair amount of plastic being used in the higher voltage range of cables, up to 11 Kv, on the Continent, PVC apparently being the most suitable, probably because it is the most suitable one in the economic range, but it would be interesting to know what the impulse characteristics, and also the short-circuit characteristics, of that cable are like in relation to the paper cable. It is one aspect that is getting more and more important in our systems as the short-circuit level is rising.

The other points I must leave till discussion time tomorrow, but I would again like to thank Mr. Evans very much for this most useful contribution to papers presented to this Association. It will be welcomed by everybody as it gives us a guide as to the trend of events regarding thermoplastics and artificial rubbers that are becoming available to us, and will be of great value. It gives me great pleasure therefore in seconding the vote of thanks to Mr. Evans for his interesting paper.

THE PRESIDENT: Thank you Mr. Simpson.

Gentlemen it is now 12 o'clock and as we haven't much time, I shall have to bring the meeting to a close.

I would like to say that both Mr. Cave's and Mr. Evans' papers will be open for discussion—and I hope to give quite a lot of time to the discussion and the questions —some time tomorrow. Will you please show your appreciation for the interesting paper by Mr. Evans. (Applause).

Thank you Gentlemen.

CONVENTION ADJOURNED

On Resuming at 8.30 p.m.:

THE PRESIDENT: Gentlemen, the sooner we get on with the Members' Forum the better, and tonight it is over to Jimmy Mitchell.

Mr. MITCHELL — The Quiz-Master: Good evening ladies and gentlemen. This is the first time I think that we have ever had anything of this nature in the evening, and I think, although everybody is not here, that it is quite a good turnout and possibly could be popular in the future.

I unfortunately have worn out my yellow waistcoat. I brought along a yellow pullover but found it too hot, so I am afraid you'll just have to watch the colour of my face!

I was going to suggest this evening that you do not address the Quiz-Master. It is such a long item, and it takes Mrs. Simms twice as long to type "Mr. Quiz-Master" as it does "Mr. Chairman" so I suggest that, as it is a Members' Forum, you address the Chair as such.

I am not going to take the questions in order, and the first one I am going to put —and I am going to put it for our President, because he has had plenty of work to do and he actually posed it, is Question No. 17 and it is one of the two which were given to you in the Supplementary Agenda.

Mr. Chairman , I am a little puzzled about this, can the panel define the term "bend?" I do expect Mr. Kane to answer that question, but it appeared to me he complicated it all the more. This argument has cropped up on a number of occasions, and perhaps Cape Town could clarify the matter. Are they referring to sets in tubing or are they referring to bends or half normal bends? As I read this I would term it a bend, or a half normal bend, as distinct from a set in a conduit.

Thank you Mr. Chairman.

THE CHAIRMAN : Anybody else want to win the sixteen dollar prize?

Well I must thank the two members who made a reply. As far as I am concerned there are various types of bends. There is a "bender" which you go on at times, and the "bends" you get after a dive. There is also the "bend" referred to in these regulations. But it always reminds me of the Air Force Officer up in the Middle East who had on the outside of his tent a notice advertising "Harpic" and when he was asked why he said he was "clean round the bend" (Laughter).

Anyway, I have actually been primed with the answers, so this is—I won't say the official answer, but a semi-official answer to the question.

"Bend is taken to be a maximum deflection of 90° from the straight conforming with S.A.B.S. 162 (1951) Screwed Steel Conduit."

Obviously you haven't read your own standards.

Bend is not defined in the South African Wiring Regulations but it is defined in the corresponding I.E.E. Regulation No. 218. The 90° Terminal Bend in a Conduit run must be counted as one of the two bends allowed under Section 401(1). Section 401(1) is a condition which permits of easy drawing in of VIR and PVC cables into conduit, but this section must also be used in conjunction with Table 11(a) and 11(b), "General Capacity of Conduits," and S.A.B.S. 150 and 168 for VIR and PVC Cables.

I don't know who wins the prize for that one!

It is as follows :—

Question posed by Mr. C. G. Downie of Cape Town.

Section 401(1) of the Standard Wiring Regulations for the Wiring of Premises (2nd Edition) states :—

"Draw-in boxes shall be placed after every second bend."

(1) Can the Panel define the term "bend" in respect of degrees of change of direction?

(2) When adhering to the requirements of Section 401(1) is it permissible to ignore the 90° terminal bends in a conduit run?

(3) How exactly do members of the Panel interpret the requirements of Section 401(1)?

Mr. R. W. KANE (Johannesburg) : I am curious to know, first of all, why such a query has arisen, particularly from Cape Town, as I am under the impression that the second edition of the Regulations has never been accepted by Cape Town. The first edition has been promulgated from about, I should imagine 1942, and exactly the same regulation appears in the first edition. I wonder what Cape Town themselves have done these last 16 years in interpreting this Regulation.

I should imagine, but I frankly don't know, that the Regulation is a rather peculiar one. I think it has been applied in a common sense manner insofar as I should say a bend is anything 90° or more acute, and you can visualse certain occasions where one bend in several lengths of conduit would be more than enough when you're pulling conductors through conduit; on the other hand two bends in a very short length, in fact three bends in a very short length, might be quite a simple wiring problem.

I would rather Cape Town told us what they have been doing these last 16 years.

Mr. J. DOWNEY (Springs) : Mr. Chairman, alias Quiz-Master, you accused me this morning of not being properly dressed. As the ex-Quiz-Master, Mr. Chairman, let me remind you that you are not properly dressed tonight!

I would like to make a comment at this stage. You will notice if you look through the questions, and who has put these questions, that I feel all the rest of the members of the Association, other than Mr. Harry Turner of Umtali and all the members of the Executive, are to be congratulated on having such wonderful Undertakings that they have no problems to put!

I now turn to Question 16, which is also on the Supplementary Agenda, put by Mr. Giles, and I shall ask him to put the question as he put it on the Agenda.

Question posed by Mr. Giles of East London:

> A 25 horse-power three-phase motor, automatically controlled, driving a compressor for a butcher's chill room burnt out owing to the blowing of a single fuse in the Supply Authority's three-phase service fused in each of the three phases. The butcher claimed a new motor because of deficiency of supply. The Supply Authority said the butcher should have fitted protection against single phasing. Who was right?

Mr. P. A. GILES (East London): This question of single phasing is of course what one may call a hardy annual. Every time the load on the system increases to such an extent that the voltage drops there is a possibility of single phasing occurring.

The normal attitude of the Supply Authority is, "Let the buyer beware" which, I understand, is the legal standpoint in all these matters. We Electricity Undertakings are selling a dangerous commodity, and it is liable to burn out a motor, but the consumer should really protect himself against that possibility by fitting proper protection.

If he were buying water, which is also a substance which flows through pipes, and he left the cistern incorrectly adjusted and the water flowed through the bathroom, the house, and upset the carpets, I have not yet heard of a claim being made on the Municipality because his water supply caused the damage. But if by any chance the refrigerator motor burns out, then the Municipality, presumably, is liable for this. Actually when the water or electricity passes through the meter it is no longer Council property.

I feel that the gentleman who raised this query with me, and endeavoured to get the cost of a new motor from the Municipality, thought he was on a very easy wicket, but he didn't get very far with his argument.

So I feel that in these cases the consumer has no redress, but on the other hand I am not qute certain. There may be other consumers at the convention here who feel that that argument is somewhat of a dictatorial attitude to take up, and that something ought to be done about easing the situation.

Many years ago, East London, under the Cape Ordinance, the Council entrenched its position by obtaining the Administrator's consent to a Regulation which states that the Council shall not be liable for any loss or damage, direct or consequential, or arising from the cessation or deficiency of the supply resulting from strikes, breakdowns and so on (I am particularly careful about East London at the moment Mr. Chairman) whether or not the cause can be attributable to the act or the omission of any servant or agent of the Council. So in this way the responsibility of the Council is clearly set out, and the consumer must protect himself against his apparatus being damaged consequent upon any stoppage or deficiency of the electricity supply. That has been the position in East London since 1932.

I also understand that our Transvaal friends take the same attitude, because whenever a consumer installs a three phase motor they are very careful to send along a letter warning him that fuses do not give protection against single phasing, and may even produce single phasing through the blowing of one fuse, due to ageing or any other cause. I don't suppose the fuse baldheaded in the process, Mr. Chairman, but it certainly loses its vitality. (Laughter).

Apparently the Transvaal people feel that the most suitable and reliable protection is provided by circuit breakers or cut-outs, with thermal over-current releases and so on. There again the consumer has to protect himself.

Have I to give an answer to this Mr. Chairman?

THE CHAIRMAN: I was coming to that Mr. Giles. You are asking the question, not answering it!

Mr. P. A. GILES (East London): The question I want to ask, Mr. Chairman, is whether the consumer or the Council is responsible. I am trying to make a plea for the Council. Am I allowed to do that?

THE CHAIRMAN: You can make a plea for any body you like, but please ASK the question and don't ANSWER it.

Mr. P. A. GILES (East London): Must I read the question again? The consumer says the Council are responsible when single-phasing occurs, and the Council say the consumer is responsible. Is somebody going to argue the case for the consumer?

THE CHAIRMAN: Somebody is going to answer your question as to who was right.

Mr. P. A. GILES (East London): I am very pleased to know that Mr. Chairman. I shall be very pleased to know who was right.

THE CHAIRMAN: Thank you Mr. Giles. Now the answers to Mr. Giles' question. Mr. Milton's got it!

Mr. W. H. MILTON (ESCOM, Johannesburg): This is a problem which has faced ESCOM from time to time and in connection with which very senior legal advice was sought, and it is very clear that legally the consumer has no right of recovery from the supply authority. It is a risk which is associated with the supply of electricity. In spite of that, however, ESCOM has pointed out in its conditions of supply the risk of single phasing, and advises all its consumers that they should protect themselves should they so desire. If a consumer fails to do so it is assumed he has considered the cost of protection not worth the avoidance of the risk that is run. In other words, the insurance premium is too high, but there is no question of the supply authority being responsible for damage due to single phasing.

Mr. R. W. KANE (Johannesburg): I would like to cross swords with Mr. Milton. Don't misunderstand me. I do agree that the consumer is responsible, provided the bye-laws or regulations cover him, but I am wondering whether ESCOM have any such personnel as installation inspectors, and whether, in passing an installation, they are so extremely careful in checking on such protection, and whether the authority finally would not be responsible if they had accepted an installation which was not strictly according to their own bye-laws.

Mr. W. H. MILTON (ESCOM, Johannesburg): I thought I was quite specific in my reply, which was that legally there is no responsibility whatsoever attaching to the supply authority. As regards the inspection, I would like to point out to Mr. Kane, and all those present, that the passing of an installation by an inspector does not involve the municipality or supply authority in any responsibility for any defect which may later be found in that same installation. The object of inspection is to determine, to the best of their ability, whether or not the supply authority considers the installation safe before it is connected to the mains. I am dealing now with the laws of the Union of South Africa. I don't know whether Rhodesia is in the same position, but that is the law in the Union.

The responsibility in common law rests entirely with the consumer to see that he protects himself against any risks which he may run when he decides to make use of electricity.

The only aspect of damage in respect of which the responsibility is thrown upon the supply authority is leakage. That is clearly laid down in the Electricity Act, and is rather a reversal of Common Law, because the proof then rests with the supply authority (in the Union of South Africa) to prove that it was not negligent. Normally it rests with the party who has suffered damage to prove negligence before he has any claim. In our case the requirement of Common Law is reversed, but only in respect of leakage from the mains. Single phasing arises from actual utilisation of the mains, and damage which results from the nature of the supply

through those mains, which is not in the category of leakage.

Mr. R. W. KANE (Johannesburg): I still think Mr. Milton answered that question by saying that the person has to claim negligence before they have any right. I would rather Mr. McIntyre said something about this.

Clr. JOHN McINTYRE (Durban): It appears to me, Mr. Chairman, that this is a "Cain" and "Abel" argument! (Laughter and Applause). Who carries the brand I'm not quite sure, or whether it is the brand of Cain or the brand of the S.A.B.S.! Of course, as an old official and now a member of the City Council, I always take the view that the Council is never wrong—not even if the Town Clerk does not agree—because whatever the Town Clerk might think, he is only one person. His Council is a multitude of counsel, and we are taught that in a multitude of counsel there is wisdom.

A consumer accepts an installation which is O.K.'d by the wiring inspector at the time it is completed, which of course is the correct course to follow. Although the wiring inspector says "The installation is in order," he cannot be responsible, nor can his employers, the Council, be responsible, for any defect which may occur later on, due possibly to the carelessness, shall we say, of the consumer. I think that in the circumstances visualised in this question, if the consumer is at fault, he has no redress against the Council.

Clr. D. DIVARIS (Salisbury): I rise as a layman, and fighting for the consumer tooth and nail! I would like to say that in Salisbury I have always noticed that whenever anybody comes in with a complaint or anything like that, he is shot down from 100 miles away irrespective of how good or how bad his case maybe. They start giving him the works as soon as he enters the main gate, and he gets the Irishman's farewell as he departs out of the back! (Laughter).

However, I do think that in many instances the consumer has a good case. He puts in a motor in good faith, it is a motor made by some of the best brains in the manufacturing world, and he installs it expecting to get a certain life from it, and he installs it in the full knowledge that the municipality is going to give him power for it, and this power varies due to an overload, and his motor burns out and he asks why he can't get a claim and the municipality, as we have just been told, is always right, especially on financial matters, they want to keep the money in their own pocket, and they won't help them out at all.

Now in Salisbury, and I would like Mr. Mitchell to bear me out on this, we had a case a short while ago, and it arose because the charges on current were raised by some 18 or 20%, and certain residents in an area complained their lights were always fusing, their motors burning out, and they got no redress from the Council. So much so, that they wrote to the Government and the Government was forced to take action by writing to the municipality and asking what the municipality was going to do about it, but as I said before, our Government comes second to the municipality up there, they also got the Irishman's rise, but I must say I was not very happy about the outcome and I would like to know more about it.

THE CHAIRMAN: I don't know whether I'll be getting the Irishman's rise when I get back or the bum's rush . . . (Laughter).

Has anybody else got any ideas that they are always right?

Mr. A. JACKSON (Provincial Administration ,Cape Town): Mr. Chairman, in the Cape we have standard electricity supply regulations which may be adopted by municipalities by reference. In these standard supply regulations the legal position is set out quite clearly. There is one section of these regulations entitled "Responsibilities of the Supply Authority," and the clause to which Mr. Giles referred and which is in force in East London, is also another section of these regulations in included in these regulations. There is another section of these regulations in which a paragraph is headed "Inspection does not relieve the Contractor of Responsibility," and this heading, I think, is self-

explanatory. That is the legal position here in the Cape where a local authority adopts the standard supply regulations.

THE CHAIRMAN: Does anybody else wish to speak on this question?

Mr. J. L. K. POMPE VAN MEERDERVOORT (Harrismith): Our municipal regulations are so framed that every consumer using a motor over 3 h.p. must use an efficient starter. Now a motor starter is not efficient unless it has some device for switching off in case of over current. Should the municipal electrician who inspects the installation find that there is no device for tripping the motor in case of over current, on one or more phases, then the instllation is not passed. Supposing a man installs a motor with no further protection than just fuses, puts on an overload, and one fuse blows, with the result that the motor single-phases and overloads the remaining phase, which then burns out. I consider that this is due to the consumer not having complied with the regulation and installed the necessary protective equipment, and it is therefore his baby. I don't think the municipality can be blamed. If the wiring system does not contain the protection it should contain and motors have "gone" in our part of the world, and I have always said, "Well, it is your own fault," and as has been said tonight, it is because the man has not paid the premium for insuring his motor by installing an efficient starter. He is carrying it himself. If we can, of course, we insist on his doing so, but if an installation should slip by, or what frequently happens, if a motor is installed without our knowledge, or a switch installed which is defective and the switch doesn't do its job, I can't accept that the municipality is responsible.

Thank you, Mr. Chairman.

Mr. R. M. O. SIMPSON (Durban): In problems of this nature I also support Mr. McIntyre in his outlook that "The Council is always right," but there is one point on which I would like another opinion and that is, that whilst we are protected by the bye-laws, application form, in addition, is in effect a contract under which supply is given to a consumer. Very often this application form is signed by the contractor, without reference to the consumer and we accept this as a contract under which the consumer agrees to abide by the bye-laws; is this then binding on the consumer? if not, are we protected by the bye-laws against future possible troubles. I have put this forward as other Undertakings may have had similar problems.

Mr. F. STEVENS (Ladysmith): I, like Mr. Simpson, am not trying to say who is right or who is wrong, but explain what our attitude is in Ladysmith.

Our bye-laws state that the Council will not be responsible for any interruptions whatever. I consider supply authorities, agents for single phasing preventive equipment, electrical contractors, and such like, should somehow make it known to users of electric motors that single phasing preventive equipment is available on the market, so that they haven't the excuse for saying, after the motor has burnt out, that they didn't know. The reason why we will not accept responsibility for interruptions is the very fact that there is such equipment available.

Thank you, Mr. Chairman.

THE CHAIRMAN: Thank you Mr. Stevens. I am not going to pursue this any further. I think I ought to be given a chance to reply to my councillor who stated that, despite the fact he is a member of the Finance Committee, a man installs a motor and we give him power. I don't. I always make him pay for it.

He also says that we get complaints mainly as a matter of fact because of low voltage. There again he takes full responsibility. I ask for money. He doesn't give it to me.

I think possibly the answers to this question have been given. The actual regulation is in the I.E.E. regulations, and is 710(1)(i), of the 2nd Edition which states that every motor shall be provided with approved over-current protection on each live pole, and the design shall be such as to effectively prevent single-phasing in the case of polyphase motors. But I think there are two points which have been brought forward.. One is in regard to

negligence, and the other is in regard to reasonableness. If a fuse blows on your main system which gives the consumer single phasing, I don't think you can consider that negligence. On the other hand, if it was definitely caused, for instance, by a jointer connecting up neutral and phase, then I feel that there is a certain amount of negligence and a claim could be made.

The other thing is in regard to reasonableness. For instance, if a high tension fuse blows, and you get peculiar voltages on the LT side, no single phasing preventer will give protection, it should be brought out on overload, but as you know on small motors that is difficult. You might have to be reasonable in a case like that, too, but that is as far as I think we can go on that one.

There is one question which I am going to take now—the additional question which has been put on the table for you—but I shall close that at 9.30 when the refreshment interval takes place so that we can get on to the remainder of our questions afterwards.

SUMMARY OF DISCUSSION IN MEMBERS' FORUM on 16th April, 1958 on LEVEL PRICE TENDERING

Question:

Taking into account the large number of tenders of exactly similar price submitted to quite a large selection of goods required for Municipal Electricity Undertakings, should some action be taken to make it legal for Municipalities where considered by the Council to be in the best interests of Ratepapers, to purchase by negotiation without calling for public tenders?

Speakers:

Chairman: J. E. Mitchell (Salisbury)
D. H. Pieksma (S.A. Philips (Pty.) Ltd.)
R. W. Kane (Johannesburg)
R. M. O. Simpson (Durban)
J. McIntyre (Durban)
W. H. Milton (Escom)
Major A. Z. Berman (Cape Town)
A. R. Sibson (Bulawayo)
H. Prins (English Electric Co.)
L. Axe (BEAMA)
J. Berry (African Cables Ltd.)
J. L. van der Walt (Krugersdorp)

Debate:

During preliminary discussion it was generally agreed that association of suppliers had led to a large number of tenders at identical prices for electrical plant and equipment. While, as Mr. Pieksma pointed out, cut-throat competition led to amalgamation and price maintenance, the price thus determined was not necessarily a fair one, and Mr. McIntyre felt that the practice was to be deprecated. Mr. van der Walt later endorsed these remarks, and pleaded for fair prices, not ring prices.

Mr. MILTON stated that recently identical tenders had been received for the same equipment from both British and Continental companies, indicating that the price rings were extending. He mentioned that price rings ensure a reasonable price from competing firms, leaving, in effect, to the purchaser the choice of manufacturer. However, he did think that rings had got out of hand from the point of view of the sums allocated to the common pool for reimbursing unsuccessful tenderers the costs of submitting their tenders.

Enlarging on a point of Mr. Simpson's in regard to Natal, Mr. Milton said that all the Provincial Local Government Ordinances permitted municipalities, subject to the Administrator's consent, to purchase without calling for public tenders when it was in their interests to do so. Municipalities when doubting prices offered as being fair, could on this basis obtain authority to negotiate purchases. This could result in lower prices, and tend to reductions in ring prices.

Major BERMAN stressed that the foundation of the system of public tendering is competitive prices, but price rings amongst manufacturers nullified the entire competitive system, and were against the public interest. Negotiation of purchases, as had been suggested earlier, would not preclude consultation amongst manufacturers.

Major Berman suggested that the users of electrical plant and equipment throughout the country should combine to form a co-operative purchasing agency, or request the Government to institute an inquiry into the level price system.

Mr. SIBSON pointed out that in the past price-wars had reduced the margins available for research work. During the War bodies such as the Cable Makers' Association had adopted price-fixing procedures primarily to make funds available for research.

Mr. Sibson mentioned that the level price procedure tended to reduce efficiency, so that in the course of time prices tended to rise without real reason. And he was sure that ring prices were frequently quoted in excess of prices that could have been offered by at least some of the ring members. He felt that the purposes for which price rings had been established could be achieved by another method, and suggested a percentage tax on the turnover of members of a particular group. Funds thus obtained could be used by the groups, or allocated individually to members in some fashion. Competitive prices under this system could then be retained by members of the groups.

Mr. AXE said that it appeared that four questions had so far been posed. Firstly, for whose benefit were level prices quoted? He suggested that they were for the consumer as much as for anybody else, and he demonstrated that an article with a given input must cost approximately the same, whoever produced it. Secondly, who could decide what price was economic? He submitted that if the manufacturers were not in a position to determine an economic price, nobody else was.

In regard to the third question, were level prices a coincidence? Mr. Axe stated that much of manufacturers' policies was based upon level prices, which substituted for price competition, with the tendency to reduce quality to enable prices to be lowered, quality competition. As far as the last point was concerned, relating to manufacturers' large hidden profits, Mr. Axe pointed out that the balance sheets of public companies were published, and the profit margin of large companies manufacturing capital plant were relatively small.

Mr. BERRY referred to legislation regulating monopolies in both the United Kingdom and South Africa, and stated that these laws required that it must be proved that what associations did was contrary to the public interest. Application of the law would therefore ascertain whether associations were illegal as being in fact contrary to the public interest. He mentioned that in the United Kingdom the Monopolies Commission had seriously criticised Government Departments for purchasing by negotiation instead of inviting public tenders.

He quoted electricity undertakings, public omnibus services, and agricultural producers as having much in common with electrical manufacturers in that they determined level prices, and he pointed out that it was the policy of South Africa that producers should be entitled to fix certain prices. Level prices permitted the facile selection of equipment preferred, eliminating the difficulties of embarrassing lower prices.

Mr. Berry proposed that a study group be set up with the Association of Chambers of Commerce in South Africa to produce a statement clarifying the position and removing misconceptions.

Mr. PRINS stressed that through crippling open competition electrical plant manufacturers had been forced to seek fair prices through trade associations. The benefits of such associations and their policies included research and development, apprentice and engineering training schemes, stabilized and fair salaries and wages, equitable returns to investors, and good service, often long after the the expiration of the guarantee period. He emphasised that the adjudication of tenders would not be affected by the difficulties of municipalities in not accepting the lowest price, and they could be advised by their engineers on the bases of quality, service and design.

He remarked that the anti-trust laws of the United States had failed to prevent

two large companies dominating the position. He also quoted as further instances of fixed prices in South Africa cement, coal, and wholesale chemists.

Major BERMAN, replying to points that had been made, said that the evils of the case were beyond the control of the South African Monopolies Act, and other remedies must be found. As regards level prices for agricultural products, he pointed out that these were fixed by a Government Board, and could not substantiate the legitimacy of manufacturers combining to determine prices.

On the question of research, Major Berman said that in the United States motor industry where free competition prevailed, the two major manufacturers had spent vast sums on research without any necessity for combination. He felt sure, too, that the municipalities of South Africa would be prepared to fund research in the interests of their own industries.

He stated that it was the intention of the City of Cape Town to call a conference of interested municipalities to discuss the present state of affairs, and with a view to forming a co-operative purchasing agency.

The CHAIRMAN, in closing the debate, supported the suggestion that the A.M.E.U. should work together with a committee of commerce and industry.

The President: Gentlemen, my job now is a very simple one, and that is first of all to thank Jimmy Mitchell, for so ably acting as quiz-master this evening.

(Applause).

Jimmy has made a reputation for himself in this particular job, and I think I am expressing your setiments in saying that I appreciate very much the way he does it.

He mentioned that we would have an opportunity of continuing this forum later, and I hope to be able to arrange for that, either tomorrow or on Friday, so that we can dispose of the rest of the questions.

The meeting is now closed gentlemen, and I look forward to seeing you tomorrow.

Thank you.

The Convention Adjourned at 10.30 p.m.

THIRD DAY

The President: Good morning, gentlemen.

I would like to start this morning by referring to the remarks made by His Worship the Mayor on Tuesday.

As you know, the Convention was to have been opened by the Administrator, the Hon. P. J. Olivier, who passed away recently. The Mayor suggested that a letter of sympathy be written to Mr. Olivier's widow, and I just want to tell you that the Mayor's suggestion is being followed up by a letter from our Association expressing our sorrow to Mrs. Olivier and her family.

I also regret to have to announce that Mr. P. Bechler, Town Electrical Engineer of Newcastle passed away during the course of the year. I omitted to mention this previously. I would like you to stand as a mark of respect to Mr. Bechler.

Thank you.

Communications from Council.

I have to announce that the following sub-committees and representatives have been appointed:—

Electrical Wiremen's Registration Board: Mr. R. W. Kane.

South African Bureau of Standards: Mr. J. C. Downey with Mr. C. Lombard as alternate. They have power to co-opt.

Coal Allocations Committee: Mr. D. J. Hugo, with Mr. R. W. Kane as alternate.

Safety Precautions Committee: Mr. J. C. Fraser with Mr. J. C. Downey as alternate.

Tariff Survey Committee: Mr. J. L. van der Walt, with Mr. A. R. Sibson, Mr. R. W. Kane, Mr. J. C. Downey and Mr. C. G. Downie.

Recommendations Committee for New Electrical Commodities: Covenor Mr. J. L. van der Walt, with Mr. J .C.Downey.

Papers Committee: It is usually the President who is the Convenor, with Mr. R. W. Kane, Mr. J. L. van der Walt, and Mr. J. E. Mitchell.

The Technical Staff and Manpower Sub-Committee has concluded its work and and there have been no appointments.

Right of Supply-Industrial Consumers: Mr. C. Lombard as convenor. Other mem-

bers: D. J. Hugo, J. C. Downey and P. A. Giles.

Finance Committee: Mr. R. W. Kane and Mr. J. C. Downey.

The next item, gentlemen, is the continuation of the discussion on Mr. Cave's and Mr. Evans' papers. We have both Mr. Cave and Mr. Evans on the platform with us today, and they will be very happy to answer any questions and reply to the discussion.

I will call upon Mr. J. C. Downey to start the discussion on Mr. Evans' paper.

Mr. J. C. DOWNEY (Springs): Mr. President, Mr. Evans, gentlemen: Mr. Evans mentioned the need for quality specifications for PVC. I should like to mention that in South Africa the S.A.B.S. have only one specification for PVC wires and cables, which is a quality specification.

It was mentioned by the author that black PVC was the best colour for weathering. I understand that an authority in the U.S.A. has established that it is possible for other colours to be used with excellent results; where iron oxide is used as a pigment for red, iron oxide yellow for PVC, iron oxide for brown, and titanium dioxide for white PVC. I would be pleased to hear the author's comments on this, and the possible comparable ability of each colour to withstend weathering.

At a recent meeting of engineers on the Witwatersrand, a sample of PVC was submitted where the copper wire had completely eroded and caused a break in the neutral of a service connection. The outside of the wire, that is the PVC, appeared quite normal, but there was a complete break inside this PVC covering.

When the (in this case it was red) PVC covering was cut open, a strong acid smell was apparent, and yet other samples of black and red PVC which I have here show no signs of corrosion. It is suggested that chlorine is released from the PVC which, in turn, forms hydrochloric acid and that attacks the copper. I should like to know from Mr. Evans if this is correct.

It is contended that both the samples - these and the ones I previously mentioned as corroded - were made to the same specification, and both came from the West Rand.

Will the author kindly explain this?

In regard to the current ratings, recent information received has stated that PVC wires and cables can be regarded as having the same rating as rubber insulated wires and cables. I would be pleased to know if this information is correct, and if so is there any precaution to be taken in regard to fault conditions? The use of PVC insulated wire and PVC sheathed cable is now taking place in larger, quantities every month in the Witwatersrand area, mainly due to the ease and speed with which it can be handled by the artisan. Does the author consider this a trend of the future? and a healthy competitor to the larger paper-insulated cables? What about the ageing of the cables and can one take PVC buried underground to have a life equivalent to paper-insulated cables?

Mr. Evans mentioned the use of PVC as a covering for overhead wires. In the past, some undertakings have used compounded braiding to provide some sort of protection, but the ravages of the weather have deteriorated the covering to such an extent that the lines in most cases now look like some second-hand washing line.

From a safety point of view, does the author consider the use of a thin covering of PVC on overhead lines to be satisfactory, and what thickness would he recommend for ,say, a 0·1 sq. in. cable? That is hard-drawn copper wire, and what life could one expect from this PVC?

The author's remarks in regard to neophrene are most interesting, but judging from the charges made by the motor industry for OHV grommets which almost require a microscope to find them, which at one time cost a 1/- each, I should imagine the cost of neophrene is nearly equal to that of platinum.

While neophrene does provide one with a very pliable flexible, how is the neophrene affected by continuous use in heating in cases of hot oil and greasy situations, at about 80 to 90 degrees C. From what I have seen the neophrene forms into a hard, rigid and brittle substance after some time in use. Is this observation correct?

In recent months the use of an epoxy resined joint has become quite notable. The use of the epoxy resined jointing materials has been introduced into this country and seems to be growing in popularity.

I would like to know from the author whether he would give us his opinion on the use of this material when used for jointing PVC cables to paper cables, and the terminations of PVC cables and wires.

Thank you.

(Applause).

Mr. B. B. EVANS: To answer all these questions almost requires giving another paper, but I'll do the best I can.

With regard to the question of colours other than black, I assume that what the speaker has in mind is use out of doors. We are not particularly keen on red iron oxide in England for two reasons, firstly because it gives a very poor red colour, and secondly because we have got some evidence that iron compounds tend to detract from the stability of p.v.c. compounds in colours other than black which will resist weather reasonably well. However, these special stabilisers are quite expensive and frankly, there doesn't seem much point in using them when you can use a cheaper compound and make it black. I think that is the answer to that point.

As regards light ageing, although I have no knowledge of conditions in the West Rand, it is a fact that when p.v.c. compounds are exposed to strong light you get what is known as photo-oxidation, the polymer breaks down and you get hydrochloric acid formed which can, of course, cause corrosion of copper. Whether that is the only explanation of the particuler example quoted by the speaker I don't know. It is very unwise to be dogmatic on these matters unless one knows all the circumstances.

As regards the temparature at which p.v.c. and rubber may be used, the latest conclusion we have come to in the United Kingdom is that rubber cables are suitable for a conductor temperature of 60°C with p.v.c. at a conductor temperature of 70°C.

I will go back to the question of specifications because this does touch on a point made yesterday. I think perhaps a remark I made may have given the impression that we haven't specifications for p.v.c. in the United Kingdom. However, the actual position is that there is a British Standard Specification for p.v.c. dielectrics and sheaths and the number is B.S.2746; this caters for three different grades of dielectric and three different grades of sheath. The specification contains a number of tests and test requirements which the dielectrics and sheaths removed from the cable are required to meet.

Then we have another specification, B.S. 2004, which lays down constructional details for 250v. wiring cables and, of course, makes reference to B.S.2746 for the actual compounds. This particular specification is, at present, under revision and is to be extended to cater for 660v. cables. Then there is this other specification to which I referred yesterday which is being prepared by a committee of which Mr. Cave is Chairman and is intended to cater for p.v.c. single wire armoured mains cables. The main point about that specification is that is is going to cater for shaped conductors.

In addition, the British Post Office has its own specification for p.v.c. communication cables.

All this means, of course, that we regard p.v.c. very seriously in the United Kingdom and there is no doubt that it has come to stay. The fact that we are drawing up this British Standard Specification for mains cables means that the trend may well be to go for p.v.c. mains cables, and it is quite likely, as I implied yesterday,

that the overall cost of an installed p.v.c. mains cable may be less than that of an impregnated paper cable.

As regards the weathering of braids, there again you are confirming what we have found in Great Britain, and as I mentioned yesterday, the braided and compounded textile coverings for overhead outdoor cables are being replaced either by p.v.c. sheaths or by neoprene sheaths.

As regards the thicknes of p.v.c. for uses such as I described yesterday, we do not regard this sort of thing in the strict sense as an overhead cable. On the particular size mentioned by the speaker, we would supply something of the order of 60 miles of p.v.c., but as mentioned in the paper, we regard that merely as sufficient thickness to give protection against momentary contact from overhead lines and not in the true sense as an insulated conductor. We refer to such conductors as "covered" or "protected."

As regards what happens to neoprene when you have it in oil at temperatures of the order of 80°C, I confirm that in due course it will go hard, as the speaker mentioned, as the hardening effect of the heat will overcome the softening tendency of the oil. I would expect much the same sort of thing to happen to conventional types of p.v.c. because the plasticisers used in conventional types of p.v.c. compound would be leached out by the oil and the p.v.c. would gradually go very hard.

As regards the epoxy resins, we know a good deal about them, but they are not being used to any great extent. At the moment we visualise that the p.v.c. mains cables will be armoured and there seems no reason why their jointing should be any different from that for paper cables, that is to say we visualise using the conventional cast iron box and pouring in the usual sort of hot bitumen compound. We appreciate that in doing this we may soften and possibly remove the p.v.c. by the hot compound, but the p.v.c. insulation will be replaced by the bitumen, and as the cables are required only for low voltage work the bitumen will give all the insulation required.

The epoxy resin types of compound might come in, of course, if you were using an unarmoured cable or if it was extremely inconvenient to heat up the usual type of bitumen compound. In the epoxy resin type of compound you have, of course, to mix base resin with a hardener. If you use the wrong type of hardener there is a risk of dermatitis; secondly, of course, any compound which is unused when jointing is finished is wasted because it will set hard and become unusable, and finally, in England at any rate, the epoxy resins are quite expensive and work out to about 10/- a lb. As I have said, therefore, while we are quite familiar with the technical properties of thse epoxy resins, we are giving them quite a lot of thought before going for them in a big way.

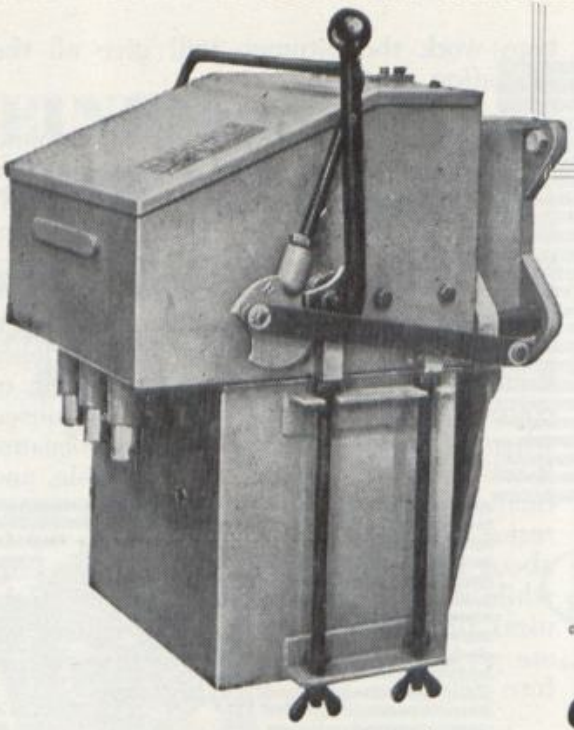
I hope I have answered all the questions, sir.

(Applause).

The PRESIDENT: Thank you, Mr. Evans. Any further discussion?

Dr. H. EINDHORN (S.A.I.E.E.): I should like to ask about the relative use of PVC and rubber in conduit. I have been under the impression that PVC is less suitable for hot positions, and was surprised about the plus sign in the table next to PVC. Our Wiring Regulation No. 307 also expresses doubt about the use of p.v.c. in hot positions, and in fact quotes a figure of 57°C. I should like to ask Mr. Evans whether, in positions which are not hot enough to warrant mineral insulated cables, but rather hot, such as under a hot roof, would he recommend p.v.c. rather than rubber, or vice versa, in conduit?

Mr. B. B. EVANS: So far as ordinary wiring in conduit is concerned, as I mentioned yesterdy, the choice of rubber or p.v.c. seems to depend on the personal preference of individual contractors. I would say that, overall, about equal quantities of



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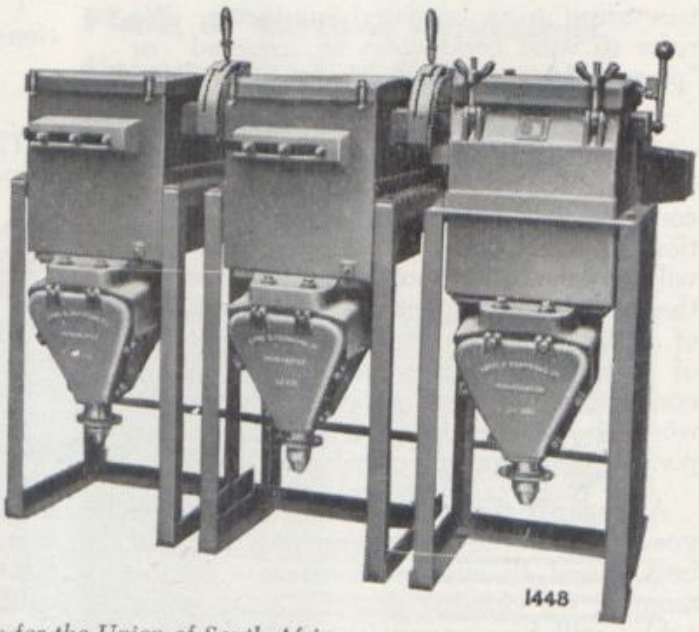

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conventional V.R. braided and compounded cables and bare p.v.c. cables are being used. As regards what I would advise in a hot situation, it depends, of course, how hot is is. I think on the whole for a situation where you expect to get temperatures of the order 70 or 80°C and provided you are not too fussy about dielectric resistance, the thing to go for would be one of the special heat resisting p.v.c. compounds I mentioned yesterday.

Does that answer your question?

Dr. EINDHORN: The relative values of p.v.c. and rubber would interest me. Are p.v.c. and rubber equally good or not?

Mr. B. B. EVANS: Not for a situation round about 80°C. As I say, I think the best thing to go for would be one of these heat resisting p.v.c. compounds because I think that at temperatures of 80°C that would be better than rubber.

Dr. EINDHORN: And round about 60 or 70?

Mr. B. B. EVANS: Round about 60°C it doesn't matter much, but if you get above 60°C then I think p.v.c. is probably better than rubber.

The PRESIDENT: Thank you Mr. Evans. Any further questions, or discussion gentlemen?

Mr. SUTHERLAND (Scottish Cables, Pmb): Mr. President I have been particularly interested in the last question as to the relative advantages of PVC or rubber, and I must say that, with all due respect, I find myself in complete disagreement with what Mr. Evans has said.

I have seen quite recently a case of PVC cables which have been installed in conduit close to a roof of a building in Natal, where three single core PVC cables, properly manufactured, fused together in a section into what virtually looked like a three-core cable. I would say that under such conditions one of the old type VR, insulated cables would have given very much better protection. The rubber insulation would undoubtedly have aged and become brittle, but as a result of quite long experience of cable installations, as distinct from cable manufacture, I am convinced that so long as rubber insulation is not disturbed is will continue to give good service. PVC in my opinion will not do that.

There is one other point which I would like to raise and that is Mr. Evan's remarks on Section 4 about the experiments which are taking place in Britain between the C.M.A. and the C.E.A. in connection with thermoplastics or thermosetting materials embedded in the ground as a possible alternative to the traditional paper insulated lead covered and armoured cable.

I rather gather that the main line on which the investigations will be conducted will be to determine the resistance to water absorption and the mechanical robustness of these cables.

I feel that at a gatherin such as this, one should sound a note of caution in accepting the results of this investigation, and any designs which may eventually be approved as being satisfactory for Great Britain, because in Southern Africa we have a problem which does not exist in Britain at all, and that is the problem of the white ant. White ants are very peculiar animals their behaviour is quite unpredictable. I have seen cables deliberately laid through a live antheap which have not been touched at all; I have seen examples of cables which have been attacked which have not been apparently near a colony of white ants at all. I would like to ask Mr. Evans whether this particular factor is going to receive consideration. It would be unreasonable to expect actual experiments to be carried out in Great Britain, although I have no doubt that a number of people in this hall, particularly our friends from the Rhodesias, would be only too pleased to export a large quantity of their white ants to assist in such an investigation.

We do know of course that there are repellants which will keep the ants away for some time, but the effect is not permanent. Equally, we know of toxic materials which will kill the white ants, but they are not particular and after the first wave has been killed there are plenty of reserves to come along and carry on the attack and sooner or later breakdown will occur.

I am not personally aware of any treatment which will be completely effective against the attack of termites, and I would be very reluctant to recommend the laying underground of any thermoplastic or thermosetting materials in preference to the traditional metallic covering. I shall be most interested to know if Mr. Evans can throw any light on or make any suggestions, as to a more effective treatment for this particular attack.

(Applause).

Mr. B. B. EVANS: As regards the first point, may I say that as a rubber man I am glad to hear of something good which can be said about the rubber cable vis-a-vis p.v.c. I quite agree that a rubber cable will continue to function quite satisfactorily although the rubber dielectric has become quite brittle due to perishing, provided the cable is not disturbed, and have seen quite a large number of examples. As regards the p.v.c. which fused together, I can only say that I would think the temperature must have been much higher than that quoted by Dr. Eindhorn or that the p.v.c. must have been a very soft grade and I would still adhere to my previous opinion that for temperatures of the order of 80°C one of the latest types of heat resisting p.v.c. would be better than a V.R. cable.

As regards the question of white ants, of course, in our trials in the U.K. we do not include the hazard of white ants or termites. I quite agree with Mr. Sutherland that the habits of termites are quite unpredictable. We have gone into this question quite a lot, because we know that neoprene sheathed cables have suffered attack in Rhodesia, and in view of the chemical similarity between neoprene and p.v.c. we cannot see any theoretical reason why p.v.c. will be immune. In our attack on this problem we have not only carried out our own experimental work but have maintained contact with various research institutes throughout the world. We know of the capabilities and possible shortcomings of insecticides and that promising results are being obtained in some cases. Nevertheless, the present view of the cable makers, which is confirmed by the Commonwealth Institute of Entomology, is that the only remedy which can be relied on to give 100% protection is the use of some physical barrier which will prevent the termites getting to the sheath and dielectric. The particular physical barrier which we recommend is the traditional brass tape, and at the moment I don't know of anything better. I hope that answers Mr. Sutherland's point.

The PRESIDENT: Thank you Mr. Evans. I think Mr. Turnbull would like to ask a question.

Mr. A. F. TURNBULL (Vereeniging): I am afraid I am going to ask more than one question, Mr. President.

The papers presented by Mr. Cave and Mr. Evans are interesting and enlightening. I do not profess to be an expert on either subject, and I will venture to speak on both papers. I make apology if I repeat matters raised by previous speakers, but I wish to maintain the continuity of my notes.

On the subject of thermoplastics there are one or two matters bothering me, and I know that several engineers from the Rand have similar doubts.

It is accepted that black PVC is more suitable for outdoor conditions. I have noted, however, that the intensity of the colour appears to vary. I am curious to know if it is important for the percentage of carbon black to be controlled within fine limits, or is there a fairly wide range of application?

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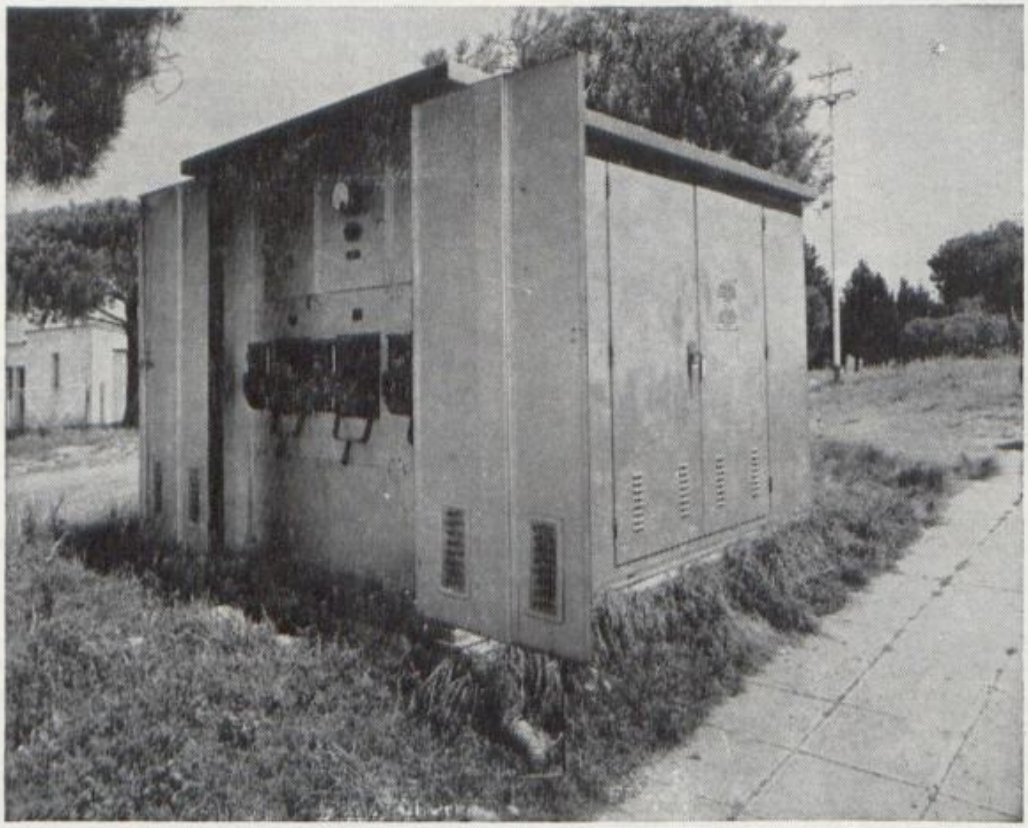

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I have found that there is a tendency to classify all plastic insulated cables as PVC. It is not always easy to identify the insulating medium. Identification marks do not appear on all cables. Very often they are confined to the reel or container only. PVC, therefore, may be blamed for the vagrancies of some other plastics, similar in general appearance to PVC. An aspect which may or may not be important, is the porous or spongy appearance found generally on the PVC sheath of the two core cables, and it often appears in the insulation of the cores or conductors themselves. PVC has a reputation for resistance to moisture, but I have seen beads of water oozing from the severed ends of a cable where the spongy appearance was evident. What are the consequences of this? Is it serious? What causes it? And what effect has it on the life of a cable buried directly in the ground, or drawn through an underground duct where water is likely to accumulate?

There are tales of termites attacking plastic-insulated cables. Are termites partial to any particular plastic or colour? Is this a serious matter and what progress has been made in this direction?

There is, too, another aspect which I feel should have been developed on lines parallel to the development of the plastics themselves, and that is the question of jointing. The standard methods and joints provided for paper insulated lead covered cables are not always so succcessful when applied to plastic insulated cables. There is available - this has been mentioned - on the market today, self-contained kits of plastic compounds or resins for insulating cable joints, and it is claimed that these may be used on plastic cables, paper cables, and any other type of cable, over a voltage range I believe of up to 22KV. I understand that they are exceedingly popular in America and on the Continent.

Have the Cable Makers' Association given any consideraton to the development of plastic for the jointing of all types of cable, and what is their opinion on this matter?

I do know that this plastic compound, or resin, is being increasingly used on the mines where you can make a joint in any position without having to worry about hot compounds.

Plastic insulated joints are finding very strong support. There is in existence on the Rand trial joints on 6 KV and 11 KV cables. After reading the paper on thermoplastics I am wondering if the plastic medium for jointing is universally compatible to all the rubbers and thermoplastics now in fairly common use.

I would like to hear more about this.

Finally, if I may take the opportunity of obtaining a little expert opinion: for plastic insulated multi-core pilot cable, can these be relied upon when buried directly in the ground and used for important protective and alarm circuits? Does the life of such a plastic insulated cable compare favourably with a lead covered paper-insulated cable or would it be wise to play safe and stick to the proven and tried lead covered paper insulated type of cable?

It was the little doubts on the forementioned matters which are causing engineers today to be a little more wary in their approach to the plastic-insulated cable field generally.

(Applause).

Mr. B. B. EVANS: Time is getting on, so I'll answer only those questions which have not been touched on before and I'll do it as briefly as possible.

So far as the question of black p.v.c. is concerned, the main point to ensure is that it is really black and we usually reckon that a minimum of about 0·5% to 1% of a really black black is necessary. I say "black black" because if you examine the tinting power of various blacks you will find that they differ very much in blackness.

As regards spongy appearanes, if you found that on a freshly manufactured sample which has not been used at all, I would say that it was a case of bad manu-

facture and that is about all I can say on that particular point.

Termites I think we have dealt with.

Epoxy resins we have touched on. So far as I know, these have not been examined for high voltage purposes because at present in England, we are considering plastic cables only for relatively low voltage.

As regards the last point, if I had an important service, what I think I would do would be to carry on with the time-proven lead sheathed cable, but I would put in one or two lengths of plastic cable in places where, perhaps, failure would not be very important, and would accumulate field experience with plastic cables in that way. I don't think there is any other way of really answering the particular point you raise there, sir.

Mr. G. J. MULLER: Mr.President, I'll be very brief. I suppose we will be adjourning for tea soon.

I would like to thank the gentlemen, both Mr. Cave and Mr. Evans for their most interesting papers. I would then proceed to suggest that I put a request rather than a question to Mr. Evans.

To many of us, the use of gas and oil filled cables is comparatively new, and it is quite difficult for us to decide, except on purely economic grounds, what to recommend to our Councils. I was hoping that I would get a bit more on these lines from the paper, but I presume that Mr. Cave's position is somewhat difficult, representing a group rather than one type of cable.

Would Mr. Cave be prepared to enlarge on the relative merits and limitations of oil versus gas? And if there is any foundation for the thought that a gas cable may ionise at a more rapid rate in use than oil filled cable. The thought emanates from the idea that we are all used to oil in transformers and oil in switchgear, oil as an insulating medium is very familiar to most of us; gas does not therefore appeal to many of us in the same way.

We therefore, would, like just a little bit more information, perhaps on general lines, but sufficient to be a guide to us in our recommendations.

Thank you Mr. President.

Mr. C. LOMBARD (Germiston): Mr. President, gentlemen: mention was made in Mr. Cave's paper regarding approval tests for gas pressure and oil filled cables and accessories. When calling for tenders for switchgear in this country it is usual to call upon tenderers to submit short-circuit test certificates for the switchgear offered to prove that the equipment has the required rupturing capacity. I would like to ask Mr. Cave whether it would be practical and reasonable at this stage, for Municipal Undertakings, when calling for tenders for 33 KV cable, to require tenderers to submit approval test certificates, such as mentioned in his paper, for the various types of cables offered.

Thank you.

The PRESIDENT: Thank you Mr. Lombard. I'll ask Mr. Cave to reply to the previous questions in discussion and those which have been asked; now.

Mr. P. W. CAVE: Mr. President and gentlemen: I have a transcript of the proceedings yesterday, and I would like to take this opportunity of thanking both Mr. Giles and Mr. van der Walt for the very kind vote of thanks proposed and passed yesterday.

As for the questions which they raised: Mr. Giles suggested that the increase in permissible operating stress which would reduce the insulation thickness, and therefore the thermal resistance of the insulation; this would lead to an increase in the current rating.

I would like to comment on that, because you may find, in many cases, that this does not happen because, although a decrease in the insulation thickness does give a decreased thermal resistance of the insulation, and of the coverings, it increases the thermal resistance external to the cable, and one tends to counterbalance the other.

Furthermore, the decrease in insulation thickness increases the electrostatic capacity of the cable. This leads to slightly higher dielectric losses, which tend to decrease the temperature rise available for current rating. This in turn acts as a counter-balance to the decrease in the internal thermal resistance. Therefore, the change in stress does not automatically lead to any increase in current rating.

Mr. van der Walt was somewhat critical of the fact that we appear not to have accepted the recommendations of the I.E.C.

I would like to make this point very clear, because as participants in I.E.C. matters, we do try to be loyal to whatever is decided at I.E.C. meetings, though sometimes they are not palatable. In this particular case, and we are talking about gas and oil filled cables, the position is this: first of all the I.E.C do not issue specifications; they issue recommendations which it is hoped the national standardising bodies in the various countries will adopt. The oil filled cable recommendations have not been ratified. The original draft was modified as a result of the discussion at Moscow, and has been circulated under the six months' rule. So far as the U.K. is concerned, we do not object seriously to the tests, but we do not like the manner in which they have been allocated. We prefer to adhere to our well-tried and highly satisfactory type approval scheme which has been evolved over a long period after many discussions with our principal customer, the C.E.A. The scheme does work, there is no doubt about that.

This enables me to answer another question which has been asked this morning. Any manufacturer in the C.M.A., tendering for a gas pressure or oil filled cable, would be only too willing to supply a complete certificate showing that the cable which he is offering, or one very much like it, has passed the whole of this comprehensive type-approval procedure.

As I explained yesterday, we do not test every size of cable—the amount of tesing involved would be prohibitive—but we do test the largest size in the range, and the test on the large size cable can be taken as indicating that all sizes in that range would pass the tests.

We would always be prepared and pleased to supply such a certificate.

Then a question was raised about standardising the thicknesses for different voltage.

When you think about this for a minute, it would be quite illogical to have different thicknesses for different voltages, because the purpose of the anti-corrosive covering is to protect the reinforcement from corrosion. The problem is therefore the same whether the cable is for 33 KV or 330 KV working and we have, in fact, arrived at what is practically a standard covering because the C.E.A. in their specification—and, I might add, the British Transport Commission also—have adopted a figure of 40 mils minimum for the thickness of what is termed the "water-impermeable" layer, which is usually rubber.

There are still some variations in that some members of the C.M.A. use cotton and rubber and cotton; and others use PVC and rubber and PVC, but the basic feature, that is the water-impermeable layer, which is the layer which gives the covering is anti-corrosive properties, is standardised at a minimum thickness of 40 mils.

The next question concerned the testing of this covering, and I think I did mention yesterday when I was summarising the paper, that we apply as a routine test, 10 KV.DC for one minute, to ensure that the covering is complete and satisfactory. This test is repeated after the cable is laid in the ground and the trench has been filled in, just to make sure that the covering has not been damaged in transit, or during laying. Discussions are still going on about this question of monitoring the whole length to ensure that the covering remains sound. The frequency of testing is a matter which has not yet been re-

solved, nor has the voltage. I think it probable that the C.E.A. will insist on this figure of 10 KV because experience has shown that even if a flint or sharp stone, has penetrated the rubber, it needs 10 KV to break down the fault, and so give a positive indication that this has happened. But how frequently that 10 KV should be applied has not yet been resolved. The application of 10 KV once or twice a year, or how ever often it is decided to apply it, does of course involve insulating the joints, and we do supply, and have supplied, contracts with the joints insulated in this manner.

The whole question is a very difficult one, because it is practically impossible to differentiate between a local weakness at one point, and a general fall in the insulation value over the whole of a long run of cable. It is an old problem, and is still unsolved.

Now I would like to deal with a point which was raised outside the paper yesterday by Mr. Sutherland, who referred to power factor voltage tests on 11 KV cables. He did not specify the type of cable, but I am pretty sure he was referring to three-core belted cables, and I will tell him quite definitely that we are strongly opposed to any power-factor-voltage tests being included in any specification for three-core belted cables, for a very good reason: they just do not mean anything. With a three-core belted cable in operation, or a three-phase A.C. circuit—there are two types of stress in the insulation, the radial stress and the tangential stress—when taking a power-factor-voltage test it is necessary to test single-phase, taking each core in turn, so the stress distribution, under test conditions is entirely different from that obtaining in practice. Furthermore, there is the question of what voltages should be used. The normal practice with radial field cables is to test for power factor from half up to twice working voltage. In single-phase testing, on a belted cable, if the working voltage is taken as the working voltage to earth, the insulation between cores is not stressed by anything like its full value. On the other hand, if the working voltage is taken to be the working voltage between phases, the insulation between conductor and sheath is stressed far above the normal value. So that on all counts, power-factor-voltage tests on belted cables are strongly to be deprecated. We took this line at the I.E.C. when the solid cable specification was under discussion, and we partly succeeded in limiting power-factor-voltage measurements to radial field cables, that is to say single core cables, screened type cables, and SL cables.

I was asked a question this morning regarding the relative merit of gas and oil filled cables. The only answer I can give is a quite straightforward one: they all work, they all give perfectly satisfactory performance in service, and the choice as to which one one should use for any particular installation must be very largely determined by the price.

Gentlemen, I think that covers all the points. (Applause).

THE PRESIDENT: Well, gentlemen, I think we could spend the whole Convention on the subjects of these two papers. Unfortunately we haven't time now for any more discussion, but I am quite sure that both Mr. Evans and Mr. Cave will answer any questions that any member would like to put to them individually during the remainder of this Convention.

I now ask you to show your appreciation, gentlemen, in the usual way, for these two very interesting and informative papers.

(Applause).

TEA ADJOURNMENT.

On Resuming:

THE PRESIDENT: Gentlemen, we now come to the paper by Mr. Wood, who is an Electrical Engineer in the Cape Town Electricity Department. It is entitled "The Design and Economics of Township Reticulation by Low Voltage Overhead Mains."

I have pleasure in inviting Mr. Wood to come up here and deliver his paper.

Fig. 1. POLE PLANTING MACHINE.

Fig. 2 CONCRETE POLE ERECTION.

THE DESIGN AND ECONOMICS OF TOWNSHIP RETICULATION BY LOW VOLTAGE OVERHEAD MAINS

by
H. WOOD, A.M.I.E.E.

1.0 INTRODUCTION

The cost of low voltage networks and their losses are so significant in distribution costs that thorough consideration is nececessary in planning a layout that is both sound and economic.

The paper has been written in a serious attempt to show how this can be done and to introduce a more realistic approach to the problem. It also endeavours to eliminate some of the old rule of thumb methods which the writer has encountered from time to time. Mistakes made in the design of a low voltage network can be very costly to rectify later when reinforcement becomes necessary in order to meet changes in loading or voltage conditions. Low voltage and excessive voltage regulation can be of considerable nuisance to the consumer and also results in a loss of revenue to the Supply Authority.

Townships vary considerably in size and shape, and for distribution purposes they are usually divided into a number of areas each containing its own substation or transformer supplying its own low voltage distribution network. For design purposes these areas may be regarded as approximately circular and the radius of these circles is referred to as the "radius of distribution".

Many variables, such as load density and voltage regulation, must be taken into account to enable the best radius of distribution for a particular township to be determined.

It is proposed to consider the relative advantages and disadvantages of the various overhead line materials and equipment and to present methods of arriving at the data required to design a network. Thereafter a method of assessing the best radius of distribution of a unit distribution area will be developed and finally an application of these methods to the design of a network will be given together with an assessment of the costs of such networks.

In order to ascertain the most economical layout, it would be necessary to design and estimate for each type of township, making due allowance for all the possible variables such as consumer density, after diversity maximum demand, and size of conductor. This would be an extremely tedious task and the writer was therefore considerably impressed by the method developed by Mr. F. G. Copland (1) in his paper (*Journal I.E.E.*, July, 1952), wherein he presented a method based on cable ratings of ascertaining the most economical layout for a low voltage underground network. This paper was described by Mr. Wrigley (2) to this Association in 1954.

However, in the case of low voltage overhead networks, as used in most South African towns and city suburbs, the limiting factor in the loading and radius of distribution is

voltage regulation and not cable rating as with underground networks.

It is now proposed to adopt a similar approach in the design of an overhead network and to develop a formula for the radius of distribution based on maximum permissible voltage drop.

The theoretical network has been designed using mid-boundary construction and it will be shown that this form of reticulation is cheaper and, from an aesthetic point of view, a considerable improvement on the normal street reticulation.

A comparison of costs will be made between these two types of construction and reference will also be made to the use of line drop compensation.

2.0 MATERIALS

Before proceeding to consider the most economic design of a network, it is proposed to give consideration to the various materials which may be used in the construction of overhead lines. The engineer is confronted with the following alternatives :—

(a) *Poles*
Wood, steel (painted or galvanised) or concrete.

(b) *Conductors*
Copper or aluminium.

(c) *Insulators*
Pin type for horizontal or bobbin type for vertical construction and shackle type.

(a) *Poles*

From the point of view of initial capital cost, the cheapest form of reticulation is the wooden pole vertical type construction. However, it is unsightly and, due to the comparatively short life of wooden poles, is not necessarily the most economical.

Ungalvanised steel poles require painting at regular intervals of several years which adds considerably to maintenance costs, besides being a drain on the available labour force.

In a small undertaking this may not be a serious disadvantage, but in an undertaking of the size of Cape Town with 54,000 ungalvanised steel poles the annual cost of pole painting is approximately £15,000, or 5s. 7d. per pole per annum.

By the use of a recently introduced method of treating poles, using a phosphoric acid preparation, it is anticipated that the cost of pole painting will be reduced by approximately 50%, i.e., to about 2s. 9d. per pole per annum.

Expenditure on pole painting can be avoided by using galvanised steel poles and such poles are in fact used extensively. The present day cost of galvanising a 30-ft. steel pole is approximately £4 0s. 0d., but this additional expenditure can be justified when account has to be taken of the cost of the necessary regular painting of an un-galvanised pole.

Concrete poles are today proving to be the most economical for reticulation purposes. Such poles are cheaper in initial cost and require no maintenace but due to their bulk and weight, are a little more difficult to erect.

Extreme care must be taken during erection to avoid cracking or fracturing the pole. The concrete pole is used extensively in new townships near Cape Town and pole planting is carried out by means of the small portable machine shown in Figs. 1 and 2.

From experience it has been found that the concrete cross-arms used in conjunction with these poles are not suitable for use on either terminal or shackle poles with conductors over 0·025 sq. in. cross section. At these poles it is necessary to use galvanised steel cross-arms, galvanised fittings being used to avoid painting and to prevent rust marks on the pole.

Collapsing of concrete terminal poles has been experienced where the horizontal component of the pull in the stay wire was not in line with the conductors. This has now been overcome by the use of two stay wires (1 — 5/8 and 1 — 3/8) in lieu of a single stay wire, as shown diagrammatically in Fig. 3.

Concrete poles are extremely weak when under torsion and it is essential when stringing conductors to slacken off the cross-arm bolts on all terminal and shackle poles until stringing is complete to prevent any torsional load being applied to the poles.

(b) *Conductors*

Many papers have been written on the economics of using aluminium instead of copper as a conductor material. Most of these were based on the considerable price

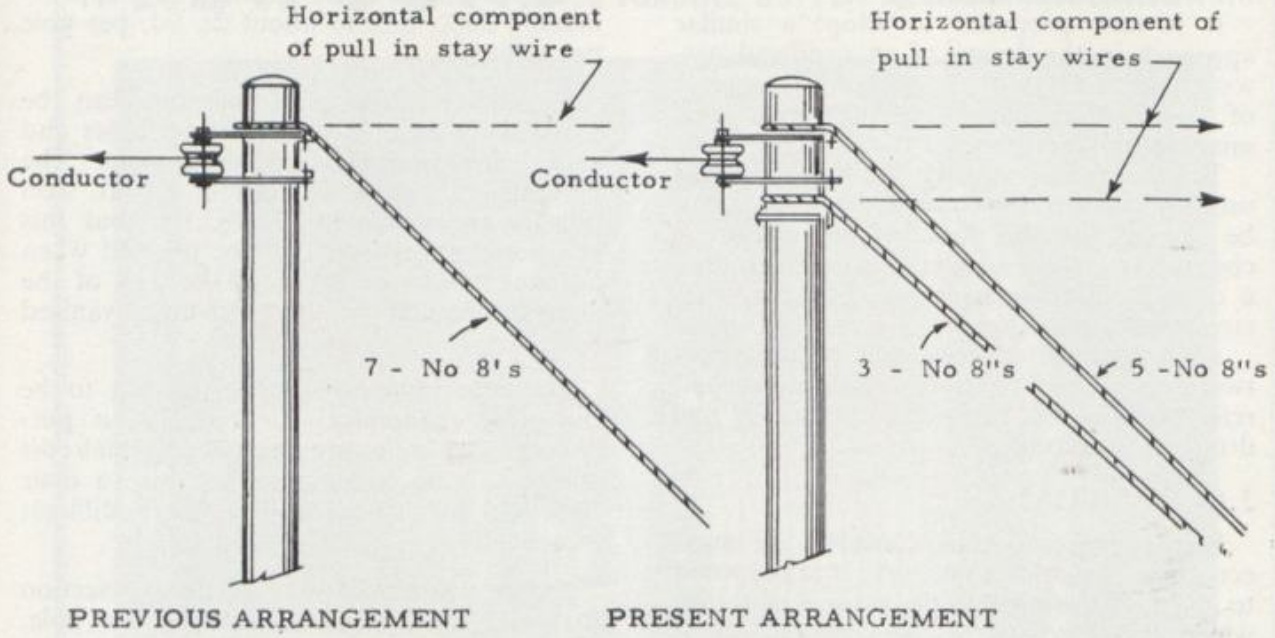


Fig. 3 STAY ARRANGEMENTS FOR CONCRETE POLES.

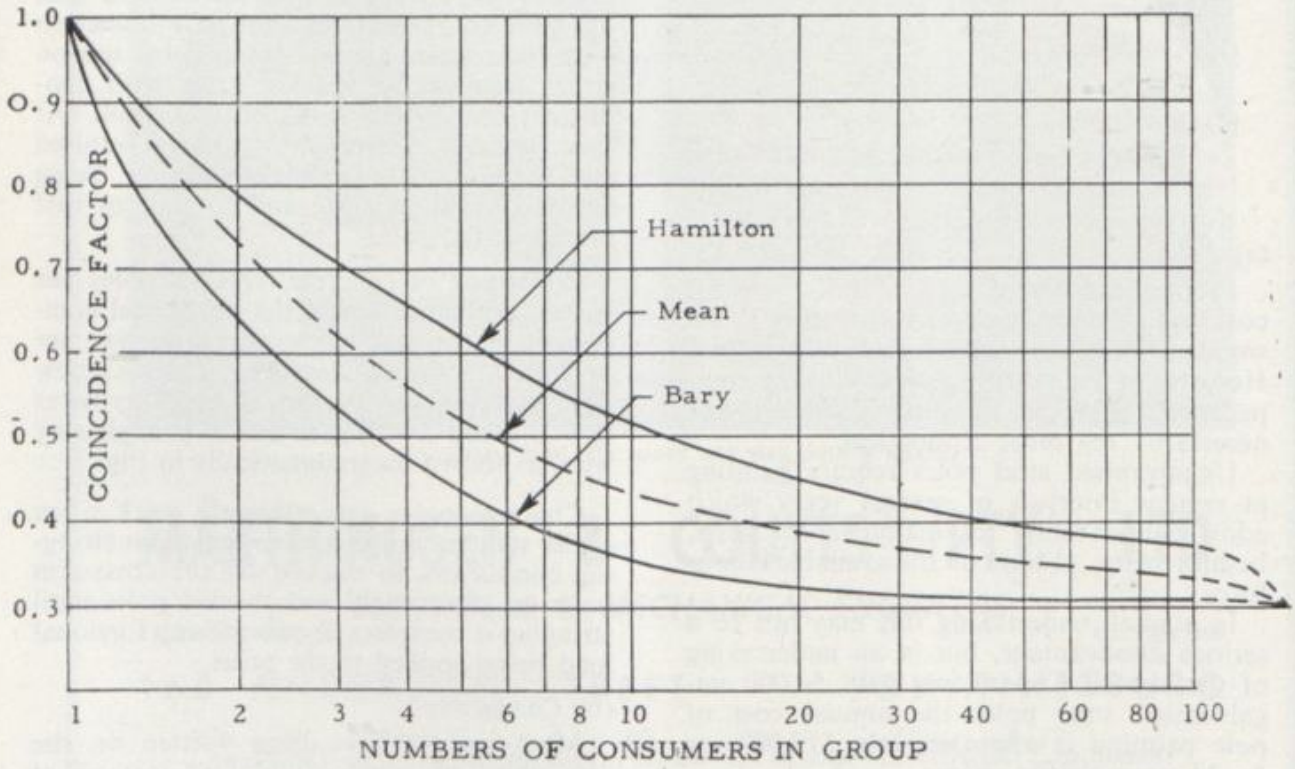


Fig. 4 COINCIDENCE FACTOR CURVES FOR DOMESTIC CONSUMERS.

difference existing between the metals at the time of the comparison. It is now considered, however, that in view of the present trend towards lower copper prices it would be advisable to continue the use of copper and so avoid the necessity of using special connectors and the possibility of corrosion of the conductors due to electrolytic action at bi-metal joints.

As an experiment in Cape Town, aluminium conductors were used to reticulate a small township. At that time the cost of 0·05 sq. in. copper was 2—4d. and aluminium (0·05 copper equivalent) was 1—2d. per yard, the resultant saving on the cost of the conductor thus being 50%. However, in view of the high cost of the special connectors and the increased labour costs due to the more careful handling required the overall saving on the whole scheme was only 11·5%.

This network has now been in commission for approximately two years in a salt laden atmosphere. There has been no evidence of metal corrosion except in one instance where an aluminium wire was inserted into the brass connection of a Yorkshire type fuse, the no-oxide grease having been inadvertently omitted.

It appears therefore that the use of aluminium conductors presents no technical difficulties when compared with copper, provided that the linesmen are efficiently trained in their erection.

The problem thus resolves itself into a direct comparison of the costs of the respective materials, and, at the present time, the cost of copper favours its use as a conductor material.

(c) *Insulators*

The insulators generally used in low voltage networks, namely, shackle, round top and bobbin types, have undergone very little change in design for many years and have proved to be very satisfactory in service.

It has been found in Cape Town that angles up to 15° may safely be taken by using four large shackle insulators and shackle pins in lieu of the usual eight shackle insulators, straps, bolts and line taps necessary at angle poles. This method of construction results in a small saving besides improving the appearance of the line.

(d) *Conclusion*

Bearing in mind the above remarks on poles, conductors and insulators, it is considered that, both from an economic and an aesthetic aspect the concrete pole — copper conductor construction is the most suitable for the conditions obtaining in South Africa at the present time.

3.0 DATA REQUIRED FOR DESIGN OF NETWORK

Having decided on the type of construction to be adopted for the overhead network, the next step is to obtain the data required to enable the network to be designed. The information required is considered under the following four headings :—

(1) Diversity and Maximum Demand.

(2) Electrical Losses and Loss Load Factor.

(3) Voltage Regulation.

(4) Phase Unbalance.

3.1 DIVERSITY AND MAXIMUM DEMAND

An important requirement for the design of a distribution network or a portion of it is a knowledge of the diversity existing between consumers' loads. This diversity results in the maximum demand of a group of consumers being less than the total of their individual maximum demands.

The terms used to denote this lack of coincidence in time between consumers' individual maximum demands are (a) the diversity factor and (b) the coincidence factor, the latter being the reciprocal of the diversity factor.

If N = number of consumers
I = individual consumer maximum demand
and I_N = simultaneous maximum demand of N consumers

$$\text{then Diversity Factor} = \frac{I \times N}{I_N}$$

$$\text{and Coincidence Factor} = \frac{I_N}{I \times N}$$

The after diversity maximum demand per consumer (abbreviated to admd) is defined as the simultaneous maximum demand of a group of consumers divided by the number

of conumers. This is also equal to the individual consumer maximum demand multiplied by the concidence factor. However, it is a well-known fact that as the number of consumers decreases the coincidence factor and admd increase and this is most important when considering the voltage drop along a distributor. The current in the distributor is not only proportional to the number of consumers but also to the varying concidence factor.

Investigations into the problem of the variation of the coincidence factor with the number of consumers carried out in England by Bary (3) and Hamilton (4) produced the results shown graphically in Fig. 4, from which it can be seen that there is very little reduction in the coincidence factor for numbers of consumers exceeding 50.

The simultaneous maximum demand of a group of consumers is found as follows :—

Maximum Demand = I × N × Co-incidence Factor.

These results are useful for estimating loading and voltage drop in individual distributors, for determining transformer sizes and voltage drop in individual distributors, for determining transformer sizes and also for estimating the loading of large blocks of flats for metering purposes.

To estimate the maximum voltage drop in a complex distribution network by this means would be extremely tedious and consequently, in practice, the much simpler method of allowing for an overall increase in the large group admd is resorted to. This method accordingly has been used for calculating the radius of distribution as shown later in the paper.

3.2 ELECTRICAL LOSSES AND LOSS LOAD FACTOR

The determination of electrical losses is an important feature in the economics of any distribution network and, due to many factors which may be only approximated, it is one which tends to be very complex. The only accurate method of computing the losses is to obtain a load curve for every day of the year and to calculate the mean value of the squared ordinates. This would be an arduous task, however, and the method generally adopted in practice is to use a formula involving the load factor.

The ratio of the actual losses to the losses which would obtain if the maximum load remained constant over the whole period is called the "Loss Load Factor".

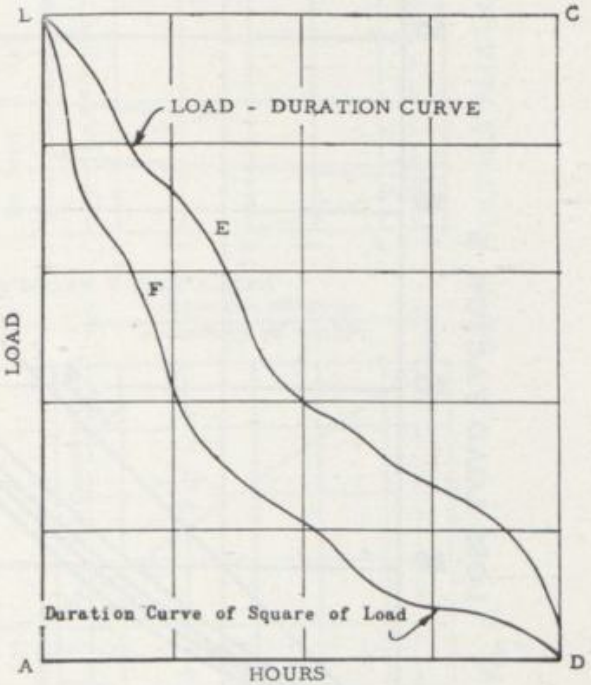
The method of obtaining these factors is illustrated in Fig. 5.

Various authors have suggested formulae for the calculation of the loss load factor, based on investigation of a number of load curves. Typical examples of these are :—

(1) $LLF = 0{\cdot}5(LF)^2 + 0{\cdot}5\ LF$
(2) $LLF = 0{\cdot}67(LF)^2 + 0{\cdot}33LF$
(3) $LLF = 0{\cdot}7(LF)^2 + 0{\cdot}3\ LF$
(4) $LLF = 0{\cdot}8(LF)^2 + 0{\cdot}2\ LF$

Where LLF = Loss Load Factor
and LF = Load Factor

These formulae are shown graphically in Fig. 6 and it can be seen that there is considerable variation in the derived loss load factors. It is therefore necessary for the engineer when planning a distribution network to use a formula applicable to the type



$$\text{LOAD FACTOR} = \frac{\text{Area ABED}}{\text{Area ABCD}}$$

$$\text{LOSS LOAD FACTOR} = \frac{\text{Area ABFD}}{\text{Area ABCD}}$$

Fig. 5

of conumer in the area to be reticulated. This he should know from local knowledge of his particular undertaking.

A good average figure for the load factor of a purely domestic area is 30% and using formula (3) as generally applicable in Cape Town, the loss load factor would be 15·3%.

3.3 VOLTAGE REGULATION

As already mentioned in the introduction, the limiting factor, when determining the loading and radius of distribution of low voltage overhead networks is voltage regulation. This is determined not only by the voltage drop in the low voltage network but also by the regulation of the Extra High Tension network and the transformers and it is thus essential for the engineer to undertake a careful analysis of the whole system before deciding upon the permissible regulation of the low voltage distributors.

Statutory requirements in South Africa permit a voltage variation of ±5%. In England this has been increased to ±6% to assist in the case of rural distribution.

In general the supply to urban areas may be obtained by one of the following systems :—

(a) 11 or 6·6/0·38kV. fixed ratio transformers are fed by a higher voltage system (say 33kV.) having on-load tap-change gear and line drop compensation. This is shown in Fig. 7(a). The figures given are purely arbitrary for the purpose of the illustration and can vary considerably in practice. Curve (1) shows the conditions obtained when the supply point is maintained constant at 33kV.

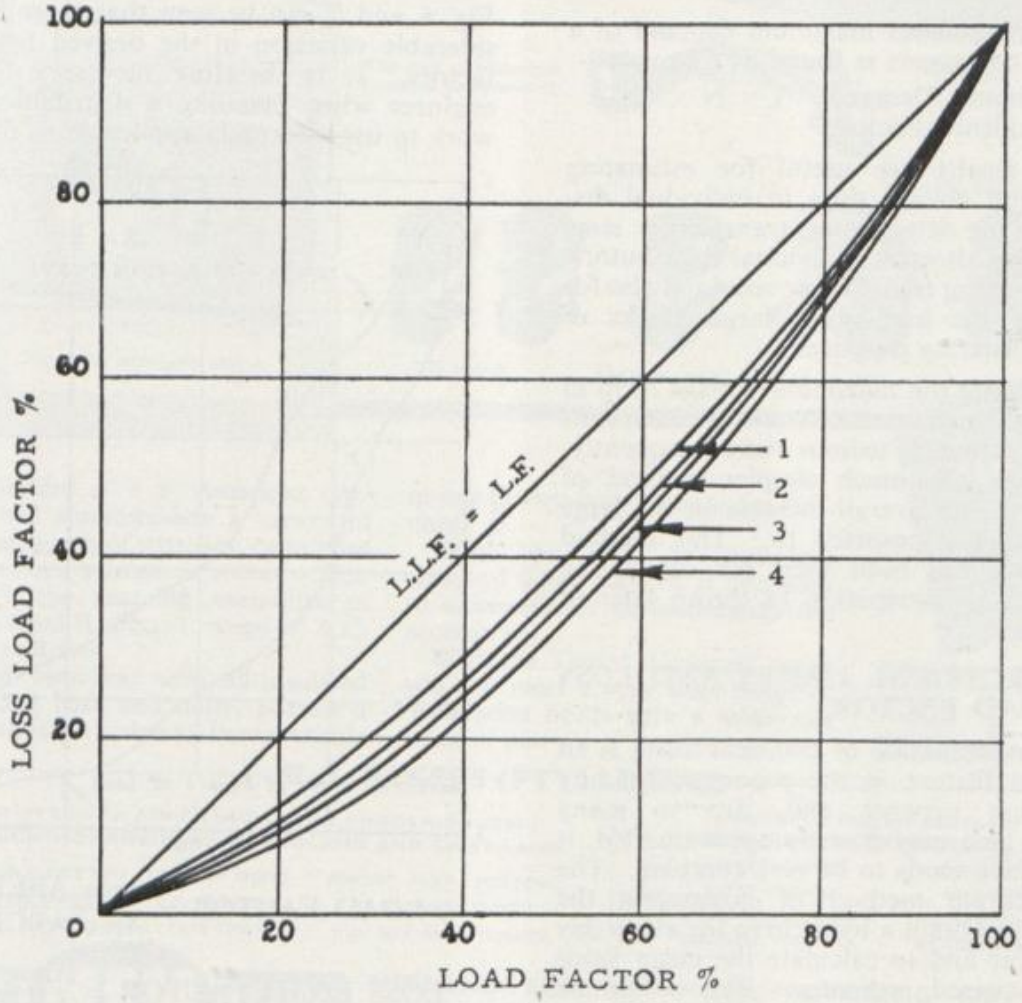


Fig. 6

LOSS LOAD FACTOR RELATIONSHIP

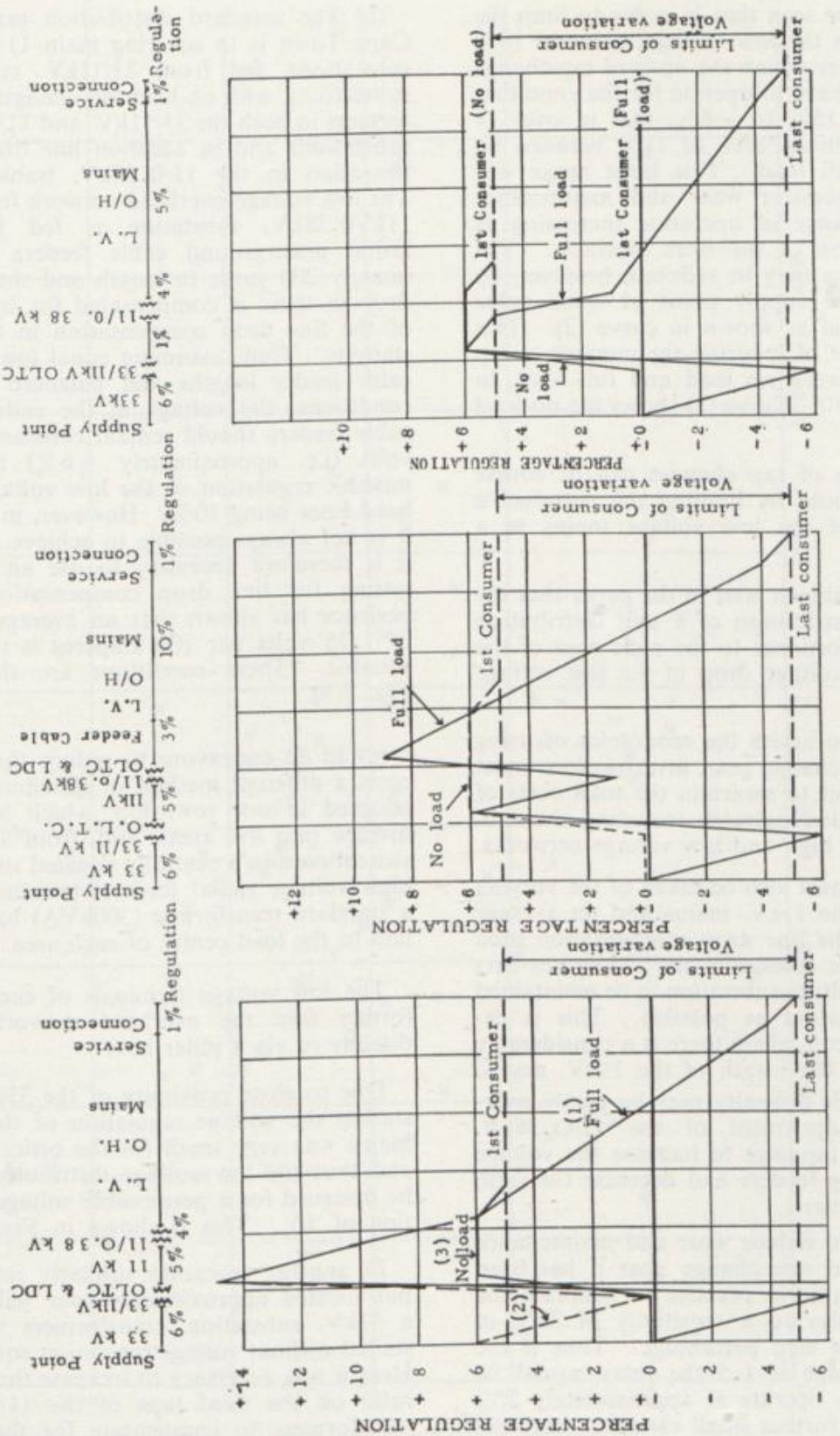


Fig. 7a.

Fig 7b VOLTAGE REGULATION DIAGRAMS

Fig. 7c.

and it can be seen that in order to limit the regulation in the low voltage mains to 10% the range over which the on-load tap-change gear would have to operate for the condition shown is +15% to −6%, that is, over 14 tapping positions each of 1½% between no load and full load. This large range will result in excessive wear and maintenance costs, the range of operation increasing as the regulation of the lines increases. The tapping range may be reduced, however, by operating the supply point at some value above normal as shown in curve (2). This has the effect of reducing the number of tap changes between no load and full load, in this case to 10. Curve (3) shows the no load conditions.

The range of tap changes can of course also be reduced by limiting the permissible regulation of the low voltage mains to a lower value.

It will be shown later in the paper that the radius of distribution of a unit distribution area is proportional to the cube root of the permissible voltage drop in the low voltage mains.

In order to assess the economics of using on-load tap change gear, investigations must be carried out to ascertain the total costs of the distribution network including the substations and high and low voltage networks.

Account must also be taken of the varying lengths of the 11kV. mains and an average setting for the line drop compensation used to enable the voltage at the 11kV. bus-bars in the low voltage substation to be maintained as near constant as possible. This is extremely difficult where there is a considerable variation in the length of the 11kV. mains. However, this difficulty may be partly overcome by adjustment of the 11/O.38kV. transformer tappings to increase the voltage ratio on long feeders and decrease the ratio on short feeders.

In order to reduce wear and maintenance costs on the tap change gear it has been found advisable in practice to calibrate the operating relay to a sensitivity of 33% in excess of the step percentage. Thus if the step percentage is 1.5 the relay would be calibrated to operate at approximately 2%, producing a further small variation from the initial calculated conditions.

(b) The standard distribution practice in Cape Town is to use ring main 11/0.38kV. substations, fed from 33/11kV. step-down substations, with on-load tap changing transformers in both the 33/11kV. and 11/0.38kV. substations and in addition line drop compensation in the 11/0.38kV. transformers. The low voltage overhead network from each 11kV0.38kV. substation is fed by four radial underground cable feeders approximately 200 yards in length and the voltage drop in these is compensated for by means of the line drop compensation in the substations. Thus, assuming equal low voltage cable feeder lengths and balanced loading conditions, the voltage at the ends of the cable feeders should remain constant at 233 volts (i.e. approximately +6%) the permissible regulation of the low voltage overhead lines being 10%. However, in practice it is not always possible to achieve this and it is therefore necessary to use an average setting for line drop compensation. Experience has shown that an average setting of 1.25 volts per 100 amperes is the most suitable. These conditions are shown in Fig. 7(b).

(c) In an endeavour to reduce the capital costs a different method of distribution was adopted in one township, which has been divided into five areas, and, from an 11kV. switchboard in a centrally situated substation high voltage radial feeders, terminating on a standard transformer (300kVA) have been laid to the load centre of each area.

The low voltage terminals of each transformer feed the overhead network either directly or via a pillar box.

Due to close proximity of the 33kV. substation the voltage regulation of the 11kV. mains was very small (in the order of 1%) and thus the low voltage distributors could be designed for a permissible voltage regulation of 5%. This is shown in Fig. 7(c).

In another township similarly reticulated but located approximately four miles from a 33kV. substation, transformers were installed without voltage regulation equipment. Here it was necessary to increase the voltage ratio on the fixed taps of the 11/0.38kV. transformers to compensate for the higher regultion in the 11kV. feeders.

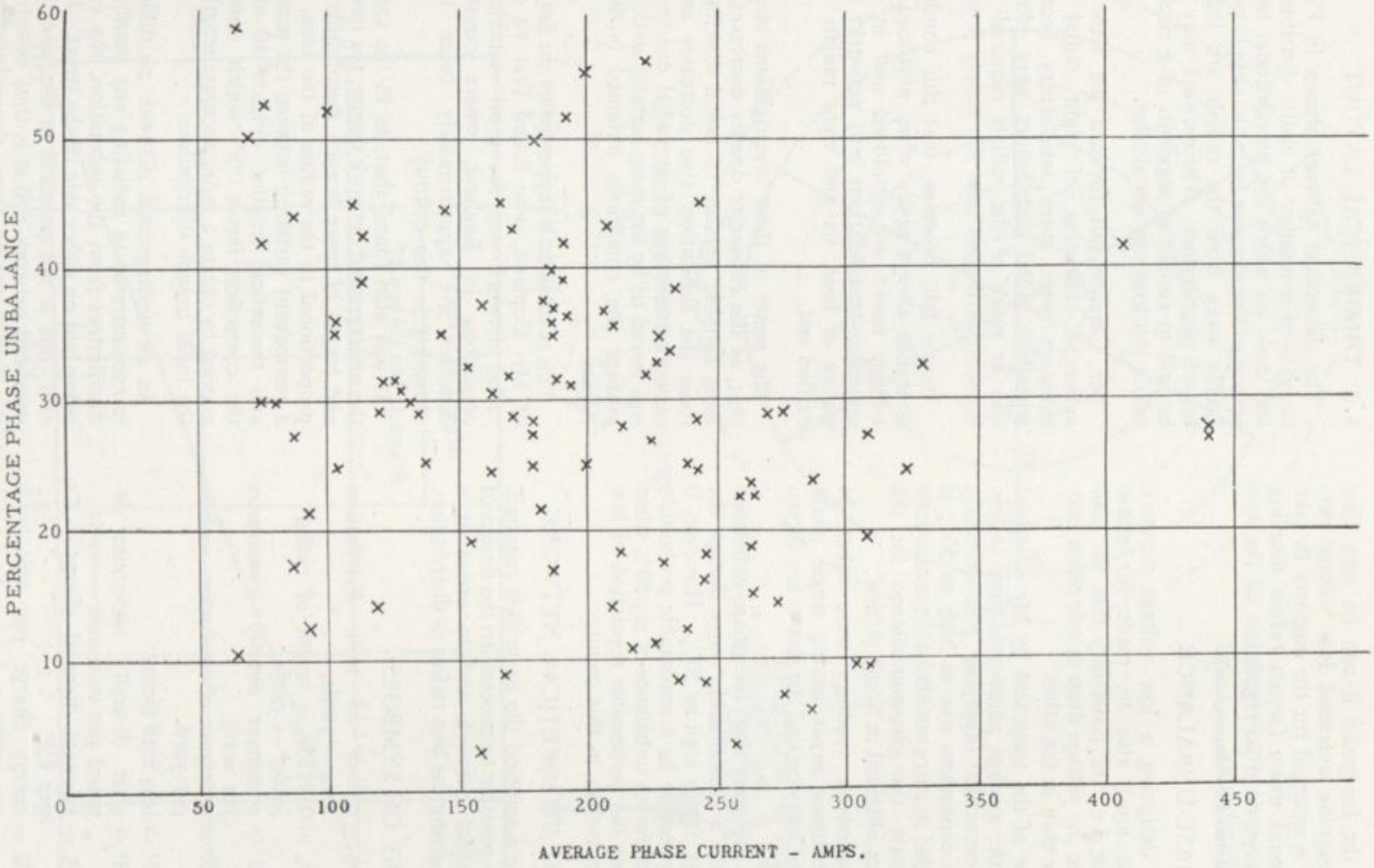


Fig. 8 PHASE UNBALANCE IN LOW VOLTAGE NETWORK.

From the foregoing it can be seen that when designing overhead low voltage networks it is essential for the engineer to take into account many factors before deciding upon the permissible regulation of the low voltage distributors.

3.4 PHASE-UNBALANCE

When designing a low voltage network allowance must also be made for phase unbalance, i.e., the possibility that the load and hence the voltage drop in one phase may be higher than in the other.

In view of the statement by Mr. Copland (1) that the average phase-unbalance in low voltage networks supplying predominantly domestic consumers was as high as 50% it was decided to carry out similar investigations to ascertain the phase-unbalance for the conditions obtained in South Africa.

Phase-ammeter readings were taken in eight substation areas having single phase service connections and the results are shown in Fig. 8.

It can be seen that the phase-unbalance varies over a considerable range though the average is not as high as 50%. However, it would appear to be a reasonable precaution to provide for an unbalance of say 30% when calculating the permissible regulation of low voltage networks in this country.

4.0 THE THEORETICAL NETWORK

Having assembled the basic data required, it is now possible to proceed to the design of a theoretical network and to arrive at a formula giving the best radius of distribution.

4.1 LIST OF SYMBOLS

r_3 = radius of unit distribution area — yards.
$r_c = 0{\cdot}9125 r_3$ = length of radial feeder — yards.
d = consumer density (consumers per acre).
R = resistance of conductor — ohms per yard.
LLF = loss load factor.
P = after diversity maximum demand per consumer — watts.
A = kilowatt demand charge — £'s per kW.
B = energy charge per unit — £'s per unit.

4.2 THEORETICAL LAYOUT

The theoretical network shown in Fig. 9 consists of a number of radial distributors, the loads on which are proportional to the square of the distance from the supply point. Loads away from the radials are fed by branch distributors. The network may thus be said to consist of segments of a circle in which the loadings are similar.

Mr. Copland put forward the view that networks consisting of eight radial distributors were more satisfactory because, when six radial distributors were plotted, one or more of the radials required long branch distributors near the supply point.

It was felt, however, that this condition does not always apply when overhead low voltage mains are employed and in consequence, investigations into networks consisting of four, six and eight radials were carried out.

The result of these investigations showed that, as the consumer density decreases, the most suitable number of radial distributors from the substation also decreases and a network consisting of six radial distributors was found to be the most suitable under the average site conditions obtained in South Africa.

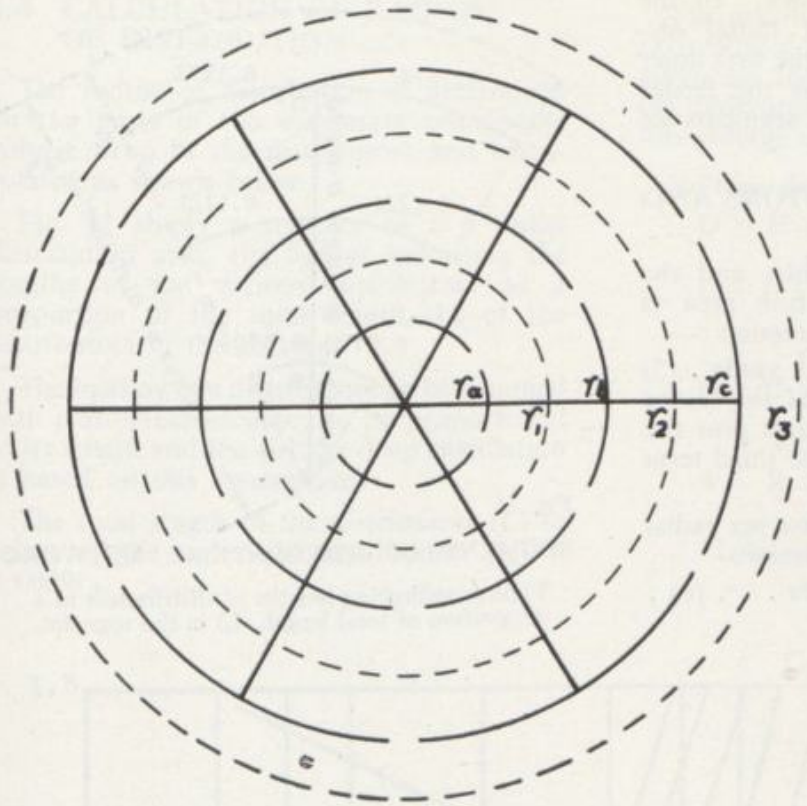
This conclusion is supported by the findings of Mr. Copland, who found that an eight radial network was the most suitable for conditions in England, where consumer densities are approximately twice those obtaining in this country.

It was also found that, as in the case of the underground network design, the number and length of inner branch distributors was proportional to the radius of the area, with a consequent variation between the practical and theoretical lengths. Figure 10 shows the correction factor "k" which must be applied to obtain a more accurate length for the inner branch distributors.

In an underground network no difficulty is encountrered in radiating any number of distributors from the substation, the cables being laid on either side of the street. However, this is not practical in the case of an overhead network and it is thus essential to lay feeder cables from the substation to

Fig. 9

THEORETICAL NETWORK



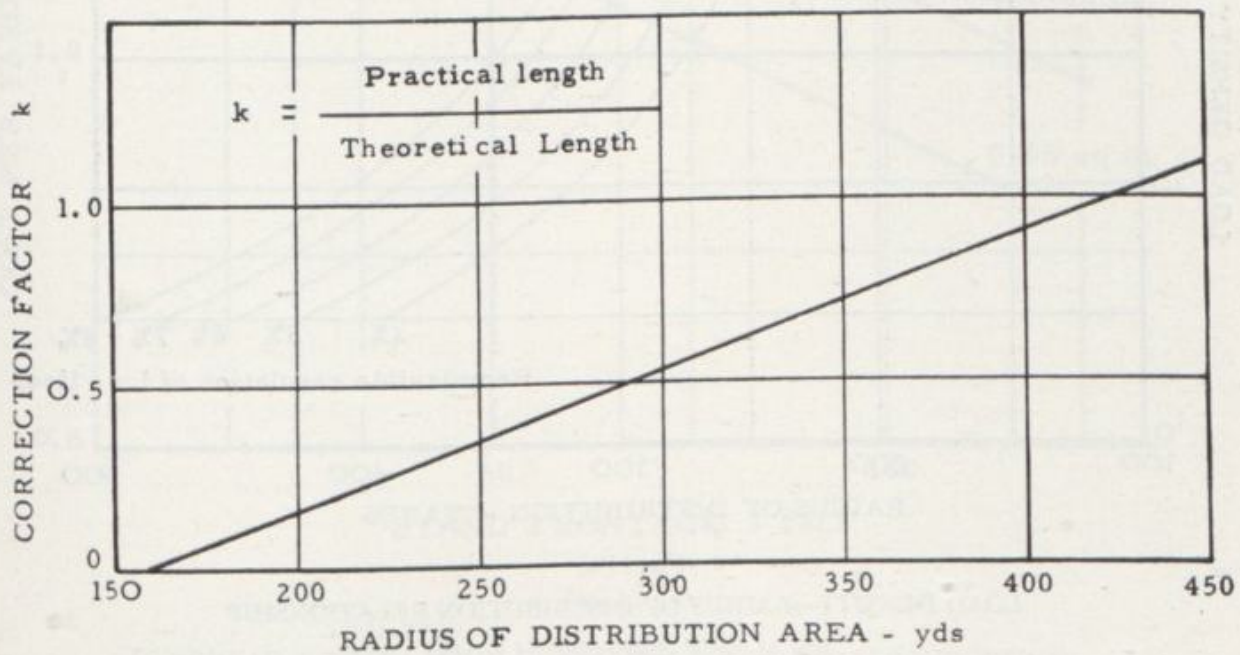
NETWORK SHOWN IN FULL LINES

$$r_a = \frac{r_1}{\sqrt{2}} \qquad r_b = \frac{\sqrt{3}}{\sqrt{2}} r_1 \qquad r_c = \frac{\sqrt{5}}{\sqrt{2}} r_1$$

$$\pi r_1^2 = \tfrac{1}{2}\pi r_2^2 = \tfrac{1}{3}\pi r_3^2$$

Fig. 10

RELATIONSHIP BETWEEN THEORETICAL & PRACTICAL LENGTH OF INNER BRANCH DISTRIBUTORS.



suitable positions on the network. In the practical layout the length of radial distributor from the substation to the first inner branch distributor is treated as the feeder cable, each cable feeding two segments of the network.

4.3 LENGTH OF DISTRIBUTORS AND LOADING

The length of the feeder cables and the distributors in a unit distribution area is obtained from the following expression :—

$$L = 1 \cdot 22r_3 + 8 \cdot 76r_3 + 7 \cdot 0r_3k \text{ yards} \quad . \quad (5)$$

the first term being the length of the feeder cables, the second term the radials plus the outer branch distributors and the third term the inner branch distributors.

The maximum current per phase per radial is given by the following expression :—

$$I = 0 \cdot 1646r_3^2dP \times 10^{-6} \text{ ampres} \quad . \quad . \quad . \quad (6) \quad .$$

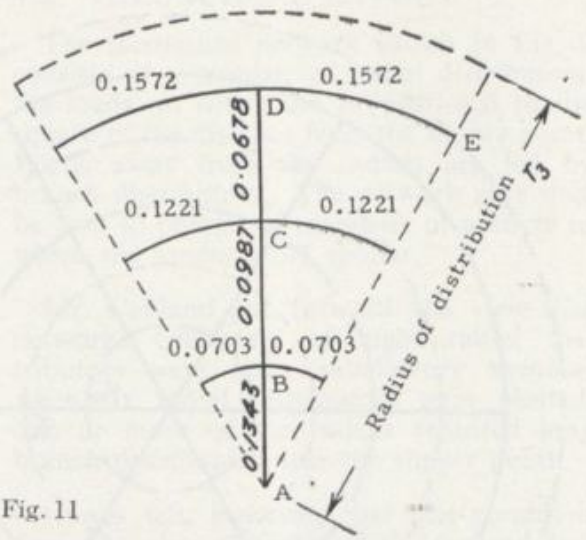


Fig. 11

SEGMENT OF THEORETICAL NETWORK

Figures indicating lengths of distributors as a proportion of total length (L) in the segment.

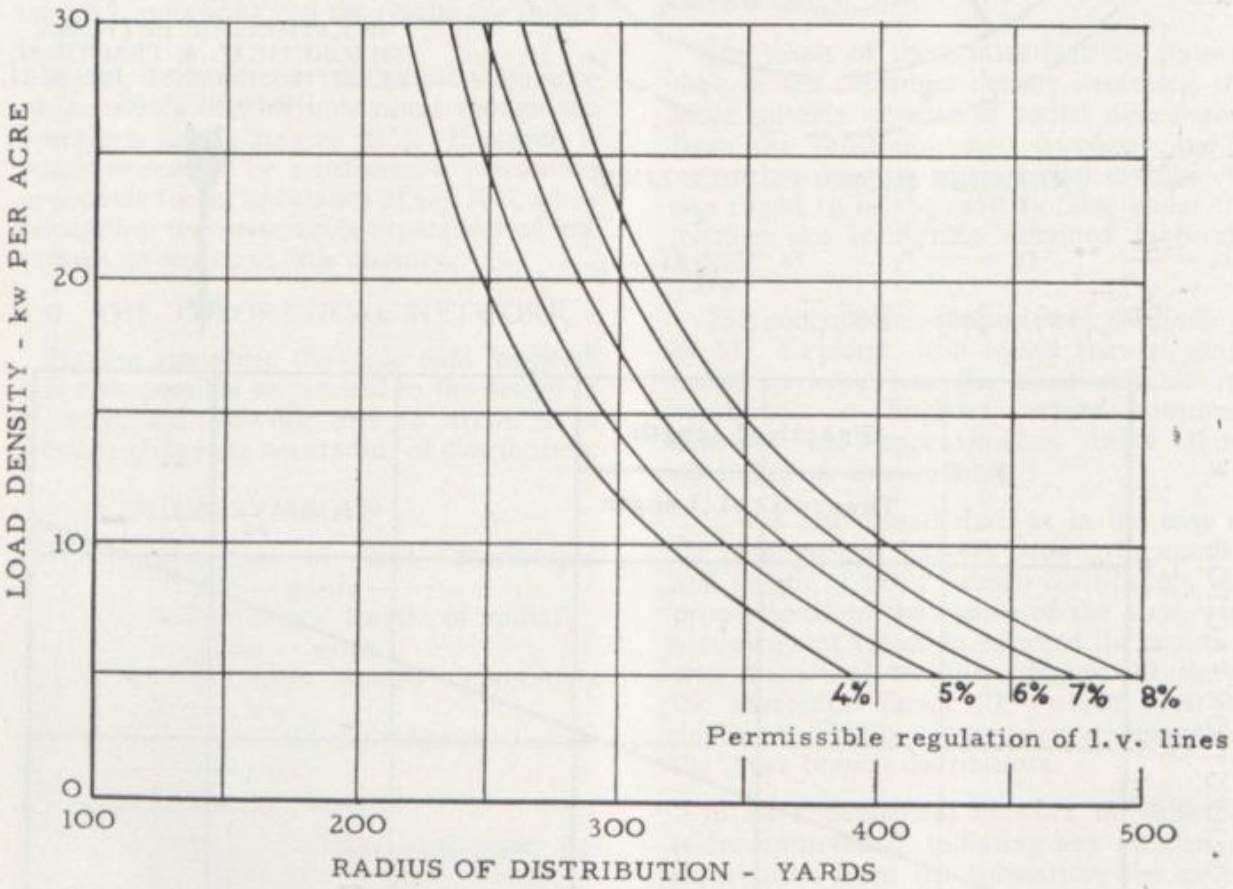


Fig. 11(a)

LOAD DENSITY—RADIUS OF DISTRIBUTION RELATIONSHIP

Size of radial distributor 0·1 sq. in.

4.4 CALCULATION OF RADIUS OF DISTRIBUTION

The radius of distribution is determined on the basis of the maximum permissible voltage drop in the distributors and is calculated as shown below.

Fig. 11 shows a segment of a 6 radial distribution area, the figures indicating the lengths of the various distributors as a proportion of the total length (L) of the distributors in the segment.

The loading of a distributor can be assumed with reasonable accuracy to be proportional to its length and the voltage drop calculation is based on this assumption.

The total length of the distributors (L) in terms of the radius of distribution (r_3) = $3{\cdot}0329r_3$.

The maximum voltage drop occurs at the extremity of the outer branch distributor and assuming that the length A—B represents the underground feeder cable to the network, this voltage drop is calculated as follows :—

Voltage drop

$$D - E = (0{\cdot}1572\,I \times 0{\cdot}0786L)R = 12{\cdot}35\,ILR \times 10^{-3}$$

$$C - D = (0{\cdot}3144\,I \times 0{\cdot}0678L)R + (0{\cdot}0678\,I \times 0{\cdot}0339L)R = 23{\cdot}65\,ILR \times 10^{-3}$$

$$B - C = (0{\cdot}6264\,I \times 0{\cdot}0987L)R + (0{\cdot}0987\,I \times 0{\cdot}04935L)R = 66{\cdot}61\,ILR \times 10^{-3}$$

$$A - B = (0{\cdot}9657\,I \times 0{\cdot}1343L)R = 129{\cdot}8\,ILR \times 10^{-3}$$

$$\therefore \text{ Total voltage drop} = 232{\cdot}41\,ILR \times 10^{-3}.$$

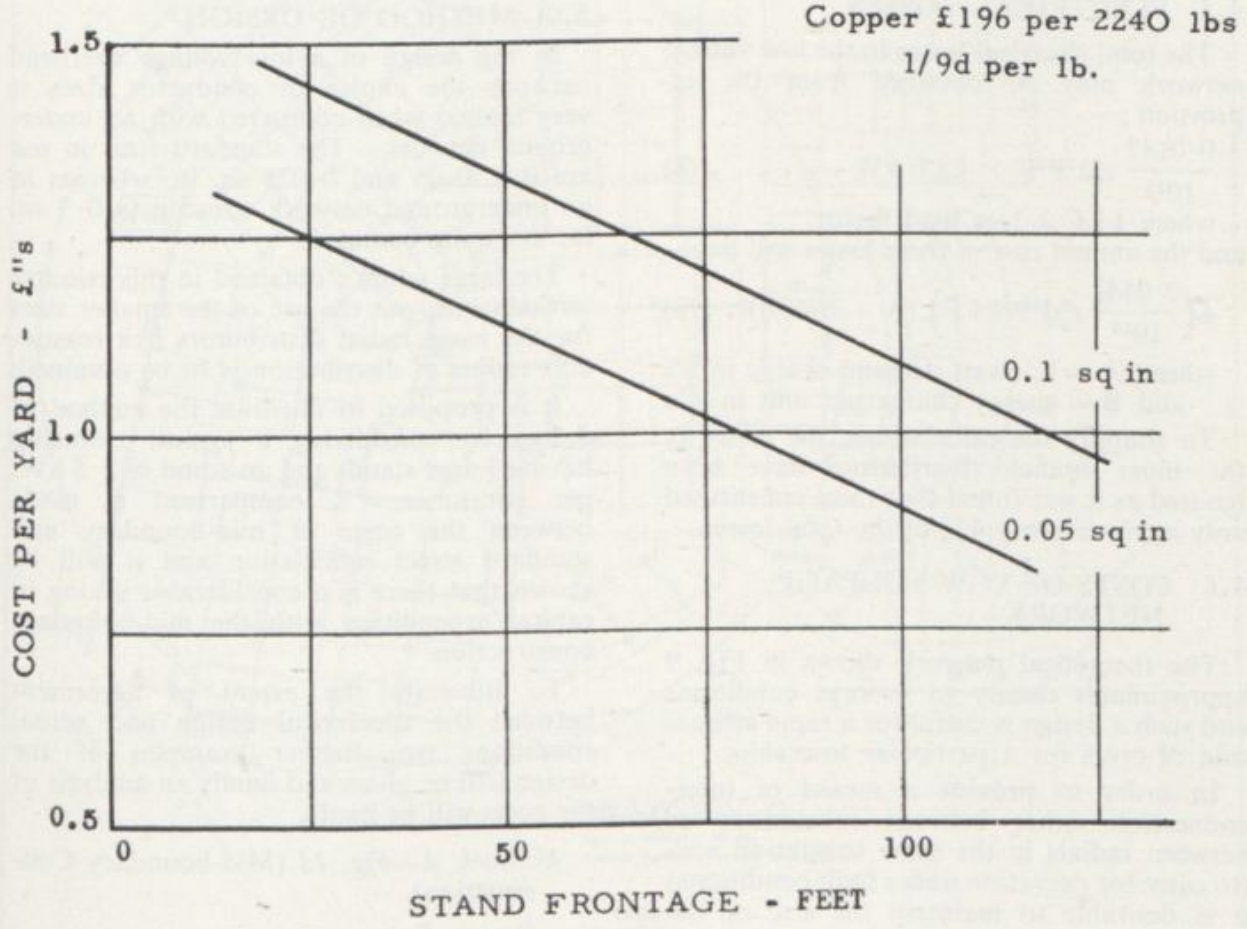


Fig. 12

OVERHEAD RETICULATION COSTS (MID-BOUNDARY CONSTRUCTION)

Substituting for $I = 0{\cdot}1646\, r_3^2 dP \times 10^{-6}$

and $L = 3{\cdot}0329 r_3$

the total voltage drop V is

$$V = 0{\cdot}116 r_3^3 RdP \times 10^{-6}$$

.. Radius of distribution r_3

$$= \sqrt[3]{\frac{V}{0{\cdot}116RdP \times 10^{-6}}} \text{ yards} \quad . \; . \; . \; (7)$$

Where V = maximum permissible voltage drop in the low voltage distributors

R = resistance of conductor per yard

d = consumer density per acre

P = after diversity maximum demand in watts.

Fig. 11(a) shows the relationship between the load density (d × P) and the radius of distribution using 0·1 sq. in. radial distributors.

4.5 ELECTRICAL LOSSES

The total electrical losses in the low voltage network may be obtained from the expression :—

$$\frac{0{\cdot}0142}{10^{15}}\, r_3^5 d^2 P^2 R \times \text{LLF kW} \quad . \; . \; . \; . \; . \; . \; (8)$$

where LLF = loss load factor,

and the annual cost of these losses will be :—

$$£\left(\frac{0{\cdot}0142}{10^{15}}\, r_3^5 d^2 P^2 \text{LLF}\right) (A + 8760B) \quad . \; . \; (9)$$

where A = kilowatt demand charge in £'s

and B = energy charge per unit in £'s

To simplify the calculations, the losses in the inner branch distributors have been ignored as it was found that these constituted only approximately 4% of the total losses.

4.6 COSTS OF LOW VOLTAGE NETWORK

The theoretical network shown in Fig. 9 approximates closely to average conditions and such a design is useful for a rapid estimation of costs for a particular township.

In order to provide a means of interconnection either between substations or between radials in the same substation area (to cater for operation under fault conditions) it is desirable to maintain the size of the radials to the extremity of the outer branch distributors. However, to obtain maximum economy in the design, smaller conductors may be used for the inner branch distributors.

The total cost of the theoretical network, excluding substation equipment, may be obtained from the expression :—

$$£1{\cdot}22 r_3 A + £8{\cdot}76 r_3 B + £7{\cdot}0 r_3 Ck \quad . \; . \; . \; (10)$$

where A = cost per yard of feeder cable,

B = cost per yard of radial and outer branch distributors,

C = cost per yard of inner branch distributors ,

k = correction factor,

and r_3 = radius of distribution.

It must be noted, however, that the cost per yard of an overhead network varies according to the stand frontage. This is due to the necessity of having to place the poles in suitable positions for the service connections and account must be taken of this when calculating the theoretical costs. Figure 12 shows this variation of cost as applicable in Cape Town.

5.0 METHOD OF DESIGN

In the design of a low voltage overhead network the choice of conductor sizes is very limited when compared with an underground network. The standard sizes in use are 0·1, 0·05 and 0·025 sq. in. whereas in an underground network sizes up to 0·3 sq. in. are quite common.

The large admd's obtained in this country virtually rule out the use of the smaller sizes for the main radial distributors if a reasonable radius of distribution is to be obtained.

It is proposed to illustrate the method of design by considering a typical township having ¼ acre stands and an admd of 2·5 kW. per consumer. A comparison is made between the costs of mid-boundary and standard street reticulation and it will be shown that there is a considerable saving in capital expenditure with the mid-boundary construction.

To illustrate the extent of agreement between the theoretical design and actual conditions two further examples of the design will be given and finally an analysis of the costs will be made.

Network A—Fig. 13 (Mid-boundary Construction)

Design Data

Average stand frontage.....	100 ft.
Average consumer density...	3·5 per acre

Admd	2·5kW	4kW. per consumer
Phase unbalance	0·75kW	
Variation in admd	0·25kW	
Future increase in load	0·5kW	

Radial distributor size ..... 0·1 sq. in

Inner branch distributor size 0·05 sq. in.

Maximum permissible voltage drop in LV distributors (5%) ..... 11 volts

Number of consumers 167

From Equation (7)

Radius of Distribution

$$= \sqrt[3]{\frac{11}{0{\cdot}116 \times 0{\cdot}248 \times 3{\cdot}5 \times 4000 \times 10^{-6}}}$$

$= 300$ yds.

Costs

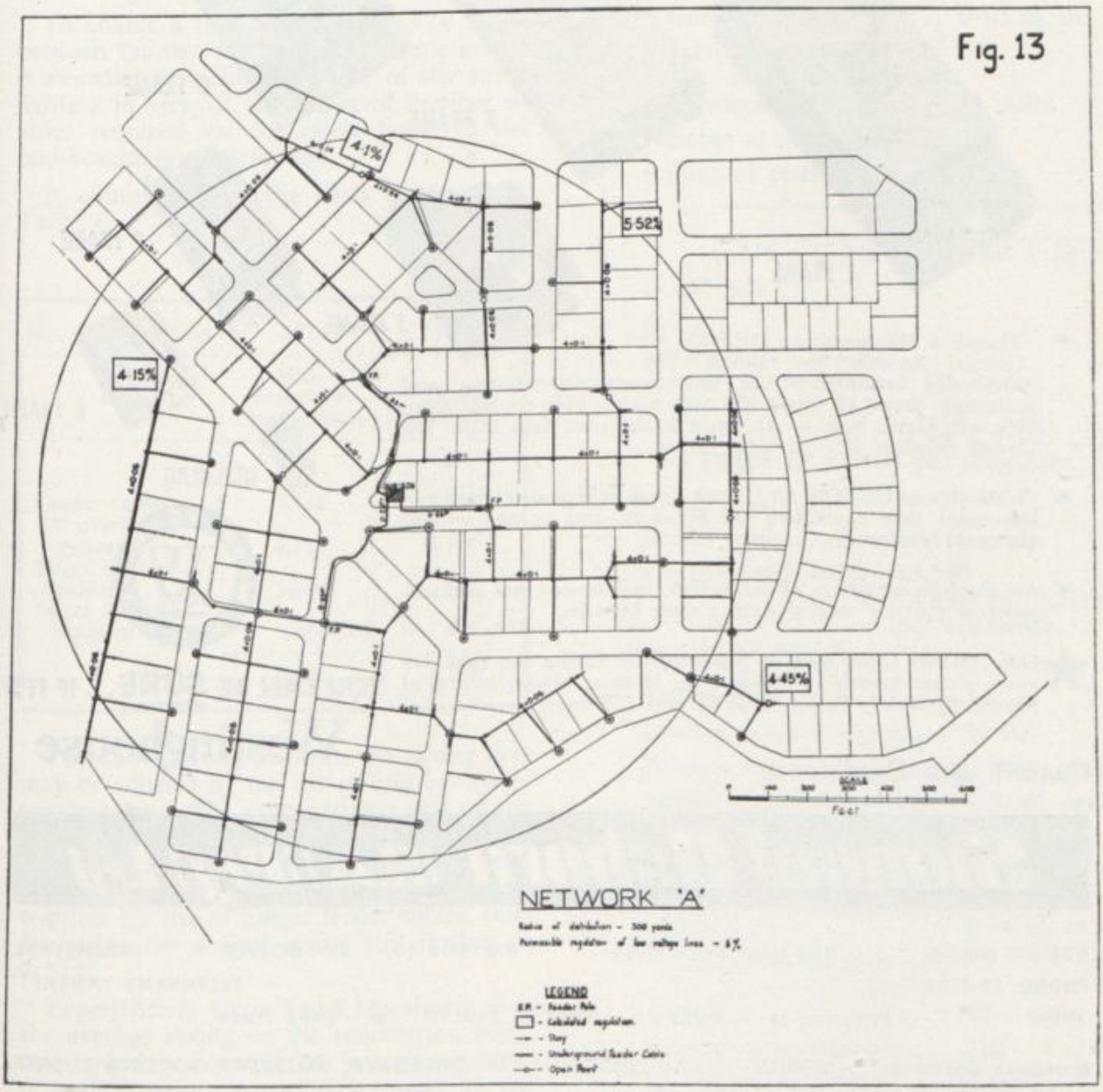
Total theoretical cost

$= £1{\cdot}22r_3A + 8{\cdot}76r_3B + 7{\cdot}0r_3Ck$

where A = £3·1 B = £1·08 C = £0·9 and k = 0·54

= £4,995 or £29·8 per consumer.

Fig. 13



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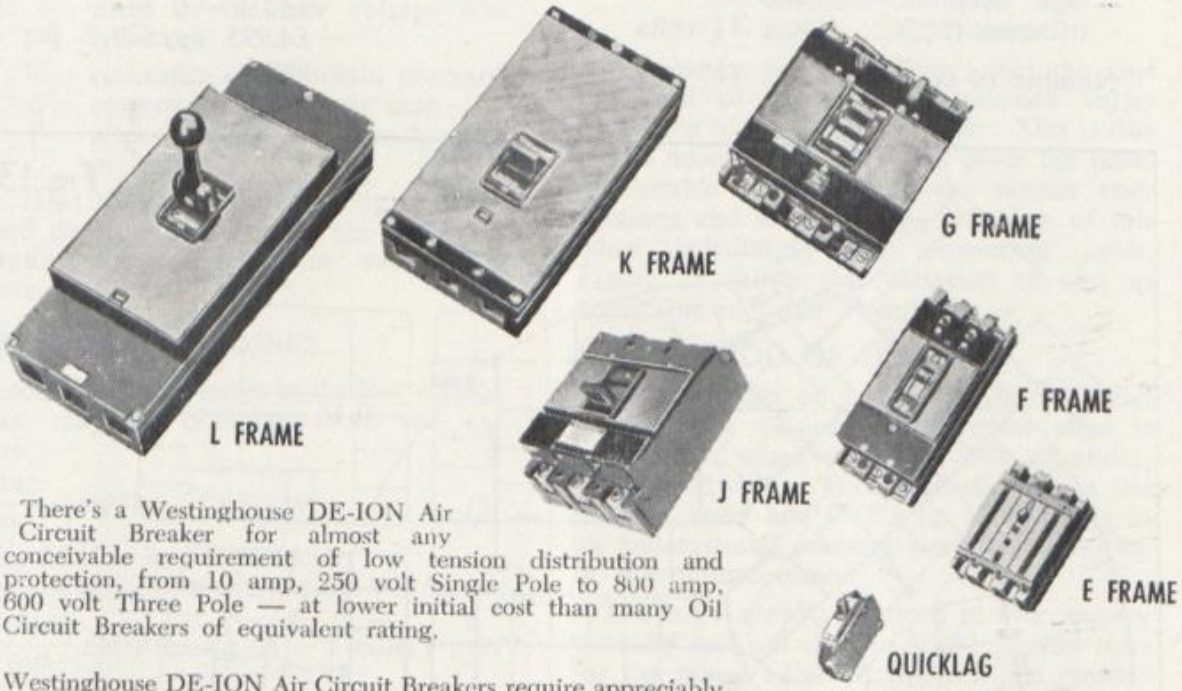

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Actual Cost

Feeder cables £1,154
LV overhead mains..... £3,815
= £4,969

or £29·7 per consumer.

Details of the respective route lengths and costs for all the networks are shown in Appendix 1.

Network B—Fig. 14 (Street Construction)

The network shown in Fig. 14 is designed for the same area as that of the previous design, but in this case the design is based on street construction.

To enable a true comparison to be made between the two methods of construction, it is essential to include the cost of the street lighting in view of the increased number of poles required for the street lights in the mid-boundary construction.

A comparison of the costs is shown in Table I.

TABLE I.

No. of Consumers	167	163
Item	Mid-boundary Construction	Street Construction
	£	£
Feeder cables	1,154	1,362
LV overhead mains	3,815	4,718
Street lighting mains	1,240	667
Street lighting lanterns	486 (63)	479 (62)
	6,695	7,226

The above figures illustrate the saving that may be effected by the use of mid-boundary construction. The saving in the cost of the overhead network including the street lighting mains is 6·12%. It has generally been found, however, that street construction requires the use of longer feeder cables, thus increasing the overall saving still further to 6·52%.

Experience in Cape Town has shown that the average saving on the reticulation using mid-boundary construction is approximately 6 to 8% where provision is made in the street lighting for a level of illumination of 800 lumens per 100 ft. linear. This saving increases considerably if the level of illumination is reduced.

Network C—Fig. 15

Design Data

Average stand frontage... 75 ft.
Average consumer density 5 per acre
Total admd (as in Network A) ..... 4kW. per consumer
Radial distributor size.... 0·1 sq. in.
Inner branch distributor size ..... 0·05 sq. in.
Maximum permissible voltage drop in LV distributors (5%) ..... 11 volts
Number of consumers.... 200
Radius of distribution

$$= \sqrt[3]{\frac{11}{0{\cdot}116 \times 0{\cdot}248 \times 5 \times 4000 \times 10^{-6}}}$$

= 267 yds.

Costs

Total theoretical cost
= £(1·22 × 267 × 3·1)
+ (8·76 × 267 × 1·2)
+ (7·0 × 267 × 0·42 × 1·02)
= £4,608 or £23·04 per consumer.

Actual Cost

Feeder cables..... £1,118
LV overhead mains. £3,580
= £4,698 or £23·5 per consumer.

Network D—Fig. 16

Design Data

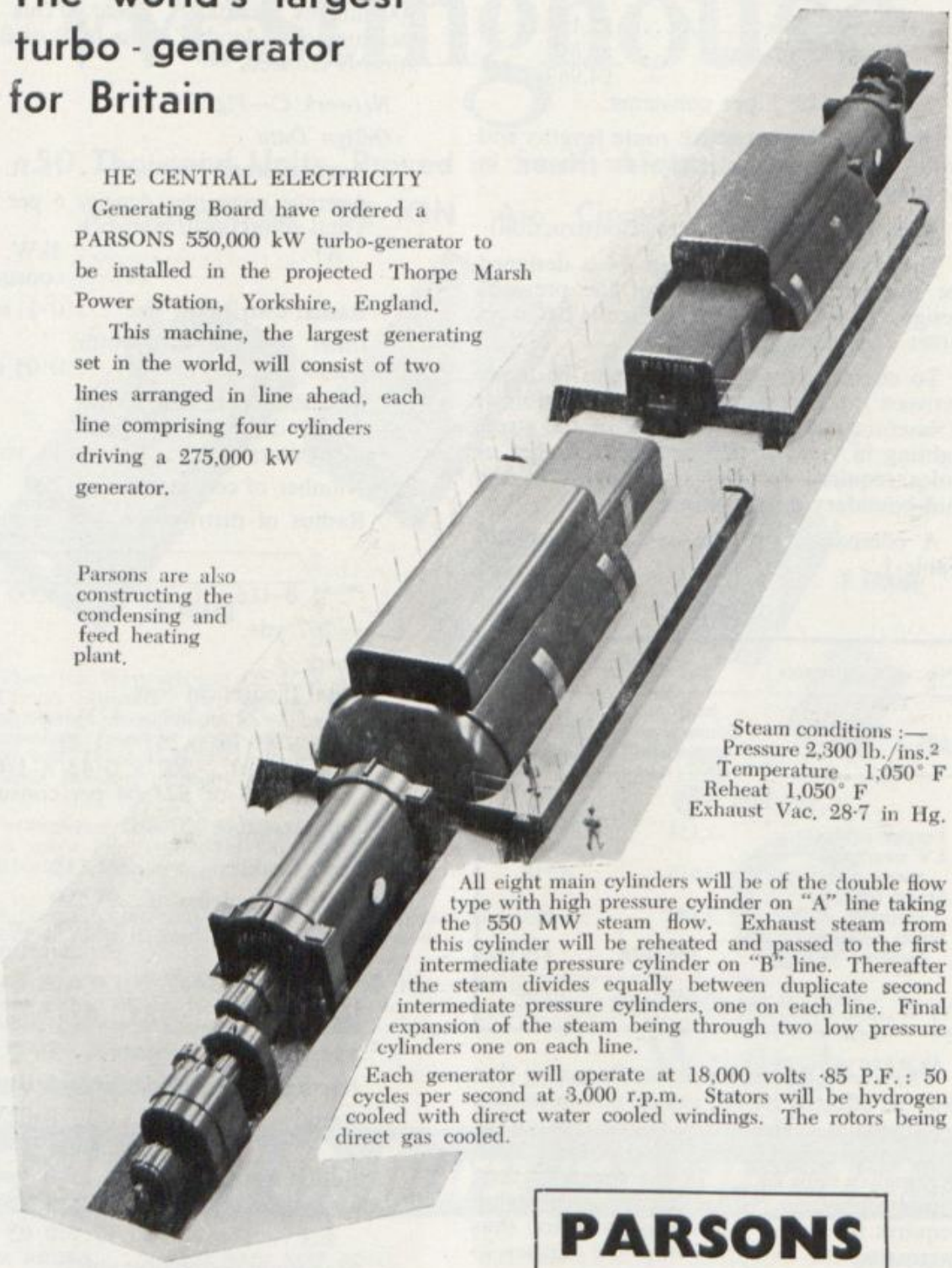
Average stand frontage... 80 ft.
Average consumer density. 5·0 per acre
Admd..... 3·0kW. per consumer
Radial distributor size.... 0·1 sq. in.
Inner branch distributor size ..... 0·05 sq. in.
Maximum permissible voltage drop in LV distributors (6%)..... 13·2 volts
Number of consumers.... 210
Radius of distribution = 316 yards.

The world's largest turbo-generator for Britain

HE CENTRAL ELECTRICITY Generating Board have ordered a PARSONS 550,000 kW turbo-generator to be installed in the projected Thorpe Marsh Power Station, Yorkshire, England.

This machine, the largest generating set in the world, will consist of two lines arranged in line ahead, each line comprising four cylinders driving a 275,000 kW generator.

Parsons are also constructing the condensing and feed heating plant.



Steam conditions :—
Pressure 2,300 lb./ins.²
Temperature 1,050° F
Reheat 1,050° F
Exhaust Vac. 28·7 in Hg.

All eight main cylinders will be of the double flow type with high pressure cylinder on "A" line taking the 550 MW steam flow. Exhaust steam from this cylinder will be reheated and passed to the first intermediate pressure cylinder on "B" line. Thereafter the steam divides equally between duplicate second intermediate pressure cylinders, one on each line. Final expansion of the steam being through two low pressure cylinders one on each line.

Each generator will operate at 18,000 volts ·85 P.F. : 50 cycles per second at 3,000 r.p.m. Stators will be hydrogen cooled with direct water cooled windings. The rotors being direct gas cooled.

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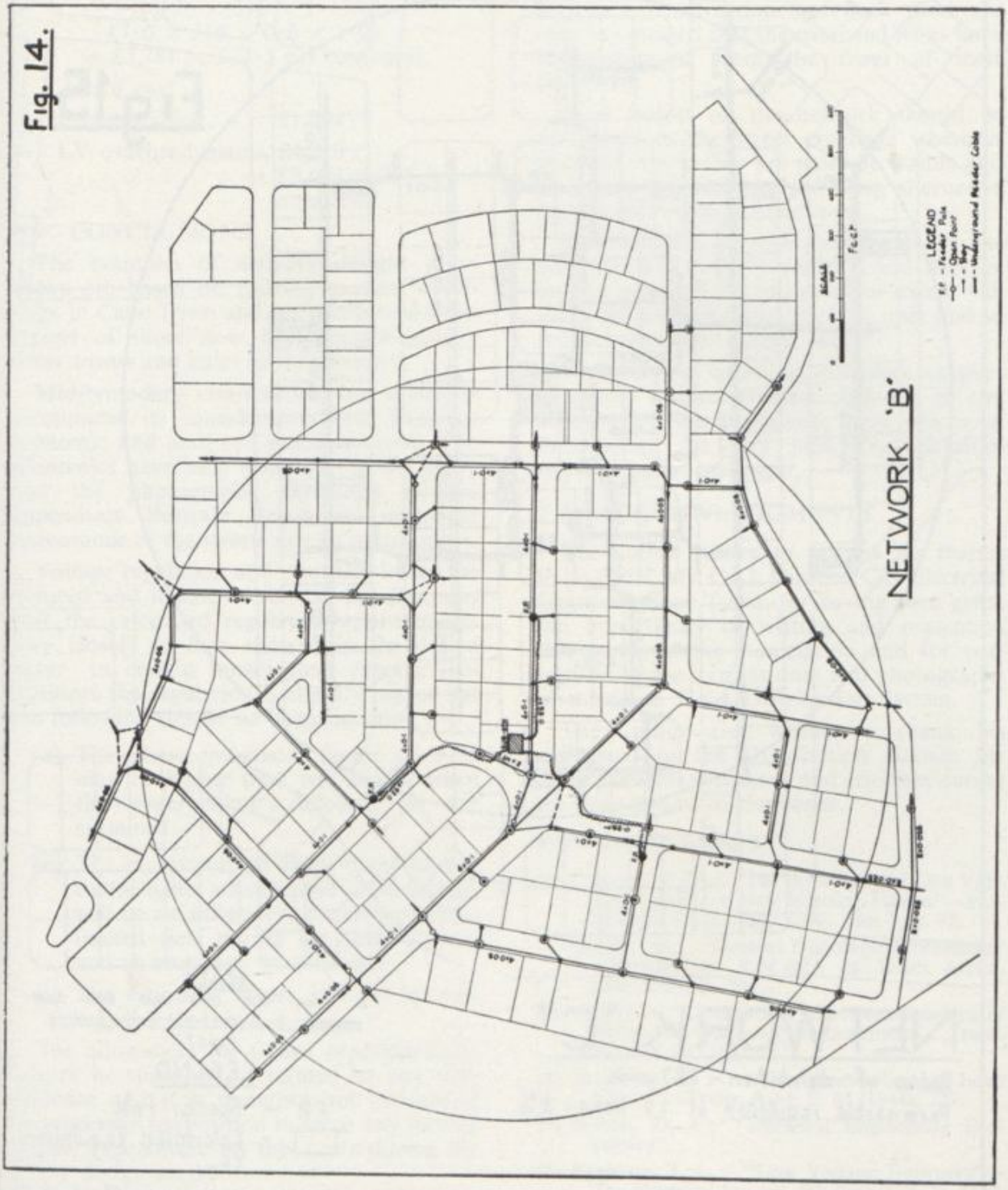
Fig. 14.



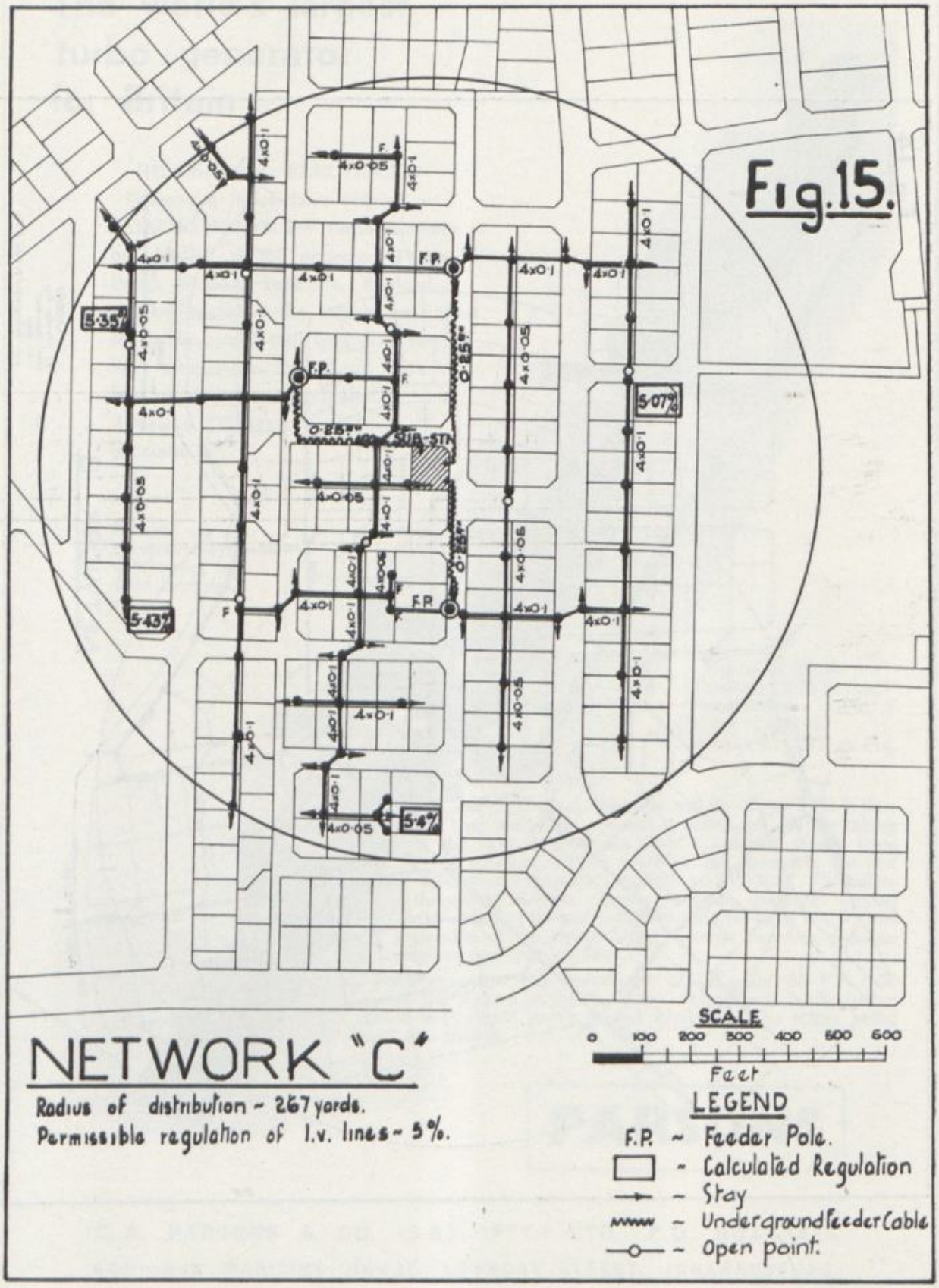


Fig.15.
NETWORK "C"
Radius of distribution - 267 yards.
Permissible regulation of l.v. lines - 5%.
SCALE
0 100 200 300 400 500 600
Feet
LEGEND
F.P. - Feeder Pole.
- Calculated Regulation
- Stay
- Underground Feeder Cable
- Open point.
SUB-STN
F.P.
5·35%
5·43%
5·07%
5·4%
4x0·1
4x0·05
0·25"

Costs

Total theoretical cost

$= £1 \cdot 22 \times 316 \times 3 \cdot 1)$
$+ (8 \cdot 76 \times 316 \times 1 \cdot 175)$
$(7 \cdot 0 \times 316 \times 0 \cdot 6 \times 1 \cdot 0)$
$= £5,781$ or $£27 \cdot 5$ per consumer.

Actual cost

Feeder cables £1,424

LV overhead mains £4,210

= £5,634 or £26·8 per consumer.

6.0 CONCLUSIONS

The examples of network designs given above are based on existing modern townships in Cape Town and are considered to be typical of those now being established in other towns and cities in this country.

Mid-boundary construction has much to recommend its consideration both from an economic and aesthetic point of view. The economics have been dealt with in the paper and the photographs contained in the appendices illustrate clearly the improved appearance of the streets due to its adoption.

Voltage regulation and electrical losses are reduced and it can be seen in the diagrams that the calculated regulation approximates very closely to that allowed in the design data. In certain longer than average distributors the regulation is slightly higher but the following should be borne in mind :—

(a) The phase unbalance factor of 30% may be higher than will obtain when the larger admd's allowed for are sustained.

(b) The excess voltage drops obtained due to the higher admd's used in the designs will be an infrequent occurrence for a limited time during the peak periods and as such may be tolerated.

(c) The estimated future increase in load may be too high.

The allowances for future expected loads cannot be sustained or refuted by any firm evidence and it is therefore not considered an economic proposition to incur any further capital expenditure on this score during the initial design stage.

One of the main objections to mid-boundary construction appears to be the necessity of encroaching on consumers' property for maintenance or repair purposes. However, in Cape Town very few difficulties have been encountered and, in fact, most consumers in the townships where mid-boundary construction has been used are only too pleased that the overhead wires have been removed from the front of their properties.

Open points on the network should be positioned at the street crossings wherever possible, where they are more accessible and so reduce any delay in providing alternative supplies during fault conditions.

The number of poles and stays in the streets is considerably reduced and damage to the poles, in the majority of cases, will affect the street lighting network only and so reduce consumer outage.

The design is based on providing supplies to purely residential areas and not to city centres or areas containing large blocks of flats where the very high load densities require special treatment.

7.0 ACKNOWLEDGMENTS

The author wishes to express his thanks to his Chief, Mr. C. G. Downie, City Electrical Engineer, Cape Town, for having been given the opportunity of writing and presenting this paper to the Association and for permission to use various data and photographs of the Cape Town Distribution System.

The author also wishes to thank his colleagues in the Distribution Branch for much valuable assistance and criticism during the preparation of the paper.

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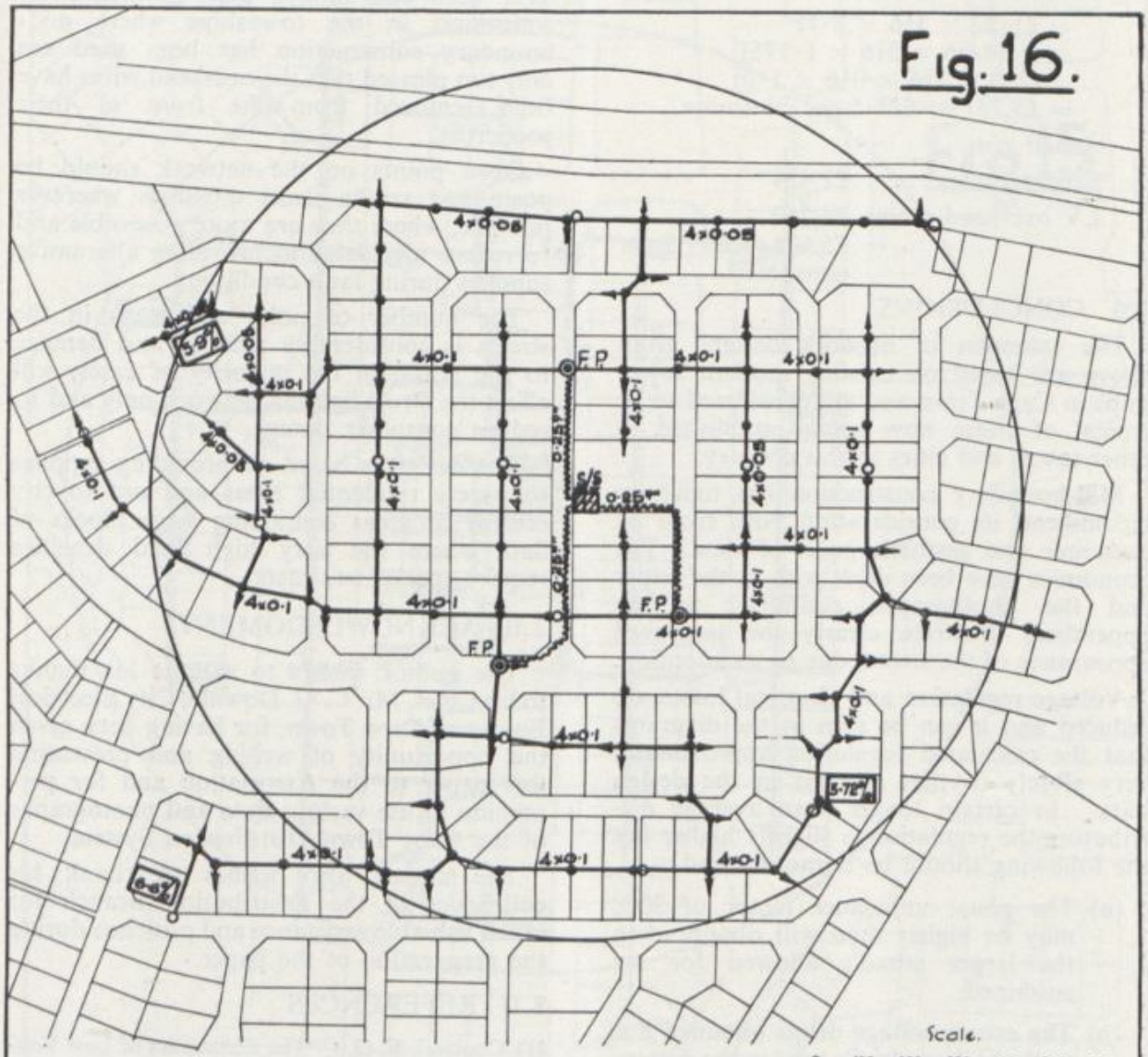
Fig. 16.



NETWORK 'D'

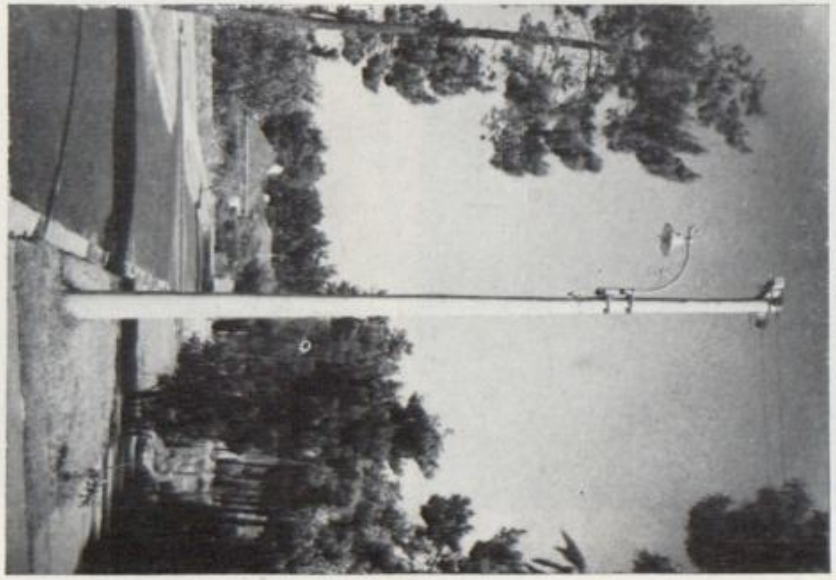
Radius of distribution ~ 316 yards.
Permissible regulation of l.v. lines - 6%

LEGEND
F.P. - Feeder Pole
□ - Calculated Regulation.
→ - Stay
www - Underground Feeder Cable
—o— - Open Point.

ANALYSIS OF NETWORKS (LOW VOLTAGE MAINS ONLY)

Appendix 1

Fig.	Network	No. of Consumers	Route Lengths						Actual Costs per Unit Area					Total Theoretical Cost per Unit Area	Cost per Consumer	
			Theoretical			Actual			Overhead Mains			Feeder Cables	Total		Actual	Theoretical
			Feeder Cables	Radial Distributors	Inner Branch Distributors	Feeder Cables	Radial Distributors	Inner Branch Distributors	Material	Labour	Transport					
			yds.	yds.	yds.	yds.	yds.	yds.	£	£	£	£	£	£	£	£
13	A	167	366	2,628	1,132	355	2,410	1,366	2,849	910	56	1,154	4,969	4,995	29·7	29·9
14	B	163	—	—	—	427	2,420	1,830	3,502	1,144	72	1,362	6,080	—	37·3	—
15	C	200	326	2,340	786	363	2,283	876	2,692	832	56	1,118	4,698	4,608	23·5	23·04
16	D	210	386	2,770	1,330	445	3,040	1,236	3,211	936	63	1,424	5,634	5,781	26·8	27·5



MID BOUNDARY CONSTRUCTION STREET LIGHTING POLE AND CONNECTION.

APPENDIX II.

STREET CONSTRUCTION.

MID BOUNDARY CONSTRUCTION.

MID BOUNDARY CONSTRUCTION—STREET SCENE.

MID BOUNDARY CONSTRUCTION—ROAD CROSSING.

MID BOUNDARY CONSTRUCTION DURING BUILDING OPERATIONS

THE PRESIDENT: Gentlemen, I shall now call upon Mr. R. W. Kane to propose a vote of thanks to Mr. Wood for his paper.

Mr. KANE (Johannesburg): Mr. President, and gentlemen, Mr. Wood has to be congratulated on his serious attempt to provide what he calls "a realistic approach to the problem of planning a low voltage network layout that is both sound and economic," and for his earnest endeavour to adapt Mr. F. S. Copland's methods to overhead reticulation schemes. The examples given of his costing formulae and the actual results obtained in construction are particularly interesting. I note though that the examples given are confined to reticulation emanating from one load centre, and quite naturally so, and consequently it is assumed that where several centres are involved in any one township, the sum of the costs for each area will be more or less the total cost.

However, I think the value of his paper would have been enhanced if some reference had been made to the provision of supplies to business and flat sites and the effect of parks and other open spaces.

The author's remarks in his choice of materials must not be taken too seriously, for although I have no doubt that the facts given are substantially correct as far as his local experience is concerned, it does not necessarily follow that the reasons for his choice are correct for the balance of the country.

To quote one example, I should imagine that the source of manufacture of the concrete poles will have a considerable influence on the ultimate cost of the pole at erection site when railage and other transport costs are added, and, to take this a stage further, one can visualise the steel pole having quite a financial advantage in certain circumstances.

Again, on poles, I am inclined to wonder whether the much-maligned wooden pole, apart from occasions when appearance is important, is as black as it is invariably painted, particularly from the total life aspect. In the High Veld I suspect that the total life of these poles is much greater than admitted.

One other point of interest is that of the author's comment on the old rule of thumb methods which he had encountered. I suggest the author does a little research into the journals of this Association, wherein he will find that the so-called rule of

thumb methods are based on practical and theoretical considerations, established at that time, for the material and labour devices then available. Please do not misunderstand me over thes ecomments. The point I wish to make is that the value of a paper of this description lies in the timely reminder that well-tried methods should be constantly reviewed, but one must not blindly accept proposals submitted by the author without a careful analysis of all local conditions.

The author states that concrete poles are cheaper in initial cost than steel poles. This is appreciated, but can it be said for the erected pole? No reference is made to the nature of the soil in the schemes discussed, presumably on the basis that the cost of the hole is identical for any type of pole, but the latter is not always true, and, I think, depends on the mechanical planting methods.

In Fig. 2 ten men can be counted planting what seems to be a 30 foot pole, and there may be more outside the picture busy with the anchor points. Is this standard practice, or is it merely the dress rehearsal, with additional photogenic personnel that invariably appear in photographs when such records are made?

I wonder if the author is able to give the life of an un-galvanised non-sleeved steel pole at the coast, and at what intervals is such a pole painted for the average cost of 5s. 7d. per pole per annum? The reluctance to use aluminium at the coast under present-day costs is understood, but for inland installations where rain, and climatic conditions are different, there are relatively long periods without it would seem that the elaborate bi-metal connections are unnecessary. The experience of other authorities in this connection would be appreciated.

Would the author also inform us how Fig. 8 was prepared? There are 103 readings taken at the eight load centres. Does this mean approximately 12 outgoing feeders each, or a number of readings at differing periods and were the readings taken over peak periods, or over the 24 hours?

Perhaps the author would answer that in his replies, for the sake of the people in the country who were not present at this convention.

Finally one very important aspect of the paper is the novel but not entirely original mid-boundary construction which the author claims can result in up to 8% saving, or even more, if the level of street illumination is reduced. He also claims that most consumers prefer this type of construction. I fully accept the statements made, but I wonder if this is the end of all expenses in this connection. Comparison of the photographs printed, showing the two types of construction, emphasises the author's statement that the mid-boundary construction has been introduced in modern townships. Actually the illustrations shown on the screen, both the street construction and the mid-boundary construction, rather indicate what I would say are newly developed townships, insofar as there was very little fully established foliage shown in the pictures. The author does not state whether the service connections were linked or fused at the service pole. Presumably the legal requirements of mid-boundary reticulation have been carefully considered, and rights of access at all times, tree-planting requirements and other infringements of servitude catered for, but what will the future bring?

Apart from having to yet meet the dog or dogs, that have a proper appreciation of the legal rights of access, to even a mere meter reader! What would the position be when the service man, with helpers, ladders, and other apparatus and materials, descends on the property, particularly during the hours of darkness, apart from other times? Even European consumers have been known to be somewhat trigger happy under similar circumstances.

I am afraid that the mid-boundary construction, whilst laudable in intent, can, and will, bring endless irritations and difficulties to all concerned as a township develops fully.

The Table giving the relative costs of Boundary versus Street Front Reticulation gives insufficient data to allow an objective

analysis of the two systems. From the illustrations it would seem that the boundary system requires at least 20% more poles than the street front system. (I think Mr. Wood explained that in his presentation). The lower cost of materials, labour, and transport is not therefore apparent. Furthermore, it is not understood, why the feeder cables cannot be terminated at the nearest pole in the street front system.

Mr. Wood will be wondering whether I have anything to say in support of his scheme. I do wish to remind him that despite my queries and criticisms, his object is entirely laudable, and a paper of this description provides impetus to review present methods in the light of modern materials and labour-saving devices.

I hope that the Convention of 1959 will hear the actual results of an experiment on the Reef, whereby what we consider a somewhat novel reticulation method using single-phase high-voltage reticulation and no overhead mains whatsoever, will result in considerable capital savings. Under the copper costs of 1956, and the original methods, the complete cost was estimated to be £41,000. More recent copper prices brought this down to about £39,000, whilst the new method, with earlier copper costs was about £34,000 giving a saving of approximately 17%. However, it has to be proved yet.

On your behalf I have great pleasure in proposing a vote of thanks to Mr. Wood for his very provocative and interesting contribution to the proceedings of this Association. (Applause).

THE PRESIDENT: Thank you Mr. Kane.

I will now call upon Mr. F. Stevens, of Ladysmith, to second the vote of thanks.

Mr. F. STEVENS (Ladysmith): Mr. President, this is a bit of a surprise. I had no idea you were going to call on me. As a matter of fact I have made a note here to complain of the short period we had to read the paper and collect information to enable us to contribute to the discussion, so if I don't say very much you will forgive me.

I was extremely interested in what Mr. Wood said. I am inclined towards the views expressed by Mr. Kane, and do agree that it will give us food for thought as to whether we should perhaps get away from the usual construction or mid-block construction, although I am very doubtful.

I have very great pleasure in seconding Mr. Kane's vote of thanks.

Thank you.

THE PRESIDENT: Thank you Mr. Stevens.

I would like you to show your thanks in the usual way for the presentation of this paper by Mr. Wood.

(Applause).

The paper is now open for general discussion.

Mr. J. E. MITCHELL (Salisbury): I must first of all congratulate Mr. Wood on his very excellent paper, and not only for the interest which it has aroused, but also for its layout and design, and he has obviously had to carry out much investigation and detailed analysis of the conditions in Cape Town in order to present it.

I have, however, one or two comments which I'd like to make on certain points, the first being in regard to materials, on Paragraph 2 of Page 9.

In view of the well-known use of concrete poles in Salisbury, which use started as far back as 1940, I was of course very pleased to see the author stating that these are proving the most economic for reticulation purposes. Like Mr. Kane, I realise that transport is a big feature, and it depends on where they are manufactured. I am not aware of what he pays for poles in Cape Town, but in Salisbury, where as you are aware the Electricity Department itself manufactures its own poles, the price of the normal 28 ft. pole comes out at £4 15s. today, and the 29′ 6″ terminal, or angle pole, which will take up to a 30° angle without staying, is £7.

I would say, however, that the use of cross-arms on low tension concrete poles does seem to me illogical. Vertical construction offers much neater facilities to my mind for service takeoffs, with the

requisite ground clearance, and has the benefit of a neutral conductor below the phase wires. This is accentuated in Cape Town, where street lighting feeds in addition to service connections, are taken from mid-boundary construction. Furthermore, the erection of straight poles, and the pulling up of wires, is far easier, and the difficulties in regard to torsion, as mentioned by the author, are avoided.

I was particularly interested in the author's pictures of the methods employed in the erection of concrete poles in Cape Town, and his statement that extreme care must be taken during erection to avoid cracking or fracturing the pole.

I was first of all surprised at—may I say it?—to me a rather ingenious but at the same time an archaic method of erection. And secondly, that the pole should be of so delicate a nature that cracking could occur if extreme care was not taken. It is obvious that by the method used for erection, it would be very difficult to use an augured hole. You would have to have a batter to it to allow the pole to be put in. I am sorry about this, because it does not appear that my remarks, made in this city in 1951, have been noted in any way. At that convention I stated that with a pole-operated pole augur and derrick it was possible to erect 20 poles a day with 1 European and 2 Africans, and on our investigations, at a much lesser cost.

I have brought a series of photographs with me, which I'll put on the table, which show a series of erecting poles by the pole augur and derrick method. I brought another series of photographs for the interest of the author showing the various methods of using vertical construction which has been used in Salisbury since the war, and where we have, I think, practically always used mid-boundary reticulation.

May I say that I don't agree with Mr. Kane that mid-boundary reticulation is likely to cause maintenance troubles, because that is not our experience. In town planning in Salisbury the actual mid-boundary is 15 ft. off centre. That is, of course, all new areas—and practically all of Salisbury is "new area," and the 15 feet is a servitude for all services, the boundary of which we use.

Salisbury's experience with aluminium conductor is very similar to that of Cape Town. The over-all saving amounted to as little as 8%, and with the lowering of copper prices this price differential has been further minimised.

Turning to tap changers, I do not feel that on-load tap changers, either 33/11 KV. step-down or 11/0·38 KV local transformers are justified. Such luxuries can well be done away with to reduce costs, and off-load tap changers, intelligently set, together with a + or − 5% statutory allowance, is all that is required if the network is designed properly. The 50% phase out of balance quoted by Mr. Copland refers to distributors with only four consumers, and of course with such a small number of consumers this figure can easily be obtained. 30% is much nearer the average phase out-of-balance, and is a much safer figure to assume for design work. The remarks regarding the number of radial feeders from any sub-station are not quite correct. It is agreed that consumer density in England is twice that in Southern Africa, but the A.D.M.D.'s in Rhodesia—if not in South Africa—are proportionately higher than those obtaining in England, and therefore I doubt whether there is much difference between the kilowatt demand per acre in the two countries.

A study of the typical networks given shows that practically all the circuits within the townships are boxed, with suitable open points. It is agreed that with underground networks, boxing by means of link boxes is essential for difficulties encountered in fault location. But with overhead networks where all is visible, and where usually any faults on the overhead lines can be repaired just as quickly as the network feeds can be altered, such elaborations would only seem to put up the cost and not to be really justified.

This point is accentuated in mid-boundary construction which is away from vehicular access, and consequently not subject to the type of damage that can be caused through collision of a vehicle with a street pole.

I may mention here that the difficulty in regard to trees and foliage is of course mitigated in Salisbury by the 15 ft. servitude, where planting of trees is not allowed.

It is interesting to note how the street light feeds are made across private property, from the mid-boundary construction. This practice I feel sure, from experience with service connections, will provide opposition from plot holders to such street-lighting leads being placed across their land.

I was very delighted with the exercises the author has caried out in regard to the cost of mid-boundary reticulation with street lighting in the roads themselves showing that this method was in fact more economic than what to me is a very unsightly method of roadside reticulation.

The present day cost of low-voltage overhead mains to half acre development in Salisbury is about £33 per consumer, which compares very favourably with the Cape Town figures. I feel I must disagree with Mr. Wood's conclusions in Paragraph (b) " It is considered that the network must be designed for compliance with statutory voltage conditions throughout the peak period." This period is normally 6 to 8 p.m. in the evening, and that surely is the time when the consumer is most concerned about the quality of the service given. He is generally not prepared to wait a long time for his dinner to cook or for his bath water to heat, and in major cities in the tropics where the evening draws in very quickly he requires a good standard of illumination from a normal and not over-elaborate lighting installation.

Like Mr. Kane, despite my disagreement with some of Mr. Wood's conclusions, and despite my being a little critical in regard to horizontal design and method of pole erection, I think the convention should be very grateful to the author for bringing forward the paper which he has given us, and will give us in the future so much meat to get our teeth into.

THE PRESIDENT: Thank you Mr. Mitchell.

Mr. A. R. SIBSON (Bulawayo): Mr. President, Mr. Mitchell and I are very often in this position. There was actually no collaboration between us, Mr. President. It is only a question of who could get in first to say the same things.

I had also noted the practice indicated by Mr. Wood of duplicating supplies on low tension networks which I also disapprove of. I don't consider that the cost of doing it is justified at all. I would also say that mid-boundary construction has been standard in Bulawayo since 1897, and as far as I am aware has not led to any difficulties.

The question that I do want seriously to raise is this question of regulation, and here this is not so much a criticism of the paper as warning to the whole country. Mr. Wood indicates that the regulation which is being permitted in England is 6% plus or minus, against the 5% in this country, and in the Federation.

In actual fact, however, recent events in Britain have led to the need for a much finer control than that. I refer to the introduction of television.

I understand that unless the regulation is kept to very much finer limits than plus or minus 6% difficulties arise with television sets, and in this country it seems to me that if there is a possibility in the future of TV ever becoming a habit, we should be very much on our guard in this matter, otherwise we'll find ourselves, no matter what the legal position may be, having very heated times with our consumers.

In respect of the phase unbalance conditions referred to by Mr. Wood, I wonder whether he has any information as regards the difference between phase unbalance in areas containing three phase connections to its consumers, and those in which these are only single phase connections.

I know that at one time, Cape Town more or less standardised on three-phase connections. I don't know whether they have learnt wisdom yet, and gone in for single-phase connections in some of their areas. If they have, it would be interesting to have a comparison. I am inclined to think that you might get a better result with single phase connections.

THE PRESIDENT: Quite right!

Mr. SIBSON: I too criticise the continued use of horizontal construction. We have no justification for it at all. There are many advantages in vertical construction. I would like to take this opportunity of telling you, just in a few words, of a new development which we are experimenting with in Bulawayo in regard to tap-offs for service connections, and this particular scheme that we are developing can also be applied to other things, in particular the street lighting connections that Mr. Wood has dealt with in his mid-boundary supplies.

I have here a piece of PVC—I'm glad to say it's black—which was made for us by a local manufacture. It is a three-core piece of cable, the middle core being twice the section of the other two, and this combined three core piece of PVC is what we are now using for service connection. The two outer half size cores are the earth-cum-neutrals to which I have made numerous references in the years gone by at this conference, and the middle one is the phase. The two outer wires are bonded together at each end and they support the phase wire, there being no insulators, because they are earth wires and not phases. The phase wire in the middle at each end hangs loose and is therefore not under any stress other than its own weight, which is supported by the web of the PVC and at the consumers' end this is carried in the conventional way into the service, and at the other end it goes into a pole mounted cutout.

Now one of the major advantages of this particular arrangement, apart from its reduced cost, is the high surge impedance it provides for transients arising from lightning, and things of that sort. In fact it has an impedance very comparable with that of underground cable, and one of the reasons that I believe Johannesburg Munipality have set their faces against overhead service connections, is the lack of this surge impedance. This system provides it in an overhead connection, and does so at a reduced cost. I will leave this sample on the table for anyone who wishes to have a look at it.

I would like, before sitting down, to express my appreciation to Mr. Wood for the enormous amount of work he has done in preparing this paper. It is always a great joy to have a paper given by a member of the staff of the host undertaking of the towns to which we come. It is always of particular interest, because we can see the reality while, at the same time, hearing what he has to say about it, and what he has to say has been most interesting however much some of us may have different views about it. Thank you Mr. Wood, very much indeed, and thank you Mr. President. (Applause).

LUNCHEON ADJOURNMENT

On Resuming:

THE PRESIDENT: The first item on this afternoon's programme concerns our Constitution. You will recall that at the Margate Convention last year, you had a copy of an amended Constitution before you. The Constitution has been reconsidered and suitably revised by your Executive, and has now been put into proper shape for adoption. I now formally move the following resolution:—

(a) That the Constitution of the Association, as adopted at the 31st Convention of the Association held at Margate, be amended so that the reading thereof will now be as in the Constitution annexed to these Proceedings;

(b) That the Constitution as annexed to these Proceedings be translated into Afrikaans by Mr. A. P. Burger, the Hon. Legal Adviser;

(c) That a copy of the English version of the Constitution as annexed to these Proceedings be signed by the President of the Association and by the Secretary/Treasurer and that the same be kept in safe custody by the Secretary/Treasurer and be the official version of the Constitution as adopted by the Convention at Margate and as now amended.

I now call upon Mr. van der Walt to give an explanation of the amendment before you finally accept this Resolution.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, gentlemen: you will remember, as the President has said,

that at the Margate Convention at the last moment, the Executive had to put before you a number of amendments and since then there have been further amendments which we thought advisable so as to clarify certain anomalies and misinterpretations. The amendment now proposed by the Executive Council to the Constitution as adopted in 1957 at Margate mainly apply to Section 7(2)(ii) where we give a better definition of members.

The next clause materially amended is Section 9(4) which deals with the fees payable.

Another section materially altered is Section 11. There we have provided for voting powers for our Honorary Members which we did not have in the Constitution adopted at Margate. Your Honorary Members now have voting power.

Section 12(5) is the next one amended since Margate. 12(5) provides for Sectional Voting.

Mr. R. W. KANE (Johannesburg): Mr. President, with your permission, I would suggest that the Convention accept the Constitution as it stands.

THE PRESIDENT: Gentlemen, may I take it then that this Resolution has been adopted. (Agreed).

What I intend to do now, gentlemen, is to dispose of the reports of the sub-committees and representatives, and after that continue with the Forum. I think we should have time this afternoon to have some more of the Forum as well.

I now call upon Mr. Fraser to give his report on the Safety Precautions Committee.

Mr. J. C. FRASER (Johannesburg): Mr. President, gentlemen: I understand all the delegates have received a copy of my report, and I will therefore not bore you by reading it. I would like to mention a few of the salient points.

The earthing of electrical installations and earth leakage circuit breakers. As I state, the Committee has felt that this problem is of national importance and it has invoked the assistance of the S.A.B.S. and the Council for Scientific and Industrial Research to carry out research programmes. We have not gone very far with this matter. We have handed the matter over to these two bodies, but so far we have had no answer to our queries.

I included here an extract of the Chief Inspector of Factories' (Machinery) letter to our committee and I felt it may be of value to our delegates—those who are in difficulty in knowing how to earth their poles. If they are in such difficulties it looks as if it is possible to approach the inspector in the area who may advise them as to how to do it.

Standard Wiring Regulations, Mr. President. As I state in my report, the committee is very concerned to know that some Municipalities are still using the Red Book as their standard, and have not, as yet, adopted the Blue Book as part of their bye-laws. A good deal of the Committee's time is spent in amending the regulations to keep them in line with modern practice, and for this and other reasons, the Committee considers that it is inadvisable for municipalities to divert from standard regulations.

In conveying my thanks to the Committee, I want to convey the Committee's good wishes to you, sir, in being appointed as President of the Association for the coming year, and to wish you all success in that office, and to thank your predecessor, Mr. van der Walt, for his very fine efforts during the last year.

Thank you. (Applause).

REPORT OF THE SAFETY PRECAUTIONS COMMITTEE

Mr. President, Gentlemen, I have pleasure in presenting a short summary on the work of the Safety Precautions Committee covering the period since the last Convention to March, 1958.

Electrical Operated Children's Toys.

Following the discussion which took place at the last Convention on the danger of children's toys being operated from low voltage domestic mains, the committee persuaded the S.A. Bureau of Standards to

issue a national warning through the medium of the Press. The Bureau also agreed to prepare a General Safety Specification controlling such apparatus for submission to the Minister for his approval.

Earthing of Electrical Installations and Earth Leakage Circuit Breakers.

The committee through the A.M.E.U. issued a questionnaire to a number of supply authorities and others in an endeavour to find the correct solution of this problem. The replies received show a wide diversity of view concerning a reliable form of earthing but a strong consensus of opinion considers that, if practicable undue cost should be avoided in rendering earthing effective.

The committee felt this problem of such national importance that it has invoked the assistance of the S.A. Bureau of Standards and the Council for Scientific and Industrial Research in carrying out research programmes more particularly in the direction of organising field testing by those supply authorities sufficiently equipped and skilled to participate in securing data as to the comparative results between different methods of protection and testing.

Electrical Equipment Specifications Co-ordinating Committee.

Members of the Committee have assisted the South African Bureau of Standards in revising the following specifications:—

(a) S.A.B.S. 151—1952. Water Heaters.

(b) S.A.B.S. 155—1956. Miniature Circuit Breakers.

(c) S.A.B.S. 150—1957. P.V.C. Cables.

(d) S.A.B.S. 168. Rubber Insulated Power Cables.

(e) S.A.B.S. 169. R.I. Telephone Cables.

(f) S.A.B.S. 97. Paper Insulated Cables.

It should be noted that S.A.B.S. 150—1957. P.V.C. Cables Specification covers multi-core armoured cables as well as single core cable. The specification is now available in roneoed form and is in force.

Earthing of Poles.

On enquiring into the question of Earthing Steel Distribution Poles it is of importance to quote for general information, an extract from a letter the committee received from the Chief Inspector of Machinery (Factories):—

> "The Department is fully aware of the advantages and disadvantages obtaining to the various systems of earthing as practised here and abroad and if any user failed to implement one or other systems of his own free choice the Departmental Inspector cannot be impeached for them prescribing a system which in his opinion offers the greatest safety for that particular distribution system and area."

Standard Wiring Regulations.

The committee has under consideration amending the wiring regulations applying to (a) number of socket outlets on a circuit (b) equipment in hazardous situations and (c) mineral insulated metal sheathed cable.

A number of queries on the interpretation of the Wiring Regulations have been received from Municipal Engineers and suitable replies thereto were made.

It is thirteen years ago since the South African Institute of Electrical Engineers published the First Edition of the Standard Wiring Regulations (known as the Red Book). Some 3,900 copies in English and Afrikaans were sold of this edition.

The Second Edition (known as the Blue Book) published in 1951, was amended in August, 1955, and to date some 23,000 copies in English and Afrikaans have been sold by the South African Institute of Electrical Engineers.

The committee is very concerned to know that some municipalities are still using the Red Book as their standard and many have not as yet adopted the Blue Book as part of their Bye-laws.

A good deal of the committees' time is spent in amending the Regulations to keep them in line with modern practices, for this, and other reasons, the committee

considers it inadvisable for municipalities to deviate from the Standard Regulations.

The Committee.

The bodies represented on the Safety Precautions Committee at present are:—

The Institution of Certificated Engineers, South Africa.

The South African Institute of Electrical Engineers.

The Electricity Supply Commission.

The Association of Municipal Electricity Undertakings of South Africa.

The South African Association of Consulting Engineers.

The South African Bureau of Standards.

The National Federation of Building Trade Employers of South Africa.

The committee is composed of sixteen Electrical Engineers holding important positions in the Electrical Industry, and, at times, they find it exceedingly difficult, owing to heavy business commitments, to devote the time required for this important work. It is hoped that this position will improve during the coming year.

To all members of the committee and the Secretary, Mr. Sinclair, I wish to extend my grateful thanks for their co-operation and support during the year. Thank you, Mr. President.

J. C. FRASER,
Representative

THE PRESIDENT: Thank you Mr. Fraser.

Are there any questions on Mr. Fraser's report?

Mr. GILES (East London): Mr. President, there are a number of municipalities in the Cape who are still operating on the Red Book, being the First Edition of the Standard Wiring Regulations, and I was wondering if some action could be taken to ascertain when it will be possible for the municipalities in the Cape to adopt the Blue Book or the Second Edition, to keep in line with the Electricity Supply Commission in the surrounding areas of the Cape, and also the rest of the country.

Mr. JACKSON (Provincial Administration) C.T.: Mr. Chairman, the Administration has under consideration promulgation of the Blue Book. As far as I know there are no obstacles to publication, excepting that of getting down to the job of promulgating a very considerable book of regulations.

Mr. J. C. DOWNEY (Springs): I am most interested to hear Mr. Jackson's remarks regarding the promulgation of these regulations. Some time ago I was the convenor of this particular committee, and we were requested to promulgate these regulations. I am most interested to hear that in the Cape they intend to promulgate. While we were considering the question of promulgation, we were informed, not only from the Provincial, but also the Government Legal Advisers that due to so many references we could not promulgate these regulations.

I would be most interested to hear how Mr. Jackson has overcome these difficulties.

Mr. J. L. K. POMPE VAN MEERDEVOORT (Harrismith): In the Free State the Municipalities are coming together to promulgate a number of different regulations, including building regulations, and the Blue Book is amongst them. I believe that a very large majority of the Free State municipalities are busy with this, and very shortly these will all have the Blue Book as standard regulations.

Mr. R. M. O. SIMPSON (Durban): Mr. President, we tried very hard in Natal to get the Provincial Authorities to promulgate the Blue Book as standard bye-laws for Natal, but they came up against the same legal difficulties of legislation by reference that had been found by the Transvaal Provincial Administration. In Durban we have therefore adopted The Blue Book as a Code of Practice. One of the primary functions of the Natal Branch will be to interest the other municipalities in Natal, who have not yet adopted the Blue Book, to follow on the same lines as we have done.

Mr. JACKSON (Provincial Administration, Cape Town): In reply to Mr. Downey of Springs, I believe that one of the legal difficulties which is encountered in other provinces is that of group promulgation. We do not have that particular difficulty in the Cape because we are empowered under the Electric Power Ordinance to promulgate standard regulations which may then be adopted by Local Authorities by reference.

In regard to the other apparent difficulty, namely that reference is made in the regulations to standards which have not been promulgated: This appears to be exactly the same condition as existed when the Red Book was promulgated, and whilst I am not a legal man, I don't quite see why there should be any legal difficulty in promulgating the Blue Book because it has clauses or references in it which are identical to those promulgated when the Red Book was promulgated.

In regard to using the regulations as a code of practice, in the Cape we prefer, if we can, to have bye-laws which may be enforced, rather than to operate on a code of practice.

Mr. J. DOWNEY (Springs): I am most interested to hear Mr. Jackson's explanation of this, but having been the representative of the local authority which was responsible for the promulgation of the Red Book, I think I should give some explanation of it.

The Red Book was promulgated with all sincerity and purpose, and it was only when we proposed to promulgate the new edition that we found that the Red Book was not sound in law.

The reason for this is that it refers to so many British Standard Specifications, and S.A.B.S. specifications, it was contended by the Government law advisers that unless all the specifications referred to were included in the promulgation, we would find that many cases taken to court would be ultra vires.

Thank you.

THE PRESIDENT: We seem to have been functioning very satisfactorily in the Cape on the Red Book, and when I hear this kind of discussion it makes me feel like saying "Let's carry on business as usual with the Red Book." In Cape Town, however, we would like to see the Blue Book promulgated. But how long after that book is promulgated will it take to have another book—maybe the Green Book? And so it will go on and there will be no end to it.

Mr. J. R. MITCHELL (Salisbury): Mr. President, as one of the gentlemen of the original committee that started the hare in regard to bye-laws by reference, I think you are living in a fool's paradise too. Your Red Book is ultra vires as well—never mind the Blue Book.

The whole point is this, that you can get away with it forever. You have the Red Book and you can have the Blue Book, until somebody takes you to Court, and then none of them is any good to you at all. That is the position. I haven't got the case in front of me, but it is Donges vs. something or other, which came up, I think, four or five years ago. That case, of course, is now common law, and that is the trouble. If the Administrator in the Cape is willing to substitute your Blue Book for your Red Book, there is nothing to stop him doing it, provided he is willing to do it. But, as I say, it is all right until you get caught.

Mr. W. H. MILTON (Escom): Mr. President, I had a talk to some people in the Provincial Administration, on this very point. The line of approach I took on that occasion was: "This means then, that whenever you promulgate a bye-law, or any regulations, they must be definitely intra vires" and they said, "Oh, no, we can't guarantee that until it is challenged in Court." So I said then, "How can you throw out something which you say is ultra vires until it has been proven in Court? Has this been proven?" As it has not been proven, I think you will find that this is probably one of the reasons why the Provincial Administration of the Cape will proceed with promulgation. They do not set up to be a Court to decide whether or not a bye-law which a municipality requires to have promulgated is good in law. They are not the legal advisers. Your legal advisers say that it is no good going

ahead, but your legal adviser is not the final authority—it is the judge in a court of law.

Mr. R. W. KANE (Johannesburg): Mr. President, I wanted to raise a similar point. Mr. Milton has actually put the point very well. There have been one or two people who say that the bye-laws are ultra-vires. I know of one very able legal man who states that the bye-laws are intra vires until they are really proven ultra vires. The interesting thing is that Mr. Downie referred to the Government legal advisers. The Radio Act in this country refers to British Standard Specifications without any reproduction of the complete standards. In other words they regulate by reference.

Mr. G. J. MULLER (Bloemfontein): Mr. President, I may say that we are, as has already been said, in the process of promulgation in the Free State, and I personally have discussed this matter of intra or ultra vires with the Provincial Authorities, pointing out that in the Transvaal there seems to be some doubt, in spite of which they have definitely decided to go on with the promulgation. They are apparently therefore satisfied that they are on good ground.

Mr. C. LOMBARD (Germiston): Mr. President, gentlemen: I think Mr. Kane, and some of the other Reef engineers here will bear me out when I mention this other point, and that is that one legal opinion we had was that whilst the Wiring Regulations were prepared by a body of engineers and not by legal men, and consequently if they were adopted as bye-laws, the legal people will have a very nice picnic. I think that at that time the opinion was that it was much safer to adopt them as a code of practice.

Mr. J. C. FRASER (Johannesburg): Mr. President, I was very pleased indeed to hear Mr. Jackson's remarks, and I would suggest that the other Provinces ask Mr. Jackson how to get over the difficulties, because he doesn't seem to have any difficulty at all.

With regard to Cape Town, I am very sorry to hear that you are still working on the Red Book. I would like all the delegates to appreciate that this so-called Safety Precautions Committee is a voluntary body who does its best to try and keep the Wiring Regulations up to standard, and one very important point about it is that all Wiremen throughout the Union are being examined on the Blue Book and not the Red Book. It might be very difficult for some of your local contractors to pass the examination questions.

In regard to Rhodesia, it may interest our members to know that the Federation of Rhodesia has written to the Safety Precautions Committee asking them whether they can use our Blue Book to their own requirements in Rhodesia and the Federation.

THE PRESIDENT: Thank you Mr. Fraser.

I think we will carry on now with the next report. The S.A.B.S.

Mr. J. C. DOWNEY (Springs): Mr. President, the report, I understand, has been tabled and I do not propose to prolong the proceedings by reading out the report, except to draw your attention to the matters in regard to Electric Storage Water Heaters and the Report on PVC Cables.

I must draw you attention to this question of water heaters, as it appeared to me at any rate that it has been generally assumed that specifications will cover a multitude of sins. I would commend members to read the report very carefully and take note and refer this matter to their water engineers in regard to various types of waters.

Then the other matter of PVC insulated cables. Your attention is drawn to one point I should like to make clear. That is, the omission in the new specification on new PVC cables to the marking of the cables. Apparently something went awry, and the marking, according to the specification, only need to be placed on the drum itself. Many of us consider that is inadequate, because immediately the cable has been removed from the drum, there is no indication whether it complies with the specification or not.

The report has been tabled and I am willing to answer any questions, but I

think Mr. du Toit is also here and may wish to elaborate on my comments.

Mr. C. W. H. DU TOIT (Bureau of Standards): Mr. President gentlemen: before I make any further comments on Mr. Downey's report, I would like to take this opportunity on behalf of the Bureau of Standards of thanking your representative, Mr. Jack Downey, for his co-operation during the past year on the Bureau Committees. The co-operation of the A.M.E.U. is very much appreciated on those committees, because they represent a very large body of knowledgeable consumers, who assist us in keeping our specifications on the right lines.

Coming to PVC which seems to have caused a little doubt in Mr. Downey's mind, there is the question of marking, and I do believe that the specification was intended to include a clause that all cables should be marked in some way or another, except that for multi-core cables it would be a little difficult. I will look into the matter in detail, and can report that we are having another meeting of the Committee on 29th April to sort out not only that particular point, but also one or two others which have arisen as regards the quality of the plastic used on the cables themselves.

If there are any other questions, we will try to answer them.

REPORT OF THE TECHNICAL COMMITTEE OF THE SOUTH AFRICAN BUREAU OF STANDARDS

Mr. President and Gentlemen, I have much President and Gentlemen, I have much pleasure in submitting the report on the South African Bureau of Standard's activities during the past year, and particular attention is drawn to the remarks indicated by °°° in the report on Electric Storage Water Heaters and the report on P.V.C. Insulated Cables.

S.A.B.S. 555—Overhead Service Line Connector Boxes:

1st Meeting, 27th August, 1957.

Sent out for comment. Return Date: 28th February, 1958.

Revision of S.A.B.S. 151-1952 — Electric Storage Water Heaters:

1st Meeting, 19th February, 1957.

2nd Meeting, 6th August, 1957.

Final meeting, 18th February, 1958.

The revision of the specification for water heaters was undertaken with three objectives in view.

(1) As separate specifications for immersion heaters and for thermostats have now been published, it was desirable to refer to these two specifications in S.A.B.S. 151 and thus delete requirements and tests relating only to thermostats and immersion heaters from the specification for water heaters; this has been done.

(2) Owing to the fact that South African manufacturers are to an increasing extent supplying water heaters to Rhodesia (where compliance with the B.S.I. specification for water heaters is specified) an attempt was made to bring the Bureau's specification more in line with the British one. Here a measure of success was achieved by specifying a minimum test pressure, for C.F.D. water heaters, of 50 lbs. per square inch, the provision of a drain cock on all water heaters, a non-return valve for free-outlet water heaters, and incorporating requirements for heaters having rectangular containers, and other minor changes.

°°° (3) An attempt was also made to deal as far as possible with the problems encountered with water heaters used in areas where the water is either very hard or prone to cause dezincification. During the past few years the Bureau and latterly the Corrosion Unit of the C.S.I.R. have investigated this ploblem and much have investigated this problem and much preliminary work has been done. In the revised specification for water heaters, requirements are laid down for the brazing material to be used in the construction of the inner container and for the cistern of cistern type water heaters. In addition, an appendix has been added containing recommendations

to manufacturers producing water heaters to be used in areas where very hard or dezincifying waters are encountered.

It must be stressed, however, that the standard type water heater is not designed for operation in very corrosive or dezincifying waters. Consumers who have such active waters to contend with should consult with the supplier and bear in mind the recommendations of the appendix of the specification S.A.B.S. 151.

S.A.B.S. 150—P.V.C. Insulated Cables:

The revision of S.A.B.S. 150—P.V.C. Insulated Cables was completed and approved by the Standards Council during 1957. The revised specification covers the multicored types of armoured cable, which is now being widely used.

Recent investigations in this country as well as overseas has shown that a more satisfactory ageing test is necessary. The Bureau is now completing interesting tests in this connection, and hopes to have more satisfactory ageing tests in the near future. For this reason the printing of the Specification has been delayed.

*** There is an important aspect of P.V.C. cables which should be brought to the attention of all concerned. The present specification for P.V.C. cables does not specifically cover cables for use in situations where they are exposed to the sun. P.V.C. is known to age rapidly under these circumstances although careful selection of the constituents of the P.V.C. can improve matters tremendously.

The Bureau is unable to include tests to cover this aspect at present, as there is no proven test available even in overseas specifications. However, they are working on this problem and should be able to include a test in the near future.

There is no direct recommendation at present, therefore, apart from the suggestion that when consumers wish to use P.V.C. exposed to the sun they should consult with the manufacturer, as regards the stability of his compound. Particular attention should be paid to the stabiliser; where among others, basic lead diphosphite is good, the plasticiser and antioxidant and most important of all the colouring agent. Black always gives better service than others and red is very poor.

S.A.B.S. 97—Paper Insulated Cables:

The revision of S.A.B.S. 97—Paper Insulted Cables for General Purposes—was started during 1957 and the revised draft sent out for comment during January, 1958. The closing date for comment was 31st March, 1958. The revision has therefore still to be finalised.

Code of Practice—Cables:

The preparation of a Code of Practice for the storage, handling and installation of cables was initiated, and at present various sub-committees are engaged in the preparation of the different charpters of the code.

Committee Work of Electrical Engineering Section during 1957:

S.A.B.S. 2—Storage Batteries:

The revision of this specification was approved by the S.A.B.S. Council in August, 1957. The main amendments to the original included the following:—

(a) Three duty classes of battery are now covered by the specification, as compared to one originally.

(b) Capacity test at 20 hour rate now complies with I.E.C. recommendations.

(c) High rate discharge tests have been made more comprehensive.

(d) An overcharge life test based on S.A.E. tests has been included to stimulate actual life conditions.

(e) Life cycle tests now comply with I.E.C. recommendations.

(f) All chemical tests of components have been deleted.

(g) Recommended battery sign for standardisation purposes have been included.

The revised S.A.B.S. 2 will be available in its final printed form shortly.

S.A.B.S. 165—Lampholders:

This specification had been held on the recommendation of the committee responsible, pending finality by the International Electrotechnical Committee of their document 61 dealing with lampholders. The final draft was received last year and at a committee meeting held in October, 1957, the S.A.B.S. draft specification was amended to include these I.E.C. recommendations.

The S.A.B.S. specification No. 165 is now being prepared for approval by Council and thereafter publication.

S.A.B.S. Safety Specification SV 110 for Electric Pads and Blankets:

No committee meetings were held during the year, but extensive research into maximum safe temperature settings for thermostats has been undertaken by the Bureau, and it is hoped to convene a meeting of the committee shortly.

S.A.B.S. Safety Specification SV 122 for Domestic Radio and Electronic Apparatus.

This has been held pending finality of I.E.C. recommendation 65 received recently, and it has not been possible to convene a committee meeting until now. It is hoped that a meeting of the committee responsible will be arranged soon.

S.A.B.S. 516—Motor Cycle and Scooter Batteries:

At the request of the Union Tender Board, preliminary investigations for a Motor Cycle Battery Specification were put in hand. A draft specification has been prepared and the first committee meeting has been held.

It is of interest that this is the first specification dealing with these known to the Bureau.

S.A.B.S. 515—Induction Motors:

A committee has been approved by Council and the preliminary work required for the drafting of a specification is well in hand.

Vocabulary and Definitions of Illumination Terminology:

The South African National Committee on Illumination has compiled the Vocabulary and Definitions of Illumination Terminology, which has been handed to the Bureau and printed copies of the above will be published shortly by the S.A.B.S.

S.A.B.S. 171—Domestic Type Lightning Arrestors:

Three meetings of the Committee were held during 1957, in March, April and November, and the final specification is now ready for approval by the Council.

It is anticipated that the specification will be printed and be available for sale shortly.

Transformers and Bushings:

Work in now in progress on these specifications, and it is hoped to convene the first committee meeting very shortly.

Standardisation has been the main consideration in preparing the drafts and when finalised, these two specifications will benefit both the local manufacturer and the consumer.

Thank you very much indeed, Mr. President.

J. C. DOWNEY,
A.M.E.U. Representative.

THE PRESIDENT: There is the question of promulgating the Safety Specifications, gentlemen. I think Mr. Downey would like to say a few words on that.

Mr. J. DOWNEY (Springs): Mr. President, gentlemen: This matter has been considered by the committee and reported back to your Executive for consideration, and it is suggested that we urge the promulgation of the safety specifications without delay, and to introduce a safety repair label system. This matter will be referred to the Bureau of Standards for their consideration. As you know this matter has been on the cards now for a number of years and we still feel that the time has arrived when some minimum

standard of quality should be introduced. The unsuspecting public get caught up in a cheap commodity which is "that's good enough" attitude which we feel is not quite serving the purpose. We feel that if the safety codes were introduced this would eliminate most of the trouble. It would be the onus of the manufacturers and suppliers to see that that minimum standard is adhered to. I think it would be of benefit to the whole country.

THE PRESIDENT: Thank you Mr. Downey.

Would Mr. du Toit like to say something about that?

Mr. C. W. H. DU TOIT (S.A.B.S.): Mr. President, the position in connection with the safety specifications has been rather difficult. A complete stalemate has been reached with respect to the financing of the scheme, due mainly to inability on the Bureau's part to get a ministerial decision about promulgation. Now it seems to me that Mr. Downey's suggestion that we try to persuade the Minister to promulgate these regulations and rely on the assistance of members of the A.M.E.U. and other interested bodies in applying them in the worst cases, will be a better solution than we have had previously, and we might have more success with the Minister.

Mr. Chairman, all I can say at this stage is that we will take it up, as suggested by Mr. Downey, and we hope to bring you a much better report at the next convention.

THE PRESIDENT: Thank you Mr. du Toit.

Any further questions? I think Mr. van der Walt has something to say on the Code of Practice in Sub-Stations.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, my friend Mr. Downey earlier today said that anything could happen on the West Rand, even post getting lost, but as far as I know no meeting was held. There is nothing further to report. Thank you.

THE PRESIDENT: The Recommendations Committee for New Electrical Commodities. I think Mr. Downey disposed of that in his previous remarks.

Mr. J. DOWNEY (Springs): Mr. President, one meeting of the above committee was held during the year, under review, and the recommendations circularised to members. A number of matters are still pending and will be receiving the attention of this Committee immediately the test reports are received from the S.A.B.S. I don't think there is anything else to report. The matters under consideration will be of vital interest to this Association.

THE PRESIDENT: Any questions, gentlemen? If not, the next report is on Technical Staff and Manpower.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, gentlemen: you have the report, it has been circulated. If I may just summarise it. Your sub-committee has found a shortage of 8·9% of journeymen according to returns submitted some two years ago. The only disturbing thing we do find is that you have only 1 apprentice per 4·2 journeymen which we think is not sufficient, and we would like to see that figure increased to a value of say 1 for every 3, or even every 2, journeymen. I think Mr. Sibson would like to say something about that at a later stage.

We have made various recommendations according to the report. I don't think I need enlarge on that, but I do want to repeat the last recommendation made by your sub-committee, and that is that these recommendations, as tabulated, be forwarded to the University authorities, technical college authorities, Department of Education, Arts and Science, and the Department of Labour.

I suggest at this stage that the activities of this sub-committee now be wound up, with this proviso, that a sub-committee can be formed at any stage if considered necessary.

Thank you.

REPORT OF TECHNICAL STAFF AND MAN POWER SUB-COMMITTEE

It is the opinion of this sub-committee that it has served its purpose since its establishment in Pretoria in May 1955.

The sub-committee dealt with the problem under two distinct headings and to finalise its work, a resumé will be given of its findings and recommendations:

A. *Training of Artisans for Future Requirements.*

(1) There is no national shortage of artisans in the Municipal Electricity Supply Industry. (8·9%).

(2) It appears however, that Municipal Electricity Undertakings are training too few apprentices, (1 apprentice to each 4·2 journeymen) and depend on other industries to train more apprentices.

(3) The right type of youngster is not coming forward to be trained as an artisan.

B. *Recommendations re Apprentices.*

(1) A substantial increase in starting wages for apprentices to make the career more attractive.

(2) Raising the status of the trade by more guidance and publicity at an earlier age at school.

(3) Classification of trades into major and minor trades. Major trades to attend school five years with qualifying examinations — practical and technical. Minor trades—two years school attendance with no qualifying technical examination. Qualifying trade test to apply.

(4) Supervised correspondence courses for country districts.

(5) A bonus scheme for technical qualifications.

(6) Apprenticeship training and conditions must be continuously under review in order that timely changes may be made to meet the ever changing conditions.

(7) That a probationary period of 12 months be introduced into the Apprenticeship Act to enable employers to make recommendations to the controlling authorities, re classification into technician trainees, major trade apprentices or operator trainees, which they will be capable of learning.

(8) The Departments of Education, Arts and Science and Labour be informed of these recommendations and be requested to investigate the advisability of having the training and education of apprentices placed under the control of one department alone, preferably the Department of Education, Arts and Science.

C. *Technical Trainees and/or Pupil Engineers.*

(1) The sub-committee feels that the system of training technicians as inaugurated by the Department of Education, Arts and Science as from 1958, should do much to alleviate the shortage in the future.

(2) It cannot be too strongly recommended to member organisations to encourage promising apprentices to avail themselves of this opportunity. Employers should assist by giving the time off on full pay and paying the tuition fees. Under this system the apprentices attend Technical College continuously for 4 months in the year for a period of 4 years and obtain qualifying diplomas.

Technical Colleges of all the large centres have been approached to inaugurate these classes.

Facilities exist at Witwatersrand. Pretoria and Cape Town Technical Colleges are considering the establishment of these facilities.

(3) The University and Technicial College authorities should come to an agreement whereby these technicians after obtaining their final diplomas could study for their B.Sc. (Engineering) degrees on a part time basis, either through the University or the Technical Colleges which should now become Schools of Technology and be separated from Technical Colleges as they are known today.

(4) Industries (including A. M. E. U. members) should co-operate financially and otherwise (e.g. staff) to make the above recommendation possible.

(5) These recommendations be forwarded to the University authorities, Technical College authorities and the Departments of Education, Arts and Science and Labour.

J. L. VAN DER WALT,
Convenor.

THE PRESIDENT: Thank you Mr. van der Walt. Any further remarks gentlemen?

Mr. H. T. ASPINALL (Witwatersrand Technical College, Johannesburg): Mr. President and gentlemen: I would like to take this opportunity of saying a few words in regard to the sandwich courses which have now been introduced at the Witwatersrand Technical College and are sponsored by the Department of Education, Arts and Science. The courses represent a revolutionary step in technical education in this country in that we now have post-matriculation full-time technical training at technical colleges.

I do not wish to take up too much time, but would like to describe the sandwich scheme in brief outline.

As you are aware, the course involves four months' full-time attendance at a technical college plus four months' one-day per week attendance at classes with laboratory work on two evenings per week. The first two years of the four-year course are devoted to the fundamentals of such subjects as Mathematics, Physics, Chemistry and, in addition, courses in Drawing, Workshop Technology, etc. At the end of the two-year course the successful candidate obtains a Technician Grade 2 Certificate. Specialisation is introduced in the third year so that technicians can qualify in such categories as design, production, mine electrical, distribution and power station technician. The standard of the corresponding examination will be broader than that for the existing National Engineering Diploma.

I have described briefly the technician aspect of the sandwich course. We have, however, provided an avenue for the ambitious and outstanding apprentice who wishes to reach professional status equivalent to that of the overseas chartered electrical engineer. The final examination at the end of the fourth year would be of similar standard to that of the overseas engineering institutions. I would mention, incidentally, that a good proportion of engineers in Britain received their training at technical colleges and attained professional status through the medium of the London Institution of Electrical Engineers, for example.

One of the good features of the technicians' courses is its flexibility. An employer may be satisfied with the training of his apprentice as a technician following the termination of the second or third year course. If the apprentice proves to have outstanding ability, the employer may agree to the student proceeding to the final year of study.

There is a strong possibility that the examinations for the grades of Technician Grade 2 and Grade 1 will be accepted by the London Institution for exemption from Parts I. and II. of the Institution Examinations. In passing, it may be mentioned that the electrical engineering laboratories of the Witwatersrand Technical College have been approved by the Institution of Electrical Engineers. Some difficulty will be experienced in the case of exemption from Part III.; well established colleges in Britain have not received this exemption. Any exemption would apply to the student who wishes to proceed beyond the technician stage to professional status.

The minimum technical qualification for entrance to the technicians' course in N.T.C. 2 which is of rather a low standard but the great majority of our first students are matriculants.

It was originally intended that a youth must serve the first year of his apprenticeship prior to admission to the course. This procedure has now been abandoned and matriculants direct from high school are accepted. Students in possession of the A.T.C. or A.T.C. II. Certificate are also admitted to the course.

It is of interest to note that of the 44 students who began their studies in February of this year, a good proportion are employed by the mines in the Transvaal and the Orange Free State. Some of the students are employed by municipalities and private firms. A number of employers are able to attract boys of good education wishing to serve an apprenticeship through releasing apprentices to attend technicians' courses. Generally, the employer pays the fee of £40 per annum.

Some years ago sandwich courses were adopted by such firms as Metropolitan-Vickers Ltd. and the British Thomson Houston Company and have proved extremely successful overseas. We are of the opinion that, judging from the type of boy selected for our technicians' course, the final product will be comparable with that anywhere in the world.

In conclusion, I would like to mention that technical colleges, generally, are extremely keen to arrange B.Sc. Engineering degree part-time courses to meet the requirements of students who have served their apprenticeship and have passed the Matriculation and National Engineering Diploma Examinations. Members must be aware of the opposition to the scheme by universities. At the present time, a commission is investigating training for degrees.

We, at the technical colleges, do hope that these young men, journeymen, be allowed to study for the B.Sc. Eng. degree and prove, in every sense, creditable to this country.

(Applause).

THE PRESIDENT: Thank you Mr. Aspinall.

Mr. A. R. SIBSON (Bulawayo): Mr. President, I have a few comments to make on this report which I did in fact make to the convenor but just too late to be included in the proceedings of this Convention.

In taking account of the various factors, such as increase in the size of undertakings and inevitable wastage in artisans and apprentices, I consider that the proper ratio of apprentice to artisan should be of the order of 1:3.

I, myself, am not satisfied that increasing salaries will necessarily produce what is described as "the right kind of youngster." For my part, I think that apprentices are already overpaid and that a considerable amount of damage is done by their possession of excessive financial resources. This is perhaps a national problem, because not only municipal apprentices are concerned, and perhaps the matter could be given consideration by all apprenticeship committees.

Anyhow, if the employers or undertakings are in a position to pay more money to their apprentices, I suggest that there are many other ways in which that money could be spent, with advantage to the apprentices, because except in the case of some of the larger undertakings, I think that the arrangements made for the training of apprentices may leave quite a bit to be desired.

In connection with technical college training, other speakers at previous meetings of this convention have referred to the fact that so many of the apprentices not only waste their own time but everybody else's by going to technical colleges under duress, and I am inclined to the view that we should consider making compulsory technical education applicable only for the first year or two of an apprentice's training, and that his subsequent attendance at technical college be regarded as a privilege which he would have to earn by success in his early years, and in the absence of that success he should not be compelled to attend but rather prohibited from attending technical colleges.

Mr. Aspinall has just told us something about the new courses that have been developed in the Witwatersrand, and, I think, perhaps by other technical colleges in the Union, and although these have not yet been given a fair trial, having only just started, it does seem to me that there is a tendency for these courses to fall between two stools.

It seems that if intended, as according to their title, to be technician courses, they go too far, and if intended, as some of the substance of them would suggest, to be technological courses, they don't go far enough, or not quite far enough.

In the Federation we have adopted certain standards of progressional status and, broadly speaking, what is required there is either a B.Sc. Degree in Engineering, plus suitable subsequent experience, or corporate membership of one of the chartered institutions, and we do from time to time suffer from embarrassment as a result of applications received from what is, after all, one of our principal reservoirs of labour, the Union of South

Africa. Men that we may know to be well-equipped technically, but who do not comply with either of those requirements have to be turned down, and it does seem to me that it would be a pity if you went to a lot of trouble to develop the resources of your technical colleges and yet failed to make use of them to the extent that they can, in fact, enable an engineer to obtain his full professional status in any one of the chartered institutions.

Mr. Aspinall has indicated that there is a likelihood of their courses being accepted by the I.E.E. in respect of Joint Part 1 and Part 2. This, as he knows, is not sufficient unless he gets acceptance for Part 3 as well. I do suggest that this be urged and achieved before you relax your efforts in regard to technical education.

As far as the courses that have been laid down are concerned, if they are, as I said earlier on, aimed at developing a technician, then perhaps they might be reduced a little in the degree to which they aim, because otherwise I am sure you are going to have a lot of fellows who succeed in such courses, but who are not acceptable as professional engineers, and who are going to become rather disgruntled men in the future.

Gentlemen in regard to these courses that have been laid on by the Department of Education, I wonder whether the Department has circularised all the employers. For instance, the Cape Town City Council. I am not aware of these technician courses having been brought to the notice of the Cape Town City Council. It would be better, as far as I am concerned, for the approach to come from the Department of Education rather than from me, and I wondered whether the Department had circularised employers.

THE PRESIDENT: I think Mr. van der Walt can say something about that.

Mr. J. L. VAN DER WALT: Mr. President, as you will see in my report it is the Witwatersrand Technical College that has these courses available. The Cape Town and Pretoria colleges are still considering it, and are still getting their machinery in order, and I presume as soon as that is in order you will be circularised. I am of the opinion that all the Municipalities in the Transvaal have been circularised that these courses are available. I know in my own home town we have received such a notification. If you so wish, Mr. Chairman, we could ask the Department of Education, Arts and Science, if courses are available at certain centres, to notify all local authorities in that area so that they may make use of them.

THE PRESIDENT: Thank you Mr. van der Walt.

That disposes of the Report on Technical Staff and Manpower.

Mr. G. J. MULLER (Bloemfontein): Mr. President, I would like to support much of what Mr. Sibson has said. His idea of precluding students who cannot pass in the first two years is quite a novel thought. There is however another angle in the same direction that I have been trying to propogate for some years, and that is that future artisans should branch off on to technical education say from Standard VI and reach N.T.C. 1 before they are engaged by anybody. In other words if the Government can pay for their education for general schooling, it can also pay for the education of the artisans, and it should therefore not be a burden any more than it is a burden on parents to educate them at day school.

The idea would then be that these people would not be eligible to apply for an apprenticeship until they had achieved, say, N.T.C. 1 just for the sake of argument, but at least a technical standard which can be fixed, after which all technical education should be optional and whether they get a refund may be at the discretion of their employers.

Thank you Mr. President.

Mr. H. T. ASPINALL (Witwatersrand Technical College, Johannesburg): I feel sure that everybody present found Mr. Sibson's remarks of great interest.

In the first place, I would mention that the standard of the third year technician grade is very high—generally in line with the Higher National Certificate overseas. The course is broad in structure and involves laboratory work associated with

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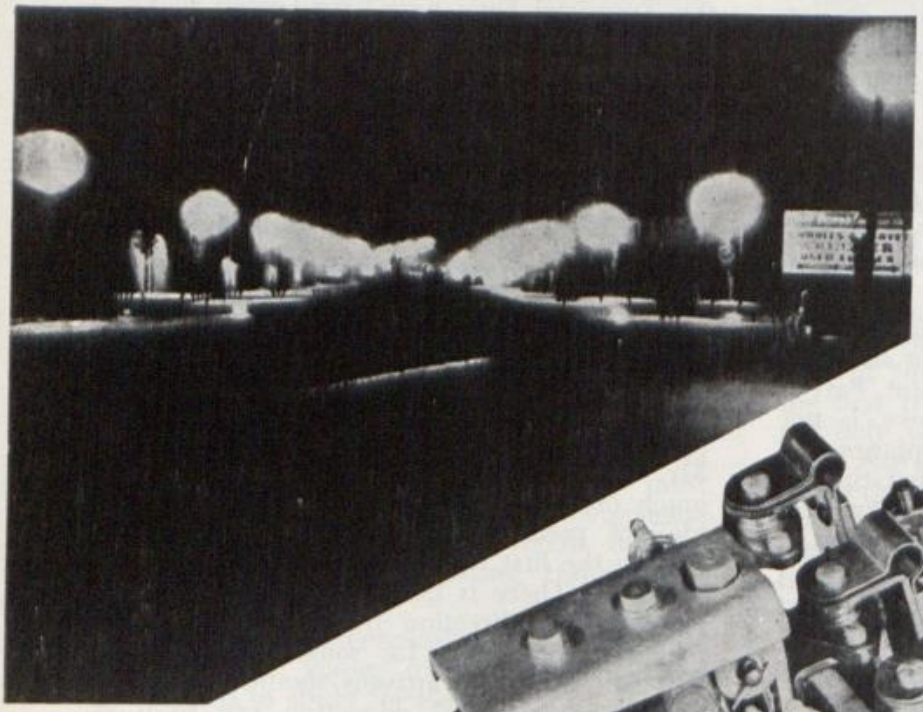

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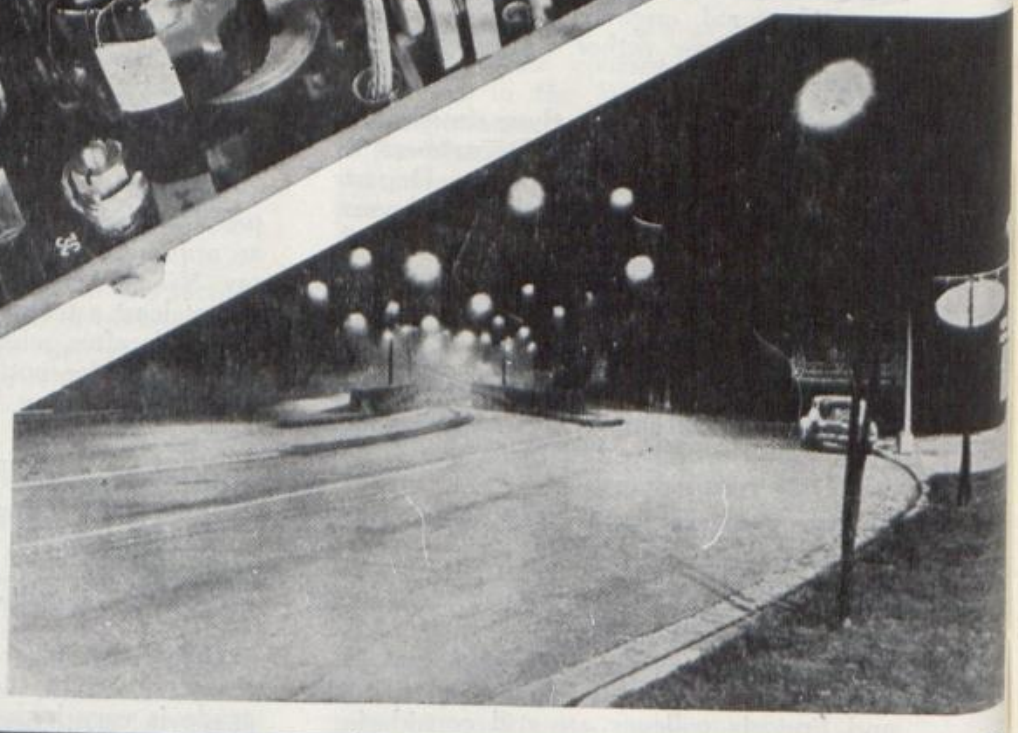

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physics, chemistry, electrical and mechanical engineering subjects, assessment of marks for classwork, etc. During the third year, guest lecturers will be invited from mines, municipalities, private firms, etc. to lecture on specialised aspects of electrical engineering. Every effort will be made to ensure the high standard of the technician; no good purpose would be served in the adoption of a mediocre standard in any system of technical training.

In regard to the fourth-year course, I did mention that the London Institution of Electrical Engineers might give exemption from Part III. of the Institution. We are not greatly concerned for if this does not prove to be the case, we should be able to enter the students for an examination evolved in this country, of the same standard possibly with overseas moderators. Alternatively, we might be allowed to adopt the overseas Institution examinations; this has been the practice for many years in conjunction with our evening courses for the various overseas engineering institutions.

It is very encouraging to have the sympathy and interest of such eminent electrical engineers as Mr. Sibson and others; this is vital to us in our efforts to raise the standard of technical training in this country.

Mr. P. A. GILES (East London): Although I agree substantially with what Mr. Sibson has said, in the course of his remarks he said that he felt the apprentices were being paid too high a salary. This question was discussed very carefully with the committee on Technical Staff and Manpower, and although, at the moment, there is not a shortage of apprentices, we have come to the conclusion that "the right type of youngster" is not coming forward, and one of the recommendations is that a substantial increase in starting wages for apprentices, to make the career more attractive, be put in hand. We have to remember that in this country today, the reservoir of young men who are willing to become apprentices is not increasing at the rate at which the electricity undertakings are expanding, and I feel that if the starting wage is made so low that the ordinary boy is unable to support himself at the outset of his career, and to make all the necessary arrangements for his technical training, and leave himself with no money whatsoever for enjoyment, because all young boys like a bit of enjoyment, suitable applicants will not be forthcoming.

I don't want to belabour the subject, but those particular remarks of Mr. Sibson were in direct contradiction to the recommendations of the Technical Staff and Manpower committee.

THE PRESIDENT: Thank you, Mr. Giles.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, I wonder if Mr. Sibson realises that it is only the starting salaries that we recommend should be increased, not the final salaries. I think we are satisfied with the final salaries in the fourth and fifth years. The idea is to make the career at the start more attractive.

Mr. A. R. SIBSON (Bulawayo): Mr. President, I see that the recommendation is a substantial increase in starting wages. I think I assumed that a general rise all round was implied and that was what I was referring to. Now I am not personally aware of what the starting salaries in the Union are, but I am quite sure that the salaries we are paying apprentices in the Federation are more than they are usually fit to spend. The average apprentice seems to regard the acquisition at the earliest possible moment of a motor cycle as the be all and end all of his employment.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, just to give Mr. Sibson an idea of the salaries, they are very low. I think the starting apprentice starts at two pounds, odd shillings a week.

THE PRESIDENT: I think we have had a pretty full discussion on this subject. It has been suggested that the recommendations of the sub-committee on Technical Staff and Manpower be forwarded to the Department of Education, Arts and Science, and I take it that you are in

agreement with this. That is, the recommendations contained in sections (b) and (c) of Mr. van der Walt's report, and all the other departments that have been referred to in this report. Are you in agreement that this be done?

(Agreed).

There is one more item under this heading, and that is "Rights of Supply, Industrial Consumers." Perhaps Mr. Lombard might like to say something here.

Mr. C. LOMBARD (Germiston): Mr. President, gentlemen: I have pleasure in presenting the report of the Rights of Supply Sub-Committee. The report is in front of you and all that I wish to add is that a sub-committee has been appointed by the Executive to interview the Electricity Supply Commission on this matter at the earliest opportunity.

Thank you Mr. President.

REPORT OF RIGHTS OF SUB-COMMITTEE

Since the Sub-Committee's last report no further progress has been made in connection with this matter.

It will be recalled that your Association has submitted a Memorandum on this subject to the Electricity Control Board and that the Transvaal Municipal Association supported the representations made to the Board in this Memorandum.

At the request of the Electricity Control Board, certain additional information was submitted to it by your Association and various local authorities.

The Chairman of the Electricity Control Board has now advised your Association that, after giving careful consideration to the Memorandum and other information submitted, the Board has come to the conclusion that the nature of the problem is such, that it can only deal with the matter on instructions from a higher authority and suggests that if your Association should wish to proceed with the matter, any representations which it may wish to make, be submitted direct to the Honorary the Minister of Economic Affairs.

This matter is now under consideration by your Executive Council.

C. LOMBARD,
Convenor.

THE PRESIDENT: Thank you Mr. Lombard.

Well gentlemen, that disposes of the reports of sub-committees and representatives. I suggest now that we continue with the discussion on Mr. Wood's paper. I understand there are several other people who would like to contribute to the discussion.

Mr. J. C. DOWNEY (Springs): Mr. President, I wish to congratulate and thank the author for his most interesting and valuable paper. I am most interested in his terminal pole without stay wires, and the question of mid-block construction is most interesting. We in Springs, on many occasions, have considered this method of construction, but have refrained from taking the plunge on account of the possibility of running into trouble with the owners of stands, and the question of easy access, especially when such access would be required during the early hours, or the hours of darkness.

Perhaps the author would elaborate on any of the difficulties he may have encountered in this respect.

Street Lighting. I welcome Mr. Wood's suggestion, and feel that he has stolen most of my thunder by providing a system which can be so easily developed for good street lighting purposes.

This matter in the past has been very considerably neglected, and Mr. Wood's suggestion provides a very encouraging and enlightening means of giving good street lighting at the minimum cost. An additional advantage is the elimination of damage to distribution poles and interruption of supplies which are encountered when the mains are placed in main thoroughfares.

One cannot stress the importance of correctly positioning poles in regard to street lighting, and Mr. Wood's suggestion gives a positive means of providing efficient and adequate street lighting, a matter which has not received the fullest consideration it deserves in this country.

I have had the pleasure of seeing quite a lot of Mr. Wood during the past two weeks. Perhaps he would explain how he would tackle Signal Hill. For incandescent filament lamps, voltage regulation is a very important matter, but what can the poor bulk consumer do when he is initially tied to a + or − 7½%?

In conclusion, I should like to congratulate Mr. Wood on his most enlightening and refreshing paper, which I am sure will go down as a fine contribution to a balanced distribution system, with well designed street lighting, in the records of the A.M.E.U.

Thank you Mr. President.

(Applause).

Mr. P. A. GILES (East London): I wish to congratulate the author on an exceptionally well thought out paper which stresses the background and the basis for planning an economic distribution system for domestic circuits. A considerable amount of detail work has ben done to evaluate the requirements of a scheme which is satisfactory by technical and financial considerations, as well as capacity for growth of load, and the detail included in the paper is valuable for comparison with other schemes.

Perhaps the author could indicate how his preference arose for open overhead line circuits, each fed by a radial feeders from the sub-station in comparison with complete closed ring circuits for each substation, where all the copper erected is available to assist in regulating the voltage within close limits on the low voltage overhead line circuits.

The savings in capital expenditure for mid-block construction are appreciated, and the method has been tried in East London, but the difficulties of entry along boundary lines for maintenance has proved a deterrent to the idea and it has been necessary in projected townships, where it is clear that mid-block construction will show a saving, to arrange for cable and overhead line right-of-way to permit the passage of the mains, and the facilities for maintenance, as indicated by Mr. Mitchell and Mr. Sibson as being standard Rhodesian practice.

This procedure requires very early planning and co-operation with the authorities responsible for town planning arrangements.

In regard to East London, the supply to domestic consumers is single phase from three phase lines, and the degree of out of balance is averaged at 20%. An allowance of 25% is made on all feeder cables to compensate for this characteristic of the load. The radius of supply averages 300 yards, which compares very closely with the figures worked out in the paper.

It has been found out that once a township has been fully developed the need for balancing the load on the lines arises on an average once per annum, when conconsumers are changed from the heavily loaded phases to the lightly loaded phases. This is probably because the consumers in any particular area become fixed in their habits and use electricity at regular times during the day, thus creating maximum demands which can be balanced at peak loads with a fair degree of accuracy. Generally speaking, it seems to me that mid-block construction will only be economic if the township layout permits straight runs and allowances for straight crossovers of the streets. Where the township is laid out in hilly country, as is the case in East London, the steep and reverse contour results in the plots being offset with respect to each other, and this nonsymmetrical layout prevents straight runs down the mid-block at the rear of the property, and the construction costs increase. It would appear, therefore, to us Mr. Chairman, that from practical considerations, mid-block construction can only be applied to symmetrical layouts and if unsymmetrical layouts and town planning are encountered, the advantages are nullified by the disadvantages.

Thank you Mr. Chairman.

Mr. W. H. MILTON (ESCOM, Johannesburg): Mr. President, gentlemen: there are a number of points that were of particular interest to me in the paper, and some features which I feel should be taken into account very carefully.

You'll excuse me if I deal with these items in a higgledy-piggledy fashion, but it is as they appeared to me from the paper.

First was the question of galvanising, where the author mentions an amount of £4 per pole for that purpose, and draws the conclusion that it provides a saving on regular painting.

You must get money very cheaply in Cape Town! Because in my calculations, £4 in capital results in a higher charge on electrical finances than 5/10d. per annum, or reduced to 2/9d., which were figures he had already mentioned.

The second point arising is the often misleading results obtained when we follow data which has been collected from overseas practice, and among this data are those figures of loading per acre and coincidence factors. I have often expressed the view that, if the householder in Great Britain was as electrically minded, on the average, as those we meet in the Union and the Federation, Great Britain would have been in real trouble before now, and would have found extreme difficulty in meeting its load.

You, Mr. President, mentioned certain figures in your paper, which, on the face of them, are astounding. I feel sure those figures do not deal with the domestic loading, but the overall average per consumer, and must include the industrial load. If we were as highly industrialised as Great Britain, dealing with day peaks and not night peaks, I think our outlook would be very greatly changed in the matter of electricity supply and provision therefor.

We have been given a figure by the author of an expected average loading of 4 kilowatts per consumer. That, I think, is a reasonable figure, although there are many cases where that loading is far exceeded.

Using the figure of 4 kw per consumer which the author has given, it is noticed that his networks are estimated to cost approximately £30 per consumer. The network cost specifically excludes the cost of the sub-station feeding the network. The figure of £30 per consumer exceeds £7 per kilowatt. If the sub-station cost is taken into account, with, say high voltage feeders, I wouldn't be surprised if this raised that figure to twice the amount obtained directly from the figures given in the paper.

At £14 invested per kilowatt of a.d.m.d. load, we are getting into fairly high figures of capital investment to meet consumer requirements. In my opinion, the figure of expenditure and capital investment to meet consumer loading, in the areas such as are dealt with by the author, have arisen from attempts to develop the domestic load. I well remember the attention given to that subject at a previous conference in Cape Town when the late Mr. George Swingler made available a very voluminous document setting out the hire purchase terms and the consumer assisted wiring schemes which had been adopted by the Cape Town Corporation with a view to developing this very load. It rather looks to me as if we have developed a juggernaut. At the time when our domestic load was almost entirely lighting, we had a substantial valley during the day time and felt that we ought to try and fill that valley. We assumed then that water heating and cooking would be done during the day time, and could be supplied at low rates.

Unfortunately, I fancy that both the cooking and heating loads do come on to the peak. This means we have encouraged the development of a load which is a source of embarrassment today because it involves quite appreciable capital outlay on distribution networks, sub-stations, and generating plant.

Therefore, I feel that something should be done to encourage the greater spread of domestic and other loads.

In view of the nature of the loading which we are dealing with, I think it is not quite correct to assume that the loss load factors, which have been derived in Great Britain from a study of load characteristics there, are applicable here, and I feel that some investigation should be carried out in order to obtain more realistic figures in that connection. By utilising data obtained under very different conditions from those prevailing in the Union and the Federation, we may be aiming at what we consider economical investments which, in fact, are not economies.

Coming to the question of mid-boundary developments, I think you will find that even in spite of the strange characteristics of modern township layouts, the mid-boundary system does result in savings. We have had the job of doing an investigation of the cost of reticulating a very large township for the Government, and were given the alternatives of mid-boundary and of roadside construction. Undoubtedly the mid-boundary layout was by far the cheaper. Although street lighting was required, and the roads were extremely wide, most of them had been provided with substantial mid-islands.

May I point out that where the mid-boundary is irregular you will probably find that your roads are also irregular. By the suitable placing of poles in the mid-boundary sections, you can make use of a dividing fence to accommodate stays and that accommodation is not available in the roadway.

In conclusion, I would like to sympathise with our friend Mr. Jack Downey in connection with this + or − 7½% regulation, and tell him what we are forced to do ourselves, where we are reticulating towns receiving a supply subject to the same + or − 7½% regulation.

In most cases we have found that, instead of insisting on the Supply Authority—ourselves—providing for automatic tap changing gear in the transformers to give us a regulated or even a compensated bus at the point of supply (in bulk) it is far cheaper to install voltage regulators. That is a practice which we ourselves pursue.

I trust that Mr. Jack Downey will be able to follow the same practice that we have been forced to do ourselves.

(Applause).

Mr. J. DOWNEY (Springs): I am afraid Mr. Milton has forced me to my feet. I have a confession to make. We are not affected by bad voltage regulations in Springs. We have line drop compensation and voltage regulation with tap changers. We find the E.S.C. regulation a little on the high side, but I know many of my friends on the Watwatersrand do not find themselves in the same position. As far as we are concerned, we are extremely happy, but it has been suggested to me to bring this matter at some time before the Convention.

Thank you Mr. President.

Mr. P. H. LEVICK (Superconcrete Pipes, Roodepoort): I would like to add my congratulations to Mr. Wood for his very interesting and provocative talk. I would like to raise a few points under section 2, "Materials."

I was very surprised to hear his remarks regarding the care necessary in handling concrete poles. I think that a trip through South Africa will clearly show that these poles have been used extensively, and when you travel down, for example, du Toit's Kloof, it is obvious that they cannot always be handled very carefully. It is common practice among a lot of the electrical contractors when handling concrete poles to actually tow them behind their lorries. I have also seen the practice adopted for off-loading poles, one pole on the lorry being tied and fixed to the preceding pole and the lorry then driven way. This, surely, could only happen if the poles were very robust. Naturally we don't recommend that as a method of off-loading.

The S.A.B.S. published a specification covering the manufacture of concrete poles in 1954. This specification lays down certain design criteria, and specifies strength requirements for transverse strength, crushing strength of the pole, and in addition certain requirements regarding the weight, length, and cover of concrete over

steel. Any municipality or undertaking purchasing poles manufactured to this specification can be completely confident that the poles will resist any rough handling and will be suitable for all reticulation purposes.

The specification lays down the value for torsional strength of 500 ft. lbs., and the author did mention that this is possibly on the low side. It is however common practice for a special pole to be made for use at terminal points where the torsional strength is increased by up to 750 ft. lbs. by increasing the diameter of the top of the pole from 5 to 6 inches.

The author also mentioned in his talk that concrete cross arms cannot be obtained for use at terminal points. Now this is a very surprising remark because it is simply a matter of design and the cross arm can be designed by the addition of extra reinforcing to meet any horizontal pull with the necessary factor of safety. Of course, the concrete pole can also very easily be adapted for vertical type formation, and this is commonly used these days.

The question of concrete poles is never fully discussed until the bugbear of erection raises its ugly head, and I must agree with Mr. Kane in this respect, that I feel the labourers shown in the photographs displayed were merely there for stage effect. Experience has shown that the concrete pole can be erected in the same time as a steel pole without any additional labour or mechanical equipment. Naturally where an earth augur and a mechanical lifting device is used, then there is no problem.

Thank you.

Mr. J. A. MATHEWS (Kimberley): I should like to add my appreciation to that of others who have lauded Mr. Wood for his paper. It was with great interest that I noted the tendency to construct lines along the mid-boundaries of erven in subdivided townships. I should, however, like to learn how the right to construct and maintain these lines in this position has been secured and enthrenched. As far as I am aware the only procedure that can be used to obtain these rights is that contained in the Electric Power Act of 1922.

Assuming that these are more than monetary savings to be obtained in this form of construction, the Kimberley City Council has already suggested to the Administrator of the Cape, via the Cape Provincial Municipal Association, to give consideration to the amendment of the Electric Power Ordinance No. 6 of 1911, to give to municipalities in the Cape the same rights that are given for sewers and water mains under their respective clauses in the Municipal Ordinance No. 19 of 1951.

This suggestion was made some while back when consideration was being given to various types of reticulation systems for a new township being developed in Kimberley. It was found, under present legislation, that the Council might have been placed in an embarrassing position over its legal status for access to properties had the mid-block system been adopted. If the amendment is accepted by the Administrator it will be possible for the municipalities who desire to use this mid-block system to have a legal right of access for construction and maintenance.

Clr. E. L. CHAPLIN (Port Elizabeth): Mr. President and gentlemen: I am not a technician, I am a mere city councillor. I would like, however, to say that I have been very intrigued with Mr. Wood's paper, and the possible economies which might follow if this practice became general. However, there are two points in particular, as a councillor, to which I would like to draw Mr. Wood's attention. The first one is this question of servitudes which has been referred to by the previous speaker. It seems to me that on the average town erf, possibly running six to the acre, to take up 15 feet on the boundaries for servitudes is going to rather circumscribe the erf owner, and probably invalidate any improvement which he might like to put on the ground. I think this 15 ft. servitude is or will be, a very great embarrassment to the citizen.

The next point to which I would like to draw your attention, sir, is the layout of these proposed reticulation systems, say for example on page 22, and the following pages. I was wondering if Mr. Wood, in drawing up his scheme (and I would like

to give him very great credit for the amount of work which he put into it), I was wondering whether he had consulted his City Engineer in these layouts; I was wondering if in saying a few thousand pounds in electricity reticulation, he was bearing in mind the additional few thousand pounds that erf owners would have to subscribe for the construction of their roads and sidewalks. It looks to me, and I have had quite a bit of experience in Port Elizabeth on the subject of town planning over the last 7 years, that the few thousands that you are going to save on electricity reticulation by the adoption of this system is going to be more than swallowed up by the thousands of pounds which are going to be paid for road construction.

Mr. A. F. TURNBULL (Vereeniging): Mr. President, by the time I manage to get to my feet there is very little left to say!

I found the paper presented by Mr. Wood extremely interesting, first of all because smaller undertakings take a lead from the larger undertakings who can afford the staff and time to devote to the economic studies of distribution networks.

I was particularly interested in the paper because we have tried both the mid-boundary and street boundary type of construction. I heartily agree with Mr. Wood when he stresses the necessity to design the street lighting reticulation first, and the the main distribution. We positioned our mid-boundary poles to suit service connections, and now find ourselves in difficulty with the street-lighting scheme.

In view of Mr. Wood's paper I do believe serious consideration should be given to mid-boundary construction. I was also particularly interested to hear of the scheme suggested by Mr. Kane for single phase, high voltage distribution with the mid-boundary form of construction.

On the practical aspect may I ask what precautions are taken in the event of a conductor breaking? Are nets or cradles provided? We in Vereeniging use the vertical construction much on the lines mentioned by Mr. Sibson of Bulawayo. We run an earth conductor and a neutral conductor of half a sectional area of the phase conductor above and below the phase conductors. Do Cape Town run an earth conductor or do they accept the concrete of the pole as a sufficiently good insulating medium.

The flange pole for the termination points is interesting, for the terminal pole, with its full complement of conductors and in the deep clay soil in Vereeniging does not work quite so well.

For the mid-boundary construction are overhead service connections permitted, and where is the consumer's meter located?

May I also ask, in purely residential areas, whether or not any steps are taken to offset peak demands by the use of a maximum demand tariff which, I understand, is giving excellent results in Springs, or by the use of some remote control relays installed on the apparatus owned by the consumer, such as electric water heaters.

I am not familiar with the climatic conditions in the Cape. Their winters may not be so severe as those experienced in the High Veld where demand limitation at peak periods is a consideration.

Mr. H. C. DREYER (George): I found Mr. Wood's paper of particular interest and would like to make a comparison between Figures 13 and 14 in the paper. Something which struck me, which I don't think has been mentioned yet, is the very important function of your LT overhead mains, which is very often ignored. The overhead mains of the distribution scheme are often regarded merely as a means of getting electricity to the consumer which I think is not the full use to which the overhead mains could be put.

One of the very important uses of your LT overhead mains is to provide an alternative supply if a feed point should drop out, or if a sub-station should drop out completely, on account of things that may happen beyond your control. Especially where this may involve considerable delay in restoring the supply, Supply Undertakings often have to revert to their overhead mains as an emergency measure.

I see one shortcoming in mid-block construction, and that is that most of your LT feeds are basically radial in nature. This

is fairly clear if you compare it with Fig. 14, where you have the ordinary street construction, since there are usually not so many "cul de sacs" you find that in practice in street construction most of your LT mains naturally form their own rings.

Another point which I would like to raise in connection with this paper is this: I think it would be very interesting if Mr. Wood could give us some information on the comparison of costs bteween HT and LT networks of his scheme; how would it compare with other systems on the HT side?

The third point I wanted to mention I think was mentioned before, and that is the question of wayleaves.

Then a fourth point—I don't think it is very important, but it does crop up at times—that is: has Mr. Wood ever had occasion to have to disconnect a consumer, sometimes a very agitated consumer, for non-payment of accounts, or contravention of the regulations, when you perforce have to enter his property?

Thank you, Mr. President.

Mr. H. T. TURNER (Umtali): Mr. President, gentlemen: there are two or three points I would like to raise arising out of Mr. Wood's excellent paper. First of all, has Mr. Wood taken out comparative costs between overhead construction and underground cable? Bearing in mind the difficulties with the salt laden air of Cape Town and the comparatively low cost today of plastic covered cables, whether the cost in fact of underground cable reticulation is not reasonably near that of overhead construction. Now I raise this point particularly insofar as the position in Rhodesia is concerned. We up there are like you are down here in the Union, I suppose, very much town-planning minded, and you would be surprised if you saw some of the plans for housing schemes drawn up by our town planning people. They are, first of all, surrealistic, their design is quite fantasic, and we find the only possible way to service the building sites at all is by underground cable. It is quite impossible to do anything else.

For that reason I would like to have some idea as to whether, in this particular type of construction, the costs of overhead reticulation are very much lower than underground reticulation. Bearing in mind also of course that you get a better system of earthing with underground cable, which is a very important point, and lower maintenace costs much can be said for underground reticulation. The other point is on the question of earthing. I would like a little enlightenment from Mr. Wood on the system he adopts on this scheme for earthing whether it is PME or whatever he adopts and how it is done.

Furthermore, the final question: Can we get some information from Mr. Wood on whether there are any ampere reading maximum demand meters in sub-stations in outgoing LT circuits. If so, are they permanently connected through recording maximum demand ammeters and does he find it necessary to very often effect external alterations of the circuits to get correct balancing on the system?

THE PRESIDENT: Well, gentlemen, it is almost half past four, and I think we have had a very wide and fruitful discussion on Mr. Wood's paper, but I doubt whether Mr. Wood is going to have enough time to be able to reply to the discussion. The only time we have left is tomorrow morning, and then there will be only an hour in which to do any more business. I propose, therefore, that we devote tomorrow morning to the rest of the Forum. Or would you prefer Mr. Wood to reply to the discussion?

What Mr. Wood has to reply to I think will almost form another paper. What I suggest is that Mr. Wood prepare a written reply to all the questions and discussions, and that he sends a copy to everybody who has contributed to the discussions.

Mr. W. H. MILTON (ESCOM, Johannesburg): The question of the use of cables has arisen resulting from Town Planning. We have had several cases where the Town Planners provided what seemed to be mazes instead of towns. Hardly a street goes right through, and most are twisted. When we examined these cases, we found that the cable system was considerably cheaper than the overhead system, largely because it avoided the use of many stays. The average cost

per consumer was surprisingly low. The cost per consumer, dealing with the ordinary residential township area, only amounted to about £85 per consumer, all in, but it did involve adopting rather unusual methods regarding the supplies to individual consumers. Cubicles were arranged at suitable points from which a number of consumers were supplied, with the meters located in those cubicles. Mr. Wood might be good enough to say whether or not he has experienced anything in the way of this development.

THE PRESIDENT: A thought has just occurred to me—would you rather disperse or would you rather carry on?

(It was decided that the meeting would carry on).

Is there any further discussion on Mr. Wood's paper?

Mr. R. M. O. SIMPSON (Durban): I am very pleased I have the opportunity of joining with the other speakers in complimenting Mr. Wood on his most interesting paper. It is always refreshing to get other ideas on the planning of distribution systems, which after all calls for a lot of individual spade work and research on the part of each particular undertaking. One can work to certain ideas that have been developed by other people, but it does eventually fall to you to develop a lot of your own ideas depending on the particular layout of your own city, and the conditions that exist therein. We have found that in Durban, and it has been very interesting to hear what you have developed particularly for Cape Town.

In Durban we do not use mid-boundary construction. I suppose at one stage in our history we did, this was when they had sanitary lanes that were situated at the back of every property, but though these did serve a very good purpose at the time, the practice had, very quickly to be abandoned due to misuse. It is interesting to see the results you have produced in this paper, which so strongly advocates this method.

There is one point I would like to raise, in this photograph of the equipment you use for pole planting, you show it being used in a very level stretch of road. Working on mid-boundaries, in a place like Durban, and I should imagine the same must apply in Cape Town, you will encounter very uneven ground to work on which would cause great difficulty in using our augur and pole planting machine. The only way we can use that and get poles planted at fairly high speed is by making use of the nearest road, so the introduction of boundary construction would place us at a disadvantage for the use of mechanical plant. I am not saying that wouldn't be offset by savings, because I have not had the paper long enough to really give the time that was warranted to study it.

In Durban we suffer very badly from the rusting of steel and it is interesting to see that you have adopted concrete poles similar to the policy we have adopted in Durban. We use them almost entirely in the built up areas. With regard to life of wood poles, I don't think it is right to say that wood poles have a short life, and we have had wood pole lines in Urban areas, or semi-rural areas, that have been up for well over 25 years—the wood is either perniculata or maculata gum, they still appear to be in very sound condition, and I can see no reason why a properly impregnated gum pole—I won't say all wood poles, but those of a good quality strength group, say AA or A—should not last just as long as a concrete pole. It would appear to be so from our experience, so far, in Durban.

There is a further aspect in regard to the layout of a system particularly one using mid-boundary construction and that is, that this form of distribution will be quite satisfactory provided you don't have to cater for Blocks of Apartments. This appears to be the trend of development in Durban's residential areas. You start off with a residential area, and possibly within the life of the pole line, you will be faced with alterations due to the fact that plots are bought and blocks of flats erected necessitating the removal of the pole line.

A further point I would like to comment on, you have chosen 4 Kilowatts as your after diversity maximum demand per consumer, and in that you have allowed for future development. Here again one has

to deal with the particular area in which you live, and in Durban there seems to be, even though Mr. Milton doesn't like to see too much encouragement for the use of domestic appliances, as they are using up our country's very valuable natural resources, but there seems to be a strong move towards air conditioning units in the home. I imagine in the course of the next few years there will be a very extensive use of room conditioners in houses. They will primarily, in the house, be a night load, but they will probably overlap the evening peak load as they will most likely be switched on towards the latter end of the cooking period to make the house more comfortable for the evening. In Durban we are therefore faced with the fact that we may have to provide for a future higher after diversity demand than 4 Kilowatts.

Regarding the painting of poles, we still have many steel poles in Durban. We use them for transformer poles and in certain key positions, we have therefore given some thought to the question of rust. As we can lay claim to the notorius distinction of being the worst centre in the Union for rusting, it has forced us to using concrete poles, and to hot-dip galvanising of all our ferrus metal work, the cost quoted by the author of £4 a pole for galvanising is very high. In Durban we are considering purchasing steel poles with the top six foot hot-dipped galvanised. You can paint the bottom very easily, and a handyman can do it, without having to work close to live mains, and having the top six feet galvanised, will I feel sure assist considerably with future painting.

With those few remarks Mr. President, I wish to join the other speakers in thanking Mr. Wood very much indeed for his most useful and interesting paper.

THE PRESIDENT: Mr. Wood will reply now, gentlemen, so if there is no more discussion, I will call upon him to reply to the points that have been made.

Mr. F. STEVENS (Ladysmith): Since coming to Cape Town and doing a bit of riding round as I did earlier this afternoon, I am beginning to wonder just to what part of Cape Town Mr. Wood was able to apply his ideas. There seems to me to be a tremendous amount of development, but where the mid-block construction was carried out is not evident. I am sure that what he had told us is based on experience, but the design referred to seems impracticable in the best part of Cape Town.

Thank you.

THE PRESIDENT: You haven't been far enough afield Mr. Stevens!

I will now call upon Mr. Wood to answer some of the questions and the discussion.

CONTRIBUTION TO THE DISCUSSION ON THE PAPER BY MR. H. WOOD

BY

E. B. MARTIN (Johannesburg)

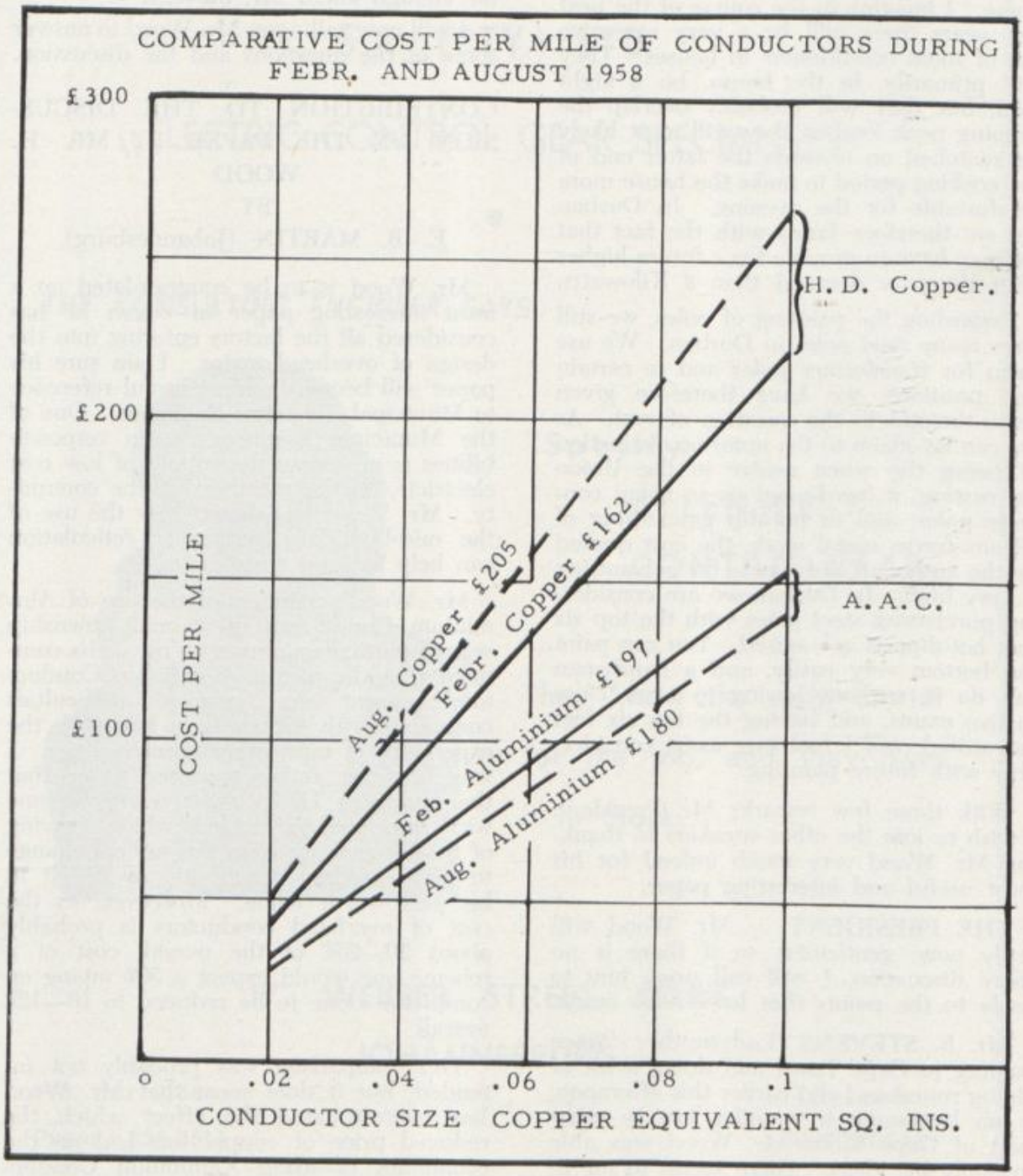
Mr. Wood is to be congratulated on a most interesting paper in which he has considered all the factors entering into the design of overhead mains. I am sure his paper will become a most useful reference to Municipal Electrical Engineers. One of the Municipal Engineer's main responsibilities is of course the supply of low cost electricity to the members of the comunity. Mr. Wood has shown how the use of the mid-boundary system of reticulation can help to keep costs down.

Mr. Wood's mention of the use of Aluminium Conductors in a small township was of particular interest to me. His comment that the use of Aluminium Conductors present no technical difficulties compared with copper is in line with the experience of most other municipalities. I was, however, rather surprised to see that the saving of 11½% on the whole scheme was considered rather low while a saving of 6—8% resulting from the radical change to mid-boundary construction was felt to be well worth while. Moreover, as the cost of overhead conductors is probably about 20—25% of the overall cost of a scheme one would expect a 50% saving on conductor alone to be reduced to 10—12% overall.

This comparison was probably not intended, but it does seem that Mr. Wood has overestimated the effect which the reduced price of copper has had on the economics of using Aluminium Conductors. It is stated that at the time the

experimental scheme was erected the cost of ·05 sq. in. copper (weight ·593 lbs. per yd.) was 2/4d. per yard and the cost of the equivalent All Aluminium (weight .291 lbs. per yd.) was 1/2d. per yard. These prices are equivalent to almost exactly 4/- per lb. for both metals.

When Mr. Wood presented his paper in April the copper price was standing at its lowest for very many years i.e. about £162 per long ton. The corresponding price for hard drawn stranded copper conductor was about 2/1d. per lb. (cost of ·05 sq. in. copper therefore about 1/3½



per yard). However, the aluminium price had also come down and ·05 sq. in. copper equivalent was then being offered at about 3/- per lb. (i.e. about 10½d. per yard). Thus there was still a saving of about 30% available on conductor cost. Even if the overall saving were as drastically reduced as stated by Mr. Wood it would still have been possible to save 7% based on April conductor costs. This is no less than the saving possible with mid-boundary construction.

With increased experience in the use of Aluminium Conductors there should be no difficulty in reducing the cost of erection in standardising on more economical fittings. The light weight of aluminium should make erection easier particularly if it were used on mid-boundary construction where material must be moved off the street frontage.

Since April the price gap between aluminium and copper has increased again and to-day (September 1958) copper has risen to about £205 per ton while aluminium has dropped from £197 to £180 per ton. This difference is illustrated graphically in fig. 1 from which will be seen that a 50% saving on conductor cost is once again possible.

REPLY BY Mr. WOOD TO DISCUSSION ON HIS PAPER.

Well, gentlemen, I have before me a list of all your questions which I shall endeavour to answer, but firstly, I must thank you all very sincerely for the keen interest you have taken in the paper.

It was my intention to write a controversial paper in order to encourage the discussion and to hear the many useful ideas put into use on low voltage lines in other parts of South Africa and the Rhodesias. I must say I have learnt quite a lot from the discussions and would like to thank you very much.

Mr. Kane brought up the question of the type of materials recommended in the paper. I did present Cape Town's position as far as the choice of materials was concerned, but it is obvious that the choice will depend on the relative costs of these materials to each individual supplier. In Cape Town, steel obtained from the Transvaal cost the Department almost nineteen guineas whereas concrete poles manufactured locally cost approximately £8, so you will understand our great preference for this type of pole.

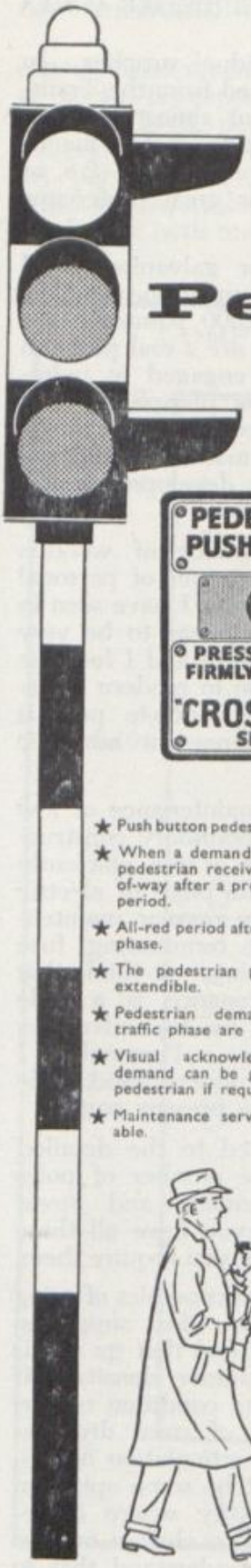
As far as painted or galvanised steel poles are concerned, I mentioned in the paper that we have 54,000 painted poles in Cape Town and they are a real problem labour is continuously engaged in painting. However, the new phosphoric acid treatment has helped considerably in reducing costs besides making additional labour available for the development programme.

Regarding the appearance of wooden poles, I consider this a matter of personal opinion. The wooden poles I have seen in South Africa generally appear to be very knotty and far from straight and I feel one cannot consider their use in modern European townships. The concrete pole is much more pleasing from an aesthetic point of view.

With regard to the maintenance of low voltage lines with mid-boundary construction, I feel that this type of line, efficiently erected, is a very reliable piece of electric equipment and the only regular maintenance required is at the terminating, fuse and interconnecting points. I think that the question of maintenance is a little exaggerated, especially by the advocates of underground cables. Personally, I would like to see more underground cable networks but not at the present cost.

Mr. Kane also referred to the detailed estimates, especially the number of poles required for mid-boundary and street reticulation. I can let you have all these details, Mr. Kane, should you require them.

On the question of the economics of using high voltage reticulation for supplying domestic consumers. I feel that its use is dependent on the consumer density. If we consider the extreme condition of low consumer density, that of rural distribution. then high voltage reticulation is generally used. There must be some optimum point in consumer density where it becomes more economical to change over to the higher voltage. I understand that in



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Johannesburg, using this scheme, 12 consumers are fed from a 75 kVA transformer. Am I correct, Mr. Kane?

Mr. KANE: To the best of my knowledge, 50 kVA.

Reducing the number of consumers on transformers results in an increase in the admd per consumer. The smaller the transformer the higher the cost per kVA. The present-day cost of a 50 kVA transformer is approximately £6 per kVA and of a 500 kVA transformer, £2 per kVA. Consequently one must consider very carefully the increase in cost of the total kVA per consumer when using smaller transformers in view of no advantage being taken of the higher diversity existing between larger groups of consumers. With only 12 consumers the admd is liable to be in the order of 5 or 6 kVA compared with, say, 4 kV Ausing low voltage reticulation, and this higher admd has to be supplied at £6 per kVA compared with £2 per kVA of the larger transformer.

In Cape Town, where the average consumer density varies between 3·5 and 6 per acre, low voltage reticulation is the more economical.

I was very interested, Mr. Mitchell, to hear that your Department manufactures its own poles in Salisbury and at a cost of only £4-15-0 per pole. I believe it is by the vibration method, isn't it? We are having to pay £8 for a spun type of pole. Regarding vertical construction, it is necessary, in Cape Town, to provide a clearance of 23ft. 6ins. for Post Office purposes. All large schemes are submitted to the Post Office Engineers and in all cases this clearance is stipulated. As the standard size of pole in use is 30ft., it is doubtful, with vertical construction, whether this clearance could be maintained. In England I erected a number of low voltage lines using vertical construction and it was only when I came out to South Africa that I came across the horizontal construction which impressed me personally as being much neater.

Mr. Mitchell, I think you mentioned a figure of 20 poles per day planted. With this small machine we are able to plant 12 poles per day in soft ground.

I was very interested to see the photographs showing the methods of pole planting in Salisbury. These were very similar to those I saw in England using the truck mounted machine.

I was glad to hear that you agreed with the figure of 30% for phase unbalance among domestic consumers. I think you will remember in the scatter diagram that there was no trend towards any definite figure and I assumed this figure of 30% to be a good average for most conditions.

I agree that the load densities in this country are very similar to those obtained in England. The 'consumer density in this country is less, but the loadings are higher and the two counter-balance to produce a similar load density. However, the most suitable number of radial distributors is dependent only on the consumer density and investigations into the average type of township having consumer densities varying between 3 and 6 per acre resulted in a figure of 6 radials being the most suitable.

I did mention that over the peak periods a small excess voltage drop may be tolerated, but I think you will notice that the excess was only of the order of 0·6%, that is approximately one volt, of which no consumer should complain.

I was glad to hear, Mr. Mitchell, that you agree on the economics and aesthetics of the use of mid-boundary construction.

Regarding the question of 100% duplication referred to by Mr. Sibson, I don't propose that one should provide 100% stand-by on low voltage overhead lines. This is unnecessary in view of their accessibility and the speed with which these lines may be repaired under fault conditions.

I was very interested to hear of Mr. Sibson's long experience with mid-boundary construction in Bulawayo and of its reliability. In Cape Town this construction was first used in Pinelands, a thickly wooded area in 1937 and very few difficulties regarding access have been experienced.

With reference to the use of single or three-phase service connections, balancing of the distributor loading at the substations

is considerably easier where single phase connections are provided. Where unbalance exists it is a very simple matter to transfer some of the connections on to lightly loaded phases. With three-phase connections it is necessary to transfer certain portions of the individual consumer's load inside the premises, which can at times prove to be very difficult.

The use of three-phase service connections does improve voltage conditions along the line due to the better distribution of the load. However, I do not consider it to be an economic proposition when, as in most cases, a single phase connection is adequate. This small increase in the voltage drop can be taken into account by reducing the radius of distribution and so still maintain the consumer voltage within the statutory + or − 5%.

Mr. Downey referred to the question of access to the property at nights. This would at first sight appear to be a difficulty, but up to the present time no trouble has been experienced. The consumers know that the mains are in their properties and raise very few objections, and the number of timse it has been found necessary to enter a consumer's property at night have been very few. I remember last year when we had quite a strong south-east gale, more trouble was experienced in the areas having standard street construction.

As far as access to the properties is concerned, all new townships and sub-divisions in the Cape Town area have to be submitted to the Provincial Authorities for approval, and in 1949 we requested them to include in the Conditions of Title that "the Municipality be given the right to take Municipal services across any erf." This condition is now included and in consequence no further wayleaves are necessary. It has been found that most consumers are only too pleased to have the overhead lines away from the front of their properties.

Regarding the use of ring main or radial distributors referred to by Mr. Giles, I think the modern practice is to use radial distributors and so reduce consumer outage during fault conditions. It is possible to use longer distributors with ring main feeds but the length is very often limited by the size and shape of the township.

The out of balance in East London of 25% compares very favourably with that obtained in Cape Town. Occasionally difficulties arise with mid-boundary construction where the township is designed having three stands on the end of a block. Here it involves a small additional expense in diverting the mains around the centre stand. I understand from the City Engineer's staff that the three stands at the end of a block make for a more economical layout of the township.

Mr. Milton mentioned the point of using overseas values for the coincidence factors. Measurements taken on networks in this country agree very closely with the mean value of the two curves shown in the paper and this value has been used in the calculations. The mean value is a little on the pessimistic side, but I think it pays dividends in the long run.

The 4 kW's per consumer is purely an arbitrary figure and is not used in a general sense. The admd varies in each class and type of suburb and it is necessary to know the actual figure before the radius of distribution can be determined.

I think you mentioned a figure of 6 - 8 kW. admd. Isn't this for one of the new mining towns in the Free State? This is rather high, but I understand that the admd in this town has now dropped to below 6 kW.

Loss load factors are quite a simple matter to evaluate and it is not necessary to accept any overseas figures. This has been done in Cape Town and it was found that the formula $0{\cdot}7(LF)^2 + 0{\cdot}3(LF)$ was very close for most practical purposes.

Underground reticulation, although highly desirable, is too costly. A comparison between underground and overhead networks made a short while ago showed that the underground network would be 3½ times as costly. Maintenance costs of the two types are very difficult to estimate, and I feel that the low capital cost of overhead networks will be the deciding factor for many years to come.

Mr. Levick, I quite agree that the concrete pole will stand a certain amount of

rough handling but much more care has to be taken than with steel poles. Dropping of the pole is liable to cause fracture at the bottom of the parallel section. I was interested to hear of the special poles manufactured for increasing the torsional strength.

We have had experience of cracking of the concrete cross arms on terminal poles and have finally decided that we must use galvanised steel cross arms in these positions.

I think I have answered the questions posed by Mr. Matthews and Mr. Chapman in regard to wayleaves in my reply to Mr. Downey.

Mr. Turbull referred to the use of nets or cradles. These are not used on low voltage lines in Cape Town. Every steel pole and cross arm is bonded to the neutral wire and every consumer's service neutral is earthed via a 6 ft. earth spike. The multiple earth system is in general use and approved by the Post Office Engineers.

The steel flange pole is used in positions where a stay would inconvenience a consumer. This pole will safely withstand a terminal pull of 3,200 lbs. equivalent to the pull of 4 × 0·1 sq. in. conductors.

Service connections are still the same as with the standard street reticulation except that the lead-in is at the rear of the property.

On the use of ripple control—this is purely a question of economics to be decided by each supplier. It is in use in the Pinelands Municipality, which obtains its supply from Cape Town, and functions satisfactorily.

Alternative supplies are provided between sub-stations as mentioned by Mr. Dreyer. The design must be such as to provide a means of interconnecting on the low voltage net works in the event of fault conditions.

Regarding Mr. Turner's questions on overhead versus underground networks and earthing, I believe I have answered these questions in my replies to previous speakers. However, on the use of recording ammeters in substations, in Cape Town ordinary reading ammeters are used and these are read monthly at the peak periods to enable a check on the loading and balance to be maintained.

Mr. Simpson, I have referred to the use of augers and pole planting machines in my reply to Mr. Mitchell. The question of rusting of steel poles is, of course, a real problem. Away from the sea the phosphoric acid treatment produces very good results, the poles only require painting approximately every eight years. At the sea front, however, the poles require painting every one to two years and the only answer in this position appears to be the use of hot dipped galvanised poles.

Flat development, of course, is a thing which can occur in later years—Sea Point is a typical example. Once this occurs the load density increases tremendously and it becomes necessary to provide high tension reticulation.

Regarding your question on the admd of 4 kW., I have referred to this in my reply to Mr. Milton.

On the galvanising of the top 6 feet only of the steel pole, this used to be the practice in Cape Town. However, it has now been abandoned in favour of galvanising the whole pole and so avoiding any painting at all.

In regard to the development of new townships referred to by Mr. Stevens, close consultation with the City Engineer is carried out and any problems can usually be solved to the benefit of both Departments.

Thank you, gentlemen. I sincerely hope I have been able to answer all your questions.

(Applause).

THE PRESIDENT: I take it you are all ready to go home. I am sorry about the tea. If I had known that you were going to carry on till 5.15 we might have had tea laid on, but as the original idea was to stop at 4.30 I thought you would have something when you got back to your hotels.

Thank you very much for your attendance this afternoon, gentlemen. We look forward to seeing you at the Ball. And try and be here on time tomorrow morning, or Jimmy Mitchell will have something to say!

FOURTH DAY

THE PRESIDENT: Good morning, gentlemen. As you know the intention is to spend this morning on the Members' Forum, and before I call upon Mr. Mitchell to take over I'd like to ask Mr. Kane to say something on the sub-committee which we have for Tariff Survey.

Mr. R. W. KANE (Johanesburg): Mr. President and gentlemen: this is merely a progress report. A fair amount of work has been done by the Committee, and you yourself arranged for a summary to be prepared which has been submitted to the Committee. Unfortunately the Committee has not had an opportunity to really study this in detail, and we hope that we should have some finality by this time next year. The most important thing that happened this week is that the Convenor has been changed, and Mr. van der Walt the original convenor has again taken over these duties.

THE PRESIDENT: Thank you Mr. Kane.

I shall now hand over to Mr. Jimmy Mitchell.

Mr. J. E. MITCHELL (The Chairman): Having started the Members' Forum on Wednesday and having had more of a debate than a Forum, we will try and conduct this on the normal lines this morning.

The first question which I am posing is No. 7 on your list. That question was posed by Mr. Turner, and I am going to ask him to tell you of his difficulties, and then ask if anybody has a suitable answer for him.

Question posed by Mr. Turner of Umtali.

Two prosecutions were recently instituted in this town for flagrant violation of Municipal bye-laws. The first, for short circuiting two water-heater circuits from the meter, was thrown out of Court at the insistence of the defending Q.C. on the grounds that no witness to the actual deed had been produced. This in the face of considerable circumstantial evidence. The second case, breaking the meter seals and removing the potential coil bridge, was withdrawn by the Prosecutor because of what had happened to the first case, i.e. no witness to the actual offence could be produced in Court.

The question then is, of what real value are the relevant bye-laws governing unauthorised use of electricity supplies and interference with apparatus if it is first necessary to catch the culprit red-handed, or to find someone else who was a direct witness to the deed before a prosecution can be successfully instituted? Can existing legislation or bye-laws be altered so that it would be possible to place the onus of the proper use of supplies and apparatus directly on the consumer who has contracted to take the supply?

Mr. H. T. TURNER (Umtali): Mr. Chairman, as you probably know every local authority has bye-laws which govern the proper use and sale of electrical energy, and penalties are provided for consumers who misuse the energy supplied by the local authority, as for example the extraction of current from the meter, in an unauthorised fashion; tampering with seals and the like.

In the Federation also there is a further set of bye-laws, or clauses, under the Federal Electricity Act, 1956, and these I understand supersede all other bye-laws governing the proper use of energy in the Federation.

We have recently in Umtali had occasion to invoke these particular clauses in that we had two consumers who, we found, were making the most flagrant misuse of the supply in that they were extracting energy for use of hot water heating appliances, with this energy being registered on a municipal meter. The one consumer had in fact completely shor-circuited the meter from the water heater circuit by making an alteration behind the distribution board: he was the owner of the house he was living in, and within three months of taking occupation of the house, he set about altering and short-circuiting the geysers behind the distribution board.

Almost simultaneously another consumer was found to have removed the cover of the meter, and by interfering with potential connections had stopped the registration of the meter.

As these instances involved the Council in quite a considerable amount of money in energy charges, we instituted proceedings against the gentleman, first of all, who had interfered with his hot water circuit. The case was brought before the magistrate, and the consumer brought down from Salisbury a very able O.C. and as a matter of fact he was a Q.C. from the Union! He was so able in fact that when the Council put up their case before the Court, which I can assure you was a very, very good one, and was supported by evidence, all circumstantial of course—and when the case proceeded we thought we had a complete open and shut case. The Q.C. got up and wanted to know whether we had any definite proof that the man had been seen making this particular connection. Naturaly you never catch anyone doing the actual deed, and we had not seen him doing so, but we had evidence that he had done so. His account alone, for example, did show that for the first four or five months he had a normal consumption of about 1,000 units a month, and it then dropped down to about 200 a month, with one 20 gal hot water heater and one 5 gal hot water heater on constant use. Despite this definite evidence, the court ruled that as the man had not been seen actually doing the deed there was no charge to answer, and the case was accordingly dismissed.

We then tried to get the other case put forward but the Prosecutor declined in view of what had happened in the first case.

Some of the brighter individuals in the C.I.D. did mention the fact that they might take fingerprints of the consumer, and thereby possibly strengthen the possibility if a conviction. Well, if we are going to ask consumers to give us their fingerprints we are going to be in trouble.

The question then is that it does appear that unless we actually find a consumer carrying out misuse of energy supplied by the local authority, there is no chance of prosecution. It did involve my Council at Umtali, in fact, in a fairly large sum of money, and the question, Mr. Chairman, is: "Is there no possibility of having the existing legislation altered so that we could have a fair chance of prosecuting these unscrupulous people?"

Thank you.

THE CHAIRMAN: The question is open to the floor, gentlemen. Has anybody any answers as to how Mr. Turner's case could have been won?

Coucillor W. F. MAYER (Welkom): Mr. Chairman, I can see nothing wrong with your bye-law. It is all a matter of proof. A case can be proved by direct evidence or circumstantial evidence. If you have direct evidence, then there is no difficulty at all, but with circumstantial evidence, you must be able to exclude the possibility of someone else having tampered with the instruments. If you can exclude all other

persons, other than the accused, then you can prove your case. I can see nothing wrong with the bye-law and it is all a matter of the presiding magistrate either accepting the circumstantial evidence as truth or not.

Mr. D. MURRAY NOBBS (Port Elizabeth): Mr. Chairman, in Port Elizabeth we have experienced similar troubles, particularly in the coloured townships where electricity is obtained through prepayment meters. We often have examples of consumers slipping safety razor blades into the meter, putting them out of action, and extracting current unlawfully. We had, on one occasion, a case before the courts, and obtained a conviction. In that particular case conviction was obtained due to the fact that the accused pleaded guilty.

We have had many other cases in which the accused have pleaded not guilty and we lost these cases. We have found it a waste of time trying to proceed in law against those consumers, but now we adopt a different tactic altogether. Where we find that the seals have been broken, or where the meter has been tampered with in any way we disconnect supply, we remove the meter to the meter test room, repair it, reinstate it, and do not connect it up again until the consumer has paid all costs associated with the repair of the meter, including transport, and when he has made those payments, we connect up again.

I don't know how we'd stand if the consumed took the matter to law, but our method of treating those offences at the present time are working quite satisfactorily.

THE CHAIRMAN: Has anybody else any ideas on this subject?

Mr. G. J. MULLER (Bloemfontein): Mr. Chairman, we have had somewhat similar experiences to Mr. Nobbs. We have had quite a number of threatened prosecutions, but our legal adviser on every occasian that we passed information to the Town Clerk's Department advised against prosecution, as we could not produce direct evidence. The Department then did a bit of legal investigation and found a clause on our bye-laws stating that the consumer takes responsibility for the service while he is the consumer on the premises, and strangely enough when this was pointed out to him, he was prepared to prosecute. So I think it is just a case of "How energetic is your lawyer."

THE CHAIRMAN: I don't want to go on too long on one question. Mr. Burger possibly can close this one.

Mr. BURGER (Parow): Mr. Chairman, here is a question and the answer is "yes, something can be done." It is possible to so formulate your bye-laws or regulations that you in fact make a rebuttable presumption. In other words, what you do is you say that the owner or occupier shall, provided that certain facts are proved, for instance if the meter has been tampered with, be guilty - unless of course he can show to the Court that he had nothing to do with the matter whatsoever.

Now there is authority for saying this, and it is actually a case in Southern Rhodesia, where it was decided not so long ago. I can give you the reference to that case, which is Rex v. Rabinowitz and Others, which is reported in the South African Law Reports 1950. It was a judgment of Mr. Justice Tredgold.

In that particular case the person charged was acquitted. If it was found that there had been an aggregate consumption of water in excess of that allowed under the rationing then the consumer concerned was guilty but there was no way of his proving innocence, or proving that he had nothing to do with the matter, or proving that somebody else was responsible for taking that water.

Mr. Justice Tredgold was very clear on the point that you cannot so formulate your bye-law that you create an irrebuttable presumption. In other words that you make a presumption that once you have proved that there has been that consumption, the man is guilty and he can say nothing. But he indicated very clearly in his judgment that it would be in order if you were to make this on the basis of a rebuttable presumption. In other words if you were to say that the occupier would be deemed to have contravened the bye-law or regulation, unless he can show he

is not guilty, or that he is not personally responsible. Mr. Chairman the whole point is that you must so formulate your bye-law that you do give an opportunity to the man concerned to show that he really was not responsible for what happened. But provided you do that, according to the decided cases, everything is in order.

But I don't think I would be frank with your convention if I were not to say that I have my own personal doubts as to these decided cases. I am personally inclined to think that they are giving too much latitude, on the principle which we all know, and which is known to everybody, namely that a man is innocent until he is proved guilty. Now I want to go a little bit further and say that I do not think that municipalities should so readily become a party to bye-laws designed - and I say "designed" advisedly - to circumvent this basic principle, because I think that as you go along and depart from a principle like this one, the principle of being innocent until you are proved guilty, you will soon find that that departure will extend itself and you will find that later your judicial officers, in fact your whole legal system, comes to a point where that principle is watered down, and where the accused person will soon find himself in a position which I don't think anyone in this convention would like him to be in; in other words, a position where you have presumptions of guilt against you.

I would rather say that the solution lies in the direction indicated by Mr. Murray Nobbs. I think the solution is a civil one, a one where, if a man's meters and his installations are being tampered with, the position should be that he should be disconnected. I don't think that one should be so quick in creating a new or watered-down system of criminal law merely for the sake of catching these particular people. We know they are a nuisance, but to eliminate that nuisance we may in fact throw overboard an important principle.

Thank you Mr. Chairman.

THE CHAIRMAN: There you are gentlemen, you have your answer.

(Applause).

If I may say so, slightly typically Q.C. You have two sides to the case. Make up your own mind which you take.

There are just two instances. Talking about proof, it struck me that Mr. Nobbs might like to know of a case I came across in the U.K. with pre-payment meters, which I abhor, where a man had a mould for his shilling in the slot - coins in the fridge. He used to have ice coins. How one proves that he had put ice in instead of a bob, I don't know.

The other one I remember was the case of a cafe where the cafe was certainly using nothing like the amount of electricity it should have done. Inspectors were sent round at all times, and they never could find a reason for it - until the meter came in to be inspected, and somebody found a very, very small hole in one side. Then they found the answer. What had been happening was that he had taken a small piece of thin wire and threaded it through the meter so that is just rested on the disc. But the wire was attached to the curtain which hung across the actual meter, so to see the meter you had to fling the curtain back which immediately extracted the wire from the meter and there was nothing to show.

So you see the difficutly in getting proof.

I am now going to turn to No. 8 which is: "What are the main factors which influence the supply engineer in his choice between copper or aluminium for his overhead conductors in any electrical reticulation scheme?

What about Mr. Wood answering that one?

Mr. H. WOOD: Mr. Chairman, I looked into this question when I saw it listed. The question does not specifically refer to high or low voltage lines, and it is in consequence necessary to consider the application in the light of the two different types of distribution. For high voltage work steel cored aluminium conductors have been used for many years, and have proved to be very reliable and economical. The relatively high tensile strength, compared with copper, permits a longer span length, with a consequent reduction in the number of supports required.

For equal resistance and relative cross-sectional area, the weight of a steel cored aluminium conductor is 48·3% that of comparable copper conductor. This lightness contributes to easier and faster handling, and a reduction in transport and erection costs. The larger diameter of the aluminium conductor also reduces the possibility of corona and corona losses, although it is not actually desirable to attempt to eliminate corona completely as this does form a type of safety valve on the network in reducing the disruptive critical voltage; in the case of very high surges it does permit the operation of the protective device.

For low voltage work all aluminium conductors are generally used because it is not possible to take advantage of the high tensile strength of the steel cored aluminium conductor, the reason being that the span length is determined by the size of the stand to be reticulated, and it is not possible to erect a line according to an economic span. In other words, the number of supports on a low voltage line is determined by the layout of the township.

When considering these aluminium conductors, however, we must also consider the possibility of galvanic corrosion between dissimilar metals where service connections are taken from these lines. Many types of special connectors are available - these, however, are quite costly. I believe some manufacturers are attempting now to manufacture these connectors in the Union, which we hope will be a little cheaper than the imported article. The cost of these imported connectors have, in the past, tended to offset the price differential between the two types of conductor. It is also necessary to cover these conductors with non-oxide grease to prevent any ingress of moisture. The linesmen must therefore be efficiently trained in the erection of these conductors and in the method of installing the special connectors.

When comparing the cost of conductors, we must be very careful to consider the extra labour costs involved in handling and connecting these aluminium conductors.

THE CHAIRMAN: Thank you, Mr. Wood. Any other advice?

I think Mr. Wood has given us most of the answers. In other words, it is economy, liability, and then with high voltage a corona disability.

We now turn to Question No. 9. I think that is Mr. van der Walt's.

Can a local authority demand payment of cost from a resident who wishes a pole or stay or both to be removed, due to it interfering with his freedom of ingress and to his property:—

(a) If the pole etc. was in existence before the resident fenced his property and placed his gates in the awkward position.

(b) If the pole etc. was installed after the resident had already fenced his property and placed his gates.

Mr. J. L. VAN DER WALT (Krugersdorp): Mr. President, as Section (b) of the question is very obvious, I suggest it be excluded. The only answer I want now is to (a). If the pole was in existence before the resident fenced his property and placed his gates in the awkward position what is the position? Should the stand or house owner pay for the moving of that pole.

This question is asked because it is held, or it has been said, that common law has it that you should not interfere with the rights of the individual or you should interfere as little as possible with the rights of the individual.

THE CHAIRMAN: Has anybody got any ideas on that question?

Mr. F. STEVENS (Ladysmith): Mr. Chairman, for many years now in setting out low tension reticulations we have endeavoured, and in every instance I think been able to put the poles in line with sub-divisions of buildings sites, and in doing that one avoids having poles in front of property and the question of having to remove them for the benefit of consumers does not really arise. However, there is the odd occasion when it does arise, and we then have always charged and have had no difficulty in recovering costs. Where, however, these poles have been erected in years gone by in front of properties, we have been asked to move them, we have done so without charging the applicant.

I think that the supply authority should make a point of doing that. Even though the spacing of the poles might vary, it does pay in many ways, especially in connection with the siting of stays and so on.

Thank you.

THE CHAIRMAN: Thank you Mr. Stevens.

Mr. R. M. O. SIMPSON (Durban): The question of payment for work carried out on municipal property - and I presume here the question posed is for a pole on a public road.

If that is the case, strictly speaking the Natal Local Government Ordinance in so-far as Natal is concerned—I am not exactly certain how the others are placed—but I presume they would be similarly placed, the Natal Ordinance does demand that payment be made for the removal of any Government property, so that first and foremost you should comply with the Ordinance if by any chance it does fit in. In Durban we do comply with the Ordinance, except where we can see that due to reconstruction changes which will be made within a short time, we tell the consumer that if he is agreeable to wait until we can carry on with the reconstruction in that road, it will be moved free of charge. If he wants it to be done immediately, then we say "Well, we're very sorry, but you will have to pay."

Mr. W. H. MILTON (Escom—Johannesburg): Mr. Chairman, I have in mind a particular case where we were reticulating in the Municipal Area, and the owner of the house built a garage to house his car which had previously stood alongside the house on the opposite side of his erf. When he built the garage there was a pole fair and square in the middle of his approach entrance, which he requested us to move at our cost. We refused to do so and pointed out that he would have to face the cost. A court case was threatening, but as far as that was concerned, we got together with this bloke, and we were able to prove to him, conclusively, that he had no case in Court. Once he admitted that we removed the pole free of charge to the consumer. (Laughter).

THE CHAIRMAN: I think Mr. Turnbull is next.

Mr. TURNBULL (Vereeniging): These complaints arise for two reasons. One is that the consumer has a genuine complaint about the municipal service, and the other frivilous reason requiring the pole to be moved. We had one request to remove a pole because the consumer wanted a photograph taken of his house before he sold it!

Generally, we adopt the policy that if it is a geniune case we consider it a service to the consumer to move a pole. If a man builds a house and later adds a garage and there is no other place for him to build it, and the pole happens to be there, we move it free of charge. If there is a stay across a gateway and we find that it is a nuisance, we treat it as a service to the consumer, and do that free of charge.

THE CHAIRMAN: The answer appears to be then gentlemen, that you can't interfere with his rights, but you can make him pay to remove it. As far as preventive work is concerned, Mr. Stevens gave you one answer, and I think Mr. Wood gave you another answer yesterday - mid-boundary construction.

I think we'll now turn to Mr. Sibson's question, No. 5. Would you mind presenting that, Mr. Sibson?

Mr. SIBSON (Bulawayo): Mr. Chairman, for one reason or another the use of some sort of current limiting device, as either a part of or in place of metering, is coming into use in various parts of the world, and in this country too. I think at the last convention we had a talk about it.

There is every possibility, with the increasing use in the Federation with supplies derived from hydro-electric sources, for the emphasis to lie almost entirely upon maximum demand and very little on kilowatt hours. There are, in certain circumstances, obvious advantages in eliminating kilowatt hour meters, and employing only some sort of assessment of maximum demand, and the easiest and most practical is a current limiter, which therefore eliminates the need for meter reading.

A current limiter then becomes a metering device, and the question arises as to whether such a device should be designed

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to contain the same limits of accuracy as any other metering device.

The second half of the question raises a doubt in this matter, because a current limiting device, the sort of device one has in mind is one that does limit current, and not kilowatts. And current of course is not, necessarily, a criterion of the service being rendered to the consumer.

The same problem exists to day with kilowatt hour meters of course, because kilowatt hours are not also necessarily an exact criterion of the service rendered to the consumer. I think we referred to this in my discussion on Mr. Wood's paper, where the service rendered to the consumer in respect of supplies to his television set would not be regarded as first class if the set didn't in fact work, although it would be drawing kilowatt hours at the time.

This is not really purely a question concerning current limiters, but I have introduced that feature because it is rather novel to those who are not accustomed to thinking in terms of amperes rather than kilowatt hours.

The main burden of the question therefore is, do we consider that current limiters should be designed to have the same degree of accuracy as a meter, and if so, how is this to be achieved?

THE CHAIRMAN: Thank you Mr. Sibson.

Mr. H. C. DREYER (George): Mr. Chairman I think we can refer to tariffs that have been used in this country and all over the world for very many years, viz. room tariffs and valuation tariffs.

I want to pose a counter question which I think will answer that one, and that is, what is the accuracy of room tariffs or valuation tariffs with regard to the cost of supply? Personally I feel that if limiting circuit breakers are used as a tariff basis whether it is only to recover capital charges, or in the case where most of your costs are only capital charges, the accuracies obtainable today are well within any sense of reason, compared to tariffs that we have been using for many, many years. An anomaly that arises from valuation tariffs is where a man has a house, and has been paying a certain tariff over the years, and then decides to build a nice little garden wall. The valuator then comes along and puts up the valuation of of the property. Up goes his electricity tariff . There is absolutely no relationship between the two.

Thank you Mr. Chairman.

THE CHAIRMAN: Thank you Mr. Dreyer.

Mr. W. H. MILTON (Escom): As you all know this is one of my babies, tariffs, and things of that sort, and measuring devices. I think we must deal really with the question as posed by Mr. Sibson, and not come on to the rather extraneous and wide field that can be opened up from it.

I think the whole problem of accuracy is one which, from a technical point of view, can assume proportions which are not the least bit realistic in the economic world of municipal supply, that is revenue and expenditure. After all, the original meters used for measuring our commodity were ampere-hour meters, and it was only with the development of cheap and accurate meters that we were able to go to higher and higher accuracy. The point cost of obtaining accuracy and the value at issue I think is a balance between the cost of obtaining accuracy and the value to the man who has to pay the piper of that improved accuracy.

One could achieve extreme accuracy in measurement, by putting up the consumer's bill to twice what he'd pay if he forfeited accuracy and had a maximum error. It is the balance between that maximum error which is involved, and the cost of removing the error which must be achieved. In other words, it is a straightforward economic problem.

From that point of view I think that at the present stage of development of the technique, the miniature circuit breaker is sufficiently accurate in its performance as it is made today to achieve a reasonable allocation of cost to the consumer. If you want to go to more accurate measuring instruments for demand on an ampere basis it can be done, but you would probably find then that you would have to charge the consumer considerably more

for the service you are rendering, with no real value to him.

As regards the use of amperes as a measurement of the demand, as related to the service rendered to the consumer, I see no objection to the use of amperes as a measure. It is far more accurate than any other, shall I say rough and ready, method of allocating the demand charge. And once again you are up against the cost problem. If you want to deal with it on a kilowatt basis, then your costs increase considerably and the charge to the consumer for the more accurate measurement of the service you are rendering is not worth the consumer's while.

Another feature with the ampere demand charge is that to a large extent the cost to the supply authority is based on the ampere loading, rather than the watt loading.

The consumer of course has the redress on the voltage problem from unsatisfactory service. If he is getting unsatisfactory voltage he will plead for an improved voltage, and he may have to pay for the improvement in voltage due to the greater investment in capital, but there again, if he knows how much it is going to cost him he will wonder whether or not it is worthwhile having the voltage improved. So you can get your accuracy on a kilowatt basis in that direction.

As far as the miniature curcuit breaker is concerned, I would like to sound a note of warning. I have had experience of living in a house with that type of device and it is surprising how often the darn thing trips through some silly action on the part of somebody present in the house, who just puts on a bit too much load, and out it comes.

With a large number of trips those miniature circuit breakers give very unreliable service. If you have a fairly heavy load you have to be careful in the handling of the circuit breaker. If you become careless, there is every risk of fire from the use of these miniature curcuit breakers.

THE CHAIRMAN: Thank you Mr. Milton. I hope we are not going to have a discourse on the reliability of miniature circuit breakers, though. We are talking about the accuracy of them, not their reliability.

Mr. G. J. MULLER (Bloemfontein): Mr. Chairman, what Mr. Milton has just said makes me think that the miniature circuit breaker is an excellent means for us to get the concumer to increase his own standing charge, because if it trips too often we can only suggest that he is overloading the breaker and what he really needs is a bigger one, and therefore a bigger standing charge, which is just about what we need.

THE CHAIRMAN: Thank you Mr. Muller. I can also think of another good idea. You put the volts up over peak and trip the lot out!

Mr. JACKSON (Provincial Administration, Cape Town): Mr. Chairman, the accuracy of miniature circuit breakers, as compared to a standard, does not appear to me to be so important as that all miniature circuit breakers used in a particular local authority should have the same accuracy characteristics. Whether the trip point is 25% or whether is is 10% doesn't make any difference, so long as they're all the same.

THE CHAIRMAN: Thank you Mr. Jackson. Are there any more comments on this question. To be perfectly honest, I don't quite know what the answer to that one was. Actually I think we got on to one or two sidelines, and didn't really get an answer to Mr. Sibson's question, which was since these revoces tfmcuml albgkgk was since these devices may become metering equipment, should similar degrees of accuracy be asked for in regard to load limiters.

I think Mr. Jackson got as near as anyone to that, and that was that at least the accuracy should be the same for all. That of course might be a difficult thing to get, and to design a meter code on the same lines as we have for ordinary meters namely 2½%, might be a little difficult on load limiters.

I was quite serious in regard to the point of volts over peak, because this is one method of altering the accuracy to

suit the suppliers. In other words, if you are measuring amps and not watts, then obviously if you put your volts up high enough over peak, you'll increase his demand for the month.

Mr. A. R. SIBSON (Bulawayo): Mr. Jackson's reply doesn't help us very much, Mr. Chairman, because if that can be achieved so can the accuracy. I know what he's getting at and that is that one of our major problems would be arguing with Mrs. Brown who said that she had the same size of current limiter as Mrs. Jones next door, and Mrs. Jones next door can put all her hot plates on at once, and she can only put three of hers on. That is the sort of problem that would arise if there were any variation between one and the other, but it seems to be just as difficult to achieve uniformity as it does to achieve any particular standard, and I am wondering whether the problem doesn't really lie with the meter manufacturers themselves, to current limiters as a metering device, rather than the problem being approached by switchgear manufacturers.

THE CHAIRMAN: Thank you Mr. Sibson. Unfortunately the time has now passed when we can carry on with this Forum. We have quite a number of other interesting questions, but the general consensus of opinion was that Wednesday night was not entirely wasted. In fact most people had a very interesting and, in certain cases, amusing evening. Therefore, although we have not been able to go through all of our questions, some of them will be saved for next year, and I would appeal to members not to wait until the last minute to think of questions for the Forum. What we want is a large number so that we can pick out the most interesting ones. Questions have not been coming forward very well, and it is entirely because of that that I almost instructed the Executive—and got a few kicks for it—that each member had to put in at least one question. Mr. Muller of course made certain that he wouldn't be called upon for the next six years!

I do appeal to members. Members, asked for this Forum, so that they can have the benefit of the advice of every engineer and councillor delegate to this Convention, and the affiliates, and I do feel that you should make more use of it. Of course it can't be guaranteed that every question will be put, but we could put forward the most contentious, but we must have a selection to work from. We don't want to leave it to the Executive every time to think up the questions. We want to know what your problems are You put questions at times to the Executive. Let's have them at the Forum so that we know just what your troubles are, so that we can help you whenever we can. So start from now, and think about your various problems, and write them down. As you think about them, just send them to the Secretary and then forget them, if you like, until the Forum comes up; but don't start thinking next April,"Oh, I'd like an answer to that one" and send it up then. Start thinking now.

That is all for the Members' Forum this morning, ladies and gentlemen. Thank you very much.

CONTRIBUTION BY G. A. DALTON

At the onset may I say that the innovation of allocating an evening solely to the Members Forum received general commendation, in fact it seemed to be the consensus of opinion that, if the Executive countenanced some further additional time being devoted to the Forum, it would receive approbation.

My interpretation of the question posed by Mr. Sibson resolved itself into two categories:—

(1) that the introduction of current limiters in place of meters for native and sub-economic housing ventures had proved worthwhile, that satisfaction in their usage was accepted, and arising from this,

(2) what would be the attitude of Members to the application of current limiters to the wider sphere, divorced from sub-economic ventures, and,—in the first instance,—giving consideration to European domestic installations, where higher ratings

would be the order. In posing the question, Mr. Sibson must have had in mind that, basically, with hydro undertakings such as the Kariba Gorge project, ample power to meet all needs would become available, and that in consequence power measured in amperes rather than Kilowatt hours would largely and logically prevail.

Mr. Sibson made no mention whatever of the economies which would undoubtedly result from the change, but was obviously testing the feeling of Members to secure their views and to determine what degrees of accuracy would be demanded by them. I do not think,—due possibly to lack of time—his questions received adequate response, but no doubt Members who are well fitted to discourse on this unimportant aspect, will repair the omission by written contributions. I have no pretensions in this respect, but my main purport in proferring this contribution is to counter the "note of warning," respecting the usage of circuit breakers as current limiters, issued by Mr. Milton in his contribution to the discussion.

I am not aware of the basic reasons which prompted Mr. Milton in furnishing the Meeting with advice. I feel sure that he had not been made fully aware of the considerable advances made in their production, accuracy, and reliability, and that had been entirely misinformed in questioning the reliability of circuit breakers as current limiters.

THE PRESIDENT: Ladies and gentlemen, before breaking for tea I would like, on your behalf, to thank Mr. Jimmy Mitchell for so ably conducting the Members' Forum. I think we can look forward to a very interesting session again at our next convention, and I hope that we will be able to give a little more time to it.

I would like you to show your appreciation to Mr. Jimmy Mitchell for the very able manner in which he has conducted this Forum.

(Applause).

ADJOURNMENT

On Resuming:

THE PRESIDENT: Ladies and gentlemen, we have now reached the concluding stage of this, the Thirty-Second Convention of our Association.

The procedure now is to call upon members of the Association to have their say, and to express their thanks in the usual way, and I now invite members to proceed.

Dr. EINDHORN (Cape Town): Speaking as a representative of the S.A.I.E.E. I would like to congratulate the A.M.E.U. on the success of this Convention.

Municipalities are responsible for supplying a great number of people with electricity, and they own and operate a very large part of the electrical plant in this country. This speaks for the importance of the Municipal Electrical Engineer and the people who look after it. Therefore one can expect, when a great number of you come together, that the whole development in electrical engineering is brought a futher step forward. The papers at this Convention, and the discussions, proved that this expectation was fully fulfilled.

Speaking as a Captonian and Chairman of the Cape Western Local Centre of the S.A.I.E.E., I must say how much more glad we were to have had the stimulating experience here and how much more glad we are to see our own City Electrical Engineer, and Past-Chairman of the Cape Western Local Centre, installed as your President. We learned to value you, Mr. Downie, as our Chairman, and I only hope that you will be just as successful as President of the A.M.E.U.

I wish you and the whole A M.E.U. a successful year. Thank you Mr. President.

THE PRESIDENT: Thank you Dr. Eindhorn.

Mr. J. WHITE: Mr. President, on behalf of the South African Institution of Mechanical Engineers, we want to give you our best wishes for a very successful year of office, and to say how much we admire the excellent arrangements that have been made for this Convention. They are absolutely admirable.

THE PRESIDENT: Thank you Mr. White.

Mr. L. C. AXE (Johannesburg): Mr. President, Mr. Mayor, ladies and gentlemen; it falls to my lot to speak on behalf of your affiliates. We in recent years have enjoyed closer and closer collaboration with you. We have watched these conferences go from strength to strength. Every year it seems that the entertainment becomes better and better, and every year the arrangements for the conference become more a matter of congratulation, and every year we see another of our very good friends take the chair, which you, Mr. President, are now occupying. We have nothing but gratitude to express to you, and to you, Mr. Mayor, and the Corporation of Cape Town, for the excellent fare we have enjoyed while we have been here and for the very fine entertainment which has been given. We wish you, the City of Cape Town, everything of the best, and we particularly express our hope, to you Mr. President, that you will enjoy the remainder of your year of office, in the same way that you have obviously enjoyed the few days that you have occupied that position.

(Applause).

Mr. W. H. MILTON (Escom): Mr. President, Mr. Mayor, I would like to take this opportunity of extending to you the best wishes of Escom for a very successful year of office ahead of you, and also for the very handsome entertainment which you have afforded us during our stay. Some of that entertainment, of course, has taken place in this hall as a result of your quips and legpulls on the members present. I think we deserve to be kept in the the proper perspective at all times.

THE PRESIDENT: Thank you Mr. Milton. I now call upon Mr. Jimmy Mitchell to perform a very pleasant function.

Mr. J. E. MITCHELL (Salisbury): Mr. President, it is said in Shakespeare that some achieve greatness and some have greatness thrust upon them. I have had this speech thrust upon me, only in very recent moments.

Before carrying on the duty of thanking Cape Town, our hosts, on behalf of the delegates to thank the ladies themselves for gracing this Convention.

(Applause).

As has been said here many times, these Conventions would be very much more sordid affairs if we hadn't the ladies with us.

I would also like, on behalf of the engineers specially, to thank the wives of the engineers, because it is amazing how cheerful they keep when they have to listen practically at all hours of the day, and at their parties, to nothing but "shop." I understand that they actually enjoy it at times. The result is that they have to put up with it, and it is amazing how well they do it.

Throughout a man's life he is looked after and cared for by the female of the species. It has been said that a man's life is 20 years of having his mother ask him where he is going, 40 years having his wife asking the same question, and at the end the mourners wondering too.

Again, before passing on to thanking Cape Town on behalf of the ladies, I notice that both His Worship The Mayor and our President have said that in the reasonable future we might see nuclear power stations.

As you know one of the difficulties of nuclear power stations is that of controlling the product, and I understand that the first Adam splitting gave us Eve—a force which man has never been able to control.

Now, on behalf of the ladies, Mr. Mayor, I would like to say that I understand from them that they have had a really magnificent time. First of all at the Civic Cocktail Party and get-together, especially the dancing afterwards, everything tuned to the right note, and everybody looked very cheerful, which gave us the right setting for starting off this Convention.

Then on the next day you kindly arranged a motor trip for the ladies round your most magnificent scenery I don't think there is anywhere I have ever been where one can see such wonderful settings in such a short time. The ladies were very pleased with that outing, and for the tea at Muizemberg.

Then, of course, they joined the men for wonderful trip to Paarl, and the tour through KWV. What surprised me most was the number of ladies asking for water. Perhaps that's a good sign. There again they had a wonderful trip—and it kept them out of mischief too at the same time.

Last night I didn't see a glum face in the whole hall. I feel, therefore, that the ladies were very pleased with the escorts provided. I may say that some of us who hadn't our wives with us were also very pleased with what was laid on for us too. I understand that Mr. Downie had five typists on tap. I didn't see them, he kept them somewhere else.

I would like to say, finally, Mr. Mayor, that apart from this morning of course, you laid on the weather which was perfect for them, and that everything which was done for them was very well organised, and everything was in very pleasant surroundings.

Therefore on behalf of the ladies, Mr. Mayor and Mr. President, I would like to say "Thank you very, very much indeed for the wonderful time you have given us."

(Applause).

THE PRESIDENT: Thank you Mr. Mitchell. Ladies and gentlemen, we have the Mayor with us today, and I have great pleasure in calling upon him to make a few remarks.

HIS WORSHIP THE MAYOR OF CAPE TOWN: Mr. President, ladies and gentlemen, I want first of all to thank all the speakers who have referred to the work that we have done automatically for your entertainment.

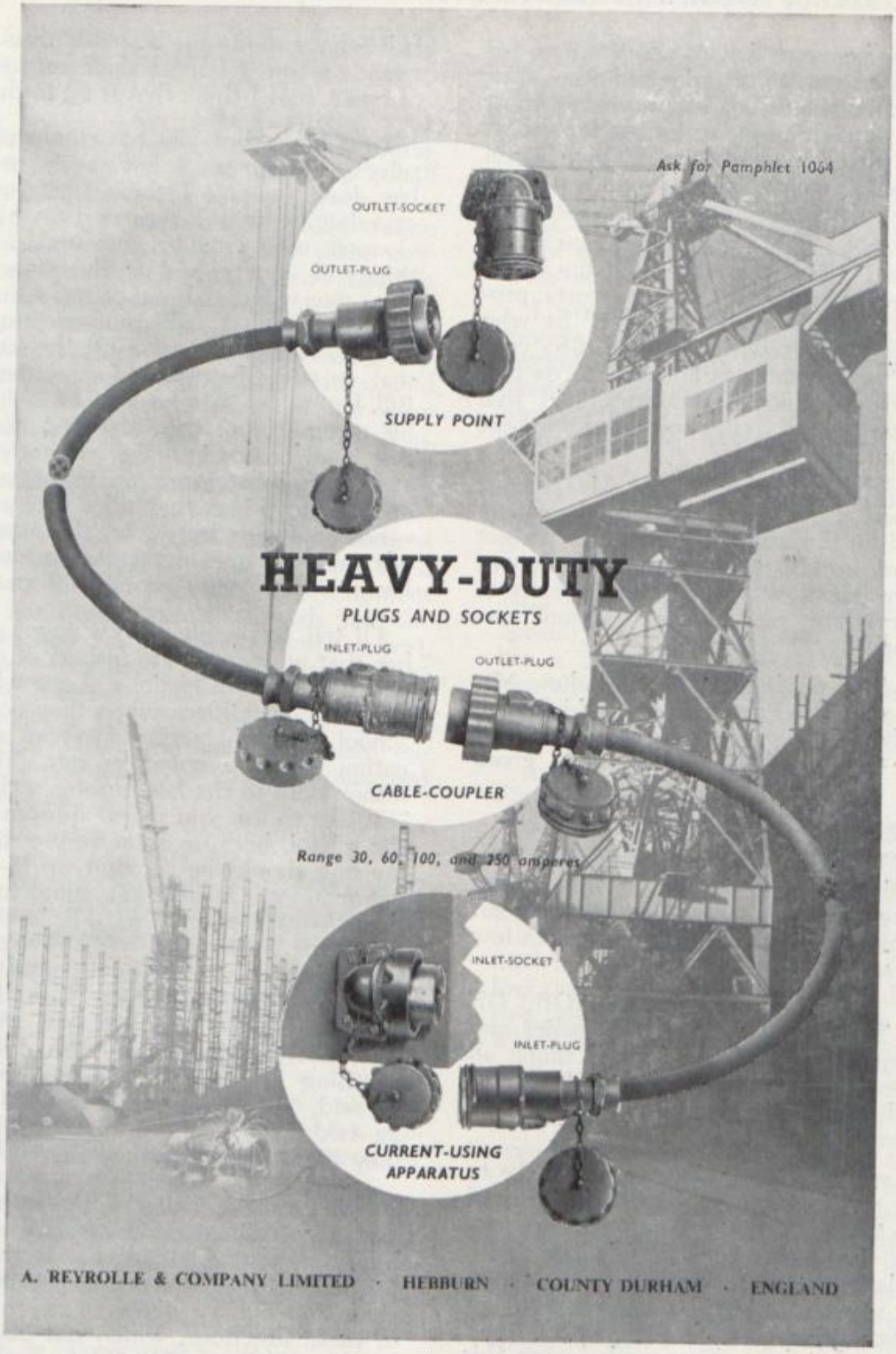
You will remember that when I spoke to you at the beginning of the week I said that in my opinion the Congress that produced the most cordial relations with councils, generally and amongst themselves, was the A.M.E.U. I think that that has been more than doubly proved from the facts that have happened during this Convention.

I myself am very pleased about this convention generally, because I have been able to make acquaintance with friends that I have not seen for years, and better still I have made the acquaintance of new friends whom I hope I shall not lose sight of again, and I think that is all to the good.

I do hope that you have enjoyed yourselves. So far as I have seen, everyone has done so, and I think that your congratulations will be carried to the City Council, who provides the funds for these things of course, and at the same time I must pay tribute to one of our Councillors who has been to all your meetings, and who has been with you all the time, and that is our Chairman of Electricity, Clr. Bill Peters, so that he will be able to tell his committee of the work you are doing. But it all comes into the amount of work, and even what went on that evening is one of the things that does worry council —not only ours but it worries other councils too, and one of these days one might have to think very seriously about it.

I'll tell you a little story now. Remember that most of us are fathers of children, and we are very anxious about what happens to our children when they go to high school, and what type of school and education they are going to get. The usual father went to the headmaster and he said, "I'd like to ask you a few questions about the school, because I am very anxious that my boy should be brought up in the proper manner. Would you mind answering them?" He said, "No, I'll be only too pleased." So he said, Well first of all, do you allow your children to smoke in this school?" "Oh, no. No. Certainly not." "Do you allow your children to drink?" "Oh, good gracious no. We don't allow anything like that on the premises." So he said, "And what about dates?" "Well," he said, "they can eat as many dates as they like—providing they don't overdo it."

Now, to the ladies I do want to say that my estimated idea of what might happen about the ladies was more than jutified, because I want to say quite honestly that I have never in my experience of these functions, which has been over a good many years, 20 years as a councillor, have seen a more jovial crowd or body of ladies than you have had at this Convention this time. The joviality at some of the parties was something that had to be seen to be believed, and I do agree with the



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speakers who say that they add not only beauty to your Conventions, but also great blessings as well. I don't believe that they are always watching what you are doing. I believe that they enjoy being on their own just as much as you men enjoy being on your own.

I also, on behalf of my daughter, the Mayoress, want to convey to you greetings this morning, and tell you how much she enjoyed the tea party at Kirstenbosch that morning. I only regret that her engagements have kept her away from us this morning, and on other days, but that does'nt matter. It has not interfered with your pleasure.

I do want to show my appreciation to the ladies particularly for the valuable work they have done behind the scenes. Their work has been to foster friendships wherever they can while the men have been doing a job of work, and they have done it remarkably well. Thank you very much ladies.

Finally I want to tell you that it is a great pleasure for us in the City of Cape Town to welcome congresses, and this year we have had some very large ones in this city, and all, so far as we are concerned, have been made to feel at home and enjoy themselves to the best of our ability.

It is one of the great joys of Cape Town to be able to entertain visitors, and as you know, I suppose as far as this city is concerned, we are most affected by visitors to the city, and it gives us a great deal of pleasure to do so. The very fact that all the ships that came through Suez, and particularly the troopships, not one of them went away without us giving them engagements and parties for every day they were here. If we could not get them on shore, we took them parties on the ships, and that happened on many occasions. We find great pleasure in this. It is not a burden to us. I don't want you to think it is a burden on the Mayor and councillors to entertain you people. It is not. It is only a little bit of a financial burden sometimes, but not generally. It is only the Chairman of Finance who worries about this. We think the dignity of this city and its reception to its guests cannot be measured in £. s. d. and I do hope that one of these days, if we don't see you again for some years on this congress, that I shall be able to meet you on congresses to which you are attached to other municipal bodies.

I want to thank you again very much for allowing me the pleasure and the privilege of meeting all of you again, and hope that you will find, when you get to your respective cities and towns, that the work that has been done at this conference has been really worth while.

Thank you very much.

THE PRESIDENT: Thank you Mr. Mayor. I will now call on Clr. Blignaut the councillor representative of our Administrative Capital to say a few words.

CLR. P. G. C. BLIGNAUT (Pretoria): Mr. President, Mr. Mayor, ladies and gentlemen; I have much pleasure in taking this opportunity of thanking you on behalf of the delegates for a very enjoyable and successful Convention. Everything was "real tops." The weather was magnificent, and we were told that is was specially switched on for us. I suggest that you overhaul your time limit switch!

Mnr. Die President, ek wil van hierdie geleentheid gebruik maak om u weer eens te bedank vir alles wat u vir ons gereel het. Ons het dit alles baie geniet. Ons het baie geleer van kabels an drading, ens. Ek wil ook van hierdie geleentheid gebruik maak om u 'n baie suksesvolle en genotvolle jaar as President van hierdie Vereeniging toe te wens.

(Applaus).

THE PRESIDENT: Thank you Mr. Blignaut. Well, Mr. Mayor, ladies and gentlemen; it now remains for me to say the closing words. I must first of all take the opportunity of expressing my very sincere thanks for your coming to this Convention. If it has been successful, this has been largely due to the fact that we were very lucky in the fine weather we have had. I was extremely nervous at first because of the fact that we had had so many weeks of fine weather before this particular week. I was afraid that the Cape might run true to its winter form

and suddenly burst into the wet, miserable weather that we in the Cape know so well. However, I think you will agree that Cape Town has come up to scratch very nicely in staving off such weather until after the Convention is over.

On personal side, I wish to thank the members of the Executive, who helped me in carrying on this job, and also Mr. Ewing, our Secretary. I realise that I have quite a lot to learn in the art of being a President, but I have done my best.

As for the success of the arrangements made for this Convention, this has been the result of a team effort on the part of a handful of employees of the Cape Town Electricity Department. Once you know a convention is coming off, although it is a year ahead, you have to start right away thinking about organising it, the arrangements that have to be made, and so on. A tremendous amount of detail work is necessary, as my colleagues know. The success of a conference like this, as far as the President is concerned, particularly if he is the Electrical Engineer of the town or city where the convention is being held, is due to the detail work of the employees in the Department which he controls. I think I can claim that we have given you a pretty good show, and the credit for that I hand to the boys and girls who are behind the scenes in my Department.

(Applause).

That brings the Convention to a close, and I look forward to seeing you all again next year at the Convention which is being held in Johannesburg.

I wish you all Godspeed, and good luck.

Thank you.

CONVENTION ADJOURNED

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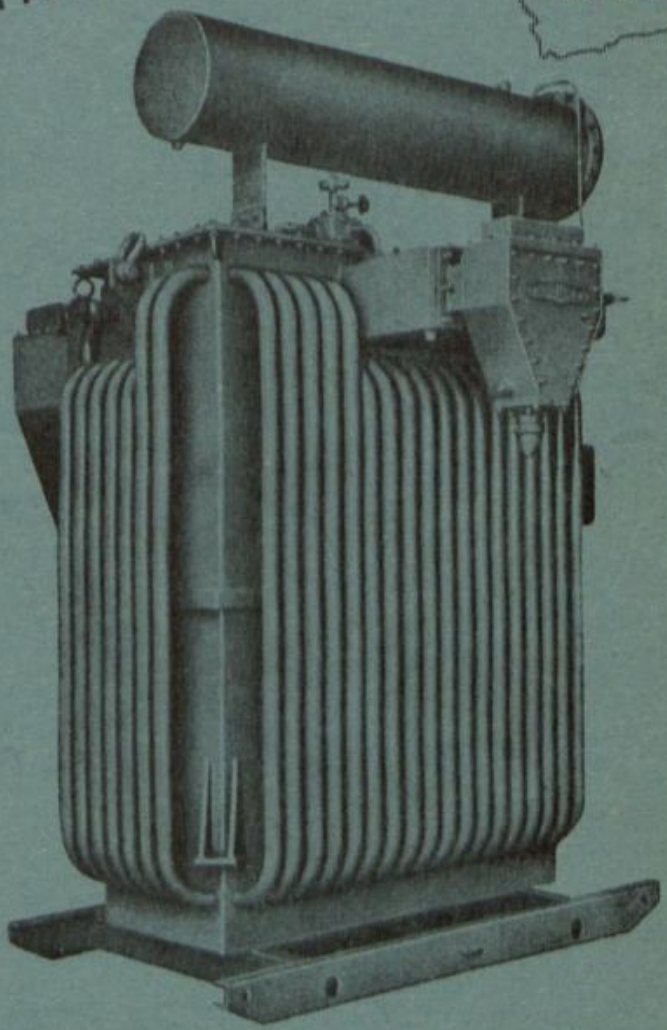

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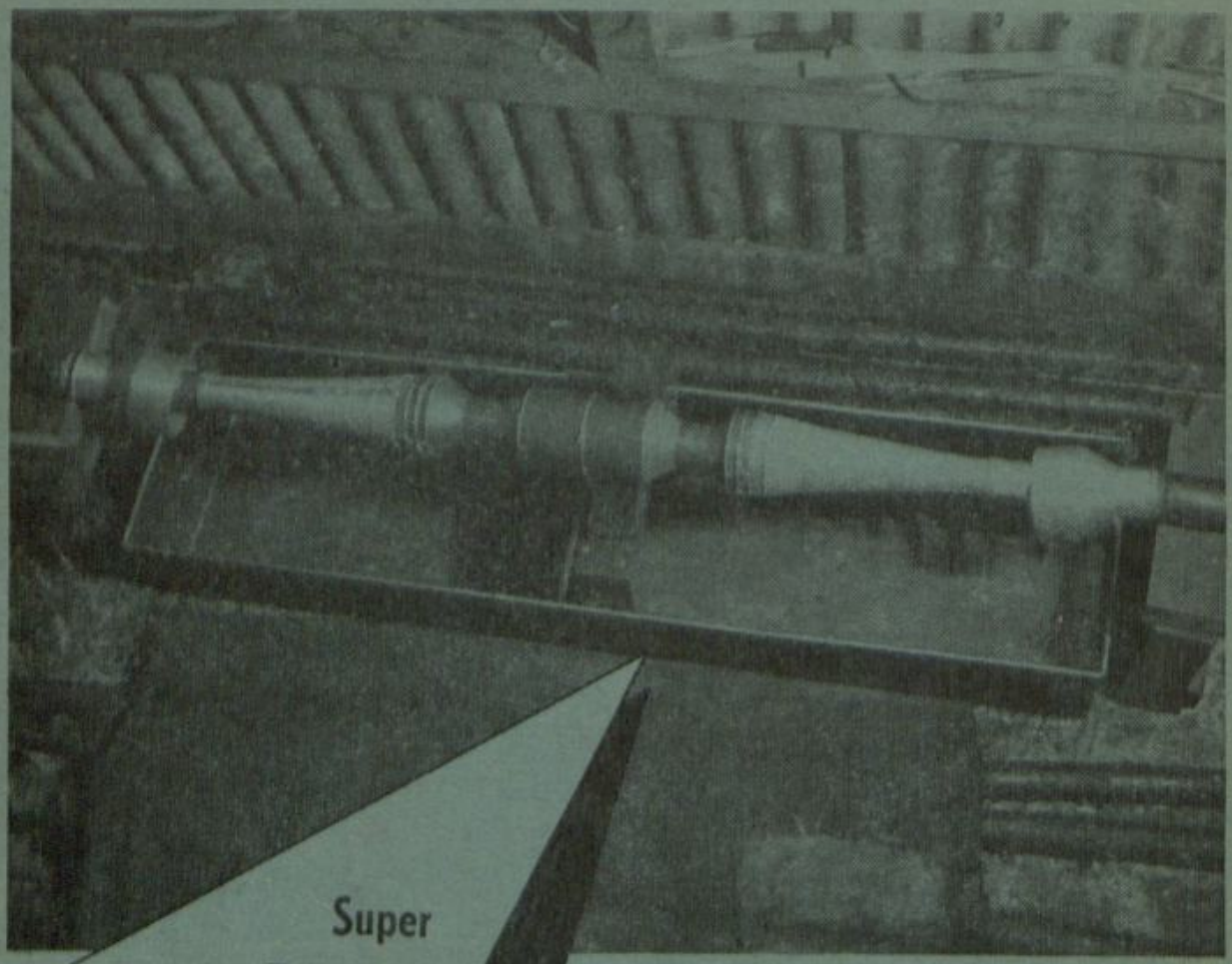

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The photograph shows a straight joint in the course of construction during the installation of some 16 miles of single core 88 kv. Oil Filled Cable supplied to the Electricity Department of the City Council of Johannesburg.

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