RADIO TRADE ANNUAL OF AUSTRALIA

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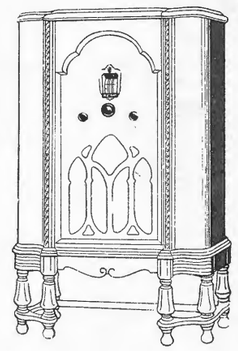
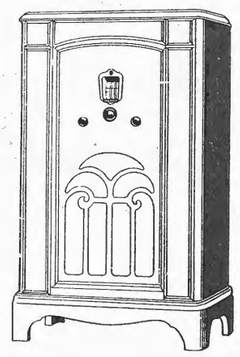
Stromberg-Carlson *leads in radio pioneering*

TO read the list of developments pioneered in Australia by Stromberg-Carlson (Australasia) Limited is to review every important milestone in radio progress. Stromberg-Carlson were the first in the Commonwealth

- to produce an All-Electric Radio Receiver.
- to master the intricacies of mass-producing Superheterodyne Receivers.
- to design a Superheterodyne Receiver working with so few as five, and ultimately four valves.
- to introduce Automatic Volume Control.
- to give the public Visual and Silent Tuning.
- to introduce a Muting System.
- to produce an Automobile Receiver.



Naturally, Stromberg-Carlson Dealers benefit. To be always first with the latest is an advantage the authorized Stromberg-Carlson dealer consistently enjoys.



Stromberg-Carlson 633 is a six-valve superheterodyne in a handsome six-legged period cabinet. Stromberg-Carlson 633 has DUAL SPEAKERS in addition to Visual Tuning and Between-Stations Muting.

Audiola 693 is a six-valve superheterodyne in beautifully proportioned walnut-finished cabinet of modern design. Visual Tuning, Between-Stations Muting and Automatic Volume Control are features.

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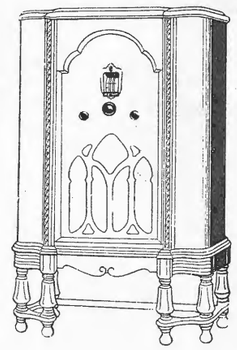

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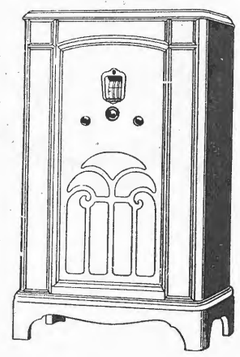

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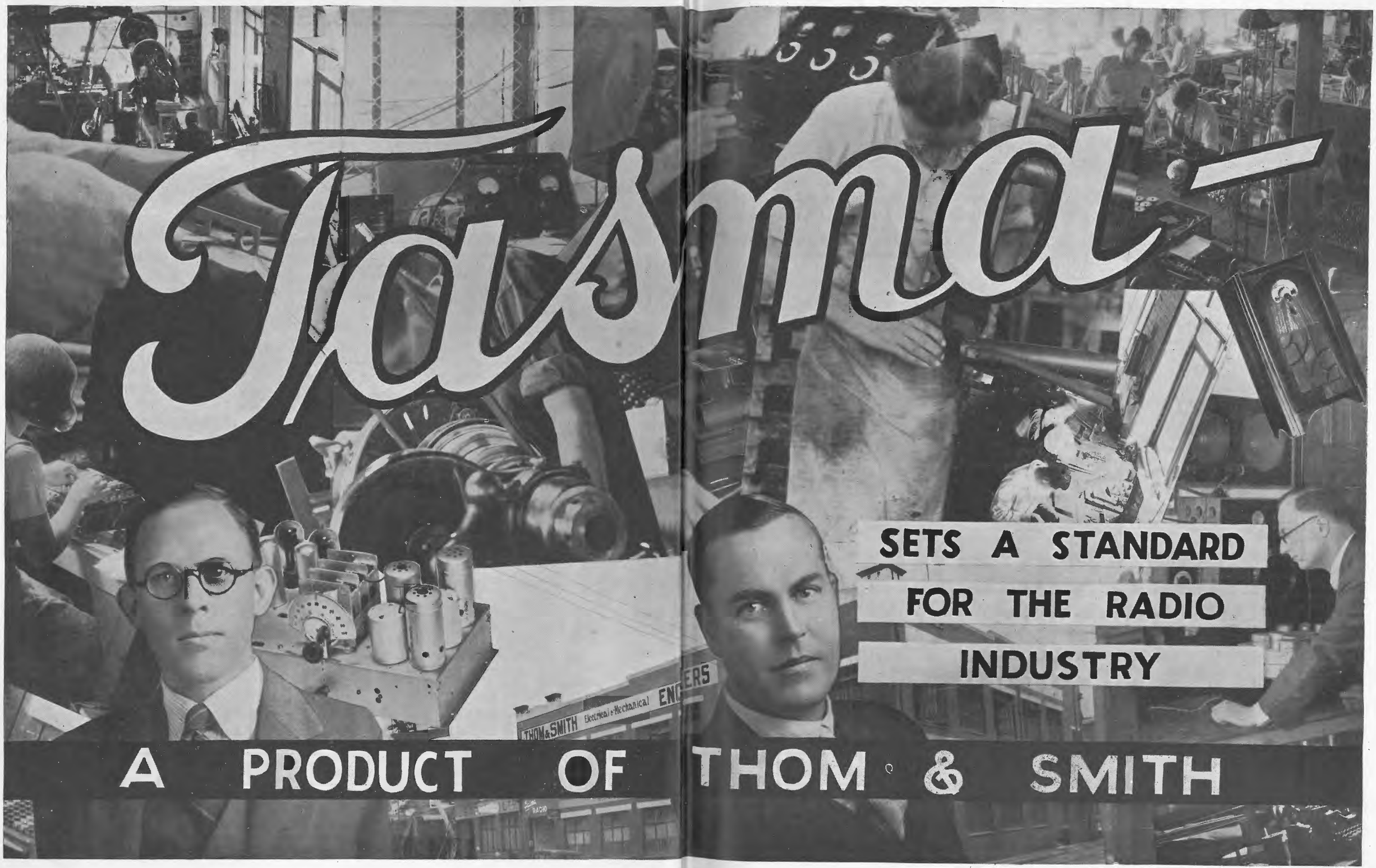
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THE

Radio Trade Annual

& DIRECTORY

OF AUSTRALIA

1933

FIRST EDITION

Compiled by the Staff of "Radio Retailer of Australia"

PRICE

10/-

Post Free in Australia

12/6 Overseas

The Publishers cannot accept any responsibility for any errors or omissions, but every care has been exercised in the compilation of this book.

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AUSTRALIAN RADIO PUBLICATIONS

15 CASTLEREAGH ST., SYDNEY, N.S.W.

P.O. BOX 3765 SYDNEY. TELEPHONE B2549.

PREFACE

This Radio Trade Annual and Directory (first edition) is presented to the Radio Industry of Australia in anticipation that it will be of material value in every direction. This publication fills a great and long felt want as it is the first of its kind that has been attempted in the Commonwealth.

The rapid progress of the Radio Industry in Australia has definitely warranted such an ambitious publication, and the reader will undoubtedly find that all this is substantiated in the hundreds of pages enclosed in this book.

The idea behind this Trade Annual is to centralise all necessary information, statistics and data that will be of any use to radio traders, manufacturers and distributors. Between the two covers of this book is information that has taken years to compile and is the result of many years of experience in the Radio industry. The Listeners' Licence figures are treated in a most exhaustive manner and if properly considered by every radio trader and sales manager should prove of material value in the planning of an intelligent sales campaign and the conduct of future business.

No responsibility is accepted by the publisher for any errors or omissions, although every care has been exercised in the compilation. Every effort has been made to ensure that the contents are absolutely reliable and of material value and while in some instances it may not be absolutely complete, nevertheless this will be rectified as time goes on. Such a new idea and such a large Trade Annual could hardly be appreciated by some people in the Radio Industry, and therefore some particulars may have been omitted which will all be included in due course.

It is realised that in the first year of a publication of this nature, the contents of many things are entirely experimental, but it is believed that this first edition will be well received. Readers are invited to submit any ideas concerning the Radio Trade Annual throughout Australia that will tend to improve the publication.

Broadcasting activities are dealt with and as time goes on this section will become even more comprehensive and important because upon the broadcasting system including both "A" and "B" class stations depends the success of the entire Radio Industry in Australia.

Sincere thanks are extended to all those in the trade and to the P.M.G.'s Department for supplying valuable information for inclusion herein.

Editor.

Trade Discount Ready Reckoner.

DISCOUNT RATE %.

Amount.	2½	3⅓	3¾	5	6	7½	10	12½	15	17½	20	25	27½	33⅓
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JANUARY							FEBRUARY							MARCH							APRIL						
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1934

JANUARY							FEBRUARY							MARCH							APRIL						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
...	1	2	3	4	5	6	...	...	...	...	1	2	3	...	...	...	...	1	2	3	1	2	3	4	5	6	7
7	8	9	10	11	12	13	4	5	6	7	8	9	10	4	5	6	7	8	9	10	8	9	10	11	12	13	14
14	15	16	17	18	19	20	11	12	13	14	15	16	17	11	12	13	14	15	16	17	15	16	17	18	19	20	21
21	22	23	24	25	26	27	18	19	20	21	22	23	24	18	19	20	21	22	23	24	22	23	24	25	26	27	28
28	29	30	31	...	...	...	25	26	27	28	...	...	...	25	26	27	28	29	30	31	29	30	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

MAY							JUNE							JULY							AUGUST						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
...	...	1	2	3	4	5	...	...	...	...	...	...	1	1	2	3	4	5	6	7	...	...	...	1	2	3	4
6	7	8	9	10	11	12	3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
13	14	15	16	17	18	19	10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
20	21	22	23	24	25	26	17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
27	28	29	30	31	...	...	24	25	26	27	28	29	30	29	30	31	...	...	...	...	26	27	28	29	30	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
...	...	...	...	...	...	1	...	1	2	3	4	5	6	...	...	...	...	1	2	3	...	...	...	...	...	...	1
2	3	4	5	6	7	8	7	8	9	10	11	12	13	4	5	6	7	8	9	10	2	3	4	5	6	7	8
9	10	11	12	13	14	15	14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15
16	17	18	19	20	21	22	21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22
23	24	25	26	27	28	29	28	29	30	31	...	...	...	25	26	27	28	29	30	...	23	24	25	26	27	28	29
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30	31	...	...	...	...	...

The Progress of the Radio Industry in Australia.

The following resume of the progress of the radio industry in Australia is offered with a full realisation that very minor incidents and even some major events may have been omitted.

Ten years ago broadcasting was introduced in a very amateur fashion in Australia, but it is really twenty (20) years since the radio industry first commenced activities.

Period 1912-1920.

The Pioneers behind this movement which was destined to grow to enormous proportions were Amalgamated Wireless (A/sia) Ltd., under the direction of E. T. FISK who, in 1913, established a wireless factory in Underwood Street, Sydney, to manufacture ship's transmitters and receivers. The outbreak of war called for the equipping of Australian Transports, and A.W.A. was immediately charged with this national responsibility. During the war, A.W.A. fitted every Australian transport with apparatus and also manufactured and installed similar apparatus on Japanese transports in the Far East and British ships in South Africa. These operations converted the manufacturing activities into a very substantial organisation which continued to expand when in 1922 A.W.A. took over from the Commonwealth Government the chain of 35 coastal stations extending around Australia and throughout the Pacific Islands.

Wireless manufacture of some character was also undertaken at R.A.N. Randwick Workshops, but this did not develop successfully.

Towards the close of the War (Sept. 1918) the first direct wireless message from England to Australia was received by E. T. FISK. This message was from Mr. W. M. Hughes, Prime Minister of Australia, who was in England, addressed to Sir Joseph Cook, Minister for Navy at the time. To those who had actual wireless experience during the war that feat must stand out as one well worthy of mention. Naturally the rapid technical development necessary in such a gigantic World War compelled wireless progress at a rate unbelievable and thermionic valves which were used in radio and telephone development again came into use when the soldiers of all armies were demobilised. Amateur development particularly in America, but also in England and Australia for the period 1919-1923 was exceedingly rapid. Records show that broadcasting of speech and music as a private entertainment was engaged in in England during the War when certain wireless units were active in acquiring knowledge for military communication purposes. It will be remembered how radiotelephone conversations were carried on between Washington, U.S.A. and American Headquarters in France, but even that did not suggest itself as being a forerunner of Broadcasting as the World knows it to-day.

Birth of Broadcasting.

It is also on record that E. T. FISK gave the first public demonstration of broadcasting before the Royal Society of N.S.W. in Sydney during August, 1920. Not until October of that year were the possibilities of broadcasting appreciated in America when four persons met at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Co. of America. That little gathering, destined to make radio history was the outcome of a suggestion by Engineer Frank Conrad, that the experimental radio station of the Company be utilised to transmit radio telephone messages in order that he could undertake experimental work on the apparatus at his home station. He remarked that the co-operations of all radio amateurs would be valuable in his work. This had already been proved months before quite by accident when during experimental transmissions the operator placed the microphone alondside a phonograph to relieve the strain on his voice. Then the late Harry P. Davis, Vice-President of the Company, suggested that the general public might be interested and it was unanimously decided to commence operations. Thus the first **public** broadcasting station was inaugurated with the call letters 8ZZ. One of the first items broadcast was the Presidential election returns and the success made those closely in touch with the station realise the tremendous possibilities of radio broadcasting. Immediately steps were taken to develop this unique service. The Government's permission to broadcast every night was obtained and the call changed to K.D.K.A. December 21st, 1920, was the birthday of K.D.K.A.

During this period A.W.A. was fully aware of what was going on and in October, 1920, Mr. Fisk arranged the first complete public broadcasting concert in Queen's Hall at Federal Parliament House, Melbourne. In January, 1921, A.W.A. commenced a weekly broadcast programme from their Melbourne station.

During 1921, 1922 and 1923 various experimental transmissions by commercial and amateur interests gradually developed, the reception being confined entirely to radio enthusiasts in the official commercial, and amateur fields. Notable among amateur transmissions were those conducted by C. D. Maclurcan (2CM), J. Pike, J. G. Reed, F. Basil Cooke, R. C. Marsden, Sid Colville and Jack Davis of Sydney and Mr. Culliver (3DP) Melbourne.

During 1922 several electrical organisations entered the radio business and some ex-amateurs commenced to trade in radio parts. The very first radio exhibition was organised (by the Editor) for the Metropolitan Radio Club, and held in Congregational Hall, Sydney September 22nd, 23rd, 1922.

The only incentive in those days for enthusiasts to buy radio apparatus was the amateur transmission carried out by such men as Maclurcan and others. Reluctance on the part of the Government to authorise a systematic broadcasting scheme compelled those commercially interested to encourage the amateurs.

With valves at £2 and more, crystal sets around £10, variable condensers at 32/6, it was an expensive hobby.

Patent Position.

The patent position also created considerable trouble and as A.W.A. was the only company who possessed any worth while and exploitable patents at that time, they would not allow all and sundry to use such patents for monetary gain or otherwise until their interests were protected. Having spent many thousands of pounds in obtaining and developing those patents and as the pioneer organisation, their fight for recognition was really in self-preservation. Looking back over the past 10 years one can now appreciate their action although the writer was one of the leaders in opposing the then alleged monopolistic attitude of A.W.A. It was not to be expected that a group of keen business men would stand by while other people entered the radio trade for the purpose of making profits without having contributed one penny towards its development.

Early 1923 the Association for Developing Wireless in Australia, New Zealand and Fiji was organised by the late George A. Taylor and assisted by executives of several electrical and other Companies interested in exploiting wireless. It must be understood that George Taylor had no commercial interest in Wireless, but was moved by a motive of encouraging the best development of wireless in which he was a pioneer experimenter as far back as 1910 with some notable achievements to his credit.

It is recorded that the first proposal for systematic broadcasting was made to the Prime Minister's Dept. by A.W.A. on 27/7/1922, when the Company indicated its desire to establish a broadcasting service in all States. On 1/11/1922 the Company formally applied for permission to establish the stations but again other interests objected to A.W.A. being given the sole right to commercialise such a service and agitated for a conference of all interested parties which was convened by the P.M.G. and held in Melbourne on 24/5/23.

The Sealed Set Scheme.

This conference was about the most representative conference ever held in radio circles in Australia. It was opened by the Hon. W. G. Gibson, Postmaster-General, who intimated that the Government was prepared to give earnest consideration to any practicable scheme propounded by this conference of radio interests. Just at this time E. T. Fisk arrived back from England where he had studied the British situation and also that in America in relation to broadcasting. Mr. Fisk laid before the conference a scheme which was adopted with very minor alterations and became known as the **Sealed Set Scheme.** It was proposed that a set would only pick up a particular station or stations for which the listener paid the fees as charged by the broadcasting stations for the service that was received and transmitted. In Sydney Station 2FC charged £3/3/0 per annum, 2BL charged 10/–, 3AR Melbourne charged £3/3/0, and 6WF Perth charged £4/4/0. Considerable discussion ensued at this conference but in the absence of any other practicable scheme the Sealed Set idea was adopted, but not without misgivings on the part of several people who doubted the efficacy of the proposition.

The Federal Government drew up regulations which were issued on the 1/8/23, and among other things contained a provision that station licensees could make their own charge for subscription by listeners who had sets suitable only to the wave length of the particular station whose service was received. Station 2SB, later altered to 2BL, commenced its service 13/11/23. Station 2FC Sydney commenced service 5/12/23, Station 3AR Melbourne commenced 26/1/24 and 6WF Perth 4/6/24.

For some months this sealed set scheme was persevered with but technical difficulties in the early stages of the scheme aroused such opposition that it finally defeated itself. The failure of the Sealed Set Scheme was evident by the fact that on 31st July, 1924 there were only 1206 licenses in the Commonwealth, 906 in N.S.W., 187 in Victoria, 74 South Australia, 23 Queensland, 16 Tasmania.) At end of August, 1924, when the new scheme doing away with Sealed Sets was introduced, and permitting open sets to receive all stations the licences increased up to 8,688 in one month. The next month they jumped to nearly 17,000, then 22,000 then on to 31,000 until December of that year licenses were 38,336. This proved that the public were not prepared to be tied down to a Sealed Set Scheme and only receive one particular station, but it may be justifiably claimed that had the sealed sets been ready for delivery to the public when the scheme was introduced or in a week or two it might have been accepted and working O.K.

Another New Scheme.

New Regulations issued 17/7/24 provided for the issue of two classes of broadcasting station licenses—Class " A " and Class " B ". Two Class " A " licenses were authorised for N.S.W., two for Victoria, mainly owing to the fact that the stations were already in existence in those States. In all the other capital cities only one Class " A " station was permitted, but the Regulations provided that additional relay stations for the purpose of serving distant country licensees could be arranged for by the owners of existing " A " Class stations.

In 1924, when stations were operating on long-wave lengths—2FC 1,100 meters, 3LO 1,720 meters, and 6WF 1,200 meters, country reception was possible almost throughout 24 hours of the day. Five valve sets were selling in 1924 for £65, a loud speaker, horn type for £9, a two valve set for £35. As there were " B " Class Stations operating on the 250 to 500 meter band and " A " Class Stations on the 1,000 to 2,000 band, broadcast receivers had to be fitted with change over switches or some tuning device to permit of both bands being receivable. Practically all of the sets sold in Australia in those days were made in Australia certainly not under conditions such as exist to-day in 1933.

Station 2FC was opened on 5th December, 1923, designed, manufactured, and operated by A.W.A. It was owned and controlled on the programme side by Farmer & Co. Ltd. 3LO was also built by A.W.A., and commenced service on the 22/7/1924.

The first gigantic radio and electrical exhibition was held in the Sydney Town Hall under the auspices of the Wireless Institute of Australia, N.S.W. division, December 1923, and was a huge success.

Pioneer Traders.

The following were exhibitors in that pioneer commercial exhibition; Amalgamated Wireless (Aust.) Ltd., Australectric Ltd., Australian General Electric Co. Ltd., Bean, L.P.R. & Co. Ltd., Bennett & Wood Ltd., Biden & Roberts, British General Electric Co. Ltd., Broadcasters Ltd., Burgin Electric Co., Colville-Moore Wireless Supplies, Continental Radio and Electric Co., Edison-Swan Electric Co. Ltd., Falkiner Machinery Pty., Ltd., Farmer & Co. Ltd., Gibson Battle & Co. Ltd., Harringtons Ltd., Hecla Electrics Pty. Ltd., Hordern, Anthony & Sons Ltd., Jones, David Ltd., Lee, Fred. S. Ltd., New System Telephones Pty. Ltd., Noyes Bros. (Sydney) Ltd., Pickering & Godfrey Ltd., Radio & Co. Ltd., Ramsay, Sharp & Co. Ltd., United Distributing Co. Ltd., Warburton, Franki Ltd., Western Electric Co. (Aust.) Ltd., Wiles, W. Harry," Wireless Press " Wireless Supplies Ltd.

The type of receivers used about this period employed the well-known system of " Tune-Plate " or " Tuned Anode " system of radio frequency amplification with detector and two stages of audio amplification except where resistance-coupled or an attempt made at three or four stages of audio transformer-coupled which resulted in more noise and distortion rather than clear reproduction with quality.

The broadcasting system then in force, including the " A " and " B " Class stations, required that " A " Class stations derive their revenue from the listeners' license fees which in more populated areas was 24/– per annum under the zone scheme within 250 miles of an " A " Class station.

The licensed listeners' fees from July 24 up to July 25 was 35/– in zone 1, up to a radius of 250 miles from an " A " Class station of this 30/– was paid to the Broadcasting company and 5/– retained by P.M.G. Dept. for administration expenses. The licensee of " A " Class stations paid Amalgamated Wireless certain fees for renting, maintenance, and technical operation of the station. From 1/8/25 to 31/12/27 the listener's fee was reduced to 27/6, of which 25/– was paid to the Broadcasting company and 2/6 retained by the Department. From 1/1/28 up-to-date the fee has been 24/– of which 12/– was paid to the Broadcasting company and now the Broadcasting Commission.

No Fees for "B" Stations.

The " B " Class stations have never participated in any way whatsoever from the revenue derived from listeners' license fees and therefore had to obtain their revenue by advertising over the air similar to the American scheme of broadcasting. That this scheme of " B " Class stations receiving revenue from advertising has proved successful lies in the fact that whereas there were only 12 stations in operation up till 1927, to-day there are well over 40 such " B " Class advertising stations.

The first " B " station license was issued to station 2BE (Burgin Electric Co. Sydney), operating on a wavelength of 316 meters and service commenced immediately. Official records show station 2UE Electrical Utilities Supply Co. received its license on the same day as 2BE 7/11/24 but did not commence service till 26/1/25. In Victoria 3UZ had been conducted as an experimental station for some years and received its official " B " Class license to operate on 322 meters on 6/2/25, the service commencing 8/3/25. Station 3DB was licensed to operate on 255 meters 18/10/26 and commenced service on 21/2/27.

Another Conference, 1926.

In 1926 a Commonwealth Radio Conference was held in Sydney Town Hall, May 3rd, 4th, 5th under the auspices of the Association for developing wireless in Australia, New Zealand and Fiji. This Conference was called to discuss the necessity for the appointment of a Royal Commission to investigate wireless in Australia and was representative of most of the interests associated with wireless in both the commercial and amateur spheres. The majority of the difficulties experienced in the development of wireless in the Commonwealth arose from the fact that the progress was so rapid that both commercial and Governmental authorities were not able to say definitely what was the best scheme and everything proposed was more or less of an experimental nature. Therefore, every year or so the deficiencies of the system in operation at the moment were brought to light and a new scheme suggested.

The Royal Commission sat in numerous cities of Australia during 1927 to investigate broadcasting conditions. The commission made certain recommendations involving among others the pooling of a portion of the licence fees of all States, with the object of guaranteeing a minimum revenue to the broadcasting companies in each State. The Commission's report was considered exhaustively by the Government and finally in October, 1927, the Prime Minister called a Conference of all the companies operating " A " Class stations. These broadcasting companies were unable to agree on any common scheme but the Government being determined to evolve an equitable proposition asked the companies to consider the matter exhaustively with the object of arranging for co-ordination between themselves so the larger States could help the smaller States in providing a satisfactory service throughout the Commonwealth. Despite the fact that negotiations continued along these lines for several months, the Federal Government found in July, 1928 that still another scheme was necessary.

National Scheme.

A National broadcasting service scheme was announced by the Federal Government on 26/7/28 whereby one organisation would cater for the National programmes for the whole of the Commonwealth while the tachnical services of the various stations would be owned and operated by the Government whereby leaving the actual programme side of the National broadcasting in the hands of people who understood entertainment.

A detailed scheme for the establishment of the National service was therefore introduced along the lines mentioned and tenders were called for the right to provide programmes through the various National stations for which the programme company would receive 12/– from each listener's licence fee. Of the balance 3/– would be paid to Amalgamated Wireless for Patents. This scheme also provided for the continuation and extension of the existing system of " B " Class stations with the control, so far as allocation the number of stations technical requirements of same, remaining in the hands of the P.M.G. Department. A system of Class " C " stations was also suggested, to be available for the transmission of publicity programmes sponsored by large advertisers. This part of the scheme did not materialise.

The assets of the various broadcasting Companies were finally acquired by the P.M.G.'s Department when the various licenses expired, and utilised for the National Broadcasting service.

New Programme Suppliers.

On 9/5/1929 tenders were invited for the provision of the broadcasting programmes in accordance with specified conditions and 8 tenders were received. The combined tender of Union Theatres Ltd., Fullers Theatres Ltd., and J. Albert & Son was accepted and those tenders formed the Australian Broadcasting Co. Ltd., which entered in to a contract with the Commonwealth Government for the provision of broadcasting programme services for a period of approximately 3 years ending 30/6/1932.

The Commission.

Early in 1932 the Commonwealth Government passed the Australian Broadcasting Commission Bill which called for the appointment of a Chairman and four members of the Board. These were announced by the Postmaster-General, on May 24th, 1932. Chairman: Mr. Charles Lloyd Jones, Sydney. Vice-Chairman: Mr. Herbert Brookes, Melbourne. Members: Mrs. Claud Couchman (Melbourne), The Hon. R. B. Orchard, (Sydney), and Professor R. S. Wallace (Sydney University). The Commission commenced activities of the National Broadcasting service on July 1st, 1932 and is at present controlling the situation.

Radio Industry Grows.

During the past 3 years broadcasting has developed to a most remarkable extent. The year 1932 witnessed the greatest activity in the Radio industry since broadcasting began. It is reliably estimated that over 120,000 radio sets and chassis were made in Australia during that year whereas in 1931 approximately only 42,000 receivers were made. Remarkable activity has taken place on the manufacturing side of radio and a large number of factories commenced operation during the past year or two and riding on the crest of the wave have been remarkably successful. In several instances factories only 2 and 3 years old claim to produce over 300 and up to 400 chassis per week for many months of the year. The most outstanding improvement in manufacturing circles has been the new factory of Amalgamated Wireless acquired in 1930 and located at Parramatta Rd., Ashfield. The floor space of 75,000 sq. feet was double that previously occupied in Knox St., Sydney. Even this huge floor space, has now been extended by an additional 40,000 ft. with 3 adjoining buildings. Up to the beginning of 1933 the manufacturing activities of A.W.A. included wireless receivers and transmitters but not valves. Very recently modern valve making plant has been installed and the factory is now engaged in production of Australian made valves but these will not be marketed for some months to come.

S.T.C. Re-enter Radio.

Another important move over the last two years has been that of Standard Telephones & Cables Ltd., who re-entered radio manufacturing with much activity and success. This company is also responsible for the erection of Australia's modern broadcasting stations located at 5CK South Australia, 2CO N.S.W., 4RK Rockhampton, Q., and 2NC Newcastle.

The rapid development on the receiving side of the radio industry brought about by the improved technique in valves permitted of a corresponding rapid development in superheterodyne receivers and the vast majority of radio factories in Australia have to some extent or other manufactured this modern equipment. Two of the leading organisations namely Amalgamated Wireless and Standard Telephones did not manufacture superhets in 1932 but it is anticipated they will do so this year (1933).

Excessive valve development overseas has placed Australia in an awkward position. On the one hand we are influenced very considerably by the American trend while on the other hand the British and Continental practice exercises some influence. The American radio influence has evidently been the stronger, maybe by reason of the most attractive methods employed in U.S.A. technical periodicals when presenting their case. The employment of long waves together with medium waves in the broadcasting receivers of Great Britain has made it rather difficult for the average radio manufacturer to follow British specifications. Another big factor was the relative standardisation of American valves and the reasonably small number of types as compared to the British multiplicity of types. But, even that order of things is being rapidly changed and despite the American claim to standardisation and an appreciation of trading difficulties with handling a multiplicity of types, they appear to be releasing even more varieties than the British valve makers. In practically every instance Australian set manufacturers adopt the American valve as a standard equipment, to such a degree that whereas only 66,000 valves were imported from Great Britian during the year 1932, nearly 20 times this quantity were imported into Australia during the same period, of which the majority came from America the balance from Holland. Import figures published elsewhere in this **Annual** support this statement.

Dry Battery Activity.

Battery manufacture has also progressed to a remarkable extent. There are now two large battery factories in Sydney and at least four factories in Melbourne. Well over 500 additional hands have been employed in the dry battery industry since the Commonwealth Government introduced prohibition of importation of foreign batteries. The Ever-Ready Battery Co., employed 48 hands in November, 1931, to-day they employ 215. The Widdis Diamond Battery factory in Melbourne has been extended very considerably and in addition have established a branch factory in Sydney. Australia's climatic condition added to the long distances over which batteries must be transported and the varying temperatures to which batteries must be subjected compel a high standard of service from dry batteries. The country areas of Auxtralia are not developed with electric supply to any extent, and batteries are still in great demand.

Loud speaker manufacture has also been established in Australia, and to-day there are approximately 10 different brands of loud speakers being made in either Sydney or Melbourne.

Components have lost their popularity as such for the home builders' market is small compared to the large market for complete instruments. In fact the majority of business in accessories and components is done with semi-amateur professionals and the professional service man. Quite a lot of the apparatus sold to-day is for replacement purposes, which is assuming large proportions and must be recognised. It is estimated that 80% of the licensed wireless sets in operation in Australia to-day are definitely obsolete and fail to operate according to present day standards.

Future is Bright.

The future possibilities of the radio industry in Australia show every promise of progress for many years to come. There are still over a million homes yet to be equipped with radio throughout the Commonwealth, and the bulk of the available market lies in the country areas. With the advent of television which is predicted to be in operation in Australia within the next two years any thought of "**saturation**" is absolutely ridiculous.

Price values have materially reduced over the last year or two with the smaller manufacturer forcing the pace, and because of his small overhead expenses his entry to an industry at the most profitable and peak period ever experienced and no necessity to contribute towards the progress of the art and industry by way of laboratories and research activities, is able to produce cheap instruments and what is more switch from one model to another almost overnight. This is a phase of industry that will in all probability be always with us but everybody in the industry must acknowledge that the 15 to 20 leading people who manufacture and merchandise on a national basis at least in their respective States do definitely contribute something material to the advancement of the Australian Radio Industry.

Broadcasting Time Schedule.

In the table below are listed the times of transmission of all Broadcasting Stations in Australia. They are divided into six sections by States and further arranged in descending order of wavelength. All times given are those of the State concerned. Stations are liable to vary their hours of transmission without notice.

Broadcasting Schedule—Monday to Friday.

Call	Wave Length	Location	Broadcasting Hours—Monday to Friday
			NEW SOUTH WALES.
2CO	536	Corowa	Relays 3LO and 3AR
2FC	451	Sydney	7 to 8.15, 10.30 to 4.45 5.45 to 11.30
2BL	351	Sydney	8.15 to 11, noon to 5.45, 6.15 to 10.30
2GB	316	Sydney	7 to 11.30, 12.15 to 11.30
2UE	293	Sydney	6 to 8.0, 8.0 to 12.30, 2.30 to 4.0, 5.0 to 11, 12 to 5 Wed.
2CA	285.7	Canberra	7.30 to 10
2KY	280	Sydney	6 to noon, 1 to 3, 5 to 10.30
2HD	270	N'castle	
2UW	267	Sydney	7.30 to 9, 10.30 to 2, 3 to 5, 5.15 to 10.30
2WG	260	Wagga	7.45 to 8.30, 7 to 10
2CH	248	Sydney	7 to 9, 10 to 12.30, 2 to 4.30, 5.10 to 10.30
2NC	241	N'castle	Relays 2FC, 2BL
2SM	236	Sydney	7 to 8.30, 1 to 2, 5.30 to 10.30
2MO	227	Gunnedah	7.45 to 8.45, 7 to 9
2XN	224	Lismore	6.30 to 11
2GN	216	Goulburn	Hours irregular
2KO	212	Sandgate	10.15 to 11.30, 5.15 to 10.30
2WL	209.06	Wol'gong	6.30 to 10.0
2AY	203	Albury	6.30 to 10.30
			VICTORIA
3AR	492	Melbourne	8.15 to 11, noon to 5.45, 6.15 to 10.30
3LO	375	Melbourne	7 to 8.15, 10.30 to 12.30, 1 to 4.30, 5.45 to 11.30
3UZ	326	Melbourne	7 to 8.30, 9 to 2, 2.30 to 11.30
3BO	309	Bendigo	7.30 to 10
3HA	297	Hamilton	11 to 2, 6 to 11
3YB	283	Mobile Station	6.30 to 10.30

Call	Wave Length	Location.	Broadcasting Hours—Monday to Friday.
3SH	278.8	Swan Hill	7.30 to 10
3DB	255	Melbourne	7 to 8.30, 10.45 to 1.45, 2 to 11
3WR	238	Wang'ta	12.30 to 1.30, 6.30 to 10
3TR	234.3	Sale	10.30 to 2, 6 to 10.15
3BA	230.8	Ballarat	7.0 to 10.30
3KZ	222	Melbourne	7 to 1.30, 2.30 to 4.30, 5.15 to 11.30
3GL	214.2	Geelong	7.45 to 9.15, 1 to 2, 5.30 to 10.30
3AW	210	Melbourne	7 to 8.30, 2 to 11
3AK	200	Melbourne	Mdt. to 2, 5 to 7, 11.30 to Mdt.
			QUEENSLAND.
4QG	395	Brisbane	7.30 to 8.30, 11 to 2, 3 to 4.30, 6 to 11
4RK	330	Rock'ton	Relays 4QG
4GR	300	T'woomba	9 to 10, 12 to 2, 6 to 10
4MB	283	Maryboro	6.30 to 10
4BC	262	Brisbane	6.30 to 9, 10 to 3.30, 5.30 to 11
4TO	256	T'sville	6.30 to 10
4MK	252	Mackay	7 to 10.15
4BK	233	Brisbane	8.30 to 1, 4.30 to 11
4RO	225.5	R'hampton	6 to 10
4BH	217	Brisbane	7 to 8.30, 11 to 2.30, 9.15 to 10.30
			SOUTH AUSTRALIA
5CK	472	C'stl Bk.	Relays 5CL
5CL	411	Adelaide	7.30 to 8.30, 11 to 2, 3 to 4.30, 5.50 to 11
5DN	313	Adelaide	4 to 11.20
5PI	288	Pt. Pirie	5.30 to 10
5KA	250	Adelaide	7 to 8, 10 to 12
5AD	229	Adelaide	7 to 8.30, 10 to 2, 3 to 5, 5.30 to 11
			WESTERN AUSTRALIA.
6WF	435	Perth	7.30 to 8.30, 11.30 to 4.30, 6 to 11
6PR	341	Perth	10.30 to 11.30, 4.30 to 10.30
6ML	264	Perth	7 to 8.30, 11 to 3, 5.45 to 10.30
6KG	246	K'goorlie	11 to 1, 6.30 to 10.30
			TASMANIA.
7ZL	517	Hobart	7.30 to 8.30, 11.30 to 5.15, 6 to 11.30
7HO	337	Hobart	8 to 9, noon to 2, 6 to 10.30
7LA	273	L'ceston	3 to 4.30, 6 to 10.30
7UV	204.5	Ulverstone	12.0 to 2, 5.30 to 10.30

Call	Broadcasting Hours—Saturday	Broadcasting Hours—Sunday.
	NEW SOUTH WALES	
2CO	Relays 3LO and 3AR	Relays 3LO and 3AR
2FC	7 to 8.15, 10.30 to 4.45, 5.45 to 11.30	10 to 2.30, 3 to 4.30, 6 to 10.30
2BL	8.15 to 11, noon to 5.45, 6.15 to midn.	10.55 to 3, 4.30 to 10
2GB	See Monday	9 to noon, 1.30 to 10.30
2UE	Noon to 5, 5 to 11	6 to 8, 9.30 to noon, 6.0 to 11.0
2CA	7.0 to 10.0	8.0 to 10.0
2KY	12.30 to 4.45, 6 to 10.30	7.30 to 11, 5.30 to 11
2HD		
2UW	7.30 to 12.30, 2.30, 5.15 to 10.30	10.30 to 1, 3 to 5, 5.15 to 10.30
2WG	Same as Mon.	No Service
2CH	7.0 to 9, 10.0 to 12.30, 2 to 5, 5.15 to 10.30	10.30 to 12.30, 2.30 to 5, 5 to 6.15, 7. to 10
2NC	See 2FC	See 2FC
2SM	7 to 8.30, 5.30 to 11.30	11 to 1.30, 6 to 10.30
2MO	Same as Mon.	7.0 to 9.0
2XN	Same as Mon.	

Call	Broadcasting Hours—Saturday.	Broadcasting Hours—Sunday.
2GN	6.30 to 10.30	7.30 to 9.30
2KO	9 to 11, 5.15 to 11	7.0 to 9.0
2WL	Same as Mon.	7.0 to 9.0
2AY	7 to 10.30	7.30 to 10.30
	VICTORIA	
3AR	8.15 to 11, noon to 5.45, 6.15 to midn.	11 to 3, 4.30 to 10
3LO	7 to 8.15, 10.30 to 12.30, 1 to 5, 5.45 to 11.30	10 to 12.30, 3 to 4.30, 6 to 10.30
3UZ	7 to 8.30, 9 to noon, 6 to Midn.	5.45 to 10
3BO	7.30 to 10.30	7 to 9
3HA	11 to 2, 6 to 11	7 to 11
3YB	6.30 to 10.30	6.30 to 10.30
3SH	Same as Mon.	12.15 to 2.15, 4.15 to 6, 7.15 to 10
3DB	7 to 8.30, 2 to 11	2.30 to 4.30, 6 to 10
3WR	Same as Mon.	8.0 to 10.0
3TR	10.30 to 1, 6 to 10.15	7 to 10
3BA	7 to 11	1 to 3, 6.30 to 10
3KZ	7 to noon, 2 to Midnt.	Mdt. to 1, 2.30 to 4.30, 6 to 10
3GL	7.45 to 9.15, 10.30 to 11.45, 6 to 10.30	7 to 10
3AW	7 to 8.30, 2 to 11	4.30 to 10.30
3AK	Mdt. to 2, 5 to 7, 1 p.m. to 2, 11.30 to Mdt.	Mdt. to 3, 12.30 to 2.30, 10 to Mdt.
	QUEENSLAND.	
4QG	7.30 to 8.30, 11.30 to 5, 6 to 11.30	10.30 to 12.45, 3 to 4.30
4RK	See 4QG	See 4QG
4GR	9 to 10, 12 to 12.30, 1.15 to 5, 7 to 10	10 to 1, 7 to 10
4MB	Silent	Silent
4BC	6.30 to 9, 7.30 to 11	10 to 11, 5.45 to 10
4TO	1.30 to 5, 6 to 10	8 to 10.15
4MK	7.0 to 11.0	10 to 11.20, 2 to 5.30, 6 to 9.30
4BK	8.30 to 10, 6 to 12	7.0 to 10.0
4RO	1.30 to 5, 6 to 10	No Service
4BH	7 to 8;30, 10 to 11, 6 to 11	Noon to 2, 7 to 10
	SOUTH AUSTRALIA.	
5CK	Relays 5CL	Relays 5CL
5CL	7.30 to 8.30, 11.30 to 5.15, 5.45 to 10.30	10.30 to 12.30, 3 to 4.30, 5.50 to 10
5DN	5.30 to 11.20	8 to 10.20
5PI	5.30 to 11	No Service
5KA	Same as Mon.	10 to 11, 3 to 4, 4.45 to 5.30
5AD	7 to 12.30, 2 to 5.30, 6 to 7.50, 8 to 11	5.50 to 9.50
	WEST AUSTRALIA.	
6WF	7.30 to 8.30, 11.30 to 5.15, 6 to 11	10 to 12.30, 3 to 4.30, 6 to 10.30
6PR	See Monday	11 to 1, 6.30 to 10
6ML	7 to 8.30, 6 to 11	7.0 to 10.0
6KG	2 to 5, 7 to 10.30	7.45 to 10.30
	TASMANIA.	
7ZL	7.30 to 8.30, 11.30 to 5.15, 6 to 11	10.30 to 12.15, 3 to 4.30, 6 to 10
7HO	See Monday	8 to 9.30
7LA	1.30 to 10.30	6 to 10
7UV	12 to 2, 5.30 to 11	7.0 to 10.0

Members of the Australian Broadcasting Commission.

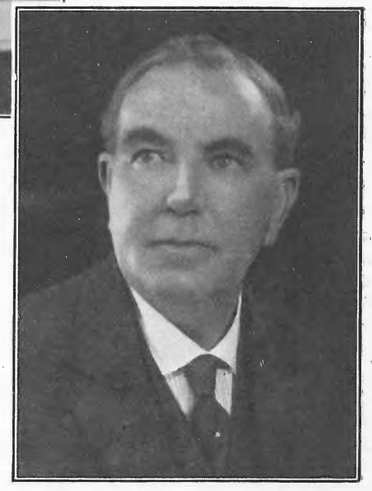
Mrs. Claude Couchman.

Mr. Herbert Brookes. (Vice-Chairman).

Professor R. M. Wallace.

Hon. R. B. Orchard.

Mr. Chas. Lloyd Jones (Chairman).



Australian Broadcasting Commission.

Chairman's First Half-Yearly Report.

(Half Year to December 31, 1932.)

No revolutionary upheaval in respect of Broadcasting programmes has been attempted during the first six months of the Australian Broadcasting Commission's control. Nevertheless, the Commission believes that the policy adopted has already resulted in a substantial all-round improvement. Certain features have been added which, the Commission considers, place the programmes of the Australian National Stations considerably above those of any previous stage of broadcasting in Australia and comparable with those of its model the British Broadcasting Corporation.

Shortly after assuming office, the Commission brought into operation its scheme of national programmes. The idea behind this policy is to make greater use if the facilities for linking up the various stations in the national service. By this means the Commission has been enabled to present a great many more programmes of the highest (and incidentally most expensive) class, by the simple expedient of broadcasting the one programme simultaneously from several stations. The cost of presenting say, a Grand Opera from one station only was almost prohibitive, but when that one programme was shared by several States the question of expense became less important. Thus, the A.B.C. has given listeners a very much greater number of grand operas, light operas, comic operas, plays, revues, special orchestral and vocal programmes than at any period in the history of broadcasting in Australia.

The A.B.C. has increased the size of its studio orchestras from 20 to 30 players, an improvement which has called forth much favourable comment from discriminating listeners. Additional rehearsals are now held which have further contributed to the standard of the performances. We have instituted a number of symphony orchestras. These programmes are well rehearsed and the Commission feels that good work is being done in introducing new musical compositions to Australian audiences. In conjunction with these orchestras the Commission is using outstanding soloists and with their assistance has already presented a number of concertos.

This system is advantageous from an educational point of view as it gives Australian soloists a chance to appear with the A.B.C. orchestras.

It is the policy of the Commission to encourage Australian composers, and to this end are introducing works by such well known musicians as Alfred Hill, Roy Maling and Willie Redstone, the last of whom, by the way, is now permanently on the staff.

Chamber music is also being given an important place on the A.B.C. programmes—a further contribution towards an enhanced musical appreciation on the part of listeners.

The Commission has taken advantage of the presence of a number of great visiting artists and presented them to the radio audience in association with A.B.C. symphony orchestras. Joseph Szigetti, Benno Moisievitch, John Brownlee and Anderson Tyrer have all been heard over the A.B.C. network.

That the programmes have been appreciated is abundantly evident from correspondence received, and the Commission expresses its gratification at the public goodwill that has been shown. The Director-General of Postal services whose official position entitles him to sit in judgment, has expressed most laudatory opinions of the A.B.C.'s stewardship during the past six months. As an indication of the work of the first half-year of the Australian Broadcasting Commission's control, it may be mentioned that the National programmes of the Commission (as distinct from those limited to one station), have included studio presentations of eight grand operas, four light operas, two musical comedies, three comic operas, nine musical plays, two revues, fourteen dramas, three comedies, two vaudeville entertainments, one pantomime, eleven symphony concerts, five oratorios, besides five special features.

The period under review was marked by the establishment of Empire Broadcasting from England by the British Broadcasting Corporation. The A.B.C. has co-operated gladly in the B.B.C.'s effort. Although the world broadcasts cannot yet be described as satisfactory for relaying regularly to Australian audiences, some of the programmes received from Britain and rebroadcast through the National stations have been heard with enthusiasm. Probably no more thrilling broadcast has taken place in Australia than the relay by the National Stations of the B.B.C.'s Christmas programme. To the Commission it was a delight to follow the English announcer round the Empire towards the setting sun. Every word he spoke, came as clear as a bell and the varying conditions of the Empire as the announcer ranged up and down meridians of longitude were described so clearly that one could almost imagine the whole scene to be visible. The King's speech was a delight to all Australians and the Australian Broadcasting Commission feels honoured to have been privileged to share in this broadcast.

Cricket Broadcasts.

Another feature of which the Commission is proud, is the broadcasting of the matches of the English Cricket Team now in Australia. In every State where the visitors have played, the A.B.C. expert commentators have described the matches in detail while the play has been in progress.

The whole national network has been hooked up and

from end to end of the Commonwealth, listeners have been able to follow the play almost as if they had been on the ground. It is the belief of the Commission that the immense interest taken in the present test series is due, more than to any other cause, to the fact that every person in the Commonwealth has been in a position to follow the game from start to finish. During the play, more than 4000 miles of trunk telephone lines were frequently used to link up the respective National Broadcasting Stations. An outcome of the interest taken by the Australian public in the cricket broadcasts was a notable increase in the number of licenses immediately before and during the currency of the matches.

The Commission has extended substantially the scope of its educational broadcasts. With the co-operation of the Universities and other educational authorities of Australia, the Commission has been able to place at the disposal of listeners the knowledge that has been stored in all our great centres of learning. Every night from one station or other lectures have been given by Professors and University teachers on a wide diversity of subjects ranging from International relations as affecting Australia to the origin and functions of the soil, the early history of Australia and the development of scientific achievement. As these subjects naturally do not appeal to all listeners, alternative programmes are always provided.

Dr. Malcolm Sargent.

The Commission hopes for steady improvement in the programmes by every means practicable. An earnest of that intention has already resulted from the visit of Professor R. S. Wallace, a member of the Commission to England. Mr. Arthur Mason the well-known musician resident in London, has been appointed to represent the A.B.C. in the United Kingdom. His duties include the selection of new music, plays and operas. As Mr. Mason is an Australian, he is able to bring to his task a judgment tempered with a knowledge of Australian tastes. The A.B.C. anticipates also that before long it will be able to announce that a representative has been appointed in New York. Arrangements have been made for Dr. Malcolm Sargent, the eminent English musician to visit Australia under engagement to the A.B.C. to conduct a series of fourteen orchestral performances which will be relayed over the national network. Players are now being chosen in Sydney and Melbourne for the Studio Orchestras, to be the nucleus of an orchestra of 86 in each city. The Commission believes that its policy of introducing distinguished musicians from other parts of the world, will tend strongly to raise the musical tone of Australia generally quite apart from the immediate pleasure derived by listeners from the performances rendered.

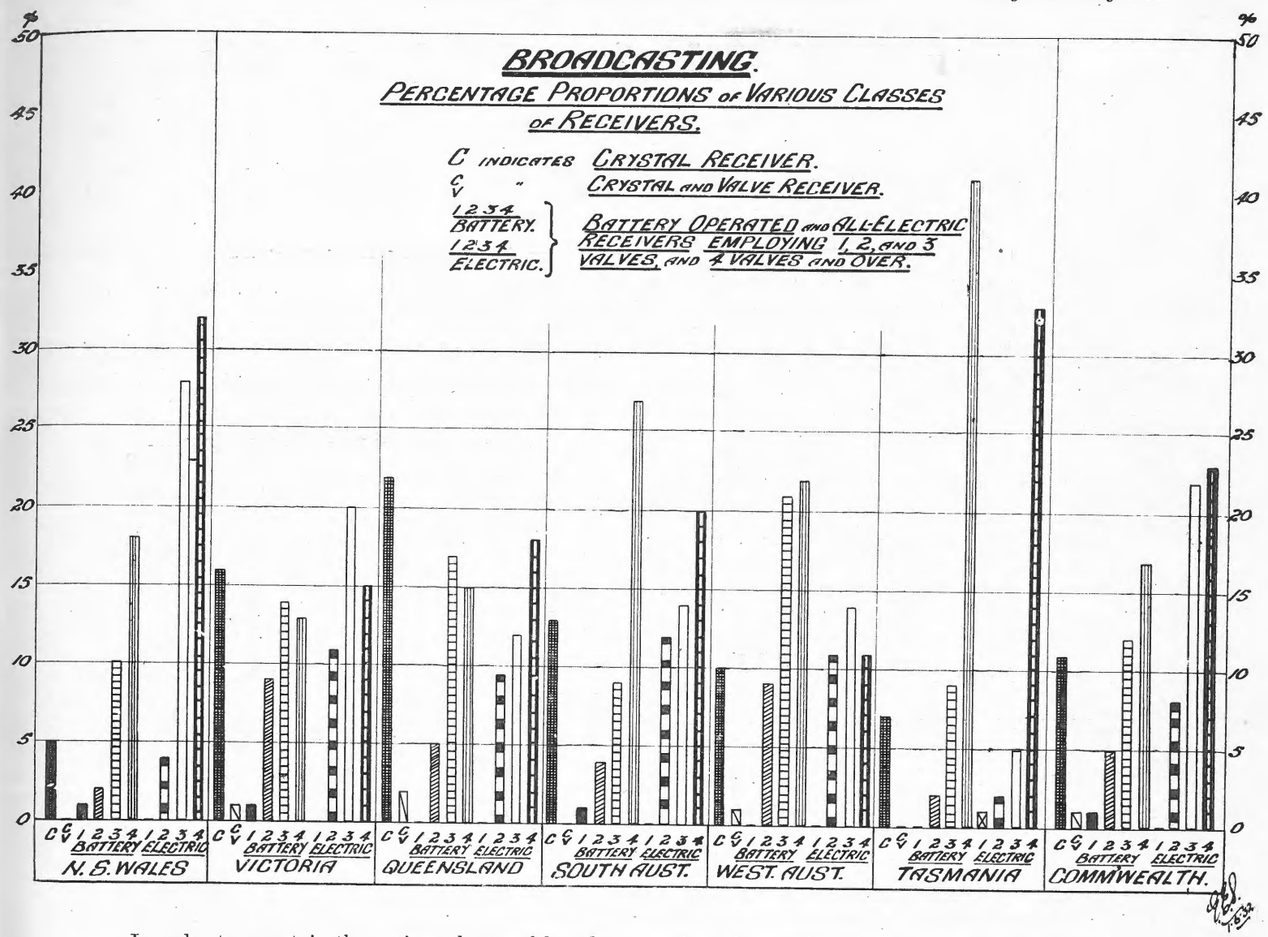
During the six months of the Commission's control there has been a pleasing increase in the number of licensed listeners in every State, Australia, so far as the Empire is concerned, being now second only to Great Britain in respect of the proportion of licensed listeners to population. Australia, indeed, occupies seventh place in the countries of the world. Denmark is first with 13.4 listeners to every 100 persons, then comes Great Britain 10.7, U.S.A. (estimated) 9.8, Sweden 9.6, Austria 7.1, Holland 6.9, and Germany 6.4.

Broadcasting.

Various Classes of Receivers in Operation.

(as disclosed by applicants for licences during 6 months ended 29/2/32).

Type of Receiver	New South Wales		Victoria		Queensland		South Australia		Western Australia		Tasmania		Commonwealth	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Crystal	2,864	5.10	7,689	15.50	2,579	22.20	1,315	13	343	10.20	247	7.03	15,037	11
Crystal and Valve	167	.29	327	.66	194	1.67	32	.31	50	1.15	5	—	775	.57
Battery Sets :														
1 Valve ...	445	.78	422	.85	60	.51	61	.59	17	.50	17	.50	1,022	.76
2 Valve ...	1,360	2.39	4,318	8.70	629	5.43	391	4	289	8.5	78	2.03	7,065	5.2
3 Valve ...	5,795	10.01	7,130	14.44	1,929	16.	912	8.9	700	21.12	302	9.27	16,768	12.4
4 Valve & Over	10,240	18.30	6,512	13.25	1,735	15.29	2,781	27.04	733	22.02	1,400	40.50	23,401	17.20
Electric Sets :														
1 Valve ...	61	—	47	—	—	—	29	.29	1	—	34	1.10	172	—
2 Valve ...	2,449	4.06	5,319	11.15	1,005	8.6	1,196	11.7	375	11.01	57	1.67	10,401	8.29
3 Valve ...	16,012	28.03	10,053	20.15	1,354	11.7	1,438	14.12	495	14.48	165	4.80	29,517	21.88
4 Valve & Over	17,579	31.04	7,573	15.30	2,087	18	2,028	20.05	364	11.02	1,108	33.10	30,739	22.7
Grand Total ...	56,972		49,390		11,572		10,183		3,367		3,413		134,897	



In order to ascertain the various classes of broadcast receivers in use throughout Australia, the P.M.G.'s Department conducted an enquiry for a six months' period ended 29/2/32. As each license was renewed by listeners they were required to state what size of set they operated. These figures have been compiled by the Department and released for the first time to this Radio Trade Annual.

The extraordinary high number of crystal sets still in use in Victoria as compared to N.S.W. is of interest, as is also those in Queensland.

Multi-Valve sets (4 valve and over) predominate in N.S.W. Out of 130,866 in force 29th February, 1932, 27,819 multi-valve sets were renewed for the previous six months with a percentage of 49.34. In Victoria 14,085 were renewed with a percentage of 28.55.

The graphic illustration above must be carefully interpreted as each State and not in comparison with other States. In Victoria 3 valve sets were in the majority while in N.S.W. 4 valves and over were most popular. Queensland favoured crystal sets but since then additional broadcasting stations, have compelled additional selectivity and consequently valve sets are no doubt in favour. South Australia prefers multi-valve battery sets while Western Australia divides nearly equal with 3 and 4 valve battery sets.

Tasmania shows a marked leaning towards multi-valve battery sets and then electric sets. The whole Commonwealth figures show definitely the tendency towards multi-valve-all-electric sets with multi-valve battery sets next.

There were about 40,000 crystal sets in operation 12 months ago, taking the percentage figures of 11%.

Readers must bear in mind that these figures while being the only ones available are now 12 months old and are only those that were renewed during the six months' period. Many thanks are due to the P.M.G.'s Department for supplying this interesting data.

Control of Wireless in Australia.

As in all other countries, wireless activities in Australia are under Governmental control. With wireless transmission recognising no national boundaries it is obvious that some form of control is necessary. Consequently the various nations of the world, work together under a form of agreement—the International Radiotelegraph Convention and its Regulations—to ensure freedom from interference.

In the Commonwealth, the Postmaster-General's Department administers the required control and supervision under the powers of the Wireless Telegraphy Act and Regulations. The Act places the responsibility on the Postmaster-General of conducting wireless services or licensing other people to do so. Therefore, no person is permitted to erect, establish or maintain apparatus capable of transmitting or receiving wireless signals unless he is in possession of a licence from the Postmaster-General. The Wireless Telegraphy Regulations summarised set out the detailed conditions under which licences are obtained.

There are various types of licences covering the activities of the different classes of services. The licences issued by the Postmaster-General's Department are :—

Coast Station	Broadcast Listeners'
Ship Station	Portable
Land Station	Experimental Station
Broadcasting Station	Aircraft Station

and

Special Licences covering such services as the Beam Service, which is not specifically provided for in other Licences.

With the exception of Broadcasting Stations Licences and Special Licences, the applicant meets with scarcely any difficulty, provided that the required conditions are complied with. The name of the licence generally indicates the type of service to be covered which, with the exception of Broadcasting Stations Licences, refer mainly to commercial wireless telegraph or telephony services.

It is very important, however, for all persons contemplating the installation of wireless apparatus to obtain full particulars from the Radio Inspector.

The issue of Broadcasting Station Licences is a matter of greater complexity because the number of such licences is necessarily limited by technical considerations. In accordance with an International agreement only a certain number of broadcasting frequencies or wavelengths is available for broadcasting services if interference, both national and international, is to be avoided. In the interests of listeners it is essential that the wavelengths of the different stations have a minimum frequency separation compatible with the performance of average broadcast receivers. Consequently the obligation rests on the Department, and it is viewed very seriously, to see to it that the stations are properly placed within the spectrum of frequencies comprising the broadcast band. And as the first demands on these frequencies must necessarily come from the national stations, it follows that only a limited number of broadcasting channels or wavelengths are left for the stations established by private enterprise, known as Licensed Broadcasting Stations. Therefore, the grant of such a licence gives to the licensee something of a monopoly and consequently the Department must select very carefully from the applicants those to whom licences are to be granted, keeping in view the essential factor that service to listeners must be the paramount consideration.

Inspection of Stations.

When licences are granted, regular inspections are made by officers of the Department in order to ensure that the conditions of the licence are complied with. Those conditions may be referred to shortly as the stipulated service to be given and adequate precautions to be taken to avoid interference with other services.

Operators' Certificates of Proficiency.

Under the international and local wireless laws, the Department stipulates the conditions pertaining to the issue of Operators' Certificates of Proficiency. These certificates are issued, after appropriate examinations have been passed, to candidates who desire to operate particular types of stations ; the examination being conducted with the object of allowing the candidates to demonstrate their possession of the required knowledge or proficiency.

The examinations are held periodically for the following certificates :—

Commercial Operators' First Class
,, ,, ,, Second ,,
Limited (Telephony)
,, (Telegraphy)
Amateur Operators'

As the dates of the examinations vary in the different States, interested persons should communicate with the nearest Radio Inspector for the desired information.

Broadcast Listeners' Licences.

This is the type of licence which in recent years has obviously become the most popular one owing to the progress of the broadcasting services. There are several differences between this type of licence and the others. Broadcast listeners are not required to sign any document as in other cases and the licence fee is on a different basis. In all other cases the licence fee is a nominal amount, sufficient to defray the administrative costs incurred by the Department.

In the case of Broadcast Listeners' Licences, however, the fee includes not only the administrative costs but also an amount forming a method of payment for the services which the listener receives, which may be described as a subscription to the service. Only a small portion of the licence fee covers the administrative costs, the far greater part being what might be termed the subscription fee.

The annual fee of 24/– for Broadcast Listeners' Licences applies to all listeners situated within an area of about 250 miles from a National Broadcasting Station ; that area is known as Zone 1. Outside that area, in Zone 2, the annual fee is 17/6 per annum. The licence fee of 24/– is distributed as follows :—

12/– to the Australian Broadcasting Commission in respect of the provision of programmes.
3/– to Amalgamated Wireless (A/asia) Limited in accordance with an agreement with the Commonwealth Government relating to patent royalties and

The remainder is retained by the Department in respect of—

(a) the provision of the technical services of the National Broadcasting Stations (installation, erection and operation) ;
(b) the inter-connecting telephone circuits between the various National Stations ;
(c) other technical services, including the investigation of radio inductive interference and research ; and
(d) administrative costs in connection with the issue and recording of licences.

Despite the obligation on listeners to obtain a licence it is unfortunately necessary for the Department to maintain a permanent staff in each State for the purpose of locating unlicensed listeners. When these listeners are detected they are brought before the Police Magistrates and during the year 1932 there were more than 1,000 convictions for this offence.

Radio Inductive Interference.

The department endeavours to give as much service as possible to broadcast listeners and one of these services which has received special attention during recent years is that of the investigation of radio inductive interference. This form of disturbance to broadcast reception has unfortunately increased, with the introduction of receivers obtaining their power from the house lighting system and the Department has energetically extended its activities in combating the nuisance. Specially qualified Radio Inspectors in each State undertake the investigation of complaints received from groups of listeners in different localities. The investigations have been responsible for considerable success in determining the cause of the interference and in almost every case it is possible for the Inspectors to demonstrate the method of eliminating or reducing the interference by the installation of suppressors.

The installation of the suppressing equipment, which is comparatively inexpensive, is obviously not a responsibility of the Department. The cause can be diagnosed, the curative measures to be taken can be demonstrated and it only remains for the owners of the offending electrical equipment to take the necessary steps to install the suppressors. While in many cases the Department gladly records the co-operation which has been afforded by electric authorities and private owners of offending equipment, it is unfortunate that in some cases the desired co-operation has not been forthcoming.

Radio dealers can be of great assistance in this connection, particularly in country districts where they are familiar with the conditions and have business or other contacts with the listeners and the owners of electrical equipment. By a recognition of a reasonable community spirit, the co-operation could be fostered by the tactful action of radio dealers, whose interests, of course, would be served by listeners generally being more satisfied with their broadcasting services.

The Department is anxious to hear from listeners who are experiencing any trouble in connection with radio inductive interference and invites them to inform the Department of their conditions by filling in a Wireless Reception Questionnaire Form, obtainable from any Post Office, and sending it completed to the Radio Inspector. In every case the Radio Inspector communicates with the complainant and it is pleasing to note that in most cases a satisfactory result has followed.

Demonstrations by Radio Dealers.

A broadcast listener's licence obtained by a radio dealer in respect of a particular address does not entitle the dealer to demonstrate or in any other way use a receiver in the home of a prospective buyer. This is a point which many dealers have overlooked. The Department, however, has always endeavoured to assist radio dealers in the conduct of their business, recognising that the radio trade has a very important part to play in the development of broadcasting.

It is recognised that the dealers must give demonstrations away from their shops and the Department grants the concession of allowing these demonstrations to be conducted without the obligation of obtaining a licence. The conditions under which these special arrangements can be made may be learned by consultation with the Radio Inspector. Generally, it is the practice to permit a demonstration period of three days in the metropolitan area and one week in country districts.

Miscellaneous.

The addresses of the Radio Inspectors in each capital city are as follows :—

Sydney : Mr. W. T. S. Crawford, Haymarket Post Office Chambers, 635 George Street, Phone : M 3402.
Melbourne : Mr. J. M. Martin, Treasury Gardens, C. 2., Phone : Central 5551.
Brisbane : Mr. T. Armstrong, General Post Office, Phone : BY 8371.
Adelaide : Mr. H. W. Harrington, General Post Office, Phone : Central 6100.
Perth : Mr. G. A. Scott, General Post Office, Phone : B 6023.
Hobart : Mr. E. J. G. Bowden, Telephone Buildings, Harrington Street, Phone : Central 5081.

Full particulars relating to Departmental Wireless Matters can always be obtained from any of the Radio Inspectors listed above.

Complete List of the A and B Class Stations in Australia

WITH CALL SIGN, WAVE LENGTH, AND BY WHOM OWNED.

Call Sign	Wave Length, Power, etc.	Name and Location.
2CO	535.7 metres 560 kilocycles 7500 watts	National Broadcasting Station, Relaying 3LO and 3AR, COROWA
7ZL	517 metres 580 kilocycles 3000 watts	National Broadcasting Station Studio; Elizabeth street, HOBART
3AR	492 metres 610 kilocycles 5000 watts	National Broadcasting Station, Studio: 120a Russell street, MELBOURNE
5CK	472 metres 635 kilocycles 7500 watts,	National Broadcasting Station, Relaying 5CL, CRYSTAL BROOK, S.A.
2FC	51 metres 665 kilocycles 5000 watts	National Broadcasting Station, Studio: 96-98 Market street, SYDNEY
6WF	435 metres 690 kilocycles 5000 watts	National Broadcasting Station, Studio: Hay street, PERTH
5CL	411 metres 730 kilocycles 5000 watts	National Broadcasting Station, Studio: Hindmarsh square, ADELAIDE
4QG	395 metres 760 kilocycles 5000 watts	National Broadcasting Station, Studio: c/o State Ins. Buildings, BRISBANE
3LO	375 metres 800 kilocycles 5000 watts	National Broadcasting Station, Studio: 120a Russell street, MELBOURNE
2BL	351 metres 855 kilocycles 5000 watts	National Broadcasting Station, Studio: 96-98 Market street, SYDNEY
6PR	341 metres 880 kilocycles 500 watts	Nicholsons Ltd., Studio: Barrack street, PERTH
7HO	337 metres 890 kilocycles 50 watts	Commercial Broadcasters Ltd., Studio: 82 Elizabeth street, HOBART
4RK	330 metres 910 kilocycles 2000 watts	National Broadcasting Station Relaying 4QG ROCKHAMPTON
3UZ	326 metres 930 kilocycles 500 watts	Oliver J. Nilsen and Co., Studio: 45 Bourke street, MELBOURNE
2GB	316 metres 950 kilocycles 3000 watts	Theosophical Broadcasting Stn., Studio: 29 Bligh street, SYDNEY
5DN	312 metres 960 kilocycles 500 watts	Hume Broadcasters Ltd., Studio: Franklin street, Parkside, ADELAIDE
3BO	309 metres 970 kilocycles 200 watts	Amalgamated Wireless (A'sia), Ltd. Studio: Kangaroo Flat, BENDIGO
4GR	300 metres 1000 kilocycles 50 watts	Gold Radio Service Studio: Ruthven street, TOOWOOMBA
3HA	297 metres 1010 kilocycles 200 watts	Western Province Radio Co., Studio: 37 Gray street, HAMILTON
2UE	293 metres 1025 kilocycles 250 watts	Radio House, Studio: 300 Pitt street, SYDNEY
5PI	288 matres 1041 kilocycles 50 watts	Midlands Broadcasting Services, Studio: Ellen street, PORT PIRIE
2CA	286 metres 1040 kilocycles 50 watts	A. J. Ryan, KINGSTON, CANBERRA
4MB	283 metres 1060 kilocycles 50 watts	Maryborough Broadcasting Co., Wynne's Station, MARYBOROUGH, Queensland.
2KY	280 metres 1070 kilocycles 1500 watts	Trades and Labour Council, Studio: 424 George street, SYDNEY
3SH	277.8 metres 1080 kilocycles 50 watts	Swan Hill Broadcasting Co., SWAN HILL
7LA	273 metres 1100 kilocycles 200 watts	Findlay and Wills, Broadcasters, 67 Brisbane street, LAUNCESTON
2HD	270 metres 1100 kilocycles 200 watts	Airsales Broadcasting Co., Studio: Civic Centre, NEWCASTLE
2UW	267 metres 1125 kilocycles 1500 watts	Radio Broadcasting Ltd., Studio: Paling's Bldg., Ash street, SYDNAY
6ML	264 metres 1135 kilocycles 300 watts	Musgroves Ltd. Studio: Lyric House, Murray st., PERTH
4BC	262 metres 1145 kilocycles 600 watts	J. B. Chandler & Co., Studio: 43 Adelaide street, BRISBANE
3YB	262 metres 1145 kilocycles 25 watts	Mobile Broadcasting Service, 430 Little Collins street, MELBOURNE
2WG	260 metres 1155 kilocycles 50 watts	Riverina Broadcasting Co., 16 Fitzmaurice street, WAGGA N.S.W.,
4TO	256.4 metres 1170 kilocycles 100 watts	Amalgamated Wireless, (A'sia) Ltd., TOWNSVILLE
3DB	254 metres 1180 kilocycles 500 watts	3DB Broadcasting Station Pty., Studio: 36 Flinders street, MELBOURNE
4MK	252 metres 1190 kilocycles 100 watts	Williams' Agencies Ltd., Address: P.O. Box 165, MACKAY
5KA	250 metres 1200 kilocycles 300 watts	Sport Radio Broadcasting Co. Ltd., Studio: 81 Flinders street, ADELAIDE
2CH	248 metres 1210 kilocycles 1000 watts	Council of Churches, 147 York street, SYDNEY
6KG	246 metres 1220 kilocycles 100 watts	Goldfields Broadcasters Ltd., Bourke street, KALGOORLIE
2NC	241 metres 1245 kilocycles 2000 watts	National Broadcasting Station, Relaying 2FC and 2BL, NEWCASTLE
3WR	238 metres 1260 kilocycles 50 watts	Wangaratta B'casting Pty. Ltd., Studio: Reid street, WANGARATTA
2SM	236.1 metres 1270 kilocycles 1000 watts	Catholic Broadcasting Co., Australia House, Carrington st., SYDNEY
3TR	234 metres 1280 kilocycles 50 watts	Gippsland Broadcasting Service, Address: P.O. Box 89, TRAFALGAR
4BK	233 metres 1290 kilocycles 200 watts	Brisbane Broadcasting Co., Studio: King House, Queen st., BRISBANE
3BA	230.8 metres 1300 kilocycles 50 watts	Ballarat Broadcasters Pty. Ltd., C'wealth Bank Bldgs., Sturt St., BALLARAT
5AD	229 metres 1310 kilocycles 300 watts	Advertiser Newspaper Ltd., Studio: Weymouth street, ADELAIDE
2MO	226 metres 1330 kilocycles 50 watts	M. J. Oliver, Address: P.O. Box 78, GUNNEDAH
4RO	225.56 metres 1330 kilocycles 250 watts	Rockhampton Broadcasting Co., ROCKHAMPTON
2XN	224 metres 1340 kilocycles 50 watts	G. W. Exton, Address: P.O. Box 138B, LISMORE
3KZ	222 metres 1350 kilocycles 200 watts	3KZ Broadcasting Station, Studio: 40 Victoria street, MELBOURNE
4BH	217.3 metres 1380 kilocycles 600 watts	Broadcasters (Aust.) Ltd., Studio: 90-92 Queen street, BRISBANE
2GN	216 metres 1390 kilocycles 50 watts	Goulburn Broadcasting Co., Studio: Auburn street, GOULBURN
3GL	214 metres 1400 kilocycles 50 watts	Geelong Broadcasting Pty. Ltd., Studio: National Mutual Bldgs., GEELONG
2KO	212 metres 1415 kilocycles 200 watts	Newcastle Broadcasting Co., Studio: 57 Hunter street, NEWCASTLE
3AW	210.5 metres 1425 kilocycles 300 watts	Vogue Broadcasting Co., Ltd. His Majesty's Theatre, MELBOURNE
2WL	209.06 metres 1435 kilocycles 50 watts	Wollongong Broadcasting Co., Address: 149 Crown street, WOLLONGONG
7UV	205.5 metres 1460 kilocycles 200 watts	North Western Tasmanian Broadcasters Ltd., Ulverstone, Tasmania.
2AY	203 metres 1480 kilocycles 50 watts	Charles Rice, Studio: 610 Dean street, ALBURY
3AK	200 metres 1500 kilocycles 50 watts	Akron Broadcasting Service Ltd. 490 Elizabeth street, MELBOURNE

Technical Progress in Radio Broadcasting.

AN ACCOUNT OF THE ACTIVITIES OF THE POSTMASTER-GENERAL'S DEPARTMENT IN THE RADIO BROADCASTING FIELD IN AUSTRALIA.

The principal technical function with which the P.M.G.'s Department is charged in connection with broadcasting is the provision of the technical services for the National Broadcasting system. The programmes for this system are provided by the Australian Broadcasting Commission.

It is important that the reader should appreciate that the provision of technical services by the Department involves very much more than merely providing Radio Stations and the technical equipment required for use in broadcasting studios. Although the radio aspect presents itself to the public as the outstanding feature of the service, it, in fact, involves no greater difficulties, nor quantities of plant and staff, than do other sections, such as the provision of the great networks of special programme lines which frequently have to be set up for the relaying of programmes to every State on the Mainland.

Research.

For instance, a necessary adjunct to the provision of technical services for broadcasting is some adequate means whereby technical developments in other countries may be continuously watched, where any such developments giving promise of usefulness in this country may be tested, and where local problems arising in the engineering, operation or maintenance of radio systems may be investigated. The Department has met this need by gathering together in its Research Laboratories a group of Physicists, Engineers, and other officers specially qualified for this type of work.

Separate premises have been set aside to accommodate this staff and its equipment. These premises provide some 16,500 square feet of floor space, accommodating upwards of 40 officers continuously engaged on the various problems relating to radio and the other engineering activities of the Department; and housing research equipment valued at approximately £23,000.

In addition to the main Laboratories housed at 59 Little Collins Street, Melbourne, there are two Field Laboratories used mainly for radio investigations, One at Mont Park, and the other at Lyndhurst, both in Victoria. This portion of the Department's organisation dealing with broadcasting also maintains close contact with the Radio Research Board, a course designed to ensure the maximum of mutual assistance, and the avoidance of any overlapping.

The bulk of the technical problems met with in broadcasting are basically similar to problems met with in moden telephone engineering, and are susceptible to attack along the same lines and with the same equipment as the latter. The association of the radio research and investigation work with the work already being done by the Department in connection with its telephone and telegraph services, therefore, avoided the unnecessary duplication of expensive equipment, and brought to the radio work research facilities on a scale which would not otherwise have been possible.

Fundamental Broadcasting Plan.

An organisation having been established for the investigation of broadcasting problems it followed that it should be used first of all to prepare a fundamental plan upon which the whole national broadcasting system could be built up with the assurance that the ultimate objective of placing high quality programmes within the reach of listeners all over Australia would be achieved in the most economical manner.

The necessity for a plan to ensure ordered development was obvious, but its preparation for a country such as Australia was found to be a matter of considerable intricacy and difficulty. The scattered population outside the principal cities makes very difficult the planning of a service capable of giving to every listener at least one programme without fading, and with sufficiently high programme to noise ratio.

Such a plan was, however, prepared in 1929, and it was hoped to complete it within a five year period. The first portion of the plan contemplated the provision of an efficient service to country areas, as the large cities were already provided with programmes, although some of the stations were equipped with apparatus which fell below modern standards. As an immediate step forward with the plan, therefore, tenders were called for the supply of five new stations to be known as regional stations, to be located in country centres, and to derive a large proportion of their programmes from the main metropolitan stations. Unfortunately the financial crisis made it necessary to cancel the orders placed for one of these Stations, and has since considerably retarded the further development of the National System under the plan.

Frequency Allocation.

Another technical function of the Department is the allocation of the available frequencies of broadcasting stations.

Under the Radio Telegraph Regulations framed by the International Radio Convention of Washington, 1927, the frequencies allotted for broadcasting purposes are those lying between 550 and 1,500 K.C./sec., and in certain instances 160 to 224 K.C./sec. To date, in Australia, use has only been made of the former band, which makes available some 91 channels to be shared by national and licensed stations. The allocation of frequencies of broadcasting stations requires constant and careful consideration. Geographically adjacent stations must be separated sufficiently in the frequency band to facilitate receiver design and avoid mutual interference, channels must be so allotted as to avoid heterodyne interference from broadcasting stations in Japan, China, New Zealand and other countries, and at the same time an equitable distribution of frequency as between the various States of the Commonwealth has to be preserved.

National Stations.

Despite the difficulties resulting from the financial crisis four new radio stations have been constructed, and brought into operation as follows :—

Station	Location	Date of Opening	Rated Unmodulated carrier in the aerial K.W.
2NC	Newcastle, N.S.W.	19/12/30	2
4RK	Rockhampton, Q'ld.	29/7/31	2
2CO	Corowa, N.S.W.	16/12/31	7.5
5CK	Crystal Brook, S.A.	15/3/32	7.5

In addition, a new transmitter has been provided to replace the obsolete plant at Station 6WF, Perth. The new station, which is located 7 miles from the city, and was opened on 14/12/32, operates with an unmodulated carrier power of 3.6 K.W. in the aerial. This power is capable of 100% modulation. The old plant, which was situated in the centre of the City of Perth, has been dismantled. Its unmodulated carrier power was 0.9 K.W. capable of only about 25% modulation. The equipment for the new station was designed by the Engineers of the Department, and manufactured in the Department's Workshops in Melbourne.

Wherever possible, whenever a new Station is installed field strength studies of the radiation are made. Extensive measurements of this kind have been made on the Melbourne Stations, Station 2CO, Corowa, and Station 6WF, Perth. These studies enable the effectiveness of the stations to be correctly estimated, and also provide valuable data for use in connection with the extension of the system, and the selection of sites for future stations. In addition to the work just described, a considerable amount of reconstruction work has also been done on the other National Stations in the Capital Cities—resulting in increased depth of modulation and generally improved quality and reliability.

In most cases also serious danger hazards have been eliminated by the re-arrangement of equipment, and the provision of safeguards within the stations.

Broadcasting Studios.

The Studios providing the programmes to be broadcast over the national stations are located in each State in the Capital City. Even when the programme to be broadcast originates and is picked up at some point outside the studio, as, for instance, in the case of a race or sports meeting, it is passed to the Radio Broadcasting Station through and under the control of operators in the studio. Each studio, therefore, acts as a collecting house for the programmes to be broadcast from the particular station which it serves. The choice of studios and their general design, and the supply of fittings and furnishings, is a function of the Australian Broadcasting Commission, which, since taking control, has considerably improved the studio accommodation. The technical equipment for these studios is, however, provided by the Department. This involves the provision of microphone amplifiers and all monitoring and switching equipment. In the Department's Research Laboratories is carried out a continuous study of this class of sound transmitting and reproducing equipment, items such as microphones, loud speakers and electrical gramophone equipment being constantly under review.

To facilitate studio reproductions, particularly rehearsal work, steel wire recording apparatus is at present undergoing test. The purpose of all of this work is to secure a continual improvement in the quality and naturalness of programmes, and to place at the disposal of the officers of the Commission responsible for programme production the latest and most effective technical facilities for use in connection with their work.

Operation and Maintenance of Stations and Studios.

The operation and maintenance of the national stations and of the technical equipment in the studios, with the exception of two rented stations and studios, is also carried out by the Department. In connection with this phase of its work, the Department was able to make very satisfactory and economical arrangements for staffing. The work involved is in many respects closely similar to and no more difficult than that carried out by the large technical staff of mechanics employed by the Department in connection with its telephone and telegraph services. This technical staff is therefore used as a pool from which can be readily drawn as required an adequate supply of officers already possessed of a considerable part of the necessary technical training and experience. From so large a staff it is also possible to select officers having a natural bent for radio work. The staff organisation is so planned also that the officers regularly employed on the broadcasting work are relieved when necessary by mechanics normally employed on telephone work. This system materially reduces the number of officers who would otherwise have to be retained solely on broadcasting work, and at the same time serves to build up a staff trained in that work.

Of the stations now operating under the Department's control, all, with the exception of the four regional stations, 4RK Rockhampton, 2NC Newcastle, 2CO Corowa, and 5CK Crystal Brook, and the newly installed 6WF station at Perth, were constructed by or to the order of their original owners, and although very extensive alterations and improvements to them have been made by the Department since taking them over, nevertheless their equipment and arrangement is generally very dis-similar and far from standard. This adds very materially to the problems and costs involved in running them. In the design of new stations—including those just mentioned—very close attention is given to the question of standardisation and of ease in operation and maintenance.

The work itself falls naturally into two divisions, that of studio operation and maintenance, and that of station operation and maintenance—although the officers employed on each class of work are mutually interchangeable and must possess an adequate knowledge of both classes. Briefly the officers attached to the studio technical staff are concerned mainly with the pick up, switching and production side of broadcasting work, while the station staff is concerned chiefly with transmission, operation and maintenance as affecting power radiation from the station.

In the studio, and outside it when items are to be picked up from some external point, the studio operators co-operate closely with the officers of the Commission in the selection of suitable types of microphone and their placement in relation to the artists and performers. To a very large extent the quality and balance of the programme as finally transmitted over the air is dependent on this work. Several types of microphone are in general use in the studios, each having characteristics which determine its suitability or otherwise for any particular class of work. Studio operators must possess a knowledge of these characteristics and an appreciation of the results which are obtained from each one when used to pick up different items of programmes under different conditions of placement. Another officer in the studio—the control operator—is required to monitor the programme continuously and to control its transmission to the radio station itself. The differences in volume between soft (pianissimo), and loud (fortissimo) passages in a performance are sometimes very great, and it is the function of the control operator to ensure that these sounds do not fall below the limits of audibility in the receiver on the one hand, and on the other hand do not overload the transmitter at the broadcasting station ; at the same time preserving the light and shade of the original performance. Special equipment in the form of level indicators is provided to assist the control operator in this work but here again the exercise of a considerable degree of care and judgment is necessary if a loss in quality of these programmes is to be avoided.

The development of broadcasting work, calling for a continually varying type of programme, and variety of other associated work, has demonstrated the necessity for the highest possible grade of maintenance in connection with the technical equipment if the failure of apparatus and consequent interference with programmes is to be avoided. In the studios a special routine for testing amplifiers, batteries, valves, microphones and cables has been laid down. All items are tested at predetermined intervals and a system of fault recording has been evolved which enables special attention to be devoted to those items of equipment which are found to be most liable to fail in service.

In addition to these routine tests an overall frequency test is made each morning by the control operator from the studio to the transmitter. On this test all transmission levels are adjusted and the circuits are prepared for the broadcasting work of the day.

The work in the transmitting station has also been closely organised and routined. Each morning all motor generators—both high and low voltage— are thoroughly examined and cleaned, duplicate and standby equipment is given a trial run, and batteries are inspected and tested. Within the transmitter enclosure all high tension insulators, busbars and arresters are cleaned free of dust and their mechanical condition examined. In particular, all failure alarms such as water flow, water temperature and overload relays are tested for effective operation. At specified intervals also the electrical characteristics of each valve in the station are measured to ensure that they have not deteriorated. In each station response measuring equipment is provided for the measurement of modulation depth and of station response over the transmission band from 35-8000 cycles/second to ensure that so far as the station equipment is concerned there is no deterioration in the quality of transmission.

An important phase of station routine which receives close attention is the maintenance of the correct station frequency. In each station has been provided measuring apparatus which enables it to be seen when the station is deviating materially from its assigned frequency. In addition to this in the Research Laboratories of the Department in Melbourne multi-vibrator equipment is installed which enables the frequency of any station to be measured with a precision of 50 parts in one million. Each week an accurate measurement of all stations is made with this equipment, and the engineering officers maintaining the stations are advised of the results.

Another matter of importance in the maintenance of a reliable broadcasting service is the provision of spare parts and equipment for emergency purposes, and of tubes, etc., required to replace those reaching the end of their useful life. This has been organised on a Commonwealth wide basis and standardised as far as the diversity of the station equipment will permit. Such a course naturally makes for economy and an increased degree of reliability.

Studio and Station Programme Lines.

Main broadcasting studios are generally located well within the city boundaries for the convenience of performers and as a central point to which can be sent programmes picked up at external points. As against this it is generally desirable to locate the transmitting station itself, with its aerial system, outside the city boundary. There is, therefore, in the majority of cases, a considerable distance between the studio and its associated station. This has to be bridged by a telephone line specially designed and corrected to make it suitable for the transmission without distortion from studio to station of musical and vocal items as well as speech. To meet this requirement the Department has provided special metallic lines having properly designed amplifiers at the studio end and equalisers at the station end. The amplifiers enable the studio control operators to maintain the correct input of power to the line to ensure proper modulation without overloading at the station. The line equalisers correct the tendency of the line to cause distortion of the programme by attenuating the high frequencies to a greater extent than the low frequencies. The equaliser for each line is designed separately—the designs being based on special transmission measurements—and these special programme lines connecting together studios and stations, with their equalisers, transmit all frequencies from 35 cycles/sec. up to above 5,000 cycles/sec. with negligible distortion.

Pick-up Lines and Equipment.

A fundamental feature of the broadcasting organisation is the use of the studio associated with each station as a central collecting and control point for the various items making up the complete programme. This applies equally to items produced in the studio or at some external point. In the latter case recourse has to be had to telephone lines to connect the pick up equipment,

consisting of microphones and amplifiers, to the studio control equipment. When items have to be frequently picked up at the same point permanent pick up lines are established connecting that point with the broadcasting studio. All these lines pass through the test room of the Central trunk exchange, although they are not switched at that point. This practice is convenient from the plant viewpoint as it greatly facilitates the use of ordinary telephone lines for pick up purposes and thereby makes for economy and flexibility. It also enables the highly specialised and expensive testing equipment provided at the trunk test room to be used for testing and maintaining them. As already pointed out, the pick up equipment used is dependent on the class of programme. In the case of speech the carbon microphone (Reiss type) is generally used, while in the case of music higher quality microphones of the moving coil or condenser types are employed.

In providing staff for pick up work, the Department follows the same practice as in the case of the studios and stations, *i.e.*, it draws selected officers from its mechanical staff normally engaged on telephone work. In this way it has secured and can maintain a reserve of staff adequately trained in all classes of broadcasting work from pick up to station duties.

Relayed Programmes and Programme Lines.

One of the outstanding features of the operation of the National Broadcasting system is the very extensive and continually increasing use made of items or programmes relayed over suitable land lines to a number of broadcasting stations. This practice makes for economy in the provision of programmes and enables items of special merit or interest to be made available beyond the locality or State in which they originate.

As the public body operating the telephone system of the Commonwealth and also supplying the technical service for the National Broadcasting System, the Department is in a particularly favourable position to co-ordinate the use of lines, equipment, and staff for the dual purpose of providing the country's normal telephone service and providing service for the relaying of broadcast programmes.

At the present time use is made of the trunk line system every night for the relaying of programmes between at least two and very often four stations. In the relatively common-place case of a programme relayed between main stations in Brisbane, Sydney, Melbourne and Adelaide, and the four regional stations at Rockhampton, Newcastle, Corowa and Crystal Brook, a total length of over 2,600 miles of trunk line—of a capital value in excess of £170,000—is involved. If such a relay were extended to Perth, as sometimes happens, an additional 1,630 miles of line would be used and the capital value—for line plant alone—would rise to something of the order of £300,000.

The problem of providing this class of service is rendered more complex by the fact that a telephone line as ordinarily arranged is not suitable for the transmission of vocal items or music, although it can be used for relays involving only speech. Telephones lines are designed to transmit frequencies lying between 300 cycles/sec. and 2,800 cycles/sec.— a band of frequencies which give satisfactory telephone conversation. The relaying of vocal items or music, however, requires the transmission with a comparatively flat characteristic of frequencies from about 50 cycles/sec. up to at least 5,000 cycles/sec. and preferably higher. To meet this requirement special programme transmission amplifiers and line equalisers have been provided at terminals and repeaters on the trunk lines, and are substituted for the equipment normally connected on those lines whenever a musical programme is to be transmitted. Very considerable expenditure has been incurred by the Department in providing this special equipment, and apart from the inevitable demand for continuous improvement in the quality of the programmes transmitted, a fair degree of completeness has been achieved except in the case of the line between Adelaide and Perth, which is as yet suitable only for the transmission of speech. Equipment will, however, be installed during the first half of 1933 which it is expected will enable musical programmes from the Eastern States to be relayed for broadcasting in Perth. This equipment will consist of a special uni-directional carrier telephone channel transmitting in the direction Adelaide to Perth. It will transmit a band of frequencies approximately 8,000 cycles wide, and will probably be the first of its kind in the world. To reduce the cost, the existing carrier telegraph repeaters in use along the 1,630 miles of line between Adelaide and Perth have been modified by the Department's engineers to enable them to transmit satisfactorily the higher frequencies used by the special carrier system. In this way the provision of much expensive equipment at each of seven repeater stations along the line has been avoided.

A feature of this portion of the technical services not generally appreciated, is the extremely close co-operation necessary between officers arranging the lines and adjusting the equipment on the actual programme transmission circuits between States, the officers operating the control equipment at the various studios, and, in order to avoid serious interference with the trunk telephone service, the Department's telephone traffic staff. The first two groups of officers are essentially one group insofar as control is concerned, with exactly similar technical training, experience, and general outlook. All three groups are in continuous touch with each other in the course of their ordinary work, and they have at their disposal the whole resources of the telephone and telegraph system with, in many cases, special telegraph order wires to enable them to arrange the setting up and alteration of lines and equipment. But for this, the problem of securing satisfactory programme relays would be extremely difficult, and failures resulting from the complexity of the organisation would almost inevitably occur from time to time. Especially would this be so in the more intricate cases where relays are concurrent or follow each other at very short intervals, and extensive re-arrangement of lines and equipment has to be made in the minimum of time.

The problem is moreover frequently complicated by the requirements of the licenced stations (B class) among which there is a rapidly increasing demand for programme relaying facilities similar to those provided by the Department for the national service.

While considering this portion of the technical services provided by the Department for the National Broadcasting System, it is of interest to note that permanent programme transmission lines have been pro-

vided to connect each regional station to its main station in capital cities. These permanent lines total approximately 935 miles in length, and with their special equipment involve a capital cost of about £65,000.

Short Wave Service.

During recent months there has been considerable activity in connection with short wave work directed towards the picking up and re-broadcasting of programmes from overseas. The British Broadcasting Corporation has inaugurated an Empire short wave broadcasting service from Daventry, England, and efforts are being made to improve reception to the stage where the programmes from overseas will afford items of high quality and interest for broadcasting over the national system in Australia. A number of very successful re-broadcasts of special items from overseas have in fact already taken place. In the case of a number of speech broadcasts, the London-Australia telephone service has been successfully used. This short wave work is being carried out at the Department's experimental short wave stations at Lyndhurst and Mont Park, Victoria.

Services to Licenced Stations (B. Class).

The licenced stations (otherwise known as "B" class) make a constantly increasing use of the Department's trunk line service for relaying special items and programmes between stations. These stations are in general, separate and independent entities but there exists—usually between city and country stations, or between stations situated in different States—mutual arrangements and understandings out of which arise the demand for relayed programmes. The technical requirements to be met in the case of these relays are the same as in the case of the relays between national stations, i.e., special high quality channels have to be provided for the transmission of musical items.

The rapid increase in the demand for relay lines for both the national and the licenced stations combined with the requirements of the ordinary trunk telephone service has resulted in a number of cases in insufficient programme channels being available, and the Department is now planning the provision of additional channels of this type between the capital cities by means of special carrier systems somewhat similar to that to be installed between Adelaide and Perth. These special systems are of only recent development, and have in fact been designed only in consequence of the Department's demand for equipment of this nature.

Australian National Broadcasting Stations.

Station. 1.	Approximate Location. 2.	Frequency kC. 3.	Wavelength m. 4.	Power Watts (a) 5.	Service Commenced (b) 6.
2BL, Sydney	Coogee, 4½ miles S.E. of G.P.O.	855	351	5,000	13. 11. 1923 (22. 7. 1929)
2CO, Corowa	3½ miles N.N.E. of P.O. Corowa	560	536	7,500 ae	16. 12. 1931
2FC, Sydney	Pennant Hills, 11¼ miles N.W. of G.P.O.	665	451	5,000	5. 12. 1923 (17. 7. 1929)
2NC, Newcastle	Beresfield, 11½ miles W.N.W. P.O. Newcastle	1,245	241	2,000 ae	19. 12. 1930
3AR, Melbourne	North Essendon 8 miles N.W. Eliz. St. P.O.	610	492	5,000	26. 1. 1924 (8. 8. 1929)
3LO, Melbourne	Braybrook, 5¾ miles W. Elizabeth Street, P.O.	800	375	5,000	13. 10. 1924 (22. 7. 1929)
4QG, Brisbane	25 chains S.W. of G.P.O.	760	395	5,000	27. 7. 1925 (30. 1. 1930)
4RK, Rockhampton	6 miles S.W. of P.O.	910	330	2,000 ae	29. 7. 1931
5CK, Crystal Brook	2½ miles N.E. of P.O.	635	472	7,500 ae	15. 3. 1932
5CL, Adelaide	Brooklyn Park, 3¼ miles W. of G.P.O.	730	411	5,000	20. 11. 1924 (14. 1. 1930)
6WF, Perth	7 miles N. of G.P.O.	690	435	3,500 ae	4. 6. 1924 (1. 9. 1929)
7ZL, Hobart	Radio Hill, 1¾ miles S.W. of G.P.O.	580	517	3,000	17. 12. 1924 (14. 12. 1930)

(a) Column 5—ae indicates unmodulated aerial power. Others are computed on d.c. input to anode of final amplifier.

(b) Stations 2BL, 2FC, 3AR, 3LO, 5CL, 6WF and 7ZL were formerly operated by private enterprise under licence granted by the Postmaster-General. 4QG was formerly operated under licence issued to the Queensland Government. These stations were transferred to the N.B.S. on the dates shown in brackets.

World Time Chart.

Sweden Germany Switzerland Italy	Petrograd Constantinople. Capetown	Bagdad. Persia.	India.	Borneo. Java. Dutch E.I.	P.I. China Western Australia.	Tokyo	Adelaide South Aust.	Sydney, Melbourne. Eastern Aust.	New Zealand.	Samoa.	Hawaiian Islands.	U.S.A. Pacific S.T.	U.S.A. Mountain S.T.	U.S.A. Central S.T.	U.S.A. New York Washington E.S.T.	Halifax Buenos Aires.	Rio de Janiero. Brazil.	London. Paris. Madrid.	G.M.T. or G.C.T.
1.00	2.00	3.00	5.00	6.00	8.00	9.00	9.30	10.00	11.30	Noon	1.30	4.00	5.00	6.00	7.00	8.00	9.00	Midn.	0000
2.00	3.00	4.00	6.00	7.00	9.00	10.00	10.30	11.00	12.30	1.00	2.30	5.00	6.00	7.00	8.00	9.00	10.00	1.00	0100
3.00	4.00	5.00	7.00	8.00	10.00	11.00	11.30	Noon	1.30	2.00	3.30	6.00	7.00	8.00	9.00	10.00	11.00	2.00	0200
4.00	5.00	6.00	8.00	9.00	11.00	Noon	12.30	1.00	2.30	3.00	4.30	7.00	8.00	9.00	10.00	11.00	Midn.	3.00	0300
5.00	6.00	7.00	8.00	10.00	Noon	1.00	1.30	2.00	3.30	4.00	5.30	8.00	9.00	10.00	11.00	Midn.	1.00	4.00	0400
6.00	7.00	8.00	10.00	11.00	1.00	2.00	2.30	3.00	4.30	5.00	6.30	9.00	10.00	11.00	Midn.	1.00	2.00	5.00	0500
7.00	8.00	9.00	11.00	Noon	2.00	3.00	3.30	4.00	5.30	6.00	7.30	10.00	11.00	Midn.	1.00	2.00	3.00	6.00	0600
8.00	9.00	10.00	Noon	1.00	3.00	4.00	4.30	5.00	6.30	7.00	8.30	11.00	Midn.	1.00	2.00	3.00	4.00	7.00	0700
9.00	10.00	11.00	1.00	2.00	4.00	5.00	5.30	6.00	7.30	8.00	9.30	Noon	1.00	2.00	3.00	4.00	5.00	8.00	0800
10.00	11.00	Noon	1.00	3.00	5.00	6.00	6.30	7.00	8.30	9.00	10.30	1.00	2.00	3.00	4.00	5.00	6.00	9.00	0900
11.00	Noon	1.00	2.00	4.00	6.00	7.00	7.30	8.00	9.30	10.00	11.30	2.00	3.00	4.00	5.00	6.00	7.00	10.00	1000
Noon	1.00	2.00	3.00	5.00	7.00	8.00	8.30	9.00	10.30	11.00	12.30	3.00	4.00	5.00	6.00	7.00	8.00	11.00	1100
1.00	2.00	3.00	4.00	6.00	8.00	9.00	9.30	10.00	11.30	12.00	1.30	4.00	5.00	6.00	7.00	8.00	9.00	Noon	1200
2.00	3.00	4.00	5.00	7.00	9.00	10.00	10.30	11.00	12.30	1.00	2.30	5.00	6.00	7.00	8.00	9.00	10.00	1.00	1300
3.00	4.00	5.00	6.00	8.00	10.00	11.00	11.30	Midn.	1.30	2.00	3.30	6.00	7.00	8.00	9.00	10.00	11.00	2.00	1400
4.00	5.00	6.00	7.00	9.00	11.00	Midn.	12.30	1.00	2.30	3.00	4.30	7.00	8.00	9.00	10.00	11.00	Noon	3.00	1500
5.00	6.00	7.00	8.00	10.00	Midn.	1.00	1.30	2.00	3.30	4.00	5.30	8.00	9.00	10.00	11.00	Noon	1.00	4.00	1600
6.00	7.00	8.00	9.00	11.00	1.00	2.00	2.30	3.00	4.30	5.00	6.30	9.00	10.00	11.00	Noon	1.00	2.00	5.00	1700
7.00	8.00	9.00	10.00	Noon	2.00	3.00	3.30	4.00	5.30	6.00	7.30	10.00	11.00	Noon	1.00	2.00	3.00	6.00	1800
8.00	9.00	10.00	11.00	1.00	3.00	4.00	4.30	5.00	6.30	7.00	8.30	11.00	Noon	1.00	2.00	3.00	4.00	7.00	1900
9.00	10.00	11.00	Noon	1.00	4.00	5.00	5.30	6.00	7.30	8.00	9.30	Noon	1.00	2.00	3.00	4.00	5.00	8.00	2000
10.00	11.00	Noon	1.00	2.00	4.00	5.00	6.00	6.30	7.30	8.00	9.30	10.30	1.00	2.00	3.00	4.00	5.00	9.00	2100
11.00	Noon	1.00	2.00	3.00	5.00	6.00	6.30	7.00	8.30	9.00	10.30	11.30	2.00	3.00	4.00	5.00	6.00	10.00	2200
Midn.	1.00	2.00	4.00	5.00	7.00	8.00	8.30	9.00	10.30	11.00	12.30	3.00	4.00	5.00	6.00	7.00	8.00	11.00	2300

NOTE: Crossing from dark to light area at midnight indicates following day. Crossing from light to dark area at midnight indicates preceding day. Thus 8 p.m. Sydney time corresponds to 5 a.m. New York time on the following day.

Licensed Broadcasting Stations (B Class)

F.C.T.

2CA.—A.J. RYAN BROADCASTERS LTD., KINGSTON, CANBERRA. St. Loc. 1 mile S.E. Canberra, P.O. Commenced 14/11/31. Freq. 1050 KC. 285m. 50 watts (ae.). Engineer and Manager A. J. Ryan. Interstate relays of Parliamentary and notable events.

New South Wales.

Metropolitan.

2CH—N.S.W. COUNCIL OF CHURCHES' SERVICE, 77 YORK ST., SYDNEY. St. Loc. Dundas 9¾ miles N.W. of G.P.O. Commenced 15/2/32. Freq. 1210KC. 248m. 1000 watts ae. Governing Director, F. H. Stewart, M.P. Manager, John T. Taylor. Programmes : Gwen Gibson. Announcers : A. S. Cochrane (" The Hello Man ") Warren H. Penny, Ernest Walsh (The Good Morning Man). Chief Engineer, T. A. E. McNeill. General news through courtesy of Associated Newspapers Ltd. in conjunction with commentary compiled by 2CH staff for three half-hour periods—11.15 a.m., 2.15 p.m. and 9.15 p.m.

2GB—THEOSOPHICAL BROADCASTING STATION LTD., 29 BLIGH ST., SYDNEY. St. Loc. Mosman 3 miles N.E. of G.P.O. Commenced 23/8/26. Freq. 950 KC. 316m. 3000 watts D.C. Mgr. Dir. A. E. Bennett, Mgr. G. A. Saunders, Advertising Mgr., C. A. Fletcher, Mgr. Copywriting Dept. C. Cousens, Publicity Dept. J. L. Davidge. Programme Director Gil Dech. Chief Engineer, L. N. Schultz. Announcers :—G. A. Saunders (Uncle George), C. Cousens, E. Colman, Miss E. Field, Mrs. D. Jordan, Mrs. W. J. Stelzer, Miss M. Valli, J. Lumsdaine, L. Maurice, F. Grose, A. Hahn (Bimbo), J. McCall. Advertising representatives :—C. A. Fletcher, G. A. Saunders, W. J. Stelzer, C. Cousens, Miss E. Field. Breakfast Session 7 to 9 a.m. First morning session 9-10 a.m. Women's Session 12.15-2 p.m. Women's Afternoon Session 2-3.10 p.m. Afternoon Tea Session 3.10 p.m. 4.45 p.m. Children's Session & Bedtime Stories 4.45-6.30 p.m. Evening Session 6.30 p.m.-11.30 p.m. Community singing every Wednesday noon to 2 p.m.

2KY—TRADES AND LABOUR COUNCIL, 424 GEORGE ST., SYDNEY. St. loc. ¾ mile S. of G.P.O. Commenced 31/10/25. Freq. 1070 KC. 280m. 1500 D.C. Station Mgr., H. E. Beaver, Chief Engr. E. G. Beard. Announcers :—Mrs. Grey, Messrs. H. E. Beaver, Harcourt Garden, John Harper, John Farrelly, Eric Walker, Donald Day. Advertising Mgr. H. Hungerford. Programmes :—Wrestling matches on Saturday nights, Tuesday nights Community singing.

2SM—CATHOLIC BROADCASTING CO., AUSTRALIA HOUSE, WYNYARD SQUARE, SYDNEY. St. Loc. Pennant Hills, 11¼ miles N.W. of G.P.O. Commenced 24/12/31. Freq. 1270 KC. 236m. 1000 watts ae. Manager, J. Meany. Studio Director, John Dunne. Programme Director, Nora McManus. Announcers :—John Dunne, John Tuttell, Nora McManus, Goodie Reeve. Engineers :—Eric Burbury, Engineering Section of A.W.A. Advertising :—G. Martin, Broadcasting Section of A.W.A. Secretary :—Olive Malone.

2UE—ELECTRICAL UTILITIES SUPPLY CO. 300 PITT ST., SYDNEY. St. Loc. Lilli Pilli 14 miles S.S.W. of G.P.O. Commenced 16/1/25. Freq. 1025 KC. 293m. 1000 watts ae. Managing Director, C. V. Stevenson, Manager and Chief Announcer, Lionel Lunn. Announcing Staff :—S. Merideth (Uncle Si), Cecil Agassiz (Aggie), C. Honeyfield (Country Man's Session), Mrs. Filmer (Aunty May), Dorothea Vautier (Afternoon Session), L. G. Melville (Racing Commissioner), Oscar Lind (General Sporting), S. B. Gravenall (Sport) Arthur Carr (Ambrose) Children's Entertainer. Don Bradman (Cricket talks), Murray Stevenson (Chief Engineer), Rex Shaw (Musical and Programme Director), Isabelle Grace (Publicity) Special Sessions of Horse Racing, Greyhound Coursing, Boxing. 2UE Old Time Dances (fortnightly). Children's Party Saturday mornings. Cricket Resumes by Don Bradman. 2UE Talkie Club. Country Man's sessions daily at 8 a.m. Friday 8 p.m.

2UW—RADIO BROADCASTING LTD., PALINGS BDGS., 16 ASH ST., SYDNEY. St. Loc. 100 yards N. of G.P.O. Commenced 13/2/25. Freq. 1125 KC. 267m. 1500 watts D.C. Phone Nos. B4849, BW6223, B3916. Telegraphic address : Twouw. General Manager, Oswald Anderson. Studio Director, J. M. Prentice, Chief Announcer J. M. Prentice. Assistant Studio Director & announcer, C. J. Arnold. Announcers :—Vernon Sellars, D. W. Virtue, Jack Win. Women's Interests, Mrs. A. Littlejohn, Miss Hurst, Miss Enid Lorimer, Miss Helga Rolunde, Miss S. Parker. Children's Session :—conducted by Farmer & Co., in association with Uncle Jack Jill, The Professor, and Midshipman, Bob Breezy. Engineers :—Chief Engr. A. W. Carlin. Engrs. H. Caldecott, M. C. Basden, A. F. Carlin. Advt. Mgr. F. R. Thompson. Feature Talks, C. N. Baeyertz. Production Dept. J. Donnelly. Publicity Dept. J. H. Finlayson. Special Features :—Talks on English Literature & Philosophy, C. N. Baeyertz. Foreign Affairs—Opera & Special Musical Presentations J. M. Prentice. Motor Session, Gordon Marsh. Parliamentary Session from Canberra, Farmer Whyte. Short Wave Radio, R. H. Power. Repertory Movement and Theatrical Matters, Miss Enid Lorimer. Gardening Session, S. H. Hunt. Sporting Session, Oscar Lawson. Piebald Philosophy, Jack Win. Cricket Comments, Captain Ballantine & W. M. Woodfull. General Sporting, J. H. Finlayson.

Country.

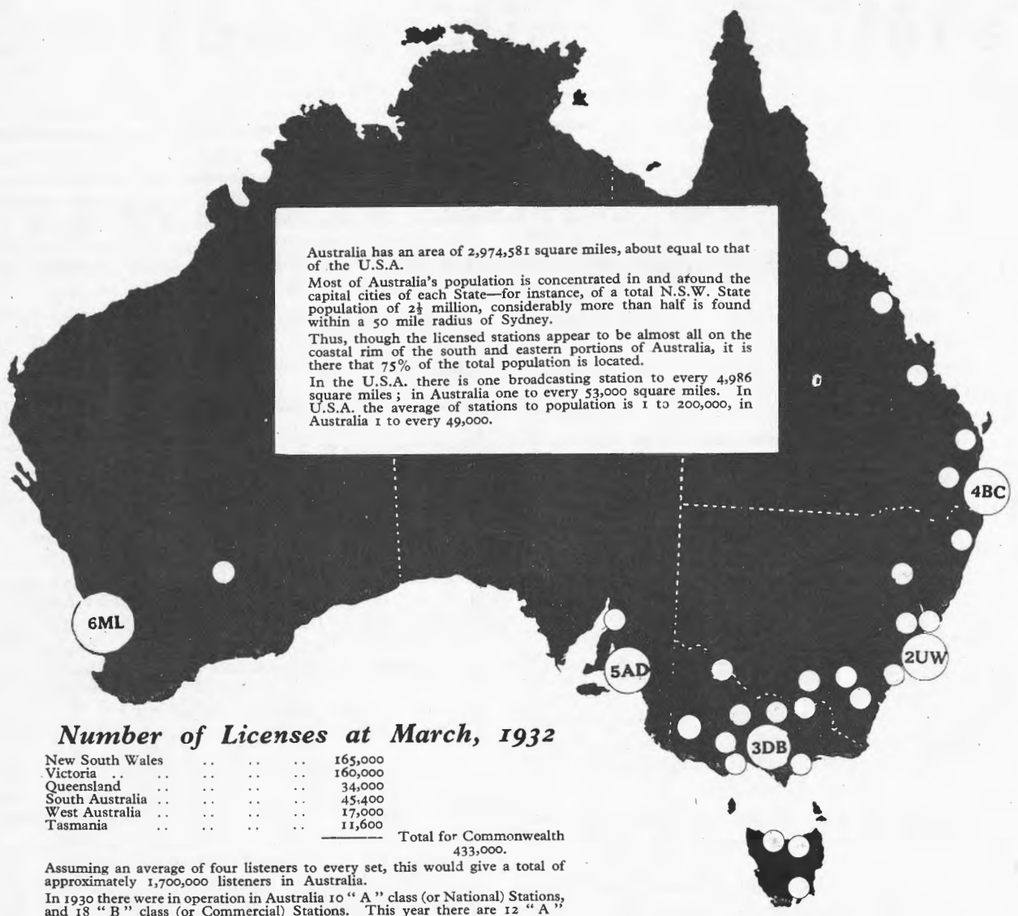
2AY—AMALGAMATED WIRELESS (A/SIA) LTD., 47 YORK ST., SYDNEY. St. Loc. 1 mile N. of Albury P.O. Commenced 17/12/30. Freq. 1480 KC. 203m. 50 Watts ae.

2GN — GOULBURN BROADCASTING CO. LTD., AUBURN ST., GOULBURN. St. Loc. 2 miles W.S.W. of P.O. Commenced 25/1/32. Freq. 1390 KC. 216m. 100 watts ae.

2HD—AIRSALES BROADCASTING CO., CIVIC CENTRE, NEWCASTLE. St. Loc. 6 miles W.N.W. of P.O. Commenced 27/1/25. Freq. 1110 KC. 270m. 200 watts ae.

MORE THAN A MILLION

BY RADIO RELAY THROUGHOUT AUSTRALIA



Number of Licenses at March, 1932

New South Wales	165,000
Victoria	160,000
Queensland	34,000
South Australia	45,400
West Australia	17,000
Tasmania	11,600
Total for Commonwealth	433,000.

Assuming an average of four listeners to every set, this would give a total of approximately 1,700,000 listeners in Australia.

In 1930 there were in operation in Australia 10 " A " class (or National) Stations, and 18 " B " class (or Commercial) Stations. This year there are 12 " A " class stations and 47 " B " class Stations with further increase in numbers in the near future.

A SURVEY of the location of the many Broadcasting Stations throughout Australia, bearing in mind the population of various States, and proximity of the bulk of the population to the coast line, visually demonstrates to the thoughtful advertiser, more than any word can convey, the great opportunities offered for Relay Radio Advertising on the lines adopted by firms in America who make use of continent wide chain broadcasting facilities very extensively to popularise their products or service.

A number of very extensive and highly successful Chain Relays of Special Advertising have been accomplished in Australia, and it is now possible almost at any time of the day or night to link up forty stations in one simultaneous advertising broadcast, and at special times the number of stations linked up may be increased to forty-six.

It would be a conservative estimate in stating that this type or method of publicity would simultaneously reach over a million listeners, and there is no other media offering in Australia to-day that can approach anywhere near these figures. An important factor for the advertiser is the relatively small outlay necessary to secure this attractive all-embracing publicity. Many firms are already using an all State link-up for advertising through events of national interest, and this phase of Radio Advertising is showing rapid development.

WILL HEAR YOUR MESSAGE

The Federal Radio network established in 1930 comprises the following key stations in the capital cities, which have almost daily contact with all stations within the borders of that State, and with each other. Most of the important chain relay broadcasts which have taken poace in Australia have been arranged through and in conjunction with 2UW Sydney, 3DB Melbourne, 4BC Brisbane, 5AD Adelaide and 6ML Perth. Advertisers using these Stations may be sure of the most careful handling of their publicity, which in the past has been found to obtain very satisfactory results.

3DB

The Studio of this prominent and popular Victorian Station is located in the " Herald " Buildings, Flinders Street, Melbourne, the transmitting station being some 7½ miles outside the city proper. Ever since the inception of Station 3D.B. it has been noted for the novelty and variety of its general programmes and the numerous innovations and stunts which have been broadcast from time to time. Each session has something of particular interest, and one outstanding success above all others was the launching some two years ago of the 3D.B. Smile-away Club, which now has a membership exceeding 20,000 and still growing.
Other feature stunts in which 3D.B. regularly inaugurates or participates in are the Test Match Relays and matters of particular news and entertainment interest.

For full particulars of Station Details, see page 42.

2UW

One of the first stations in Australia (known even then as Paling's Station) to put musical programmes on the air, 2U.W. is still located in Ash Street in the centre of the city of Sydney, and continues to lead through the quality rather than the quantity of its musical entertainment.
Station 2U.W. was one of the first stations to commercialise relays of descriptions of national events, and make these available to other stations throughout Australia.
Station 2U.W. is noted for the particular care given to the preparation and delivery of the advertising announcements which perhaps may partly account for the fact that some advertisers have been almost continuously using the station since its inception, and many for unbroken periods extending up to four years.

For full particulars of Station Details, see page 39.

AUSTRALIA'S BIGGEST RELAY.

On New Year's Eve (31/12/32) the most extensive simultaneous relay ever attempted in Australia was successfully carried out over a chain of 42 Stations extending from Townsville (Q.) to Perth (W.A.). Though some larger oneway transmissions have been made in U.S.A. where there are over 600 licensed stations, there is no record of a two way relayed broadcast transmission taken consecutively in five minute intervals from stations so wide apart. It was an all Australian relay in several features—it included all Australia—in the way of B. class stations—the music played on every Station was either composed or sung by Australians—the Subjects of the Speakers on the 42 stations were Australian topics—and last but not least the whole relay was sponsored by an Australian firm—Wrigleys (Aust.) Ltd., the parent firm in U.S.A. is the second largest user of Radio publicity in the world.
If taken Station by Station, the telephone line in the link-up exceeded 14,000 miles in length and the total number of listeners certainly exceeded a million where the full supplementary studio programme was relayed and simultaneously rebroadcast from 42 B class Stations throughout Australia, all of whom participated in this astonishing undertaking

4BC

This station, situated in Brisbane, specialises in broadcasting events of public interest, not only in Queensland but throughout Australia. It has featured many novel broadcasts by relay through a chain of stations in the Eastern States, the most recent being for the first time an actual aboriginal corroboree.
The standard of entertainment maintained by this Station always ensures a large listening audience, and ever since its establishment has justified its claim as one of the most popular stations in Australia.
The Studio is situated in one of the main streets, but the transmitting station is at Oxley some eight miles out of Brisbane. Through associate stations at Toowoomba (4 G.R.) Maryborough (4 M.B.) and Rockhampton (4 R.O.) Station 4 B.C. is in a particularly favoured position to quote State-wide radio advertising both by relay and individual station publicity.

For full particulars of Station Details, see page 44.

5AD

Adelaide in particular and South Australia in general are well served in the Radio Broadcasting field by the Advertiser Broadcasting Service operating from " The Advertiser " Newspaper which owns and operates 5 A.D. and 5 P.I., a new station situated at Port Pirie. These two stations provide a unique Radio Broadcasting coverage in South Australia and measured by every standard 5 A.D. is the most popular Station in Adelaide.
The close association with " The Advertiser " newspaper affords exceptional news-getting facilities and the musical programmes from 5 A.D. form an attractive diversion from the news and literary side of this station's activities. South Australia offers an excellent field for the sale of many commodities from other States and manufacturers have made full use of these stations for publicity and sales propaganda.

For full particulars of Station Details, see page 44.

6ML

Perth, being so far removed from actual contact with the more popular Eastern States, has a greater need for all that Broadcasting offers in the way of news and entertainment. The popularity of this pioneer commercial station would indicate it has a definite place in the artistic and business activities of the West Australian capital. Each section of the community is well catered for—the Station presents a number of sessions daily each devoted to specific or general groups of listeners, including Housewives, Children, and the Sporting fraternity—in connection with the latter 6M.L. hold exclusive rights in several directions. This station is generally heard over a greater aggregate number of hours weekly than other Perth stations, and by a careful arrangement of entertainment items and publicity announcements, obtains a full measure of appreciation for both.

For full particulars of Station Details, see page 46.

AUSTRALIAN AND OVERSEAS ADVERTISERS SHOULD WRITE TO THE ABOVE STATIONS FOR RATES ON CAPITAL CITY, COUNTRY, STATE, AND AUSTRALIAN-WIDE RADIO ADVERTISING

2KC—NEWCASTLE BROADCASTING CO. LTD., 57 HUNTER STREET, NEWCASTLE. St. Loc. Sandgate 6½ miles N.W. Newcastle P.O. Commenced 1/8/31. Freq. 1415 KC. 212m. 200 watts ae. Manager, Allen Fairhall. Announcers :—Harold Pickhover, Allen Fairhall, Stan Heanery (Sporting), Tom Horan (Sporting), Miss Nora Downie (Secretary), N. O. Whale (F.A.I.S.) (A.F.I.A.). Special Services :—Cheerio Club, Ladies Session, Sporting, Boxing and Wrestling Descriptions two nights per week. Turf Prospects. Old time and Jazz Music.

2MO—M. J. OLIVER, MARQUIS ST., GUNNEDAH. St. Loc. ¾ mile W. of P.O. Commenced 16/1/31. Freq. 1320 KC. 227m. 50 watts ae. Gen. manager, L. M. Oliver. Chief Engineer, M. J. Oliver.

2WG—RIVERINA RADIO BROADCASTING CO. LTD., 16 FITZMAURICE ST., WAGGA. St. Loc. 200 yards S. of P.O. Commenced 29/6/32. Freq. 1155 kC. 260m. 50 ae. Manager, E. V. Roberts, B.Sc. Announcers :—H. R. Hambridge, I. A. Roberts. Advertising Mgr. H Hambridge. Sessions : 7.45 a.m. to 8.30 a.m. daily. 7.0 p.m. to 10.30 p.m. daily.

2WL—WOLLONGONG BROADCASTING CO., 149 CROWN ST., WOLLONGONG. St. Loc. ¾ mile N.N.W. of P.O. Commenced Freq. 1435kC. 209m. 50 watts ae.

Manager and Chief Technician, Russell A Yeldon Deputy Engineer, Mr. A. R. Hazelton.

2XN—G. W. EXTON, 173 MOLESWORTH ST., LISMORE. St. Loc. ⅜ mile S.S.W. of P.O. Commenced 1/5/30. Freq. 1340kC. 224m. 50 ae.

Victoria.

Metropolitan.

3AK—AKRON BROADCASTING CO. PTY. LTD., 490 ELIZABETH, ST., MELBOURNE, C.1. St. Loc. Balwyn 6½ miles E. Eliz. St. P.O. Commenced 19/11/31. Freq. 1500kC. 200m. 50 watts ae. Manager G. F. Palmer, Announcers : G. F. Palmer, F. Bibby, Engineer F. Bibby, Advertising Managers, Reuter's Ltd.

3AW—THE VOGUE BROADCASTING CO. PTY. LTD., HIS MAJESTY'S THEATRE, EXHIBITION ST., MELBOURNE, C.1. St. Loc. 34 chains N.E. Eliz. St., P.O. Commenced 22/2/32. Freq. 1425kC. 210m. 300 watts ae.

3DB—3DB BROADCASTING CO. PTY. LTD., operating the HERALD BROADCASTING STATION, established 1927. Studios — 36 Flinders Street, Melbourne. Transmitting Station : Ashburton, 7½ miles east of Melbourne. Phone No. F 2118. Telegraphic addresss : Threedb. Commenced 21/2/27. Freq. 1180 KC 254m. 300 watts (ae.) Manager, David Worrall. Chief Announcer : Renn Millar. Announcers: Geoff Palmer, John Stuart. Chief Engineer : E Ashwin. Programme Director : Mr. Hugh Hunham. Womens interests : Miss Cris. Turnbull, Margaret Manning. Children's Session : Midshipman Bob Breezy and Sally Ann. Speakers on special subjects : authorized by the B.M.A. A leading doctor speaks weekly on health subjects. The Victorian Football League arranges weekly talks in season and Cricket is fully covered by experts. Among feature stunts which brought 3DB to the fore were the Test broadcasts from England, immediately following which the studio was entirely gutted by a fire which destroyed all plant, records, etc. To-day 3DB has one of the best equipped studios in Australia. There is a staff of 33, including advertising and programme specialists, continuity writers, etc. 3DB has imported thousands of records from overseas in the last twelve months.

3KZ—INDUSTRIAL PRINTING & PUBLICITY CO., 24-30 VICTORIA ST., CARLTON. N.3. St. Loc. ½ mile N. Eliz. St. P.O. Commenced 8/12/30. Freq. 1350 KC. 222m. 300 watts ae. Managing Director, Mr. Syd. Morgan. Advertising Manager and Director, Mr. W. V. Morgan. Secretary Mr. M. B. Duffy. Announcers :—Mr. Norman Banks and Miss N. Melwit, popularly known as " Norm and Joan." Mr. N. E. Palmer and Miss Dorothy Bush, known as " Eddie & Betty." Mr. Lloyd Lamble. Chief Engineer, Mr. A. Grace. Copy Dept. Mr. Frank Allen. Special Services : Dance Sessions, Sporting News, (Cricket Football, Racing, Tennis, etc.), Health Lectures, Educational Addresses, Chats to Housewives, etc.

3UZ—THE NILSEN BROADCASTING SERVICE PTY. LTD., 45 BOURKE STREET; MELBOURNE. C.I. St. Loc. ½ mile N.E. Eliz. St. P.O. Commenced 8/3/25. Freq. 930 KC. 322.5m. 600 watts (ae.) Manager: J. S. Larkin. Programme Director : Ernest Trotman. Announcers : J. Lloyd Jones, Frank Jenkin, Alec. Dear, Miss Elsie Bradshaw and Miss Anne Harvey. Engineers : L. G. Glew, S. Riches and W. Virgona Advertising Staff : O. W. Abramowski, G. S. Fawcett. Continuity Writer : J. Gurry. 3UZ's appeal is fairly widespread as their special services include : Women's Morning Tea Talks daily at 11 a.m. Children's Sessions daily at 5 p.m., (there being a membership of 12,000 in Children's Radio Club). Diggers Session 7 p.m., Fridays (half an hour devoted to Returned Soldier interests and activities), " The Argus " official starting prices at each day's races, broadcast at 7.25 p.m. (these are the official prices accepted by the V.R.C. and paid by the registered bookmakers), The Light Car Club of Australia's session at 8.00 p.m. Fridays, devoted to motoring activities and conducted personally by the President of the Club. In addition the programmes embody many exclusive features, such as the Motor Racing Grand Prix at Phillip Island ; the snow sports at Mount Buffalo ; Football descriptions from the two principal grounds (Richmond and Collingwood) ; and special relays of short wave transmission oversea. Also the Shell Radio Parties and Dance nights ; while the Sunday evening programmes of special music are probably the best known features and draw one of the largest audiences for any single programme in Victoria, if not in Australia. 3UZ was the first station to introduce the sponsored or goodwill form of commercial programme, and to-day claim to carry more sponsored sessions than any other station in Australia. Our daily schedule of broadcasting hours is as follows :—Monday to Friday inclusive, 7 a.m.—8.45 a.m., 9 a.m., 2 p.m., 3.30 p.m., 11.30 p.m. Saturday, 7 a.m., 8.45 a.m., 9.00 a.m., 12 (noon) 6 p.m., 12 midnight. Sunday, 10.30 a.m., 12.30 p.m., 5.45 p.m., 10 p.m.

Country.

3BA—BALLARAT BROADCASTERS PTY. LTD., CNR. ARMSTRONG & DANA STS., BALLARAT. St. Loc. opposite P.O. Sturt St. Commenced 31/7/30. Freq. 1300 KC. 231m. 50 watts ae. Managing Director,

Mr. J. H. Davey, Manager & Station Engineer, Mr. Warne A. Wilson, Announcers :—Mr. Stephen McDonald (Uncle Mac), Miss Lela Lake, Messrs. J. H. Davey and A. E. C. Kerr. Operating Engineer, Mr. A. D. Kerr. Special Services : Children's programme 7 p.m. Sporting Sessions, Church Services, Election News, etc. Dance programmes. Interesting talks, etc.

3BO—AMALGAMATED WIRELESS A/ASIA LTD., 47 YORK ST., SYDNEY. St. Loc. Kangaroo Flat, 3 miles S. Bendigo. Commenced 4/6/31. Freq. 970 K.C. 309m. 200 watts ae.

3GL—GEELONG BROADCASTERS PTY. LTD., NATIONAL MUTUAL BDGS., MOORABOOL ST., GEELONG. St. Loc. ¼ mile of P.O. Commenced 3/12/30. Freq. 1400 KC. 214m. 50 watts ae.

3HA—WESTERN PROVINCE RADIO PTY. LTD., 37 GRAY STREET, HAMILTON. St. Loc. 4 miles N. of P.O. Commenced 24/10/31. Freq. 1010 KC. 297m. 200 watts ae.

3SH—SWAN HILL BROADCASTING CO., CAMPBELL ST., SWAN HILL. St. Loc. ½ mile S. of P.O. Commenced 27/8/31. Freq. 1080 KC. 278m. 50 watts ae.

3TR—GIPPSLAND PUBLICITY PTY. LTD., RAYMOND ST., SALE. St. Loc. 35 yards N. of P.O. Commenced 29/9/30. Freq. 1280 KC. 234m. 50 watts ae. Director : Archibald Gilchrist.

3WR—WANGARATTA BROADCASTING CO. PTY. LTD., REID STREET, WANGARATTA. St. Loc. 200 yards W. of P.O. Commenced 5/1/31. Freq. 1260 KC. 238m. 50 watts ae. Manager : Leslie J. Hellier. Announcer : Miss Rita Wilson. Engineer : Archbald Hopton. Directors : William C. Callander, Arthur Sutton, Leslie J. Hellier. Special Services : News Service midday and evening, Smile Away Club, Sponsored Sessions, Catholic Hour Relay each Sunday, Watch Tower Session, Dance Programmes each week.

3YB—MOBILE BROADCASTING SERVICE PTY. LTD., 430 LITTLE COLLINS ST., MELBOURNE. C.1. St. Loc. throughout inland Victoria. Commenced 13/10/31. Freq. 1060 KC. 283m. 25 watts ae. Manager and Melbourne Representative, J. A. Young. Announcer : Mr. V. M. Dinneny, Engineer, Mr. Max Folie. Sydney Representative, V. L. H. Coghlan. Portable transmitter designed to serve the productive Victorian Territories not adequately covered by contemporary stations.

Queensland.

Metropolitan.

4BC—J. B. CHANDLER & CO., 43 ADELAIDE ST., BRISBANE, QLD. St. Loc. Oxley 7½ miles S.W. G.P.O. Commenced 16/8/30. Freq. 1145 KC. 262m. 750 watts ae. Manager, Russel F. Roberts. Advertising Manager : John A. Radford. Announcing Staff : Evening Session : Paul Daly, George Hardman, Rodway Gainford, Marie Landon, Ruth Rutherford. Day Session : Ruth Rutherford. Early Morning Session E. Bessemer (Sunrise Sam). Children's Session : Uncle Paul, Uncle George, Uncle Rod, Aunt Marie.

4BC—OFFICIAL BROADCASTING, Station of Brisbane Repertory Theatre, Boy Scouts and Girl Guides Association, " Telegraph " Newspaper. Queensland Amateur Swimming Association, Queensland Turf Club, Brisbane Amateur Turf Club, Tattersalls Club, Social Service League, Fox Movietone Club, Regent Theatre, Trocadero Dansant and Night Owls Club. Regular news services, official weather reports, market reports, sporting services and time services are broadcast at all Sessions.

4BH—BROADCASTERS (AUST.) LTD., QUEENSLAND, DEPOSIT BANK CHAMBERS, 231 ALBERT ST., BRISBANE. St. Loc. Bald Hills 9½ miles N.N.W. of G.P.O. Commenced 2/1/32. Freq. 1380kC. 217m. 600 watts ae. Manager : Mr. Walter R. Pym (also musical director and supervisor of programmes). Announcers : Early Morning ; John Christopher. Women's Session : Ivy Ray. Evening Announcer : " Kanga " (Frank Gorman). " Uncle Wally " (Mr. Pym) conducts Luncheon Session and is heard in night sessions. Advertising : J. Sinclair Wheeler. Continuity : John Christopher, Frank Gorman, and C. Moran. Engineering : Thorsten Gedda (chief). W. Bardin, M.I.R.E. N. Cruikshank, and C. Moran. Features, Sports : a racing commissioner, tennis lectures, cricket, sailing, etc., and Children's Sessions.

4BK—BRISBANE BROADCASTING CO. LTD., 47 CHARLOTTE STREET, BRISBANE. St. Loc. ¼ mile S.W. of G.P.O. Commenced 29/9/30. Freq. 1290kC. 233m. 200 watts ae.

Country.

4GR—GOLD RADIO SERVICE LTD., 43 ADELAIDE STREET, BRISBANE (STATION AT TOOWOOMBA). St. Loc. 200 yards N.W. of Toowoomba P.O. Commenced 9/8/25. Freq. 1000kC. 300m. 50 watts ae.

4MB—MARYBOROUGH BROADCASTING CO. LTD., 43 ADELAIDE ST., BRISBANE. (Station at Maryborough). St. Loc. 1 mile W. of Maryborough P.O. Commenced 16/8/32. Freq. 1060kC. 283m. 50 ae.

4MK—MACKAY BROADCASTING SERVICE, 64 NELSON STREET, MACKAY. St. Loc. ½ mile W. of P.O. Commenced 12/1/31. Freq. 1190kC. 252m. 100 watts ae.

4RO—ROCKHAMPTON BROADCASTING CO. PTY. LTD., 43 ADELAIDE ST., BRISBANE. (Station at Rockhampton). St. Loc. Rockhampton. Commenced 2/7/32. Freq. 1330kC. 226m. 50 watts ae.

4TO—AMALGAMATED WIRELESS (A/ASIA) LTD., 47 YORK ST., SYDNEY. (Station at Townsville). St. Loc. Townsville P.O. Commenced 5/10/31. Freq. 1170kC. 256m. 200 watts ae.

South Australia.

Metropolitan.

5AD—ADVERTISER NEWSPAPERS LTD., WAYMOUTH STREET, ADELAIDE. St. Loc. 6½ chains N. of G.P.O. Commenced 2/8/30. Freq. 1310kC. 229m. 300 watts ae.

5DN—HUME BROADCASTERS LTD., 29 RUNDLE ST., ADELAIDE. St. Loc. City. Commenced 24/2/25. Freq. 960kC. 313m. 300 watts ae.

5KA—SPORTS RADIO BROADCASTING CO. LTD., RICHARDS BLDGS. CURRIE ST., ADELAIDE St. Loc. ¼ mile N.W. of P.O. Commenced 25/3/27. Freq. 1200kC. 250m. 1000 watts. Manager : Mr. R. Lincoln. Announcers : Messrs. H. A. Thorn & R. T. Sparkes Station Advertising Specialist : Mr. T. G. Coombs. Features : Interstate Relays, Dance programmes, International News, and etc.

Country.

5PI—MIDLANDS BROADCASTING SERVICES LTD., ELLEN STREET, PORT PIRIE. St. Loc. ¼ mile S. of P.O. Commenced 7/1/32. Freq. 1040kC. 288m. 50 Watts ae.

Western Australia.

Metropolitan.

6ML—MUSGROVES LTD., LYRIC HOUSE, MURRAY ST., PERTH. St. Loc. 100 yards S. of G.P.O. Commenced 19/3/30. Freq. 1135kC. 264m. 300 watts ae. Station Director, Mr. F. C. Kingston. Station Manager: Bryn Samuel. Announcers: Eric Donald, Bram. F. Saunders, Ned Taylor, Laurel Berryman (Miss). Engineer: Harry T. Simmonds. Advertising Manager: Edison C. Churchward. Features Daily: Bright Breakfast Session, 7-8.30 a.m. Housewives' News. Day and Evening News Services, Children's Session. Bi-weekly-Organ Recitals. Weekly Classical and Dance programme, Sporting Services, including weekly ringside boxing and wrestling descriptions.

6PR—NICHOLSONS LTD., 86-90 BARRACK ST., PERTH. St. Loc. Applecross 4½ miles S.W. of G.P.O. Commenced 14/10/31. Freq. 880kC. 341m. 500 watts ae.

Country.

6EG—GOLDFIELDS BROADCASTERS LTD., 86 PALACE CHAMBERS, KALGOORLIE. St. Loc. ¼ mile S.W. of P.O. Commenced 16/9/31. Freq. 1220kC. 246m. 100 watts ae.

Tasmania.

Metropolitan.

7HO — COMMERCIAL BROADCASTERS PTY. LTD., 82 ELIZABETH ST., HOBART. St. Loc. ¼ mile W. of G.P.O. Commenced 13/8/30. Freq. 890kC. 337m. 50 watts ae.

Country.

7LA—FINDLAY AND WILLS BROADCASTERS PTY. LTD., 67 BRISBANE STREET, LAUNCESTON, St. Loc. 2¼ miles S. of P.O. Commenced 13/12/30. Freq. 1100kC. 273m. 300 watts ae. Manager and technical adviser: V. M. Brooker, M.I.R.E., M.I.W.T. (London). Engineer: V. Sydes, Studio Manager: John T. Gough. Announcers: J. H. Wilson, W. Pierson, Miss Edna McGladery. Special information services to the Bass Strait Islands.

7UV—NORTH WESTERN TASMANIAN BROADCASTERS LTD., ULVERSTONE. St. Loc. 2½ miles W. of South from P.O. Commenced 6/8/32. Freq. 1460kC. 205m. 250 watts ae. Chairman of Directors: K. W. Plummer, Announcer: Al Anstee. Engineer: Mr. W. Martin. Secretary: Miss M. Wall. The Department of Agriculture Talks; Potato Marketing Board Talks.

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ae indicates unmodulated aerial power.
d.c. indicates power computed on direct current input to anode of final amplifier.

Broadcasting Licences in Australia.

Current Receiving Licences (Total All Classes) and Ratio to Population.

At end of	N.S.W. Licences in force	N.S.W. Ratio to 100 of Population	VIC. Licences in force	VIC. Ratio to 100 of Population	Q'LD. Licences in force	Q'LD. Ratio to 100 of Population.	S.A. Licences in force.	S.A. Ratio to 100 of Population.	W.A. Licences in force	W.A. Ratio to 100 of Population	TAS. Licenses in force	TAS. Ratio to 100 of Population	COMMONWEALTH. Licences in force	COMMONWEALTH. Ratio to 100 of Population
July, 1924	906	.04	187	.01	23	.003	74	.01			16	.008	1,206	.02
Aug.	6,945	.3	887	.05	160	.02	309	.05	333	.09	54	.02	8,688	.1
Sept.	13,861	.6	1,398	.08	356	.04	537	.1	576	.1	131	.06	16,859	.3
Oct.	16,721	.8	3,080	.2	456	.05	885	.16	784	.2	161	.08	22,087	.4
Nov.	22,442	.9	5,957	.3	533	.06	1,095	.2	1,301	.3	201	.09	31,529	.54
Dec.	26,071	1.1	8,327	.5	633	.07	1,345	.25	1,716	.4	244	.1	38,336	.66
Jan. 1925	28,397	1.2	10,975	.6	697	.08	1,579	.27	2,321	.6	305	.14	44,274	.76
Feb.	30,450	1.3	13,953	.8	825	.09	1,874	.34	2,756	.7	365	.17	50,223	.85
Mar.	31,796	1.4	16,459	.9	942	.11	2,198	.4	3,029	.8	429	.19	54,853	.93
Apr.	32,847	1.4	18,036	1.09	1,050	.12	2,507	.46	3,215	.9	478	.2	58,133	.99
May	33,906	1.5	19,383	1.1	1,177	.14	2,855	.5	3,392	.93	518	.23	61,231	1.04
June	34,857	1.54	20,290	1.22	1,267	.15	3,331	.62	3,562	.97	567	.26	63,875	1.08
July	35,504	1.57	21,357	1.28	1,362	.17	4,096	.77	3,679	1.02	607	.28	66,605	1.1
Aug.	37,565	1.6	23,776	1.4	1,704	.2	4,775	.89	3,943	1.09	720	.33	72,483	1.24
Sept.	38,892	1.7	26,232	1.5	2,229	.26	5,259	.97	4,083	1.1	790	.36	77,485	1.31
Oct.	37,203	1.6	28,442	1.7	2,892	.34	5,774	1.07	4,124	1.1	836	.38	79,271	1.34
Nov.	34,744	1.5	31,318	1.8	3,660	.43	6,099	1.1	4,179	1.1	853	.39	80,853	1.37
Dec.	34,911	1.5	33,988	2	4,141	.49	6,985	1.29	4,192	1.15	913	.41	85,130	1.44
Jan. 1926	34,108	1.5	38,323	2.2	4,476	.5	8,568	1.01	4,198	1.1	967	.44	90,640	1.5
Feb.	32,444	1.4	45,274	2.7	4,795	.5	9,734	1.7	3,959	1	1,013	.46	97,219	1.6
Mar.	33,188	1.4	49,402	2.9	5,247	.6	10,480	1.9	3,764	1	1,064	.5	103,225	1.7
Apr.	34,100	1.4	53,547	3.1	5,951	.6	11,029	2	3,759	1	1,114	.5	109,500	1.8
May	35,438	1.5	57,700	3.4	6,681	.7	11,624	2.1	3,877	1	1,171	.5	116,491	1.9
June	37,082	1.61	64,587	3.83	8,450	.98	12,657	2.27	4,003	1.07	1,281	.58	128,060	2.14
July	39,206	1.7	70,070	4.1	12,892	1.4	13,764	2.4	4,113	1.1	1,347	.6	141,398	2.3
Aug.	41,929	1.8	77,493	4.6	15,082	1.7	14,631	2.6	4,157	1.1	1,444	.6	154,736	2.5
Sept.	44,962	1.9	83,077	4.9	16,619	1.9	14,904	2.6	4,225	1.1	1,649	.7	165,436	2.7
Oct.	47,127	2.04	89,055	5.28	17,971	2.08	15,252	2.7	4,143	1.1	1,750	.8	175,298	2.9
Nov.	47,879	2.06	95,136	5.6	18,902	2.1	15,136	2.7	4,118	1.1	1,849	.8	183,020	3.02
Dec.	48,858	2.1	97,744	5.8	19,414	2.2	15,165	2.7	4,114	1.09	1,933	.92	187,228	3.09
Jan. 1927	50,301	2.2	101,635	5.9	20,082	2.3	15,469	2.7	4,047	1	2,008	.9	193,542	3.2
Feb.	51,154	2.2	104,428	6.1	20,425	2.3	15,773	2.7	4,014	1	2,078	1	197,872	3.2
Mar.	52,528	2.2	106,081	6.2	20,787	2.3	15,807	2.8	3,932	1	2,153	1	201,288	3.3
Apr.	54,561	2.3	108,732	6.3	21,335	2.4	15,738	2.8	3,890	1	2,259	1	206,535	3.4
May	57,251	2.4	113,977	6.6	22,287	2.5	16,061	2.8	3,874	1	2,351	1	215,801	3.5
June	59,880	2.55	118,965	6.95	23,249	2.63	16,791	2.96	3,903	1.03	2,461	1.14	225,249	3.68
July	62,869	2.68	122,443	7.15	23,957	2.71	17,503	3.09	3,922	1.04	2,592	1.20	233,286	3.82
Aug.	65,803	2.78	126,830	7.36	24,235	2.74	17,797	3.13	3,943	1.03	2,730	1.25	241,338	3.93
Sept.	69,212	2.93	130,236	7.56	24,699	2.79	18,329	3.22	3,987	1.04	2,912	1.38	249.375	4.06
Oct.	71,479	3.03	132,871	7.72	24,914	2.81	18,417	3.23	3,932	1.03	3,125	1.87	254,738	4.15
Nov.	72,162	3.04	133,746	7.75	25,203	2.82	18,645	3.27	3,911	1.02	3.343	1.60	257,010	4.17
Dec.	72,854	3.05	134,825	7.80	24,433	2.73	18,792	3.29	3,872	1.00	3,403	1.63	258,179	4.19
Jan. 1928	74,323	3.13	135,729	7.86	24,787	2.77	19,126	3.35	3,829	.99	2,510	1.20	260,304	4.22
Feb.	75,212	3.15	136,410	7.86	24,813	2.77	19,388	3.38	3,820	.98	2,720	1.30	262,363	4.23
Mar.	75,869	3.16	136,481	7.83	24,920	2.77	19,452	3.38	3,780	.96	2,838	1.31	263,340	4.22
Apr.	77,010	3.20	136,712	7.84	25,072	2.79	19,605	3.40	3,756	.96	2,912	1.34	265,067	4.25
May	78,698	3.27	136,496	7.84	25,239	2.80	19,969	3.46	3,740	.95	3,036	1.40	267,178	4.28
June	80,197	3.34	137,758	7.91	25,287	2.82	20,319	3.53	3,774	.96	3,172	1.46	270,507	4.33
July	82,872	3.45	139,023	7.98	25,685	2.86	20,736	3.60	3,798	.97	3,327	1.54	275,441	4.42
Aug.	85,196	3.55	141,344	8.11	25,736	2.86	21,088	3.66	3,844	.98	3,480	1.61	280,688	4.50
Sept.	87,622	3.63	142,597	8.15	25,673	2.84	21,305	3.70	3,848	.97	3,645	1.72	284,690	4.54
Oct.	88,783	3.67	141,988	8.12	25,566	2.83	21,514	3.73	3,844	.97	3,855	1.82	285,550	4.56
Nov.	90,177	3.72	143,250	8.19	25,235	2.77	22,019	3.81	3,830	.96	3,946	1.87	288,457	4,59
Dec.	91,709	3.78	141,890	8.11	25,224	2.77	22,120	3.81	3,814	.95	4,117	1.95	288,874	4.59
Jan. 1929	92,681	3.83	141,279	8.08	24,761	2.72	22,420	3.88	3,819	.96	4,204	1.99	289,164	4.60
Feb.	94,404	3.87	141,642	8.07	24,543	2.68	22,682	3.93	3,820	.95	4,198	1.99	291,289	4.61
Mar.	95,487	3.92	141,932	8.09	24,642	2.67	22,942	3.97	3,790	.94	4,327	2.05	293,120	4.64
Apr.	96,877	3.97	143,393	8.17	24,627	2.69	23,186	4.01	3,767	.93	4,467	2.12	296,317	4.69
May	98,550	4.04	143,344	8.17	24,681	2.70	23,573	4.09	3,799	.94	4,604	2.17	298,551	4.73
June	101,012	4.13	142,750	8.15	24,744	2.70	24,021	4.15	3,890	.96	4,782	2.21	301,199	4.75
July	102,787	4.20	142,293	8.08	24,856	2.71	24,346	4.20	3,936	.97	4,974	2.30	303,192	4.78
Aug.	104,580	4.28	140,529	7.98	24,910	2.72	24,474	4.23	3,938	.97	5,131	2.37	303,562	4.79
Sep.	105,549	4.29	140,309	7.94	24,218	2.63	24,647	4.25	4,122	1.01	5,311	2.49	304,156	4.78
Oct.	107,489	4.37	144,295	8.16	23,505	2.54	24,737	4.27	4,353	1.06	5,441	2.56	309,820	4.86
Nov.	108,244	4.40	143,466	8.12	23,204	2.50	25,166	4.34	4,658	1.13	5,575	2.62	310,313	4.87
Dec.	107,503	4.37	144,141	8.16	22,449	2.42	25,481	4.38	4,727	1.15	5,680	2.67	309,981	4.86
Jan. 1930	108,835	4.41	144,165	8.13	22,388	2.41	25,337	4.37	4,759	1.15	5,590	2.63	311,074	4.86
Feb.	108,780	4.40	142,196	8.02	22,422	2.41	25,140	4.34	4,857	1.17	5.606	2.63	309,001	4.83
Mar.	109,193	4.42	141,853	8.00	22,589	2.43	25,265	4.36	5,023	1.21	5,649	2.66	309,572	4.84
Apr.	109,256	4.41	140,945	7.93	22,476	2.41	25,253	4.35	5,163	1.24	5,668	2.59	308,761	4.81
May	110,682	4.47	141,081	7.94	22,797	2.45	25,448	4.39	5,552	1.33	5,762	2.64	311,322	4.87
June	111,253	4.49	140,072	7.88	23,335	2.51	25,729	4.43	5,755	1.38	6,048	2.76	312,192	4.88
July	115,345	4.65	143,716	8.00	23,628	2.54	27,102	4.67	6,631	1.59	6,582	3.00	323,004	5.03
Aug.	120,673	4.86	147,180	8.25	24,217	2.59	28,227	4.86	7,298	1.25	7,442	3.45	335,037	5.21
Sept.	117,915	4.74	144,925	8.13	24,193	2.57	28,002	4.82	7,547	1.80	7,587	3.52	330,169	5.13
Oct.	118,189	4.75	143,819	8.07	24,214	2.57	28,082	4.83	7,668	1.81	7,655	3.55	329,627	5.12
Nov.	117,885	4.74	142,421	7.99	24,235	2.57	28,266	4.86	7,809	1.86	7,691	3.57	328,307	5.10
Dec.	119,131	4.79	141,687	7.95	24,418	2.59	28,447	4,90	8,030	1.92	7,752	3,59	329,465	5,12

Wireless Receiving Licences, Jan.-December, 1931.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
NEW SOUTH WALES.												
New Issues	1965	1965	2268	2505	2937	3532	3683	3442	2905	3546	3355	3916
Cancellations	2340	1752	1590	1552	2627	1704	4172	5118	2702	2193	2022	1879
Monthly Total ...	118,507	118,720	119,398	120,612	120,642	122,470	122,259	120,583	120,686	122,039	123,372	125,409
Nett Increase ...	−376	213	688	953	301	1835	489	−1676	103	1353	1333	2037
Ratio of Population ...	4.78	4.77	4.79	4.82	4.84	4.91	4.88	4.81	4.82	4.87	4.92	5.00
VICTORIA.												
New Issues	1499	1254	2054	2012	2248	3260	3454	3243	2823	2833	2427	2467
Cancellations	2821	2488	2178	2880	2836	3561	4536	5461	4225	2428	1686	2003
Monthly Total ...	140,142	138,908	138,784	138,152	137,306	137,005	136,183	133,965	132,563	132,968	133,709	134,173
Nett Increase ...	−1324	−1224	−119	868	−596	−291	−1082	−2218	−1402	405	741	464
Population Ratio ...	7.87	7.79	7.76	7.71	7.64	7.66	7.58	7.44	7.37	7.39	7.44	7.46
QUEENSLAND.												
New Issues	373	340	492	529	602	673	915	838	1138	1044	840	798
Cancellations	406	444	444	319	788	821	811	976	530	284	459	280
Monthly Totals ...	24,297	24,193	24,241	24,542	24,256	24,108	24,320	24,182	24,790	25,550	25,931	26,449
Nett Increase ...	−33	−103	51	210	−186	−140	104	−138	608	760	381	518
Population Ratio ...	2.59	2.57	2.57	2.59	2.56	2.55	2.55	2.54	2.58	2.66	2.70	2.76
SOUTH AUSTRALIA.												
New Issues	413	483	637	770	959	1069	1323	1177	916	825	793	847
Cancellations	593	265	321	368	347	560	975	1409	686	349	348	287
Monthly Total ...	28,189	28,407	28,723	29,205	29,729	30,238	30,681	30,449	30,679	31,155	31,600	32,160
Nett Increase ...	−180	219	314	402	615	513	348	−232	230	476	445	560
Population Ratio ...	4.87	4.90	4.95	5.02	5.12	5.21	5.26	5.22	5.26	5.34	5.42	5.51
WESTERN AUSTRALIA.												
New Issues	218	206	273	285	450	372	484	438	477	443	505	457
Cancellations	88	79	115	90	242	86	409	293	220	103	33	90
Monthly Total ...	8103	8230	8388	8645	8789	9075	9219	9364	9621	9961	10,433	10,800
Nett Increase ...	134	126	160	195	207	292	75	145	257	340	472	367
Population Ratio ...	1.95	1.97	2.01	2.05	2.10	2.17	2.19	2.23	2.29	2.37	2.48	2.57
TASMANIA.												
New Issuos	189	302	232	205	271	387	370	403	458	425	328	252
Cancellations	165	245	165	128	132	248	377	582	275	179	165	254
Monthly Total ...	7755	7812	7879	7978	8093	8232	8256	8077	8260	8506	8669	8667
Nett Increase ...	25	57	67	77	143	142	−7	−179	183	246	163	−2
Population Ratio ...	3.60	3.63	3.58	3.61	3.68	3.74	3.76	3.68	3.77	3.88	3.91	3.96
COMMONWEALTH.												
New Issues	4557	4550	5956	6306	7467	9293	10,229	9541	8617	9116	8248	8737
Cancellations	6413	5273	4813	6337	6972	6980	11,280	13,839	8638	5536	4713	4793
Monthly Total ...	326,993	326,270	327,413	329,134	328,815	331,128	330,918	326,620	326,599	330,179	333,714	337,658
Nett Increase ...	−1752	−709	1161	969	484	2351	−1051	−4298	−21	3580	3535	3944
Population Ratio ...	5.08	5.06	5.07	5.08	5.09	5.12	5.10	5.03	5.02	5.08	5.13	5.19

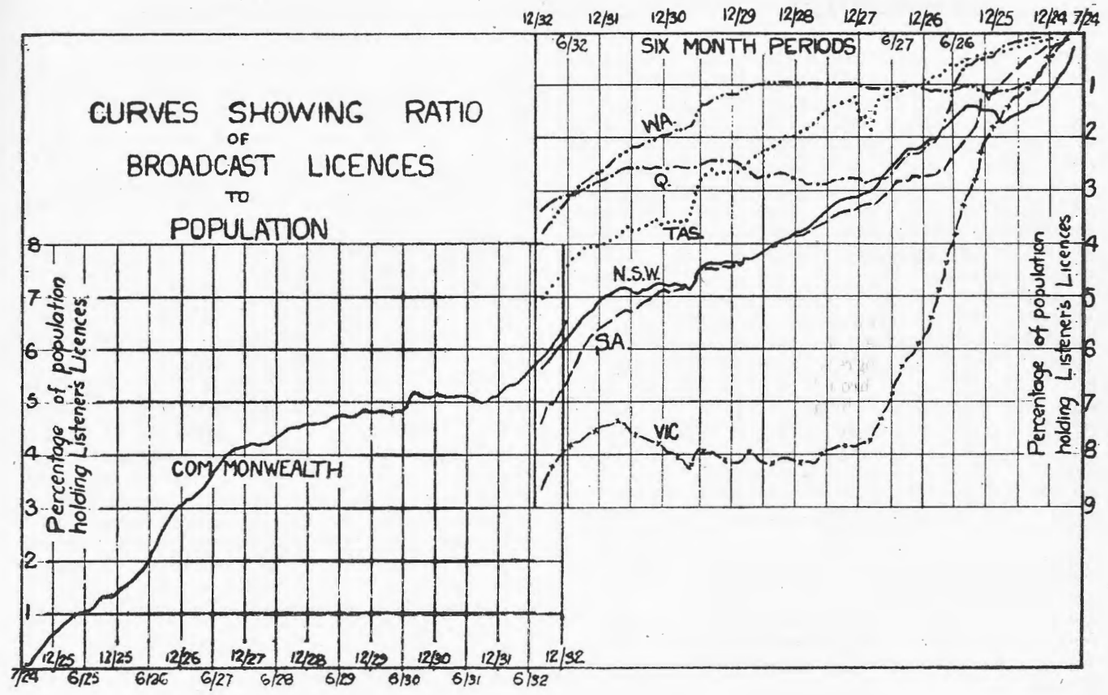
Wireless Receiving Licences, Jan.-December, 1932.

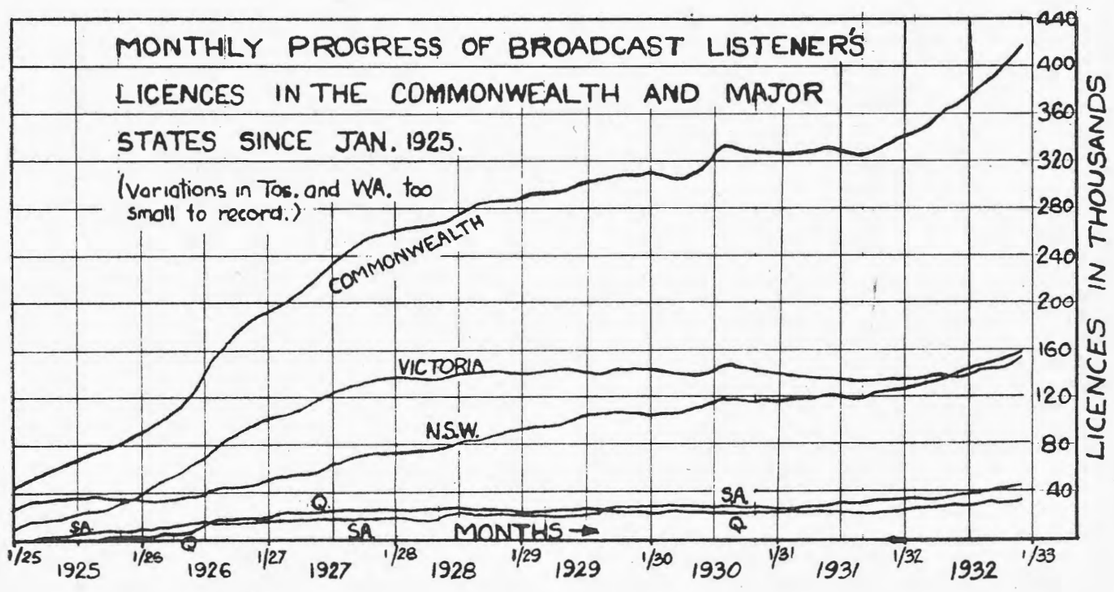
	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
NEW SOUTH WALES.												
New Issues	3992	3998	3818	3948	4684	6067	5796	5101	4066	4390	5595	4517
Cancellations	1667	866	1823	1514	1650	2651	2440	1780	2073	1809	1085	2051
Monthly Total ...	127,734	130,866	132,861	135,295	138,329	141,745	145,101	148,422	150,415	152,996	157,506	159,972
Nett Increase ...	2325	3132	1995	2434	3034	3416	3356	3321	1993	2581	4510	2466
Population Ratio ...	5.09	5.20	5.28	5.37	5.49	5.63	5.76	5.88	5.95	6.06	6.23	6.33
VICTORIA.												
New Issues	2160	2277	2198	3291	3302	3374	4215	4420	3917	4226	5466	5834
Cancellations	1810	589	2414	898	2293	3179	2775	2182	1871	1890	1620	1025
Monthly Total ...	134,523	136,211	135,995	138,388	139,397	139,592	141,032	143,270	145,316	147,652	151,498	156,307
Nett Increase ...	350	1688	216	2393	1009	195	1440	2238	2046	2336	3846	4809
Population Ratio ...	7.48	7.57	7.56	7.68	7.74	7.75	7.82	7.94	8.05	8.18	8.39	8.66
QUEENSLAND.												
New Issues	702	769	822	877	940	1052	1259	969	962	984	1647	968
Cancellations	376	203	492	374	458	648	1026	478	695	660	488	319
Monthly Total ...	26,775	27,341	27,671	28,174	28,656	29,060	29,293	29,784	30,051	30,375	31,534	32,183
Nett Increase ...	326	566	330	503	482	404	233	491	267	324	1159	649
Population Ratio ...	2.79	2.84	2.88	2.92	2.97	3.02	3.04	3.09	3.11	3.14	3.24	3.31
SOUTH AUSTRALIA.												
New Issues	809	804	1044	1218	1627	1958	1790	1760	1290	1236	1455	1355
Cancellations	409	315	336	367	420	546	819	595	483	375	182	303
Monthly Total ...	32,560	33,049	33,757	34,608	35,815	37,227	38,206	39,371	40,178	41,039	42,312	43,362
Nett Increase ...	400	489	708	851	1207	1412	971	1165	807	861	1273	1050
Population Ratio ...	5.58	5.66	5.78	5.92	6.12	6.36	6.53	6.78	6.86	7.01	7.22	7.40
WESTERN AUSTRALIA.												
New Issues	364	331	325	457	572	685	741	691	669	811	885	686
Cancellations	118	108	105	105	179	174	195	156	205	152	267	127
Monthly Total ...	11,046	11,269	11,489	11,841	12,234	12,745	13,292	13,827	14,291	14,950	15,568	16,127
Nett Increase ...	246	223	220	352	393	511	546	535	464	659	618	559
Population Ratio ...	2.63	2.67	2.73	2.81	2.90	3.02	3.15	2.28	3.39	3.55	3.68	3.79
TASMANIA.												
New Issues	187	318	232	363	386	457	441	573	543	503	572	508
Cancellations	98	255	163	124	172	231	173	295	255	326	204	125
Monthly Total ...	8756	8819	8888	9127	9341	9567	9835	10,113	10,301	10,478	10,846	11,229
Nett Increase ...	89	63	69	239	214	226	268	278	188	177	368	383
Population Ratio ...	4.00	4.02	4.05	4.09	4.18	4.28	4.40	4.56	4.65	4.73	4.90	5.08
COMMONWEALTH.												
New Issues	8214	8497	8439	10,154	11,511	13,593	14,242	13,514	11,447	12,150	15,620	13,866
Cancellations	4478	2336	5333	3382	5172	7429	7428	5486	5682	5212	3846	3950
Monthly Total ...	341,394	247,555	350,661	357,433	363,772	369,936	376,759	384,787	390,552	397,490	409,264	419,180
Nett Increase ...	3736	6161	3106	6772	6339	6164	6814	8028	5765	6938	11,774	9916
Population Ratio ...	5.25	5.33	5.38	5.48	5.56	5.67	5.77	5.88	5.97	6.08	6.25	6.40

Distribution of Licences—City and Country.

Receiving Licences in force in City and Country Areas and Ratio of Licences to 100 of Population up to 30/9/32.

AREA.	Quarter Ended 31. 3. 32		30. 6. 32		30. 9. 32		31. 12. 32.	
	Licences.	Ratio to 100 of Population	Licences.	Ratio to 100 of Population	Licences.	Ratio to 100 of Population	Licences.	Ratio to 100 of Population
NEW SOUTH WALES.								
City	93,479	7.44	99,761	7.94	105,622	8.41	111,734	8.89
Country	39,382	3.12	41,984	3.33	44,793	3.53	48,238	3.79
Total	132,861	5.28	141,745	5.63	150,415	5.95	159,972	6.33
VICTORIA.								
City	94,194	9.23	98,774	10.00	101,682	10.00	110,256	10.70
Country	41,801,	5.43	40,818	5.26	43,634	5.64	46,051	5.95
Total	135,995	7.56	139,592	7.75	145,316	8.05	156,307	8.66
QUEENSLAND.								
City	16,135	5.09	17,290	5.55	18,169	5.55	19,386	6.11
Country	11,536	1.78	11,770	1.79	11,882	1.85	12.797	1.95
Total	27,671	2.88	29,060	3.02	30,051	3.11	32,183	3.31
SOUTH AUSTRALIA.								
City	22,743	6.66	24,423	7.14	25,974	7.69	28,156	8.68
Country	11,014	4.15	12,812	4.79	14,204	5.26	15,206	5.81
Total	33,757	5.78	37,235	6.36	40,178	6.86	43,362	7.40
WESTERN AUSTRALIA.								
City	8,550	4.03	9,613	4.55	10,795	5.26	12,201	5.81
Country	2,939	1.40	3,133	1.47	3,496	1.66	3,926	1.84
Total	11,489	2.73	12,746	3.02	14,291	3.39	16,127	3.79
TASMANIA.								
City	3,588	6.25	3.755	6.25	3,988	6.66	4,334	7.45
Country	5,300	3.23	5,812	2.57	6,313	3,85	6,895	4.23
Total	8,888	4.05	9,567	4.28	10,301	4.65	11,229	5.08
Total City	238,689	7.45	253,616	7.92	266,230	8.31	286,067	8.93
Total Country	111,972	3.37	116,329	3.49	124,322	3.73	133,113	3.98
Grand Total	350,661	5.38	369,945	5.67	390,552	5.97	419,180	6.40





Australia's "B" Class Broadcasting System.

Radio Broadcasting in Australia to-day can rightly claim to be operating under a system that is about the most workable and practical in the whole world. On the one hand there is the National service, controlled more or less by the Commonwealth Government, with the principal National stations in each Capital city, aided by relay stations in various parts of the country centres, while on the other hand there are over 40 smaller Broadcasting stations working under the "B" Class system which definitely supplements the activities of the National service.

In radio trade circles to-day, and also amongst many listeners, it is the considered opinion that the success of the B class stations over the past 9 years has materially aided the wonderful progress of broadcasting and the sale of radio receivers throughout Australia. At least 50% of the popularity of broadcasting can be attributable to the B class system. The competitive element introduced by B class stations is, in itself, sufficient to keep the National service on a higher plane of public service than possibly under no competition.

The National service is on all fours with the British Broadcasting System, while our Australian B class system compares most favourably with the American broadcasting system. One is Government ownership and the other is private ownership.

The activities of the National service are dealt with fairly exhaustively in other parts of this Radio Trade Annual, and here it is intended to deal briefly with the B class developments.

Studied Overseas Conditions.

It is definitely true that radio activities in Australia, both from a manufacturing and broadcasting point of view, are modelled very largely on American methods, and therefore the progress of B class stations is in some measure, due to their having studied very closely the operations of the American system, and applying these schemes, with the necessary modifications to suit the peculiarities of Australia.

Sponsored programmes are becoming more popular, and their value is being appreciated by the large advertising fraternity on a scale hardly deemed possible a few years ago.

Australia has an area of 2,974,581 square miles, about equal to that of U.S.A. The average population density of Australia is 2.20 persons to the square mile. Victoria has a density of 20 persons to the square mile. N.S.W. and Tasmania both have a density of 9 to the square mile, but there are large areas where the population does not average 2 persons to 100,000 square miles.

Much of Australia's population is concentrated in and around the capital cities of each State, which are served by several "B" Class stations. For instance, of a total State population of 2,500,000 in N.S.W., considerably more than half is found within a 40 mile radius of Sydney.

Reference to a broadcasting map discloses that at least 75% of the total population of Australia can be served by chains of B class stations, and it will therefore be realised that although almost all of the B class stations appear to be on the coastal rim of the south-eastern portion of Australia, it is there that three-quarters of the total population in concentrated.

In U.S.A. there is one broadcasting station to every 4,986 square miles; in Australia, one to every 53,300 square miles. In U.S.A. the average of stations to population is 1 to 200,000; there is one to each 49,000 of the population in Australia.

As an instance of the growth of the B class stations, this will be evident when it is pointed out that on the night of December 31st, 1932, an all-Australian broadcast, relayed through 42 "B" class stations, sponsored by a well-known advertiser, marked another important step in the development of Australia's broadcasting system, and added further laurels to the effect of broadcast advertising. This "hook-up" covered over a million people.

For the first time in radio history, listeners to every licensed station on the mainland, heard simultaneously, an entertainment broadcast from the point in the chain of stations where the relay was initiated (Sydney). Prior to this, every one of the stations in the chain had relayed consecutively a brief programme to the key station in Sydney, which in turn broadcast these for reception by the Postmaster-General at his home in Mosman, N.S.W.

The successful accomplishment of this extensive relay of sponsored programmes from 7.30 to 11.10 p.m. opens up great possibilities for National advertisers. Even comparatively recently, during the opening of the Sydney Harbour Bridge celebrations, the limit of a similar broadcast was 20 odd stations. To-day the number is over 40, and this will be further increased as new stations are licensed in the different States.

This, therefore, shows the wonderful coverage that is possible through the large number of B class stations in Australia, and no doubt National advertisers and those desirous of covering one or more States of Australia by simultaneous broadcast publicity, will see that the way is now open to obtain at a surprisingly low cost, considering the extent of the coverage, a series of advertising announcements in an all-Australian cover that will reach over a million potential customers.

Credit must be given to the engineers of the P.M.G.'s Dept. for their technical advancement in being able to supply the landline communications for linking up the various broadcasting stations for relay purposes throughout the Commonwealth. The day has not yet arrived when relays can be carried out by short-wave broadcast with any degree of security, and, therefore, recourse must be had to wire conductors connecting the various stations together.

The story of the B class station development was more or less unfolded at the recent Royal Commission conducted in Sydney and Melbourne, in connection with Performing Rights and the use of records by various interests, and the payment of fees for such use. The finding of the Royal Commissioner, Mr. Justice Owen, which will no doubt take a month or two to prepare, will prove most interesting reading.

Original Ball-to-Ball.

One of the greatest broadcasting stunts ever put over in Australia, with no exception, was that initiated by Station 2UW, during the cricket season of 1930-31, when every evening they broadcasted the description of the cricket test match games in England between the Australian and English Eleven. Nothing that has ever occurred in broadcasting circles has ever gripped the imagination and intense interest of the population as those series of cricket match broadcasts. They were relayed to many other stations, and to such an extent was this popularity registered, and so effective was this means of distribution of news about National games, that this last cricket season, 1932-33, the Broadcasting Commission undertook the broadcasting of the various cricket fixtures throughout Australia.

Sir Robert Gibson's Speech.

May be there is one other instance which definitely proves the value of broadcasting, but while it is not associated with B class stations, it illustrates the power of broadcasting generally. That was, on a Sunday evening during 1932, when Sir Robert Gibson, Chairman of Directors of the Commonwealth Bank of Australia, broadcasted a message through the National stations. At that time there was a political and financial crisis, particularly in the State of N.S.W., which showed evidence of spreading to other States. There was even a suggestion that the Commonwealth Bank was finding it difficult to pay the people their money.

To hear what Sir Robert Gibson said and the manner in which he said it, on that historic Sunday evening, is an event which will go down in broadcasting circles and even in National circles, as unprecedented.

Advertising Support.

National advertisers as a rule are most discriminating purchasers of advertising space, and as they spend thousands of pounds every period, they needs must exercise the closest scrutiny as to the effectiveness of any particular medium. Receiving no part of the listeners' license fees, the B class stations have to rely solely on their advertising support to meet their expenses. As is well known, even newspapers and magazines rely largely on the advertising support for the success of their particular publication, and in many cases the subscription they charge hardly covers postage.

"B" Class stations have proved that advertising can effectively sell *almost anything*, and while it has taken the advertising world some little time to fully appreciate this, it is evident that they have come to a full realisation of the importance of broadcast advertising, when practically every worth-while advertising agency specialises in it in some way or other.

In this particular comment on the B class system, it is not intended to mention the names of the many people and stations who have carried on the good work in the "B" class broadcasting sphere, but it is hoped that by the next issue of this annual, a most comprehensive and detailed account of the progress of the B class stations will appear.

In conclusion it may be said that the B class stations have definitely earned their position on the air, and it is to be sincerely hoped that no Governmental or political action will be taken to disrupt or retard the progress of the B class stations.

Books on Wireless.

The Four Electrode Valve. By Fred Goddard. 105 pages, with 64 illus.—2/6 (post. 3d).

The Elementary Principles of Wireless Telegraphy and Telephony. By R. D. Bangay. 340 pages, illus.—17/- (post 6d.).

Handbook of Technical Instruction for Wireless Telegraphists. By H. M. Xowset. 478 pages, with 459 diagrams and illus.—42/- (post. 8d.).

Wireless Direction Finding and Directional Reception. By R. Keen. 490 pages, 329 illus.—34/- (post. 8d.).

The Radio Manual. For Radio Engineers, inspectors, Students, Operators, and Radio Fans. By G. E. Sterling. Edited by R. S. Kruse. 666 pages. Fully illustrated. 60/- (post. 1/-).

Wireless Telegraphy Operations Handbook. P.M.G.'s Handbook. 1/4 (post. 3d.).

The Practical Super-het Book. Written by a number of authorities, and including an introduction by J. Ashton Cooper. Edited by Bernard E. Ones. 140 pages, 65 illus. (Amateur Wireless Handbook). 3/9 (post. 3d.).

Wireless. A handbook of Instruction for the Radio Enthusiast. By J. W. Robinson, Queensland Radio Service Station, and G. Williams, Marconi School of Wireless, Sydney. 160 pages, with illus. in text. 3/6 (post. 3d.)

Radio Trouble Shooting. A complete and practical work on Radio Receiver Troubles and How to Cure Them. By E. R. Haan. 317 pages. 19/6. 7/6 (post. 8d.).

The How and Why of Radio. By Alan Hunter and the staff of " Amateur Wireless " and " Wireless Magazine." 190 pages, many diagrams. 4/3 (post. 3d.).

A.C. Radio Guide. A Practical Treatise on Alternating Current Radio Tubes, Sets, and Dynamic Loud Speakers. By K. A. Hathaway. 121 pages. 10/- (post. 5d.).

Drake. Radio and Electronic Dictionary. 20/- (post. 8d.).

A.R.R.L. Radio Amateurs Handbook. A manual of Amateur Short Wave Radio Telegraphic Communication. By F. E. Handy & R. A. Hull. 199 pages. 9/- (post. 5d.).

Practical Radio Telegraphy & Telephony. A complete Textbook for Students of Wireless Communication. By R. L. Duncan and C. F. Drew. 949 pages. 81/6 (post. 1/4).

Wireless. Modern Radio Communication: Theory and Practice. By J. H. Reyner, B.Sc. 270 pages, with 171 illus.

Audel's Radioman's Guide. A concise treatise on the proper operation and maintenance of modern radio practice. 200 pages, illus. 5/6 (post. 4d.).

Drake's Radio Cyclopedia. Fifth (1932) Edition. 1048 pages, 1178 illus. 39/- (post 1/6). Terms 42/- (post. 1/6), 12/- down, 10/- monthly

From Telegraphy to Television. The story of Electrical Communications. By Lt.-Col. Chetwode-Crawley. Illustrated in half-tone plates. 10/- (post. 8d.).

Short-Wave Wireless Communication. By A. W. Ladner, A.M.Inst. C.E., Superintendent of Instruction Marconi's Wireless Telegraph Co. Ltd., and C. R. Stoner, B.Sc., late of Research Dept., Marconi Wireless Telegraph Co. 25/- (post. 9d.).

First Principles of Television. By A. Dinsdale, M.I.R.E. Author of " Television." 241 pages, 234 plates. 21/- (post. 9d.).

The Wireless Valve. Its Design and Manufacture, By A. C. Bartlett, B.A., A.M.I.E.E. and M. Thompson. M.A., A.M.I.E.E. Fully illustrated. 18/- (post. 9d.).

The Outline of Wireless. For the Man in the Street. By Ralph Stranger. 832 pages, many illustrations and diagrams. 9/6 (post. 10d.).

The Radio Short-Wave Manual. 5/- (post. 4d.).

How to Build and Operate Short-Wave Receivers. 72 pages, illus. 4/- (post. 3d.).

The " Listener In " Handbook on all Wave Receivers 1/- (post. 2d.).

Admiralty Handbook of Wireless Telegraphy. 1931 Edition. 1012 pages. 12/6 (post. 1/2).

Modern Gramophones and Electrical Reproducers. By P. Wilson, M.A. and G. W. Webb. 270 pages, illustrated. 17/6 (post. 8d.).

Robinson's Manual of Radio Telegraphy and Telephony for the use of Naval Radiomen. By Rear Admiral S. S. Robinson, U.S. Navy. 800 pages, fully illustrated. 40/- (post. 1/3).

Everyman's Wireless. By C. L. Boltz, B.Sc. (hons. Lond.) 288 pages, illus. 8/6 (post. 6d.).

Radio Physics Course. An Elementary Textbook on Electricity and Radio. By Alfred A. Ghirardi, E. E. 986 pages, 508 illustrations. 1932 edition. 37/6 (post. 1/4).

Radio Servicing Course. A Practical Concise Text on the use of Modern Radio Service Instruments and the Rapid and Systematic Attacking of Radio Service Problems. By Alfred A. Ghirardi and Bertram M. Freed. 192 pages, 110 illustrations. 1932 edition. 15/- (post. 4d.).

All prices subject to fluctuation.

Any of these books are obtainable from Australian Radio Publications, 15 Castlereagh St., Sydney.

The Commonwealth of Australia.

Wireless Telegraphy Act, No. 8 of 1905.

An Act relating to Wireless Telegraphy. (Assented to 18th October, 1905.)

BE it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia, as follows:—

1. This Act may be cited as the *Wireless Telegraphy Act* 1905.

2. In this Act,—

" Australia " includes the territorial waters of the Commonwealth and any territory of the Commonwealth;

" Wireless telegraphy " includes all systems of transmitting and receiving telegraphic messages by means of electricity without a continuous metallic connexion between the transmitter and the receiver.

3. This Act shall not apply to ships belonging to the King's Navy.

4. The Postmaster-General shall have the exclusive, privilege of establishing, erecting, maintaining, and using stations and appliances for the purpose of—

(*a*) transmitting messages by wireless telegraphy within Australia, and receiving messages so transmitted, and

(*b*) transmitting messages by wireless telegraphy from Australia to any place or ship outside Australia, and

(*c*) receiving in Australia messages transmitted by wireless telegraphy from any place or ship outside Australia.

5. Licences to establish, erect, maintain, or use stations and appliances for the purpose of transmitting or receiving messages by means of wireless telegraphy may be granted by the Postmaster-General for such terms and on such conditions and on payment of such fees as are prescribed.

6. (1) Except as authorized by or under this Act, no person shall—

(*a*) establish, erect, maintain or use any station or appliance for the purpose of transmitting or receiving messages by means of wireless telegraphy; or

(*b*) transmit or receive messages by wireless telegraphy.

Penalty: Five hundred pounds, or imprisonment with or without hard labour for a term not exceeding Five years.

(2) Sub-section (1) of this section shall not, except as prescribed extend to appliances maintained on any ship, arriving from any place beyond Australia, for the purpose of enabling messages to be transmitted from or received on that ship by means of wireless telegraphy but all such appliances shall, while the ship is within Australia—

(*a*) be subject to the control of the Postmaster-General; and

(*b*) only be used by his authority or as authorized by the regulations.

Penalty: Five hundred pounds.

7. All appliances erected, maintained, or used in contravention of this Act or the regulations, for the purpose of transmitting or receiving messages by means of wireless telegraphy, shall be forfeited to the King for the use of the Commonwealth.

8. (1) If a justice of the peace is satisfied by information on oath that there is reasonable ground for supposing that any appliance is established, erected, maintained, or used in contravention of this Act or the regulations, for the purpose of transmitting or receiving messages by means of wireless telegraphy he may grant a search warrant to any person.

(2) A search warrant under this section shall authorize the person to whom it is addressed to break and enter any place or ship, where the appliance is or is supposed to be, either by day or by night, and to seize all appliances which appear to him to be used or intended to be used for transmitting or receiving messages by means of wireless telegraphy.

9. (1) Proceedings for any offence against this Act may be instituted in any Court of Summary Jurisdiction, and any person proceeded against under this section may be dealt with summarily or may be committed for trial.

(2) The Court in dealing summarily with any accused person under this section may, if he is found guilty of any offence against this Act, punish him by imprisonment with or without hard labour for any period not exceeding six months or by a penalty not exceeding Fifty pounds.

10. The Governor-General may make regulations, not inconsistent with this Act, prescribing all matters which by this Act are required or permitted to be prescribed or which are necessary or convenient to be prescribed for carrying out or giving effect to this Act.

Amendment No. 33 of 1915.

An Act to amend the *Wireless Telegraphy Act*, 1905. (Assented to 6th September, 1915.)

BE it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia, as follows:—

1. (1) This Act may be cited as the *Wireless Telegraphy Act*, 1915.

(2) The *Wireless Telegraphy Act*, 1905, as amended by this Act, may be cited as the *Wireless Telegraphy Act*, 1905-1915.

2. Sections four, five and six of the *Wireless Telegraphy Act*, 1905, are amended by omitting the words " The Postmaster-General " and inserting in their stead the words " the Minister for the time being administering the Act."

Amendment No. 4 of 1919.

An Act to amend Section Two of the *Wireless Telegraphy Act*, 1905-1915.

BE it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia, as follows :—

1. (1) This Act may be cited as the *Wireless Telegraphy Act*, 1919.

(2) The *Wireless Telegraphy Act*, 1905-1915 as amended by this Act, may be cited as the *Wireless Telegraphy Act*, 1905-1919.

2. Section two of the *Wireless Telegraphy Act*, 1905-1915, is amended by inserting in the definition of "Wireless telegraphy," after the word "telegraphic," the words "or telephonic."

Commonwealth Wireless Regulations under the Wireless Telegraphy Act, 1905-1919.

Statutory Rules No. 101 of 1924 have been amended from time to time by No. 123 of 1925, No. 114 of 1926, Nos. 3-24-63-153 of 1927, Nos. 79-129 of 1928, No. 81 of 1929 and No. 113 of 1930, and the following are the existing regulations as applicable to Broadcasting in Australia. Details of regulations governing other wireless stations are available from Government Printer, Canberra, F.C.T., or from the Radio Inspector in any capital city.

Part III.—Broadcasting.
Division I.—Broadcasting Stations.

"45. (1) The Postmaster-General may grant to any applicant a Broadcasting Station Licence.

(2) A Licence shall not be transferred without the approval of the Postmaster-General.

(3) The Postmaster-General shall not recognise any vested interest in the Licence, and compensation shall not be payable to the Licensee on the termination of the Licence.

46. An applicant for a Broadcasting Station Licence shall state in his application the following particulars :—

(a) Name and address of applicant (in the case of a company ; (1) the name of the company and the address of the head office thereof ; (2) the name and address of the secretary or other person authorized to act on behalf of the company.) ;
(b) Technical qualifications of the applicant or of the persons whom it is proposed will operate the licensed installation (where the applicant does not possess the necessary qualifications and proposes to engage an expert to control the station after the issue of the Licence, this should be stated) ;
(c) Location of the proposed station ;
(d) Type of transmitter and character of modulation proposed ;
(e) Proposed normal operating power of transmitter ;
(f) Hours of service ; and
(g) Class of service to be broadcasted and particulars of average programme.

47. (1) A Broadcasting Station Licence shall be prepared in duplicate, one copy of which shall be retained by the Department and the other shall be issued to the Licensee.

(2) A Licensee shall make his Licence available for inspection by any authorised officer as and when required.

48 (1) A Broadcasting Station Licence may be granted for any period not exceeding three years as the Postmaster-General determines.

(2) The Postmaster-General if he deems it desirable may from time to time renew a Licence for a period not exceeding one year from the date of expiration of the current Licence.

(3) A Licensee who desires a renewal of his Licence shall make application for the renewal thereof at least six months before the date of the expiration of his current licence, except in cases where a licence has been granted or renewed for a period of less than one year, when the application for a renewal shall be made at least one month before the date of expiration of the current licence.

49. A Broadcasting Station Licensee shall commence a satisfactory service in accordance with these regulations within three months from the date of the issue of the Licence or within such further period as the Postmaster-General approves.

50. The licensed installation of a Broadcasting Station shall be equipped, designed and controlled to the satisfaction of the Postmaster-General and shall not be altered without his consent.

51. The power of a Broadcasting Station shall be as approved by the Postmaster-General and shall not be altered without his consent.

52. (1) The frequency (wave length) on which each Broadcasting Station shall operate shall be as determined by the Postmaster-General.

(2) The operating frequency shall be maintained to a constancy to the satisfaction of the Postmaster-General.

(3) For the purpose of the last preceding sub-regulation, the transmitting apparatus shall include such equipment for indicating the accuracy of the operating frequency as the Postmaster-General approves.

53. The location of a Broadcasting Station and the periods of operation thereof shall be subject to the approval of the Postmaster-General.

54. (1) The Postmaster-General reserves the right, during the currency of a Broadcasting Station Licence, to vary the conditions upon which the Licence is granted, especially in regard to the power, location, frequency (wave length) and periods of operation of the licensed installation.

54. (2) The licensee shall, at his own expense and to the satisfaction of the Postmaster-General, give effect to any such variation.

55. The licensed installation of any Broadcasting Station shall only be operated by such persons as, in the opinion of the Postmaster-General, are competent to operate the installation.

56. The licensed installation of any Broadcasting Station shall, at all reasonable times, be open to inspection by any authorized officer, and every facility shall by given by the Licensee for ascertaining the conditions of the Station.

57. (1) A Broadcasting Station shall be connected by telephone with the public telephone exchange system of the area in which the Station is located.

(2) The Broadcasting Station Licensee shall enter into the usual telephone subscriber's agreement for the establishment of a service.

58. The Postmaster-General may require the licensee of a Broadcasting Station to include, without charge, such items of general interest or utility as the Postmaster-General, from time to time, determines.

Provided however that the requirements of the Postmaster-General shall not be such as to entail a period of occupation of the Station in excess of thirty minutes in each consecutive period of twelve hours.

59. (1) All matter including advertisements to be broadcasted shall be subject to such censorship as the Postmaster-General determines.

(2) The Broadcasting Station Licensee shall, before broadcasting any such matter which is of a controversial nature or likely to cause offence to any section of the community, direct the attention of the Postmaster-General .or an authorized officer, to such matter.

60. (1) A Broadcasting Station Licensee may broadcast advertisements.

(2) A Licensee desiring to broadcast advertisements shall publish a tariff of advertising charges, and shall make his advertising service available without discrimination to any person or firm.

61. The Licensee of any Broadcasting Station may, to such extent as the Postmaster-General approves, by agreement with the Licensees of other Stations, relay or broadcast the programmes broadcast by these stations.

62. A Broadcasting Station Licensee shall :—

(a) compile and maintain in a recognised business or commercial form, separate accounts in respect of his broadcasting activities ;
(b) make such accounts available for inspection by the Postmaster-General as required ;
(c) supply to the Postmaster-General as required duly audited annual balance sheets in detail for the year ending on the thirtieth day of June in each year or on some other date approved by the Postmaster-General : and
(d) keep such records relating to the broadcasting service, as the Postmaster-General, from time to time, directs, and supply copies thereof to the Postmaster-General as required.

63. (1) The programme transmitted from a Broadcasting Station shall, both in rendition and transmission, be to the satisfaction of the Postmaster-General.

(2) The general terms of any announcement, whether complete in themselves or referring to items to be transmitted, shall be to the satisfaction of the Postmaster-General.

(3) Every announcer employed by the Licensee shall be of good education, style and personality, and possessed of clear enunciation, as far as possible free from any characteristic dialect.

64. (1) The licence fee for a Broadcasting Station Licence or any renewal thereof shall be £25 per year or part of a year payable in advance.

(2) This regulation shall be deemed to have come into operation on the first day of November, One thousand nine hundred and twenty-nine.

65. A Broadcasting Station Licensee shall at all times keep the Postmaster-General indemnified against any claim for royalties in respect of any equipment operated under his licence, or against any claims whatsoever arising out of the Licensee's operations.

66. A Broadcasting Station Licensee shall not—

(a) transmit any work or part of a work in which copyright subsists except with the consent of the owner of the copyright ; or
(b) send out news or information of any kind published in any newspaper or obtained, collected, collated or co-ordinated by any newspaper, or association of newspapers or any news agency or service except with the full consent in writing, first obtained, of, and upon such payment and conditions as are agreed upon by the licensee and, the newspaper, association of newspapers, news agency or service.

67. (1) A Broadcasting Station Licensee who supplies in advance to the proprietor of any registered newspaper programmes of the items to be broadcasted by his Station shall, on application in writing, supply in advance such programmes on equal terms to the proprietor of any other registered newspaper.

(2) The proprietor of such other newspaper may publish such programmes in any registered newspaper owned by him.

(3) In this regulation 'registered newspaper' means a newspaper registered under the Post and Telegraph Act 1901-1923.

68. A person shall not publish any portion of the text of a broadcasted item without the consent of the Broadcasting Station Licensee and the approval of the Postmaster-General.

69. A Broadcasting Station Licensee shall not, without the permission of the Postmaster-General, transmit any message or other communication, the transmission of which would be in contravention of the provisions of the Post and Telegraph Act, 1901-1923 if the licensed installation were a telegraph within the meaning of that Act.

70. Except where any inconsistency exists, nothing in this Part shall affect the generality of the provisions of any other Part of these Regulations.

71. The decision of the Postmaster-General with regard to the interpretation or application of any of the provisions of this Division shall be final.

72. The Postmaster-General may, on such terms and conditions as he thinks fit—

(*a*) make contracts for the establishment, erection maintenance or use of wireless broadcasting stations or appliances on his behalf ; and

(*b*) for the purpose of using any wireless broadcasting stations or appliances established, erected or maintained by him or on his behalf, make contracts for the provision of programmes by such stations or by such appliances.

73. Any Licence for a Class B Station in force immediately prior to the commencement of this regulation shall be deemed to have been granted under and subject to the provisions of these Regulations.

74. Notwithstanding anything contained in this Division, any Licence for a Class A Station granted under the Regulations in force immediately prior to the commencement of this regulation shall not, on and from the commencement of this regulation, be renewed and those Regulations shall be deemed to apply to such Licence so long as it remains in force.

DIVISION 11.—BROADCAST LISTENERS' STATIONS.

75. A Broadcast Listeners' Licence in accordance with Form 5 in the Schedule to these Regulations may be granted at any Money Order Office on payment of the prescribed fees.

76. (1) For the purpose of the granting of Broadcast Listeners' Licences and the payment of fees therefor, the Commonwealth and the Territories thereof shall be divided into two zones as follows :—

(i) Zone 1 shall include all the territory within an approximate radius of 250 miles from such Broadcasting Stations as the Postmaster-General determines ; and

(ii) Zone 2 shall include all the territory of the Commonwealth and the Territories outside Zone 1.

(2) The Postmaster-General may determine the zone within which any Broadcast Listeners' Station is situated.

(3) The Postmaster-General may modify the boundaries of the Zones specified in sub-regulation (1) of this regulation, or establish additional Zones.

77. (1) The fees payable in respect of any Broadcast Listeners' Licence or any renewal thereof shall be as follows :—

(*a*) For Zone 1, 24s. per annum ; and

(*b*) For Zone 2, 17s. 6d. per annum.

(2) Licence fees shall be paid in advance.

78. Where a Broadcast Listeners' Licence is being granted in respect of receiving equipment which has been used prior to the grant of the Licence, the Licence may be given the date and shall be deemed to have been effective from the date the receiving equipment was first used without a current Licence.

79. A Broadcast Listeners' Licence shall not be transferable from one person to another.

80. (1) The user of receiving equipment, capable of being utilized for the reception of broadcast programmes or other wireless signals, shall be in possession of a current Broadcast Listeners' Licence.

(2) Where a current Broadcast Listeners' Licence is not held in respect of equipment installed or connected up or capable of being connected up for the purpose of receiving broadcast programmes or other wireless signals in any dwelling house, office, shop, premises or place, the occupier of any such dwelling house, office, shop, premises or place shall be guilty of an offence.

(3) It shall be a defence to a prosecution for an offence against the last preceding sub-regulation, if the occupier proves that he was not aware, or could not with reasonable diligence have become aware, of the existence in the dwelling house, office, shop, premises or place of the receiving equipment in question.

81. (1) Receiving equipment shall not, without the consent of the Postmaster-General, or an authorized officer, be used at a place other than that specified in the Broadcast Listeners' Licence.

(2) The Licensee shall notify the Department of any permanent change of address within two weeks of the change.

82. A Broadcast Listeners' Licence shall, at all reasonable times, be available at the address given thereon for inspection by an authorized officer.

83. A Licensee of a Broadcast Listeners' Station shall not divulge, except to an authorized officer or a legal tribunal, the contents of any commercial or defence wireless communications, other than those transmitted by a Broadcasting Station.

84. Any Licensee of a Broadcast Listeners' Station using reaction (back coupling) in such a manner as to cause interference to the reception at any other Station shall be guilty of an offence against these Regulations.

85. A person or firm shall not operate receiving equipment for the purpose of demonstration or test of receivers with the object of promoting the sale of receiving equipment without being in possession of a Broadcast Listeners' Licence.

7. Regulation 109 of the Wireless Telegraphy Regulations is repealed and the following regulation inserted in its stead :—

" 109. The fee for an Experimental Licence shall be £1 10s. 0d. per annum."

8. The regulation made on the 22nd December, 1927, under the Wireless Telegraphy Act, 1905-1919 Statutory Rules, 1927, No. 153, is repealed.

Performing Rights.

No attempt is made in this Trade Annual to give details of the position concerning Performing Rights in connection with broadcasting, and the reproduction of music per medium of records. A world wide controversy is being conducted at this moment and litigation is in the air. The position became so acute in Australia about the middle of 1932 and then on to September, that the " B " class stations and others found it necessary to agitate for a Royal Commission to investigate the conditions surrounding Performing Rights particularly in regard to broadcasting. The Commonwealth Government appointed Mr. Justice Owen to conduct this enquiry and at the moment of closing this Trade Annual the Royal Commission is still sitting. The position to-day is that the Australian Broadcasting Commission have a temporary arrangement with both the Performing Rights and the Phonograph record companies. The " B " Class stations also have an arrangement with the Australian Performing Rights Association but the record manufacturers have banned the broadcasting of newly released records.

Australian Broadcasting Commission.

An Act relating to Broadcasting. No. 14 of 1932. (Assented to 17th May, 1932.)

BE it enacted by the King's Most Excellent Majesty, the Senate and the House of Representatives of the Commonwealth of Australia, as follows :—

PART I.—PRELIMINARY.

1. This Act may be cited as the *Australian Broadcasting Commission Act*, 1932.

2. This Act shall commence on a date to be fixed by Proclamation.

3. This Act is divided into Parts, as follows :—

Part I.—Preliminary.
Part II.—Establishment and Constitution of Commission.
Part III.—Powers and Functions of the Commission.
Part IV.—Finance.
Part V.—Issue of Debentures by the Commission.
Part VI.—Miscellaneous.

4. In this Act, unless the contrary intention appears—

" Commission " means a member of the Commission;

" National broadcasting stations " means stations made available by the minister for the purpose of the transmission of the National Broadcasting Programmes ;

" the Commission " means the Australian Broadcasting Commission appointed under this Act ; and

" the Fund " means the Australian Broadcasting Commission Fund established under this Act.

PART II.—ESTABLISHMENT AND CONSTITUTION OF THE COMMISSION.

5. (1) For the purposes of this Act, there shall be a Commission, to be known as the Australian Broadcasting Commission, which shall be charged with the general administration of this Act.

(2) The Commission shall be a body corporate with perpetual succession and a common seal, and may acquire, hold and dispose of real and personal property and shall be capable of suing and being sued in its corporate name.

(3) All Courts, Judges and persons acting judicially shall take judicial notice of the seal of the Commission affixed to any document or notice and shall deem that it was duly affixed.

6. (1) The Commission shall consist of five Commissioners, one of whom shall be a Chairman, and one of whom shall be a Vice-Chairman.

(2) The Commissioners shall be appointed by the Governor-General, and shall hold office, during good behaviour, for the period for which they were appointed.

7. (1) Subject to this Act, the period for which the Commissioners first appointed under this Act shall hold office shall be, in the case of the Chairman, not exceeding five years, in the case of the Vice-Chairman, not exceeding four years, and in the case of each of the remaining Commissioners not exceeding three years.

(2) After the appointments of the five Commissioners first appointed under this Act, each further appointment shall be for a period not exceeding three years.

(3) Each person who is appointed a Commissioner shall, upon the expiration of the term for which he was appointed, be eligible for re-appointment.

8. (1) Subject to this section, the Commissioners shall receive such salaries and allowances as the Governor-General determines.

(2) The salaries of the Commissioners shall not exceed the following :—

in the case of the Chairman	Five hundred pounds per annum ;
in the case of the Vice-Chairman	Four hundred pounds per annum ; and
in the case of each other Commissioner	Three hundred pounds per annum.

9. (1) In case of the illness or absence of the Chairman, the Vice-Chairman, if present, shall act as Chairman.

(2) In case of the illness or absence of both the Chairman and the Vice-Chairman, the Commissioners present may appoint one of their number to act as Chairman :

Provided that the Governor-General may, if he thinks fit, appoint a person to act as Chairman for such period as the Governor-General specifies.

(3) If the Governor-General appoints a person to act as Chairman the appointment shall be at such salary as is determined by the Governor-General, not exceeding the maximum salary fixed by section eight of this Act.

10. (1) In case of the illness or absence of any other Commissioner, the Governor-General may, if he thinks fit, appoint a person to perform the functions of the Commissioner during such illness or absence.

(2) The salary of any person so appointed shall be determined by the Governor-General but shall not exceed the maximum salary fixed by section eight of this Act in respect of that office.

11. In the event of the absence of any Commissioner, the Governor-General may determine the conditions as to remuneration or otherwise upon which leave may be granted.

12. The Governor-General may terminate the services of a Commissioner or an acting Commissioner for inability, inefficiency or misbehaviour, or for neglect or failure to carry out any of the provisions of this Act.

13. A Commissioner shall be deemed to have vacated his office—

(*a*) if his appointment is terminated by the Governor-General in pursuance of this Act ;

(*b*) If he becomes bankrupt or compounds with his creditors or makes any assignment of his salary for their benefit or takes advantage of any provision of any Act relating to bankruptcy ;

(*c*) if he becomes of unsound mind ;

(*d*) if he resigns his office by writing under his hand addressed to the Governor-General and the resignation is accepted by the Governor-General ;

(*e*) if he absents himself (except on leave granted by the Governor-General) from all meetings of the Commission held during two consecutive months ; or

(*f*) if he, in any way, otherwise than as a member, and in common with the other members, of an incorporated company consisting of more than twenty-five persons—

(i) becomes concerned or interested in any contract or agreement made by or on behalf of the Commission ; or

(ii) participates, or claims to participate, in the profits of any such contract or agreeor in any benefit or emolument arising therefrom.

14. (1) The Commission shall hold such meetings as, in the opinion of the Chairman or at least three other Commissioners, are necessary for the efficient conduct of its affairs.

(2) At meetings of the Commission three Commissioners shall form a quorum, and the Chairman shall have a deliberative vote, and, in the event of an equality of votes, a second or casting vote.

15. (1) The Commission shall appoint a general manager and such other officers and such servants as it thinks necessary.

(2) The salaries payable to the general manager and the next six most highly paid executive officers of the Commission shall be subject to the approval of the Governor-General.

(3) Officers and servants appointed by the Commission shall not be subject to the provisions of the *Commonwealth Public Service Act*, 1922-1931, but shall be subject to such conditions (including tenure of office) as are determined by the Commission.

Part III.—Powers and Functions of the Commission.

16. The Commission shall provide and shall broadcast from the national broadcasting stations adequate and comprehensive programmes and shall take in the interests of the community all such measures as, in the opinion of the Commission, are conducive to the full development of suitable broadcasting programmes.

17. For the purpose of the exercise of its powers and functions under this Act, the Commission may compile, prepare, issue, circulate and distribute, whether gratis or otherwise in such manner as it thinks fit, such papers, magazines, periodicals, books, pamphlets, circulars and other literary matter as it thinks fit (including the programmes of national broadcasting stations and other stations) :

Provided that, prior to the publication of any programme in pursuance of this section, a copy of the programme shall be made available at an office of the Commission on equal terms to the publishers of any newspaper, magazine, or journal published in the Commonwealth.

18. (1) Subject to this Act, the Commission may—

(*a*) acquire by lease or purchase any land, buildings easements or other property, rights or privileges which it thinks necessary for the purposes of this Act ; and

(*b*) sell, exchange, lease, dispose of, turn to account or otherwise deal with any property, rights or privileges of the Commission.

(2) The Commission shall not, without the approval of the Minister—

(*a*) acquire any property, the cost of acquisition of which exceeds the sum of Five thousand pounds, or in any manner dispose of any property having an original or book value exceeding the sum of Five thousand pounds ; or

(*b*) enter into any lease for a period exceeding five years.

19. (1) The Commission shall provide such studios, offices and other accommodation as it thinks necessary for the purposes of this Act, and such accommodation in relation to the studios as the Minister requires for the proper carrying out of the technical services to be provided by the Minister, and shall take over, as arranged by the Minister and at the valuation determined by him, any existing studios, buildings, sites, fittings, furniture or other assets controlled by the Minister which are used for broadcasting purposes, and shall accept an assignment of any leases relating thereto, and of the rights and liabilities of the Minister under any agreements relating thereto.

(2) The location of any studios to be provided by the Commission in pursuance of this section shall be subject to the approval of the Minister.

20. (1) The Commission shall transmit free of charge from all of the national broadcasting stations, or from such of them as are specified by the Minister, any matter the transmission of which is directed by the Minister as being in the public interest.

(2) The Commission shall not, without the permission of the Minister, transmit or receive for transmission any message the transmission of which would, without the authority of, or licence granted by, the Minister administering the *Post and Telegraph Act*, 1901-1923 or the *Wireless Telegraphy Act*, 1905-1919, contravene the provisions of either of those Acts.

21. (1) The Commission shall not broadcast advertisements.

(2) Nothing in this section shall be construed as preventing the Commission from broadcasting, if it thinks fit—

(*a*) any announcement of its own future programmes ;

(*b*) a programme supplied by any organization, firm or person engaged in artistic, literary, musical or theatrical production or in educational pursuits ; or

(*c*) a programme supplied by any organization, firm or person, provided the programme is not, in the opinion of the Commission, being used as an advertisement.

22. The Commission may collect in such manner as it thinks fit news and information relating to current events in any part of the world and may subscribe to news agencies.

23. The Commission shall, as far as possible, give encouragement to the development of local talent and endeavour to obviate restriction of the utilization of the services of persons who, in the opinion of the Commission are competent to make useful contributions to broadcasting programmes.

24. The Commission shall endeavour to establish and utilize, in such manner as it thinks desirable in order to confer the greatest benefit on broadcasting, groups of musicians for the rendition of orchestral, choral and band music of high quality.

25. The Commission may, if it thinks fit, appoint Committees to advise it in relation to all or any matters connected with the provision or rendition of broadcasting programmes, or the exercise of any powers, duties or functions conferred or imposed upon it by this Act.

Part IV.—Finance.

26. (1) There shall be an Australian Broadcasting Commission Fund into which shall be paid from time to time out of the Consolidated Revenue Fund, which is hereby appropriated accordingly, an amount which represents such portion of the fees received from broadcast listeners' licences as is fixed by or under this Act.

(2) For the year commencing on the first day of July, One thousand nine hundred and thirty-two, the amount referred to in the last preceding sub-section shall be twelve shillings in respect of each broadcast listener's licence fee received, and this amount shall continue to be paid in each subsequent year unless some other amount is fixed by the Minister.

(3) The payments provided for by the preceding provisions of this section shall be made monthly, and as soon as possible after the last day of each calendar month, and shall in each case represent an amount approximating the appropriate sum relating to the licences in force during the previous month.

(4) The final adjustments shall be made as soon as convieniently possible after the end of each quarter.

(5) Any account certified by such officer of his Department as is designated for that purpose by the Minister and forwarded by the Minister to the Commission purporting to set out the sum payable to the Commission in pursuance of the foregoing provisions of this section shall be final and conclusive for all purposes.

(6) There shall also be paid into the Fund any other revenue or money received by the Commission.

(7) Income derived from the investment of any portion of the Fund shall form part thereof.

27. The moneys paid into the Fund shall be applied by the Commission as follows :—

(*a*) In payment of the expenses, charges and other obligations incurred or undertaken by the Commission in the exercise of its powers, duties and functions under this Act ;

(*b*) In payment of the salaries, wages and allowances of Commissioners and of officers and servants of the Commission ; and

(*c*) In investment in any securities of, or guaranteed by, the Government of the Commonwealth or of any State.

28. Moneys held in the Fund, uninvested by the Commission, may be lodged either in an account at call or on fixed deposit, or partly in an account at call and partly in an account at fixed deposit, with the Commonwealth Bank, and while in such Bank shall be held to be moneys of the Crown.

29. Cheques drawn on any account referred to in the last preceding section shall be signed in such manner as the Commission directs.

30. (1) For the purpose of enabling the Commission to defray any expenses incidental to its establishment and operation, the Treasurer may advance, out of the Consolidated Revenue Fund, which is hereby appropriated accordingly, such amounts not exceeding in all the sum of Thirty thousand pounds as are, in the opinion of the Minister, required by the Commission.

(2) In addition to the moneys advanced in pursuance of the last preceding sub-section, the Treasurer may advance to the Commission such sums, if any, as are from time to time appropriated by the Parliament for the purpose.

(3) The terms and conditions of any advances made in pursuance of this section, including the security and basis of re-payment shall be as determined by the Treasurer.

31. (1) The accounts of the Commission shall be subject to inspection and audit, at least once yearly, by the Auditor-General for the Commonwealth.

(2) The Auditor-General shall report to the Minister the result of each inspection and audit.

32. The Commission shall, as soon as possible after the expiration of each financial year, prepare a profit and loss statement and balance-sheet in the form prescribed, and shall forward them, together with a report on the operations of the Commission during that year, to the Minister, for presentation to both Houses of the Parliament.

33. The payment by the Commission of compensation exceeding in any individual case, One hundred pounds to members of the Commission its officers or servants, or other bodies or persons, shall not be made without the approval of the Minister.

34. The income, property and operations of the Commission shall not be subject to any rates, taxes or charges, under any law of the Commonwealth or a State, to which the Commonwealth is not subject.

35. (1) The Commission shall exercise the powers and functions conferred and imposed upon it by this Act, in such a manner that its operations will be financially self-supporting.

(2) The Commission shall establish such sinking funds as are in the opinion of the Treasurer, necessary to enable the Commission to meet repayment of loans and other obligations and to meet losses and depreciation in assets, and may set aside out of its revenue such sums as it thinks proper as a reserve fund for such purposes as the Commission deems desirable (not being purposes for which any sinking fund has been established).

Part V.—Issue of Debentures by the Commission.

36. (1) Subject to this section, the Commission may, from time to time, issue debentures to such amount, bearing such rate of interest and subject to such conditions, as the Treasurer and the Minister approve.

(2) The total amount of debentures so issued, and current at any one time, shall not exceed Fifty thousand pounds.

37. Debentures shall be in accordance with the form approved by the Treasurer, and shall be under the seal of the Commission and shall be signed and countersigned in such manner as the Treasurer directs.

38. The Commonwealth by this Act guarantees the payment by the Commission of the principal and interest due in respect of any debenture issued by the Commission in pursuance of this Act, and the Consolidated Revenue Fund is hereby appropriated for the purpose of this section.

39. (1) Every debenture issued in pursuance of this Act shall be payable to the bearer thereof, and shall pass by delivery only without any assignment or indorsement, and the bearer of a debenture shall have

the same rights and remedies as if he were expressly named therein.

(2) At the request of the bearer of a debenture, the Commission may in lieu thereof issue to him inscribed stock of the same currency, and bearing the same interest, and transferable only in manner prescribed.

(3) At the request of the holder of any inscribed stock of the Commission, the Commission may in lieu thereof issue to him debentures of the same currency and bearing the same interest.

40. The Commission may sell debentures, or cause them to be sold, at such times and at such places and in such sums and on such conditions as the Treasurer approves.

41. A trustee, executor or administrator may invest any trust moneys in his hands in the purchase of debentures issued by the Commission.

42.—(1) Any person who, with intent to defraud—

(*a*) forges any security of the Commission, or
(*b*) utters any forged security of the Commission, or
(*c*) makes any instrument for forging any security of the Commission, or
(*d*) has in his possession any such instrument, or
(*e*) has in his possession any forged security of the Commission, shall be guilty of an indictable offence.

Penalty: Imprisonment for ten years.

(2) Any person who, without authority, proof whereof shall lie upon him—

(*a*) makes any form of security of the Commission,
(*b*) has in his possession any form of security of the Commission, or
(*c*) makes or has in his possession any instrument or thing by which any distinctive mark or signature on any security of the Commission may be made or imitated,

shall be guilty of an offence.

Penalty: Imprisonment for two years.

(3) In this Part "security of the Commission" means any Commission debenture, Commission inscribed stock, or any coupon, warrant or document for the payment of interest thereon, and includes any transfer of any Commission inscribed stock, and any indorsement on any coupon, warrant or document for the payment of interest on any security of the Commission.

43. All forged securities of the Commission, and all unauthorized forms of security of the Commission, and all unauthorized instruments and things by which any distinctive mark or signature on any security of the Commission, may be unlawfully made or imitated, shall be forfeited to the King and may be seized by any member of the police force of the Commonwealth or of a State.

Part VI.—Miscellaneous.

44. The Postmaster-General shall undertake the provision and operation of all technical services associated with the transmission of programmes, including any transmission and reception for the interchange of programmes with other broadcasting administrations which is mutually agreed upon between the Commission and the Postmaster-General.

45. (1) For the purpose of providing and operating the technical services referred to in this Act, the Postmaster-General, or any person acting under the authority of the Postmaster-General, may—

(*a*) erect, place and maintain any electric line which is, in the opinion of the Postmaster-General, necessary for conveying electric current to a Broadcasting station, and in respect of the erection, placing and maintenance of any electric line, the Postmaster-General and any person acting under his authority shall have the same powers, and be subject to the same obligations, as are conferred or imposed under Part IV. of the *Post and Telegraph Act*, 1901-1923, in relation to the erection, placing and maintenance of telegraph lines; and
(*b*) arrange for and obtain from any person the supply of any electric current which, in the opinion of the Postmaster-General, is necessary or advisable for the working of any broadcasting station or the operation of any apparatus for the transmission or reception of programmes.

(2) In this section "electric line" includes all means used for the purpose of conveying, transmitting, transforming or distributing electricity and any casing, coating, covering, tube, tunnel, pipe, pillar, pole, post, frame, bracket or insulator enclosing, surrounding or supporting the same or any part thereof or any apparatus connected therewith.

46. The Postmaster-General shall provide, free of cost to the Commission—

(*a*) the transmissions emanating from recognized National Broadcasting Service studios which are to be radiated from the national broadcasting stations, including such simultaneous transmissions from two or more stations as are mutually agreed upon; and
(*b*) microphones, pick-up equipment and all other necessary portable apparatus for occasional or periodical transmission from various places within the Commonwealth.

47. The Postmaster-General shall provide, at the expense of the Commission—

(*a*) for the installation and operation of the apparatus referred to in paragraph (*b*) of the last preceding section;
(*b*) the circuits required to connect the various pick-up points with the recognized relevant studios; and
(*c*) apparatus required permanently for pick-up purposes of for other purposes affecting the rendering of programmes where such apparatus is to be installed at any place other than a recognized National Broadcasting Service studio.

48. Notwithstanding anything contained in this Act, the Commission shall not be empowered to enter into any agreement involving any expenditure in excess of Five thousand pounds, or extending over a period of more than five years, unless the approval of the Minister thereto has first been obtained.

49. The Commission shall at all times indemnify and keep indemnified the Postmaster-General against any action claim or demand brought or made by any person against the Postmaster-General or against any officer of the Postmaster-General's Department in respect of any act done by the Postmaster-General or by such officer on behalf, at the request, or in the interests, of the Commission.

50. The control of the provision and rendition of broadcasting programmes by the Commission shall commence on the first day of July one thousand nine hundred and thirty-two, but the Commission may exercise, prior to that date, any powers or functions conferred on it by this Act for the purpose of enabling it to assume full control on that date.

51. (1) The Minister may from time to time, by notice in writing, prohibit the Commision from broadcasting any matter, or matter of any class or character, specified in the notice, or may require the Commission to refrain from broadcasting any such matter.

(2) The Minister may at any time revoke or vary any requirement made in pursuance of the last preceding sub-section.

52. The Commission shall have the power to determine to what extent and in what manner political speeches may be broadcast.

53. The Governor-General may, whenever any emergency has arisen, which, in his opinion, renders it desirable in the public interest so to do, authorize the Minister to exercise during the emergency complete control over the matter to be broadcast from the national broadcasting stations, and, thereupon and so long as the emergency continues such persons as are thereto authorized in writing by the Minister shall have access at all times to any premises controlled by the Commission and may exercise full authority over all rights and privileges possessed by the Commission.

54. Nothing in this Act shall be deemed to diminish or affect the rights of any person under any contract or agreement made prior to the commencement of this Act to which the Commonwealth is a party.

55. The Governor-General may make regulations, not inconsistent with this Act, prescribing all matters required or permitted to be prescribed, or which are necessary or convenient to be prescribed, for carrying out or giving effect to this Act and in particular for providing for the issue, inscription, transfer, transmission, and redemption of inscribed stock of the Commission, and all matters in relation thereto.

Amalgamated Wireless Agreement with Commonwealth Government.

Wireless Agreement No. 37 of 1927.

An Act to approve the Agreement made between His Majesty's Government of the Commonwealth of Australia and Amalgamated Wireless (Australasia) Limited. (Assented to 22nd December, 1927.)

BE it enacted by the King's Most Excellent Majesty, the Senate, and the House of Representatives of the Commonwealth of Australia, as follows:—

1. This Act may be cited as the *Wireless Agreement Act*, 1927.

2. The Agreement made between His Majesty's Government of the Commonwealth of Australia and Amalgamated Wireless (Australasia) Limited (a copy of which is set forth in the Schedule to this Act) is approved.

3. The Consolidated Revenue Fund is hereby appropriated for the purposes of this Act to the extent necessary for the purpose of carrying out the Agreement on the part of the Commonwealth.

THE SCHEDULE.

An Agreement made the fifteenth day of November One thousand nine hundred and twenty-seven between The Commonwealth of Australia (hereinafter called "the Commonwealth") of the one part and Amalgamated Wireless (Australasia) Limited of Sydney in the State of New South Wales (hereinafter called "the Company") of the other part Whereby it is agreed as follows:—

Part I.—Preliminary.

1. This Agreement shall have no force or effect and shall not be binding upon either party unless and until it is approved by the Parliament of the Commonwealth of Australia.

2. This Agreement shall commence and come into full force and effect upon the date upon which it is so approved by the Parliament of the Commonwealth of Australia.

3. This Agreement shall be read and construed as supplemental to and amending the existing Agreements between the same parties dated the 29th March, 1922, and 20th August, 1924, respectively, and unless the context otherwise requires, as one with the said existing Agreements.

4. (1) In this Agreement, unless the context otherwise requires—

"Commercial Wireless Services" includes wireless telegraphy, wireless telephony and all further developments of wireless transmission or reception for commercial purposes;
"Post and Telegraph Act" means the *Post and Telegraph Act*, 1901-1923, and includes any amendments thereof;
"Principal Agreement" means the Agreement dated the 28th March, 1922, made between the parties hereto as amended by the Agreement of the 20th August, 1924, between the same parties;
"Wireless Telegraphy Act" means the *Wireless Telegraphy Act*, 1905, and includes any amendments thereof;
"Wireless telephone broadcasting station" means a station operating under licence under the Wireless Telegraphy Act for the purpose of the transmission of speech or music intended for simultaneous reception by all listeners as distinct from point to point communication.

(2) In this Agreement the words "terminal charges," "transit charges" and "land-line charges" have the same meanings respectively as in the International Telegraph Convention and Regulations thereunder and the International Radio-Telegraph Convention and Regulations thereunder.

Part II.—Provisions Relating to Broadcasting and to the Use of Patents.

5. (1) This Part of this Agreement shall, subject to the provisions of Clause 11, continue in force for a period of five years from the first day of November, 1927, and thereafter until determined by either party by notice given in accordance with the next succeeding sub-clause.

(2) At any time after the expiration of four years from the commencement of this Part, either party to this Agreement may give to the other party twelve months' notice of its intention to determine this Part.

(3) Unless determined at an earlier date in pursuance of Clause 11, this Part shall determine at the date specified in the notice.

6. The Company shall make its Australian patent rights available free of charge during the currency of this Part to—

(*a*) each wireless telephone broadcasting station in the Commonwealth and its Territories, for the purpose of the establishment and carrying on of wireless telephone broadcasting services; and

(*b*) each Broadcast listener and radio dealer and manufacturer licensed by the Commonwealth, to use, sell or manufacture, within the Commonwealth and its Territories any wireless receiving apparatus (including valves and all accessories), for the purpose of listening to the programmes of wireless telephone broadcasting stations in the Commonwealth and elsewhere ;

Provided, however, that if the Commonwealth and the Company agree upon a form of licence agreement to be submitted for signature to the aforesaid users (other than broadcast listeners), then those users (other than broadcast listeners) shall be entitled to benefit under this Clause only while agreeing to be bound by such licence agreement.

7. The patent rights referred to in the foregoing clause are all Australian patent rights for inventions relating to wireless telephone broadcasting which, at any time during the currency of this Part, belong to or are controlled by the Company, or in respect of which the Company has power to grant licences or sub-licences.

8. Within thirty days after the close of each month commencing with the month of November, 1927, the Commonwealth shall pay to the Company the sum of three pence in respect of each person who was on the last day of that month licensed or otherwise permitted by the Commonwealth under the Wireless Telegraphy Act to listen to the transmission of wireless telephone broadcating station and whose licence or permit was in force.

9. (1) The Company agrees, during the currency of this Part, to make all its Australian patent rights available free of charge to the Commonwealth in connexion with the manufacture or use of any plant or apparatus, provided that such plant or apparatus is—

(*a*) manufactured, and used exclusively, by the Commonwealth ; or
(*b*) manufactured by, and purchased from, the British Government, and used exclusively by the Commonwealth ; or
(*c*) purchased by the Commonwealth from the Company, and used exclusively by the Commonwealth.

(2) The patent rights to which this clause applies include not only the patent rights to which Clauses 6 and 7 of this Agreement apply. but also all other Australian patent rights for inventions relating to wireless telegraphy or wireless telephony which at any time during the currency of this Part belong to or are controlled by the Company, or in respect of which the Company has power to grant licences or sub-licences :

Provided that, where the patent rights in question are patent rights which the Company is not entitled to use without payment of royalty, the Commonwealth shall be liable to pay the royalty which would be payable by the Company if the use by the Commonwealth were use by the Company.

10. The Company agrees, during the currency of this Part, to grant a licence free of royalty, to each newspaper published in the Commonwealth and each wireless telephone broadcasting station in the Commonwealth, which makes application therefor, to use any or all of the patents to which Clauses 6, 7 and 9 of this Agreement apply, for the purpose of receiving the official news bulletins issued by the British Government and transmitted by Rugby or any other transmitting station in Breat Britain.

11. (1) The Company agrees to prosecute as expeditiously as possible to judgment the actions which have already been instituted by it in Australia for infringement of patent rights which actions it is agreed are for infringement of patent rights substantially important in connexion with wireless broadcasting.

(2) The Company agrees that, unless within twelve months from the commencement of this Agreement, judgment in its favour (otherwise than by consent) is given by the Court of final resort upon the issues raised prior to the date of this Agreement by the pleadings in one or more of the actions referred to in sub-clause (1) of this Clause, it will, within the aforesaid period of twelve months commence an action or actions in New Zealand for infringement of the New Zealand equivalents of the Australian patents involved in the actions referred to in sub-clause (1) of this Clause or other patents substantially important in connexion with wireless broadcasting, and will, unless and until there has been given in favour of the Company in the Australian actions, such a judgment as is specified in this sub-clause, prosecute such action or actions as expeditiously as possible.

(3) If the Company fails to comply with the obligations imposed upon it by sub-clause (2) of this Clause to take proceedings in New Zealand for infringement of patent rights, this Part of this Agreement shall cease and determine at the expiration of the aforesaid period of twelve months.

(4) If the Company—

(*a*) fails, in the Court of final resort, in the actions referred to in sub-clause (1) of this Clause ; or
(*b*) fails, in the Court of final resort, in the action or actions for infringement (if any) which it takes in New Zealand,

this Part of this Agreement shall cease and determine as from the date of such failure :

Provided that if, before any such failure as is contemplated in paragraph (*b*) of this sub-clause occurs, there has been given in favour of the Company such a judgment as is specified in sub-clause (2) of this Clause, this Part of this Agreement shall continue in force.

(5) In this Clause the words " Court of final resort " mean the Court to which either of the parties to the said actions respectively resorts, or, if the judgment of that Court is appealed from, the final Court to which an appeal is taken.

(6) For the purposes of this Clause any action which is conducted by or on behalf of the Company, or in which the Company gives or has given an indemnity to the plaintiff, shall be deemed to be an action by the Company.

Part III.—General Provisions.

12. (1) The Company shall retain all stations taken over by it under Clause 5 (*h*) of the Principal Agreement (hereinafter referred to as the " said Stations ") and shall complete, within three years from the commencement of this Part, the reorganization of the said stations, including the modernization of the equipment of the said stations, and shall continue to operate those stations in accordance with the Principal Agreement and this Agreement.

(2) In lieu of the method of payment for the said stations which is set out in Clause 6 of the Principal Agreement, the Company shall, on completion of the transfer of the said stations, pay to the Commonwealth the amount of the assets valuation thereof namely the sum of £56,500, the method of payment to be by deduction from payments due by the Commonwealth to the Company.

(3) As from 28th March, 1927, the Commonwealth shall pay to the Company as a contribution towards the maintenance of the said stations an annual subsidy of £45,000 per annum, and the Company shall pay to the Commonwealth thirty per centum of the revenue earned by the Company in the continuance of the services which were carried on by the said stations at the commencement of the Agreement made on the 28th day of March, 1922, between the parties to this Agreement.

(4) For the purposes of the last preceding sub-clause revenue earned by the Company from traffic of a kind which would at the commencement of the Principal Agreement have been carried on by one or more of the said stations, but which is diverted by the Company to another station, shall be deemed to be revenue earned by the Company in the continuance of the services which were carried on by the said stations at the commencement of the Agreement made on the 28th day of March, 1922, between the parties to this Agreement.

(5) The second paragraph of Clause 7 of the Principal Agreement is amended by omitting the words " seven years " and inserting in their stead the words " five years."

13. In operating the stations referred to in the Principal Agreement, and in establishing and operating any new stations which may be licensed by the Commonwealth, the Company shall comply with the provisions of any International Radio Convention, International Telegraph Convention, and International Convention for the Safety of Life at Sea, to which the Commonwealth is for the time being a party, and the Wireless Telegraphy Act. In particular, the Company shall comply, as from 28th March, 1926, with the requirements of the Telegraph Convention and the Radio Convention concerning the fixing and the payment to the Commonwealth of terminal or transit or land line charges on all messages received at or despatched from the Company's wireless stations.

14. (1) Clauses 4 and 13 of the Principal Agreement are hereby defined to mean that the Company is entitled, subject to the terms of the licences granted or to be granted by the Commonwealth to the Company, and to the provisions of any International Radio Convention, or International Convention for the Safety of Life at Sea to which the Commonwealth is for the time being a party, and to the Wireless Telegraphy Act, to establish and operate commercial wireless services between Australia and ships at sea, between Australia and commercial or private aircraft (except aircraft trading or operating exclusively within Australia), between Australia and any Territory under the authority of the Commonwealth (not being part of the Commonwealth), and between Australia and other countries, and to negotiate and enter into agreements for the conduct of such wireless services, and in such cases the licences and permits (other than licences for wireless telephone broadcasting stations and dealers' licences) shall be free of charge.

(2) Nothing in this clause shall affect the provisions of the Principal Agreement as regards feeder stations or the development and manufacture or sale of wireless apparatus by the Company.

(3) Notwithstanding anything contained in sub-clause (1) of this Clause the Commonwealth retains the right to determine whether or not any service which the Company proposes to carry on in addition to the proposed services between Australia and Fiji and any service which is in existence at the date on which this Agreement is approved by the Parliament are necessary in the public interest.

(4) Clause 5 (*h*) of the Principal Agreement is hereby defined as including an obligation on the Company to transmit and receive all official meteorological messages, and such messages shall in each year be transmitted and received by the Company without charge until the number of words contained in those messages exceeds by five per centum the number of words contained in similar messages transmitted and received by the Company free of charge during the previous year.

(5) Notwithstanding anything in Clause 11 of the Principal Agreement, the fixation of all rates for traffic to be charged by the Company shall be subject to the approval of the Commonwealth.

(6) Clause 15 of the Principal Agreement is hereby defined to mean that the Commonwealth shall not impose any conditions or restrictions of any kind upon the Company which exceed the conditions and requirements of the International Radio Convention, the International Telegraph Convention, the Wireless Telegraphy Act and the Post and Telegraph Act, and no Department of the Commonwealth shall carry on any commercial wireless service in competition with the Company.

(7) Clauses 17 and 18 of the Principal Agreement are to be read and construed as if the words " the Prime Minister " and " the Prime Minister of the Commonwealth " were deleted and the words " the Minister for the time being administering the Wireless Telegraphy Act " were substituted therefor.

(8) Clause 4 of the agreement of 20th August, 1924, between the parties to this Agreement is to be read and construed as if the words " and will pay to the Postmaster-General such amounts as may be due at standard tariff rates in respect of messages handled by the Post Office " were deleted.

15. (1) The Commonwealth shall, if so requested by the Company, provide for the Company the necessary land line connexions for the operation of its wireless stations and shall transmit over the internal communication service of the Commonwealth any overseas messages handed in by the public at any post office or handed over to the Commonwealth by the Company for such transmission and the Company shall pay to the Commonwealth for such line and such services the usual rates charged by the Commonwealth.

Provided that no charge shall be made to the Company for lines from the Company's coastal stations to the local post office, or, at the Company's option, to the Company's local office, and provided that in all cases where terminal transit or land line charges are paid to the Commonwealth in accordance with Clause 13 of this Agreement no further charge shall be made for transmission of messages over the internal communication service of the Commonwealth.

(2) In this Clause " overseas messages " means messages received from or intended for transmission to—

(*a*) a ship ; or
(*b*) a place outside Australia ; or
(*c*) commercial or private aircraft (other than aircraft trading or operating exclusively within Australia).

16. (1) The Company shall be entitled at all times, subject to the requirements of the Post and Telegraph Act, to accept from and deliver to the public through its own offices and agencies any overseas messages intended for transmission or received for delivery through its commercial wireless services and to relay such messages from one part of the Commonwealth to another through its wireless stations and/or land line connexions as it may consider most expedient, and where necessary, to a ship at sea, subject to payment of the terminal and/or transit charges, and the Company shall also be entitled to exchange, free of terminal, transit and land line charges, service messages among its wireless stations, but the Company shall not, otherwise than as provided in this Agreement, transmit or receive inland messages unless required by the Commonwealth in cases of interruption to line circuits.

(2) In this Clause—

" Overseas messages " means messages received from, or intended for transmission to—

(*a*) a ship ; or
(*b*) a place outside Australia ; or
(*c*) commercial or private aircraft (other than aircraft trading or operating exclusively within Australia) ;

" Service messages " means not only service telegrams as defined in the Regulations under the International Telegraph Convention and in the Regulations under the International Radio Convention, but also includes any messages relating to the general conduct and supervision of the service, and to experimental work carried on by the Company.

17. The Company shall at all times ,subject to the conditions of the necessary licence, be permitted to conduct research and experimental work for the further development of wireless and to establish and operate wireless stations and apparatus for the purpose of such research and experimental work, provided that the Company shall take all reasonable precautions to avoid interference with other wireless services.

18. (1) All the stations and services licensed in accordance with this Agreement and the Wireless Telegraphy Act shall be subject to inspection by any officer of the Commonwealth thereto authorized in writing by the Minister for the time being administering the Wireless Telegraphy Act, and the Company shall supply to the Commonwealth such particulars of the traffic as the Commonwealth from time to time requires.

(2) Any information obtained by any authorized officer in pursuance of sub-clause (1) of this Clause shall be used only for the purpose of administration of the Wireless Telegraphy Act, and the Post and Telegraph Act, and this Agreement, or any proceeding relating thereto.

19. In any wireless telephone service licensed by the Commonwealth and established by the Company in accordance with Clause 14 of this Agreement, the Company shall have the same facilities as herein provided for wireless telegraph services, and the Company shall pay the aforesaid terminal and/or transit charges in the case of written messages, and in the case of personal conversation between members of the public the Company shall pay such terminal charges as are fixed by the Commonwealth.

Part IV.—Other Provisions.

20. Clause 20 of the Principal Agreement shall apply in like manner in relation to any disagreement arising between the Commonwealth and the Company under this Agreement as it applies in relation to disagreements arising under the Principal Agreement.

21. All rights granted to the Commonwealth or to any broadcasting station, broadcast listener, radio dealer, manufacturer, or newspaper, under Part II. of this Agreement shall cease immediately upon the determination of that Part, and the Company shall thereafter be at liberty to demand royalties from all users of patent rights of the Company and to institute and carry on proceedings to prevent infringement of the patents.

Provided that no demand shall be made or proceedings instituted in respect of any use of the patents which occurs during the currency of Part II. of this Agreement and is in accordance with that Part.

22. Nothing in this Agreement shall be construed to prevent the Company establishing and carrying on any other wireless service under licence from the Commonwealth.

23. The Company agrees that it will not, without the consent of the Commonwealth, appoint to or engage for its service any person who is not a natural born British subject, and that it will use its best endeavours to induce all its present and future officers and employees to become members of the Reserve branch of the Defence Force.

In witness whereof the parties hereto have executed these presents the day and year first above mentioned.

(Signed on behalf of Commonwealth Government by S. M. Bruce, and on behalf of Amalgamated Wireless (A/asia) Ltd., by G. Mason Allard and E. T. Fisk.)

Registration of Firms Acts.

A person carrying on business on his own account and in his own name without any addition, e.g., " John Jones " or J. W. Jones," need not register under this Act. If, however, he trades under a name such as " J. Jones & Co. " or " Jones Bros. " or " Jones's Radio Service " or simply " Jones's " then he must register as a firm, even though he may be in fact the only person interested in the business. Registration is effected by filing with the Registrar-General a statement setting out the name under which the business is being carried on, place of business, nature of business, date of commencement and the full name and private addresses of all persons interested therein. The statement must be signed by one of the partners. Any alterations in the constitution of the firm, changes of address, etc., must be registered from time to time. Forms are obtainable from the Registrar-General in each State.

Sales Tax Assessment Act, 1930-32.

This Act requires every manufacturer or wholesale merchant to register within 28 days, and to give security to the satisfaction of the Commissioner in an amount varying from £25 to £1000 for compliance with the conditions upon which he is granted a certificate. The certificate must be renewed on 30th June in each year. Failure to register or to renew a certificate renders the offender liable to a penalty of £100.

The definition of " manufacturer " in the Act is somewhat wide, and includes " a person who makes up goods, whether or not the materials out of which the goods are made are owned by him." The line between manufacturing and assembling is a very fine one, and traders should exercise care lest any work undertaken by them should come within the definition of manufacturing under the Sales Tax Act, and so render them liable to registration, with all its attendant obligations.

It is outside the scope of this note to enumerate the rates of tax, lists of exemptions, and rulings of the Commissioner, as these are subject to variation from time to time.

Registration is effected and information may be obtained from the Commissioner of Taxation at Canberra, or the Deputy Commissioner in the Capital city of each State.

Factories and Shops Acts.

So far as it concerns the liability of factories to register and the supervision of factories with a view to the health and safety of employees, etc., the Factories and Shops Act of New South Wales and of Victoria are very similar. The Victorian Act is much longer and much more comprehensive than the New South Wales Act, but this is mainly because in addition to the matters dealt with in the New South Wales Act, it includes a number of other subjects which in New South Wales are covered by the Industrial Arbitration Acts, Early Closing Acts, etc. However, the matters referred to in the following note (unless otherwise stated) are confined to matters which are more or less common to the two States, within the scope of the New South Wales Factories and Shops Act, 1912 and Part III. of the Victorian Factories and Shops Act, 1928. The rates of wages terms and conditions of labour of all classes of employees, and hours of closing of shops, etc., vary so greatly and are governed by so many varying circumstances that it would be impossible, and indeed misleading to attempt anything like a summary of them in a general way. Information as to wages, hours of employment, overtime rates, holidays, etc., should be sought from the Department of Labour in each State (in New South Wales it is called the Department of Labour and Industry). Copies of all State Awards, Acts of Parliament, and regulations may be obtained from the Government Printer in each State. Commonwealth Awards, etc., are obtainable at the Commonwealth Offices in each State. Information as to the requirements of the law in connection with the construction and conduct of factories should be sought from the Chief Inspector of Factories attached to the Department of Labour in each State.

The principal requirements of the Acts in New South Wales and Victoria are as follows :—

Factories.

Every factory must be registered within 14 days of " going into or being in occupation " of the factory. The application for registration in New South Wales is made to the Chief Inspector of Factories, Chalfont Chambers, Phillip Street, Sydney, and in Victoria to the Chief Inspector of Factories, Spring Street, Melbourne, where the necessary forms may be obtained. Removals of factories from one address to another must of course be notified from time to time.

The definition of " factory " is sufficiently wide to include practically any place or building where steam, gas, electric or other mechanical power is used in preparing or manufacturing articles *for trade or sale*, even if only one person is employed therein ; if there is no such power then it is not necessary to register unless four or more persons are engaged directly or indirectly in working at any handicraft, or in preparing or manufacturing articles for trade or sale.

In case of a factory (in New South Wales) becoming untenantable through fire, tempest, etc., a permit to occupy other premises temporarily must be obtained from the Chief Inspector. The Acts prescribe that certain records as to the employees engaged therein must be kept at each factory and that a copy of the Act and the regulations made thereunder (in Victoria only such copies or abstracts as are prescribed) must be kept posted in some conspicuous place near the entrance of the factory.

There are numerous provisions in both the Acts and the regulations of prescribing in detail certain requirements as to the records to be kept, the rights and duties of inspectors, provisions as to outworkers, sanitary arrangements, seating accommodation for female workers the lighting, ventilation and periodical painting or washing of factories, etc., which should be carefully noted by the proprietors of all factories, however small. If in doubt on any point, it would be advisable to consult the Chief Inspector of Factories in your State.

Shops.

With regard to shops, the New South Wales Act has been practically superseded by awards under the Industrial Arbitration Acts. The provisions relating to shop workers in the Factories and Shops Act, 1912, appear to have been designed primarily for the protection of children under 16 years of age and female workers. Minimum wages, maximum hours, and rates for overtime and tea money are prescribed but these are now to all intents and purposes obsolete, and the appropriate arbitration awards should be consulted on these matters. The Victorian Act contains many more provisions relating to shops than the New South Wales Act, such as closing hours in various districts, sanitary arrangements, ventilation, overtime rates, half-holidays, etc., and traders in Victoria should make themselves familiar with these provisions, which in New South Wales are not the subject of regulation, unless specially provided in an arbitration award relating to the particular industry being carried on in the shops.

One important provision in the Victorian Act, which is not required in New South Wales is the necessity for registration of every shop within 14 days of occupation. The registration is effected by notice served on the Chief Inspector (from whom the necessary forms may be obtained) specifying the names of the person or body of persons carrying on the business, a description of the shop, the place where the shop is situate, and the classes or kinds to which the shop belongs. This registration must not be confused with the registration of a firm under the registration of Firms Act, which must also be done in every case where a business is carried on by a partnership or under a name other than the name of the individual sole proprietor ; the registration of a shop under the Victorian Factories and Shops Act covers every shop, even if the business is carried on by an individual person in his own name.

Marking of Furniture.

Attention is called to the provisions of the Acts as to the necessity of marking (inter alia) furniture with the full name and address of the manufacturer, etc. There is little doubt that a radio cabinet would be classed as " furniture " and should be marked as required.

The above is not intended to be in any sense an exhaustive summary of the Acts referred to. There are a number of other provisions in all the Acts referred to which may or may not affect the radio manufacturer or dealer, according to circumstances, but which cannot be referred to here. The man commencing business should get the various Acts and regulations, and study them carefully ; take care to effect all the necessary registrations, keep all the prescribed records, fill in all the necessary forms relating to income tax, sales tax, family endowment, workers' compensation, factories act, etc., etc., and then, if he has any time to spare, he may employ it in attending to his business.

Summary under (N.S.W.) Workers' Compensation Act, 1926-1929.

The Workers' Compensation Act, 1926-1929, provides that—

(1) There shall be kept constantly posted up in some conspicious place at or near every mine, quarry, factory, workshop, or shop, and on every ship to which the Act applies, where it may be conveniently read by a person employed, a summary of the requirements of this Act, with regard to the giving of notice of injuries and the making of claims.

(2) The summary shall be in or to the effect of the prescribed form, and in the event of the summary becoming effaced, obliterated, or destroyed, it shall be renewed with all reasonable despatch.

(3) In the event of any non-compliance with the provisions of this section, the owner, agent, or manager of the mine or quarry, or the occupier of the factory, workshop or shop, or the master of the ship shall be guilty of an offence against this Act.

(4) The want of, or any defect or inaccuracy in the notice of an injury required by section 53 shall not be a bar to the maintenance of proceedings for the recovery of compensation if the employer is proved to have had knowledge of the injury from any source at or about the time of the occurrence, or where the employer is the owner of a mine or quarry, or the occupier of a factory, workshop, or shop—

(*a*) if such summary as aforesaid has not been posted upon accordance with the provisions of this section ;

(*b*) if the injury has been reported by or on behalf of the employer to an inspector of mines or factories ;

(*c*) if the injury has been entered in any register of accidents or injuries kept by or on behalf of the employer of the mine, quarry, factory, workshop, or shop ;

(*d*) if the injury has been treated in an ambulance room at the mine, quarry, factory, workshop, or shop.

Course of Action to be Followed by the Employer of an Injured Worker.

(1) The employer of any worker who sustains personal injury by accident arising out of and in the course of his employment whether at or away from his place of employment, shall, when the injury results in death, or incapacity for work for a period of seven days, notify the Commission in writing as soon as practicable and furnish full particulars regarding the cause, nature and extent of the injury, name and address of the worker, including his dependants in case of death, also his average weekly earnings, the name of the insurer concerned, and such other information as may be prescribed.

(2) The employer of any such worker shall upon the return to employment, termination of incapacity of such worker, or from time to time if requested, furnish such further particulars as the Commission may require.

(3) For facilitating the giving of notice of injuries by an injured worker a notice of injury book has been prescribed, which shall be kept at every mine, quarry, factory, workshop, or shop at such place as to be readily accessible at all reasonable times to any injured worker who was there employed and to any person *bona fide* acting on his behalf.

Course of Action to be Taken by an Injured Worker.

(1) Notice of the injury should be given to the employer as soon as practicable after the happening thereof and before the worker has voluntarily left the employment in which he was at the time of the injury.

Such notice may be given orally, or in writing to the employer, or any person designated for the purpose by the employer or any foreman, or other official under whose supervision the worker is employed. If there is nore than one employer, the notice may be given to any one of such employers.

The notice shall give the name and address of the person injured, and shall state in ordinary language the cause of the injury and date on which the injury happened.

If notice in writing be given, the following form may be used, and may be served by delivering the same at, or sending it by post in a registered letter addressed to the residence or place of business of the person on whom it is to be served, and where the employer is a body of persons corporate or incorporate at the office or any of the offices of such body.

In the Matter of the Workers' Compensation Act, 1926-1929.

(Notice of Workers' Injury to be served on Employer).

TO (employer), Street, N.S.W.

PLEASE TAKE NOTICE, that , of , (occupation), on the day of , 19 , while in your employment has received an injury arising out of and in the course of his employment by sustaining (state nature of injury), caused by (state cause), while (state operation in which worker was engaged).

(Name)

(Address)

Dated the day of , 19 .

Note :—This notice can be given either by the injured worker himself or by anyone on his behalf. It msut give the name and address of the person injured, state in ordinary language the cause and nature of the injury, and be served on the employer as soon as practicable after the happening of the injury. "Injury" includes disease arising out of and in the course of the employment, whether of sudden onset or of such a nature as to be contracted by a gradual process other than a disease caused by silica dust.

(2) In addition a claim for compensation must be made within six months from the occurrence of the injury, or in the case of death, from the time of death, provided that the failure to make a claim within six months shall not be a bar to the maintenance of proceedings if the failure was occasioned by mistake, absence from the State, or other reasonable cause.

If desired a claim for compensation may be made in the form set out hereunder.

In the Matter of the Workers' Compensation Act, 1926-1929.

(Claim for Compensation by Injured worker to be Served on Employer.)

TO (employer) Street, , N.S.W.

In consequence of the injury sustained by me on , 193 , arising out of and in the course of my employment, of which you have already been notified, I now claim compensation under the abovementioned Act in respect of myself and dependants, as under :—

(Name of injured worker)

(Address)

(Age) (Occupation)

(Injury)

(Cause of Injury)

Dependants :—

(Name of wife or other female* totally or mainly dependent on worker's earnings.)

(Children and stepchildren under 14, or brothers and sisters under 14 years, totally or mainly dependent on worker's earnings)

(Give full particulars)

(Date) (Signed)

*This dependant must be an adult caring for a child or stepchild of the worker under 14 years of age or a member of the worker's family under the age of 14 years.

Returns :—To comply with the provisions of section 44 of the Act, an employer shall furnish to the Commission certain information in accordance with Forms "A" and "B," as prescribed by the Regulations under the Act. These forms may be purchased at the Government Printing Office, Sydney.

Notice of Injury Book :—The EMPLOYER shall supply a book in terms of Form "I" in the Appendix to the Regulations under the Act, This Book may also be purchased at the Government Printing Office, Sydney.

"**Injury**" means personal injury arising out of and in the course of the employment, and includes a disease so arising, whether of sudden onset or of such a nature as to be contracted by gradual process other than a disease caused by silica dust.

For any further information apply to The Registrar, Workers' Compensation Commission, Winchcombe House, Bridge and Young Streets, Sydney.

Factories and Shops Act 1928 (No. 3677) Victoria

Determination of the Shops Board No. 23 (Electrical and Radio Goods).

NOTE.—This Determination on the 28th November, 1932, applied to the following parts of Victoria, namely : The Metropolitan District and the Geelong District as defined in the Factories and Shops Act 1928 (No. 3677), and the Order in Council thereunder extending such Metropolitan District, such portions of the city of Sandringham as are not included within the said Metropolitan District, the cities of Ballarat, Bendigo and Warrnambool, and the boroughs of Eaglehawk and Sebastopol.

On the 18th May, 1932, the Shops Board No. 18 (Miscellaneous Shops) was deprived of the power to determine the lowest prices or rates which may be paid to any person or persons or classes of persons employed in the business of a seller of—

(a) Electrical goods ;

(b) Wireless (radio) sets, parts, or accessories ;

and such power was conferred exclusively on the Shops Board No. 23 (Electrical and Radio Goods).

In accordance with the provisions of the Factories and Shops Act, 1928 (No. 3677), the Wages Board appointed to "determine the lowest prices or rates which may be paid to any person or persons or classes of persons employed in the business of a seller of—

(a) Electrical goods ;

(b) Wireless (radio) sets, parts, or accessories," has made the following Determination namely :—

(1) That this Determination shall come into force and be operative on and after the 28th day of November, 1932.

(2)

Apprentices and Improvers.

Wages per Week of 47 Hours.

Experience	Commencing Age. 15 years or under.	16 years.	17 years.	18 years.	19 years.	20 years.
Males—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st year	15 0	15 0	20 0	30 0	40 0	50 0
2nd year	20 0	22 6	27 6	35 0	50 0	62 6
3rd year	27 6	30 0	37 6	50 0	65 0	...
4th year	35 0	40 0	50 0	65 0	...	...
5th year	45 0	50 0	...	...	...	...
6th year	55 0	...	...	...	...	...
And thereafter the minimum wage.						
Females—						
1st year	13 3	13 3	18 3	18 3	22 0	22 0
2nd year	18 3	22 0	24 3	25 9	31 3	...
3rd year	22 0	25 9	31 3	36 3	...	...
4th year	25 9	31 3	36 3	...	...	...
5th year	31 3	36 3	...	...	...	...
6th year	36 3	...	...	...	...	...
And thereafter the minimum wage.						

PROPORTION (WITHIN ANY SHOP).

Apprentices.

MALES.

One male apprentice to every three or fraction of three workers receiving not less than 67s. 6d. per week.

FEMALES.

One female apprentice to every three or fraction of three workers receiving not less than 47s. 6d. per week.

Improvers.

MALES.

One male improver to every two or fraction of two workers receiving not less than 86s. per week.

FEMALES.

One female improver to every two or fraction of two workers receiving not less than 47s. 6d. per week.

Other Employees.

Wages per Week of 47 Hours.	Within the Metropolitan District.	Outside the Metropolitan District wherever this Determination applies.
MALES.	s. d.	s. d.
Person in charge of a branch shop ...	97 6	93 6
Canvassers, travellers, collectors, installers (who, in addition to their duties of canvassing, travelling, collecting, or installing, are in any way connected with the sale of goods), salesmen—		
21 years of age	70 0	67 6
22 years of age	80 0	77 6
23 years of age or over	90 0	86 0
All others	75 0	70 0
FEMALES.		
Females	50 0	47 6

(3) PENAL RATE.—Any person who works less than 36 hours in any week shall be paid for such work at the rate of 3s. per hour. Provided that no employee shall be entitled to receive more than the rate fixed for his particular class of work for a week of 47 hours.

(4) TIMES OF BEGINNING AND ENDING WORK—

	Time of Beginning	Time of Ending.
Friday	7.45 a.m.	9 p.m.
Saturday	7.45 a.m.	1 p.m.
On the other working days of the week	7.45 a.m.	6 p.m.

(5) MEAL INTERVAL.—No employer shall require any employee to take a longer interval than one hour for a meal.

(6) OVERTIME—

Outside the hours fixed in Clause 4 ...	Time and a half.
Within the hours fixed in Clause 4 in excess of the number of hours as fixed for an ordinary week's work	

(7) SPECIAL RATE FOR PUBLIC HOLIDAYS.—Time and a half shall be paid for all work done on New Year's Day, 26th January (Australia Day), Good Friday, Easter Saturday, Easter Monday, 21st April (Eight Hours Day), King's Birthday, Christmas Day, and Boxing Day, or after 12.30 p.m. on Show Day (in localities mentioned in Royal Agricultural Show Act). If any other day be by Act of Parliament or Proclamation substituted for any of the above-named holidays, the special rate shall be payable only for work done on the day so substituted.

(8) TERMINATION OF EMPLOYMENT.—Except in a case where an employee has been guilty of a misdemeanour, seven days' notice of termination of employment shall be given by either employer or worker.

(9) ALLOWANCE.—When, in conformity with the custom of the trade, an employee wears, when at work, a washable outer garment the laundering of which is not paid for by the employer, such employee shall be paid 2s. 6d. per week in addition to the ordinary rate.

Patents, Trade Marks and Designs.

Unlike land, money, goods or other kinds of property an idea, whether it be what is commonly known as an invention or a musical or literary work, is an intangible thing. When once disclosed it will become common property unless the originator takes the proper legal steps to keep control of it. It is he who must take the necessary steps for obtaining protection and in the case of industrial invention or similar property he must take proceedings under the Patents, Trade Mark or Designs Acts.

Patent Law in Australia is based upon the Statute of Monopolies, which was passed by the English Parliament in 1624, and which declared monopolies in general to be bad but which expressly excepted "new manufactures." This exception was made because it was felt that it would be to the advantage of the State to encourage inventors as invention is a valuable factor in the development of industry. Since 1624 many other Acts have been brought into force but they deal mainly with the machinery for the granting and enforcement of patents, the broad question of whether a grant may be legally made being determined by the original Statute. The phrase "new manufactures" includes any new apparatus, device, machine or process and a grant of Letters Patent for invention gives to the inventor or his legal representatives the sole monopoly to make, use or sell the invention for a term of sixteen years, subject to the payment of annual renewal fees after the fourth year. The holder of the rights has, subject to certain wide limitations, the sole control of the manufacture and sale of the article and at the end of the period, upon the lapsing of the Patent, the Crown obtains the benefit of the invention. The grant of a patent is thus not a matter of right in that the inventor can demand protection, but is a mutual contract made between him and the State and in return for a full and complete disclosure of the invention and the method of carrying it out the State grants to him the monopoly referred to above. There are other requirements and should the inventor not carry out his side of the bargain properly the patent, even after it has been granted, may be declared invalid by any Court which has the necessary jurisdiction.

The fundamental requirements which have to be observed before a Patent can be successfully applied for and maintained are subject matter, novelty, utility and the sufficiency of the description of the invention. As to the first, it is necessary that the invention must be a "manner of manufacture," which is roughly equivalent to saying that it must have a commercial application and be of benefit to the trade. Mere ideas are not patentable unless wrapped up in something which can be applied practically. Thus it happens that a theory or scientific principle is not patentable nor is a book-keeping system, although certain kinds of rulings in books are often necessary for the latter. Summarised what may be patented can be set out as:

(1) New or old methods of applying new principles or new methods of applying old principles;
(2) New contrivances applied to new or old objects or purposes;
(3) New combinations of parts which will produce material objects or a process;
(4) New methods of applying old devices or processes provided that invention is exercised in arriving at the new method;
(5) Improvements on existing combinations, devices or processes and the application of materials or devices to useful purposes.

In all cases invention must be exercised in arriving at the alleged invention.

It is absolutely necessary that the invention be new although the degree of novelty may be slight, which means that the invention must be something more than would be normally carried out by a skilled operator engaged in the particular trade to which the invention relates. Utility is also equally important for it is of no benefit to the State or to the inventor for a patent to be granted for something which is useless.

In making application for a patent the applicant must supply what is known as the specification and this must set out clearly the nature of the invention and the way in which it is to be performed. Sometimes the applicant is tempted not to disclose some features of the process or machine, thereby hoping to retain for himself the benefit of the invention for a longer period than he would by making a full disclosure. This, however, is a highly dangerous proceeding because an omission to describe the invention fully or intentional mis-description would be quite sufficient to render the patent invalid if it should ever be brought into Court.

The main object is to describe the invention in such a manner that an ordinary skilled workman engaged in the same trade can put it into operation and obtain the same result as the inventor could. There is no need, however, to go into such minute detail that those not engaged in the trade could follow it out, but on the other hand, the specification must not need a specialist to understand how it is to be put into practice. Because of the importance of fully and correctly describing the invention it is highly desirable for an intending applicant to seek professional assistance in making his application, although he is not compelled to. There is, of course, additional expense attached to this procedure but such expenditure will undoubtedly pay in the long run.

The application may be made in either of two ways, viz.:

(a) By the filing of a provisional specification to be followed later by the complete specification, or
(b) By the filing of the complete specification in the first instance.

In an application accompanied by a provisional specification the applicant is not required to describe his invention in full detail. It is only necessary that its nature should be outlined so that when, and if, the complete specification is filed the Patent Office Examiners will have no difficulty in identifying that which follows with the invention described in the provisional application. The term of a *provisional application is nine months* and it is usually filed in cases where the inventor has not been able to bring his ideas to their complete form before he finds it necessary to make an application. If during the currency of the provisional protection he should find that it is desirable to abandon the applica-

tion he may do so without any additional expense. The application dates from the day upon which the first specification is filed, but in the case of a provisional specification the applicant *has no rights whatever* and can take *no steps to prevent infringement*. Obviously a *patent cannot exist* until it is granted and that cannot be until after the complete specification is filed and accepted and the patent issued.

During progress of the application the complete specification, drawings, etc., when filed are examined and if there is nothing in the Patent Records that would prevent the grant the application is accepted. It is then advertised for a period of three months during which any party may, if he can supply sufficient satisfactory evidence, oppose the grant. If no opposition is made or if it is dismissed, the Patent is sealed and the full rights of the patentee commence although they are *retrospective* to the *date of acceptance*. The period of advertisement is to allow anyone who may know of some bar of which the Patent Office is ignorant to come forward. For instance, the applicant may not be the inventor or his legal representative, or the invention may not be new having been put into practice or published in some technical journal, foreign patent specification or otherwise before the date of application.

As to overseas applications, Australia is a member of what is known as the International Convention which, in a few words, means that a local applicant may at any time during the twelve months succeeding the date of his application apply in any other convention country and obtain as the effective date of that patent the date of his Australian patent. This is a very useful arrangement as the detrimental effect of publication of the invention abroad, before the application is made, may be avoided. Conversely, applications made in Australia may be dated back and thus a device originating overseas *may apparently not be the subject of an application* and *yet be adequately protected subsequently*.

Trade Marks

From the point of view of the average trader the matter of trade marks which are inseparably wrapped up with goodwill is not to be neglected because although there may not be much importance attached to a trade mark in the early stages of the development of a business or of a new activity of an established concern, in later years the trade done in the goods covered by the mark may reach large proportions and unless the mark has been well chosen in the beginning the goodwill of the business may not acquire its full value. It is, therefore, wise to choose the best available mark right at the start.

The underlying feature of a trade mark is its ability to distinguish the goods of the proprietor from the goods of others engaged in the same line of business and throughout all trade mark law this question of *ability to distinguish* is paramount. Registration, which, by the way, is not compulsory but which is highly desirable, *requires this quality* of a trade mark beyond all others.

A registrable trade mark may consist of a name of a Company, individual or firm put up in a distinctive manner; the signature of the applicant or some predecessor in business; an invented word or words; a word or words having no direct reference to the character or quality of the goods and not being according to its ordinary meaning a surname or a geographical name; or any other distinctive mark such as a label, combination of devices, letters, numbers or monograms which can be fairly held to be distinctive of the goods of the proprietor. It *must not*, however, be *so like any existing mark* on the Register of Trade Marks or any mark used in connection with similar goods as to lead to any possibility of confusion or deception in the minds of the trade or the public.

An invented word or words is possibly the best type of trade mark, good examples of this being "Kodak," "Magnavox," "Osram" and such words. This kind of word may in an indirect manner introduce some allusion to the character or quality of the goods but as long as it is not entirely obvious they are acceptable. Ordinary English language words if used as trade marks cannot have any direct reference to the character or quality of the goods and therefore such words as "Best" or "Perfect" are *not* registrable. Otherwise, words such as "Kangaroo," "Cornstalk," "King Dick" are acceptable. Trade Mark law will not allow any word which may fairly describe the goods to be *monopolised* by any maker, nor will it permit a geographical name such as "Sydney" to become the property of any one individual while *surnames* are *also not* registrable trade marks unless they have acquired the necessary ability to distinguish by long and wide use of the mark, "Dunlop" and "Pears" being examples of this type of mark. Certain other of the unregistrable marks may also by reason of long use be acceptable, but it is not wise to choose such a mark for until they have had this long use they are difficult to maintain, as being unregistered it is necessary for the proprietor to fully establish his title before he can get any redress at common law and then he must supply evidence of passing off and deception. On the other hand registration immediately supplies prima facie proof of ownership which after seven years becomes conclusive unless the mark was acquired by fraud in the beginning. Furthermore, registration gives a right for infringement proceedings to be taken and mere possession of goods wrongfully marked may be an offence. It is not necessary to prove the passing off.

Registration is not a very difficult matter, but although a selected mark may conform to the definitions of what is registrable laid down in the Trade Marks Act it is desirable that a search be made in the existing records before the application is filed or the mark used so that there can be no risk of conflicting with a mark already on the register. For the purpose of registration all goods are divided into fifty classes and registration is effected in one or more of these according to the goods in respect of which the mark is to be used. Proprietors of trade marks may conduct their own proceedings with the Trade Marks Office, but as in patents it is advisable that skilled professional assistance be obtained, for there are many little points which have to be watched. The period of registration extends for fourteen years, but upon proof being furnished that the mark has been used during its period of registration may be renewed for a further period of fourteen years.

Designs

There is another form of protection which in general principle resembles that given by the Patents Act but which is commonly known as *registration of designs*. According to the Act governing this matter, design means "*an industrial design applicable in any way or by any means to the purpose of the ornamentation of pattern or shape or configuration of an article to any two or more of these purposes.*" Putting this in other words, the protection is given to that which appeals to the eye in regard to the shape, configuration, ornamentation or pattern of the article. It does not cover any principle of construction or operation of the device and if it is desired to cover any mechanical principle, process or method of manufacture Letters Patent must be applied for. In radio work cabinets are often the subject of design registrations, but such registrations only cover the outward appearance and do not give any protection for any constructional features there may be in the device. Likewise the external appearance of a switch or a transformer may be registered as a design, but the only way to protect the method of manufacture or the mechanism of the device would be to apply for patent. As in a trade mark the register is divided into classes and registration must be made in one or other of these classes.

For registration purposes *exact* drawings, photographs or samples of the design must be provided. Upon registration the proprietor is given exclusive right to use the design and any manufacturer who infringes or imitates the copyright in a registered design whether knowingly or otherwise may be proceeded against in the appropriate courts. There is, however, an important provision in the Designs Act which is to the effect that each article to which the design is applied must be marked before delivery for sale with the prescribed mark to denote that the design is registered. Failure to mark in this manner renders the maker liable to a penalty of £20 and moreover may cause the proprietor to lose his rights to get damages for infringement. On the other hand any wrongful application of a marking to indicate that the article is registered renders the person so marking liable to a similar penalty. The usual marking is "Registered No. 12345" or some abbreviation as "Reg'd.".

The term of registration is five years, but it may be extended for two further periods of five years each.

Institution of Radio Engineers, Australia.

The Institution of Radio Engineers, Australia, was registered under the Companies Act, N.S.W. in 1924 *with the following original subscribers to the Memorandum and Articles of Association :—*

Sir Thomas R. Lyle, Emeritus Professor of Philosophy, University, Melbourne, M.A. Sc. Dd. F.R.S., Thomas H. Laby, Professor of Natural Philosophy, University of Melbourne, M.A. Sc. D., F. Inst. P., E. T. Fisk, 97 Clarence Street, Managing Director, Amalgamated Wireless, J. Malone, M.I.R.E., A.M.I.E.E., Chief Wireless Inspector, F. G. Cresswell, Electrical Commander R.A.N., A.M.I.E.E., A.M.I.E.E.A., Geo. J. Weston, Supt. Coastal Radio Service, Melbourne. L. A. Hooke, 97 Clarence Street, Sydney, F. Leverrier, K.C., B. Carrister, W. T. S. Crawford, Radio Inspector, P.M.G. Dept., J. L. Mulholland, A. F. McDonald, M.I.R.E., Geo. Apperley, Joseph G. Reed, Samuel Toombs.

The objects for which the Institution is founded are subject to section 53 of the Companies Act, 1899 and as follows :—To promote the science and practice of radio telegraphy and radio telephony in all its branches and the usefulness and efficiency of persons engaged therein. To raise the character and status and advance the interests of the profession of radio telegraphy and radio telephony and those engaged therein. To increase the confidence of the mercantile and general community in the employment of recognised engineers and technical advisers by admitting to the Institution such persons only as shall have satisfied the Council of the Institution that they have a satisfactory knowledge of both the theory and practice of radio-telegraphy and radio telephony. To promote honourable practice to repress malpractice and to settle disputed points of practice and to decide all questions of professional usage and etiquette among persons engaged in the profession of radio telegraphy and radio telephony. To collect and circulate statistics and other information relative to radio-telegraphy and radio-telephony in all its branches. To provide for the delivery and holding of lectures exhibitions, etc. To encourage the study of radio in all its branches and to improve and elevate the general and technical knowledge of persons engaged or about to be engaged in the profession of radio. To conduct examinations, to award prizes, distinctions, certificates, establish scholarships, etc. In general to do all such other lawful things that the Institution may think incidental or conducive to the attainment of the objects of the Institution.

Up to 1932 the Wireless Institute of Australia which had been established in 1910 was the only active national body in the Commonwealth. There was a separate division in every State, with a Federal Executive located in Melbourne. Early in 1932 the vast majority of N.S.W. Members of the Wireless Institute decided that the time had arrived when a more professional body was necessary and that as the Wireless Institute was definitely of an amateur character in other States a movement was put on foot to resuscitate the Institution of Radio Engineers, Australia. After several conferences between the Council of the two Institutions amalgamation was arrived at which permitted of the first general meeting of the Institution of Radio Engineers taking place in May, 1932. The following were the

E. T. FISK.
F.Inst.R.E., A.M.I.E.E.Aust., M.Inst.R.E.Aust.
First President, Institution Radio Engineers.

offices for the year 1932-33, President, Mr. E. T. Fisk, Vice-President, Mr. N. S. Gilmour and Mr. W. Phil Renshaw, Honorary Treasurer, Mr. C. H. Norville, Councillors Messrs. L. P. R. Bean, L. A. Hooke, A. F. McDonald, W. T. S. Crawford, M. Tyler, T. W. Bushby, A. Emmelhainz, R. J. W. Kennell, F. W. P. Thom, R. Hill, Honorary Secretary Oswald F. Mingay.

The policy of the I.R.E. is as laid down in the Memorandum and is primarily for the encouragement of those engaged in the profession and secondly all persons interested in radio arts and sciences. An examination Board, consisting of Messrs. S. M. Grime, R. J. W. Kennell, Y. B. F. J. Groeneveld, is constituted to conduct examinations in respect to all applicants for membership referred to them by the Qualifications Committee which consists of Messrs. A. F. McDonald, W. T. S. Crawford, F. W. P. Thom, and D. Wyles. The standard of examination is taken from the Admiralty Handbook of Wireless Telegraphy 1931. Applicants for full membership generally have to submit a thesis of an acceptable character, while applicants for other grades who were unable to satisfy the Council as to their technical status are required to pass an examination based on the full contents of the Admiralty Handbook. The first examination will be held in October, 1933.

In February, 1933, a complete new set of Articles was submitted by Council to the members of the Institution and adopted. These were confirmed at the March Meeting and will come into operation as from April 1st, 1933, which is the beginning of the financial year.

During April, the Annual General Meeting will be held in Sydney and also the election of officers for the year 1933-34. A Branch will be opened in Melbourne and other States as soon as possible.

All particulars regarding the Institution can be obtained from the Honorary Secretary, 15 Castlereagh St., Sydney. Box 3120 G.P.O. Sydney.

Australian Federation of Broadcasting Stations.

360 COLLINS STREET, MELBOURNE. Telephone: F 2143 (2 lines).

Office Bearers for 1933.

President : Mr. M. B. Duffy.
Vice-Presidents : Messrs. Thorold Fink and A. E. Bennett.
Executive Committee : An executive committee is comprised of the President, Vice-Presidents and three members of the Council.
Members of Council : Messrs. O. J. Nilsen (3UZ), D. Worrall (3DB), O. Anderson (2UW), E. R. Voigt (2KY), J. B. Chandler (4BC), A. L. Holtze (5AD), A. Stoddard (6PR), W. A. Wilson (3BA), A. Fairhall (2KO).
Name of Secretary : Mr. G. L. Chilvers.

Aims and Objects of the Federation are :—

1. To stimulate popular interest in and support of broadcasting in Australia and to promote and defend the interests of licensed broadcasting stations individually and collectively.
2. To confer with and bring before the proper authorities any matters affecting broadcasting with a view to amelioration or improvement of the conditions.
3. To provide for and be a central medium of useful information available for all members and those associated or affiliated with the Federation and generally for the furtherance and promotion of their interests.

History of the Federation. The Federation was established at a Convention of stations held in Sydney in November, 1930, and at present has a membership of 38 licensed or " B " class broadcasting stations in the various States of the Commonwealth. There are many questions of common interest affecting the licensed stations, *e.g.*, fees for performing right, broadcasting of gramophone records, for the discussion of which the Federation has proved a useful medium both for members and for the outside bodies with whom the negotiations have been conducted. The system of having a number of licensed broadcasting stations in addition to the national stations has been established by the Commonwealth Government for many years, and the licensed stations are recognised as an important section of the broadcasting system. The aim of the stations has been to set a higher standard of quality in broadcasting programmes and it can be fairly claimed that the standard set by the licensed stations has been a considerable factor in inducing the Australian public to take such an intense interest in broadcasting.

The Radio and Telephone Manufacturers' Association.

Section of the Chamber of Manufacturers of N.S.W., 26 O'Connell Street, Sydney. BW 1844. Formed 1th November, 1927.

President. Mr. S. M. Grime.
Vice Presidents. Messrs. C. Plowman and L. P. R. Bean.
Secretary. Mr. P. S. Edwards.

AIMS AND OBJECTS of the Association are :—

(a) To render the maximum possible service to the trade in which its members are engaged.
(b) To assist the trade in its efforts to secure Tariff protection by co-ordinated effort.
(c) To promote closer relations and cordial co-operation in all branches of the industry.
(d) To advocate knowledge and learning in the science of business.
(e) To co-operate with other organisations in efforts towards economic advancement, standardisation and other activities.
(f) By any means of committees of skilled and experienced men to investigate solutions of the innumerable financial, technical, and commercial problems that confront us.
(g) To focus the general and sectional activities of the Association on the essential problems of the industry.

Radio Traders' Association of W.A.

(14 Weld Chambers, St. George's Terrace, Perth, W.A.)

The Radio Traders' Association of Western Australia is a section of the W. A. Wholesale Electrical Traders' Association. Headquarters 14 Weld Chambers, St. George's Terrace, Perth. Tel. B 9201.

The President : J. L. Mattinson. Management committee : Messrs. J. L. Mattinson, J. R. W. Gardam, F. L. Buhler, J. T. Pritchard, A. Thomson, H. U. Kendall and F. J. Bateman, Secretary : Mr. J. O. Smith, L.I.C.A.

Obviously the Association is to undertake such work which maybe deemed to the mutual interest of members and to the radio trade generally. A summary of the operations of the Association is as follows :—

Adoption of trade discount list. Adoption of rules and by-laws, designed for the maintenance of prices and discounts. Joint advertising and publicity campaign. First Annual Radio-Electrical Exhibition, 1932. which was most successful, and preliminary arrangements are now being made to hold a similar Exhibition during April of this year.

Date of formation of the Association, August 1929. The Association has always been a very active one, and has undoubtedly been of great benefit to Members, in addition to the Radio Trade in general.

The Electrical and Radio Association of New South Wales

The Grace Building, King, York and Clarence Streets, Sydney. M 2531.

Names of Officers, etc.

President: Mr. R. P. Godfrey (Godfrey Ltd.).

Senior Vice-President: Mr. J. Russell Greenwood (Anthony Hordern & Sons Ltd.).

Junior Vice-President: Mr. G. K. Dunbar (Associated General Electric Industries Ltd.).

Honorary Treasurer: Mr. C. Dunn (Noyes Bros. (Sydney) Ltd.).

Executive.

Messrs. P. L. Boswell (Boswell & Co.), H. W. Botten (Mick Simmons Ltd.), A. J. Bradshaw (Manly Municipal Council), A. Grundy (Nock and Kirby Ltd.), E. Hirst (British General Electric Co. Ltd.), A. E. Kaleski (Lawrence & Hanson Electrical Co. Ltd.), R. J. W. Kennell (New System Telephones Pty. Ltd.), F. L. Page (Parramatta and Granville Electric Supply Co. Ltd.), A. E. Pepper (W. G. Watson & Co. Ltd.), and A. Waddell (Coupland & Waddell).

Sectional Chairmen.

Section 1. Private Electricity Supply Undertakings: Mr. F. L. Page;
Section 2. Public Electricity Supply undertakings: Mr. A. J. Bradshaw.
Section 3. Overseas Manufacturers: Mr. C. Crome
Section 4. Australian Manufacturers: Mr. R. P. Grodfrey;
Section 5. Direct Representatives: Mr. A. E.Kaleski.
Section 6. Indentors: Mr. P. L. Boswell;
Section 7. Merchants: Mr. A. E. Pepper;
Section 8. Retailers: Mr. J. R. Greenwood;
Section 9. Contractors; Mr. T. P. Johnson;
Section 10. Radio Manufacturers: Mr. L. P. R. Bean;
Section 11. Radio Direct Representatives: Mr. G. K. Dunbar.
Section 12. Radio Wholesale Houses: Mr. F. Ainsworth
Section 13. Radio Retailers: Mr. A. Grundy;
Section 16, Electrical & Radio Development Association (ERDA): Mr. J. R. Greenwood.

Secretary: Mr. Andrew F. O. Brown.

Aims and Objects:

They are:—

1. To promote the trade interests of the members of the Association.
2. To assist and further the interests of producers, suppliers and consumers of electrical energy and of manufacturers distributors, contractors, purchasers, and users of electrical commodities and appliances, etc.
3. To encourage the use of standardised electrical material.
4. To secure for the persons, firms, companies, or corporations engaged in the manufacture or sale of electrical appliances, or employing electrical workmen, the benefits of the Industrial Arbitration Act, 1912, or any Act or Acts now passed or hereafter to be passed by the Legislature of the State of New South Wales or by the Parliament of the Commonwealthof Australia relating to industrial matters in connection with electrical workmen.
5. To originate and promote improvements in the laws connected with the electrical industry and to support or oppose alterations therein, and to effect improvements in administration in matters connected therewith.
6. To inaugurate and carry out publicity for the popularisation of electricity and electrical appliances and methods by the collection and distribution among members data relating to the electrical industry, and by advertising in approved directions the benefits of the use of electricity and to adopt such other means of publicity as may seem expedient for promoting the objects of the Association and/or educating the public to a better knowledge of the advantages and use of electric energy and appliances.
7. To provide for and be a central medium of useful and/or confidential information available for members of the Association, and generally for the furtherance and promotion of their business interests.
8. To further the objects herein contained or any of them by action directly indirectly or in co-operation with any other organised body or bodies having objects similar to those of the Association.

Date of Formation, etc.

The Association was formed nearly 25 years ago with the principal object of contesting wage claims then lodged by the Electrical Trades Union of Australia. These claims became the basis of an award which has probably the first electrical award made in the world. In those days and up to within three or four years ago the Association was known as the Electrical Employers' Association of New South Wales.

With the expansion of its services, however, this name was considered too restrictive, and it was changed by omitting the words "employers." Although the Association retains more than an active interest in industrial matters, its sphere of usefulness has been so widened that it caters now for every section of both the electrical and radio industries and only recently its name was further changed by including the words "and Radio" after "Electrical."

"ERDA."

The Electrical and Radio Development Association.

The Grace Building, King, York and Clarence Streets, Sydney. M 2531.

Some of its Services and Activities.

The ordinary services and activities of the Association include:—

1. Free advice to members as to their liabilities under Industrial Awards, Federal and State Legislation, or any other matter affecting their interests individually or collectively.
2. Representation on the S.A.A. Wiring Rules Committees, the Electricians, &c. (State) Conciliation Committee, the Municipal, &c., Councils (Electricians) Conciliation Committee, the Electrical Apparatus Safety Board, and other Public Bodies legislating in the Electrical Industry.
3. The encouragement of amicable relations between the many sections of the Electrical and Radio interests and also between employer and employee.
4. Use of accommodation exclusively set apart for members at the rooms of the Association, containing telephone, writing equipment, reference library local and overseas trade press, daily press, and other conveniences.
5. A copy of the official journal "ERDA," containing authentic and informative articles from reliable sources, posted free, each month.
6. Special and continuous activity towards stabilising and bettering conditions of the Electrical Trade, especially contracting.
7. A better service to the public—at least an implied warranty of standard in the work done by Association members; the maintenance of a high ethical standard in all business and trade relations.

The association is divided into Sections, and each Section looks after its own interests. The executive, that is the principal Committee, comprises one representative from each section, so that it can be said to be truly representative.

The subscription rates vary according to the Section, and it is possible for an electrical contractor or radio trader to be a member of the Association for as little as two guineas per annum, or roughly 10d. per week.

Chairman: Mr. J. Russell Greenwood (Anthony Hordern & Sons Ltd.).

Committee: Messrs. F. Aisnworth (Lawrence & Hanson Electrical Co. Ltd.), G. K. Dunbar (Associated General Electric Industries Ltd.), V. H.Mackinney (Philips Lamps (A/sia) Ltd.), T. E. Morgan (British General Electric Co. Ltd.) A. E. Pepper (W. G. Watson & Co. Ltd.), W. J. Wing (Amalgamated Wireless (A/sia) Ltd.), W. Wright (Standard Telephones & Cables (A/sia) Ltd.).

Secretary: Mr. Andrew F. O. Brown.

Aims and Objects, etc.

The Electrical and Radio Development Association or, as it is usually known by its initials, ERDA,is the Development Section of the Electrical and Radio Association of New South Wales and its sole function is the dissemination of publicity and propaganda as to the advantages of electricity and radio.

Date of Formation.

The Association was inaugurated in 1925 under the title of the "Radio Broadcast Bureau" for the purposes of radio publicity only and in these days it was affiliated with the parent Association. Later its scope of publicity was widened to include electricity and in this connection its name was changed to that it is to-day and an amalgamation with the parent body was then entered into.

One of the principal services of ERDA lies in the annual Electrical and Radio Exhibition which has been held in Sydney Town Hall each year since 1926. The immense publicity achieved by this display cannot be too highly valued and ERDA carries on the propaganda which the Exhibition so ably inaugarates at the commencement of every season.

Electrical Federation of Queensland.

Radio Traders' Section.

The Electrical Federation of Queensland, is formed for the purpose of promoting the welfare of members of the Federation and to further their interests by modern scientific methods of co-operation and organisation. To assist and further the interests of producers, suppliers and consumers of electrical energy, and of manufacturers, distributors, contractors, purchasers, and users of electrical commodities and appliances, and to promote and facilitate co-operative planning and inventions of various means and methods effective to this end. These are the general aims of such an organisation.

The President of the Federation 1932-33 is P. S. Trackson, Trackson Bros. Ltd., Elizabeth St., Brisbane, Vice-President: J. B. Daniell, Noyes Bros. (Sydney) Ltd., Elizabeth St., Brisbane, Chairman of the Radio Traders' Section: F. Hoe, Edgar V. Hudson Ltd., Charlotte St., Brisbane. More prominent Radio Traders in Brisbane are members of that section including Trackson Bros. Ltd., Noyes Bros. (Sydney) Ltd., Associated General Elect. Supplies Co. Ltd., J. B. Chandler & Co., Lawrence & Hanson Electrical Co. Ltd., Klarton Radio, Benns Radio Service Pty. Ltd., G. J. Grice Ltd., A. E. Harrold, E. V. Hudson Ltd., National Radio Company, King & King Ltd., Radio Supplies Unltd. The Federation is represented on the Electrical Workers' Board by Mr. P. S. Trackson; on the Uniform Wiring Rules Committee by Messrs. P. S. Trackson and R. F. Galloway and on the Group Apprenticeship Committee by Mr. P. S. Trackson. The Federation also sponsors a Sports Club and members and their friends meet about once a month to have a friendly game of golf.

Secretary: E. C. Fernandez, 334 Queen St., Brisbane. Tel. No. B 8626, G. P.O.Box No. 982M Brisbane.

Victorian Radio Association.

Head Office and Place of Meeting at Law Court Chambers, 191-195 Queen Street, Melbourne.

Head office and place of meeting at Law Court Chambers, 191-195 Queen St., Melbourne.

The objects of the Association are :—

(a) To promote the welfare of members of the Association and to further their interests by modern scientific methods of co-operation and organisation.

(b) To inaugurate and carry out publicly for the popularisation of radio by. advertising in approved directions and to adopt such other means of publicity as may seem expedient for educating the public to a better knowledge of the advantages of radio.

(c) To encourage the standardisation of radio material.

(d) To secure for members the benefits of any Act or Acts now passed or hereafter to be passed by the Legislature of the State of Victoria or by the Parliament of the Commonwealth of Australia relating to industrial or such other matters as may from time to time to determined by the Association in connection with the Radio Industry, and in general to do all such other lawful things as are incidental or conducive to the attainment of the objects for the benefit of members generally.

The activities of the Victorian Radio Association are divided up into several sections being :—

(1) Merchants' Section (2) Manufacturers' Section
(3) Retailers' Section (4) Broadcasting Stations
(5) Associate Members

Radio interests in Victoria were originally served by the Electrical Federation of Victoria, the constitution of which then provided for a radio section. In 1928 Radio interests weere entirely divorced from Electrical interests and the Federation from that date has operated wholly as an electrical organisation. At the beginning of that year the Wholesale Radio Association (Victoria) was formed and functioned until 1931, when it evolved into the present Victorian Radio Association.

The new organisation is proving very flexible and is able to deal satisfactorily with problems of each section of the Radio Industry as they arise. The association functions principally through its Council which is elected from the various sections, and has already demonstrated its status as representative of the Radio Industry in Victoria in negotiations which have taken place during the last couple of years with various Government bodies, and in particular, with the Federal Legislature where, for example, in the matter of the Australian Broadcasting Commissioner's Bill, certain influence was brought to bear in the Senate which with all due modesty, the Association claims was directly instrumental in having deleted from the bill at least one very objectionable clause : viz., that clause giving the Commission power to engage in trading activities. A reference to Commonwealth Hansard will indicate the extent to which the Association's influence was exerted in this direction.

The social side has not been neglected and during the last three or four years exceptionally successful annual dinners have been held. These functions have been very representative of the Radio Industry and have been most helpful in creating a social spirit among Radio traders.

Co-operation with the various Broadcasting Companies, in particular with the Australian Broadcasting Commission and its predecessors, has been an outstanding feature of the organisation's activities during the whole period of its existence, and close contact is at all times maintained with them.

The following are the officers of the Association of the various sections :—

President Mr. J. L. Mulholland, Vice-President Mr. J. L. Taylor, Treasurer Mr. D. Arguello, Secretary, Mr. A. D. Broad, 191 Queen St., Melbourne, Telephone, Central, 6926-7,

Manufacturers' Section.

Chairman Mr. K. G. Healing, Vice-Chairman, Mr. J. W. D. Bain, Representatives on Council, K. G. Healing, J. W. D. Bain, Deputy Representatives on Council, A. G. Warner, S. Aarons.

Merchants' Section.

Chairman H. V. Prior, Vice-Chairman, G. H. Neve, Representatives on Council H. V. Prior and G. H. Neve, Deputy Representatives on Council, K. T. Nicholls and A. Steward.

Retailers' Section.

Chairman A. F. Brash, Vice-Chairman, G, Sharwood, Representatives on Council, A. F. Brash and G. Sharwood, Deputy Representatives on Council E. S. Bailes and E. Williams.

Broadcasting Stations.

Chairman T. W. Bearup, Vice-Chairman J. S. Larkin, Representatives on Council T. W. Bearup and J. S. Larkin, Deputy Representatives on Council N. M. Sheppard and D. Worrall.

The Victorian Radio Association conducts the Radio Exhibition in Melbourne every year and these have been extremely successful.

Standards Association of Australia.

Established under the aegis of the Commonwealth and State Government for the promotion of Standardisation and Simplified Practice. Headquarters, Science House, Gloucester and Essex Streets, Sydney. Tel. B 1714. Telegrams, " AUSTANDARD " Sydney.

The objects for which the Association is established are :—

(a) To prepare and promote the general adoption of standards in connection with engineering structures, materials, matters and things and from time to time to revise, alter and amend the same ;
(b) To adopt such measures and take such steps and do all such things as may, in the opinion of the Main Committee, be conducive to the promotion of cordial relations between the Association and persons interested in the objects of the Association ;
(c) To co-ordinate the efforts of producers and users for the improvement of engineering materials, processes and methods ;
(d) To register in the name of the Association a Mark and to prove and affix or licence the affixing of such Mark to certain engineering materials and to enforce and protect the use of such Mark and to oppose any proceedings or applications which may seem calculated directly or indirectly to prejudice the interests of the Association ;
(e) To obtain any Royal Charter provisional order incorporation or Act of Parliament to enable the Association to carry its objects or any of them into effect ;
(f) To procure the recognition of the Association in any foreign country or place ;
(g) To invest the moneys of the Association not immediately required for its purposes in or upon such investments, securities or properties as may be thought fit ;
(h) To do all such other things as are incidental and the Association may think conductive to the attainment of the above objects or any of them.

CHAIRMAN, Sir George Julius, B.Sc., B.E., M.I. Mech.E., M.I.E.Aust., VICE-CHAIRMAN, Mr. W. E. Wainwright, A.S.A.S.M., M.Aust. I.M.M., M.Am.I.M.M., CHIEF EXECUTIVE OFFICER, Mr. W. R. Hebblewhite, B.E., A.M.I.E.Aust. The Standards Association was established 1st July, 1929, by amalgamation of the Australian Commonwealth Engineering Standards Association (founded 1922) and the Australian Commonwealth Association of Simplified Practice (founded 1927), has over 500 Committees including over 4,000 technical experts.

Of particular interest to the radio trade is the fact that the Association has an Electrical Committee with a wireless components and accessories Sub-Committee and a Wiring Rules Committee. The Chairman of these Committees are :—ELECTRICAL COMMITTEE, Northern Section (Sydney)—Mr. W. S. Corner, Southern Section (Melbourne)—Mr. H. R. Harper. WIRELESS COMPONENTS AND ACCESSORIES SUB-COMMITTEE—Mr. R. Lawson, P.M.G. Dept. WIRING RULES COMMITTEE—Sir George Julius, N.S.W. SUB-COMMITTEE—Mr. A. C. F. Webb, VICTORIAN SUB-COMMITTEE—Mr. W. Halabaster, QUEENSLAND SUB-COMMITTEE—Mr. W. Arundell, SOUTH AUSTRALIAN SUB-COMMITTEE—Mr. W. Hobba, TASMANIAN SUB-COMMITTEE—Mr. A. P. Benns, WESTERN AUSTRALIAN SUB-COMMITTEE—Mr. F. C. Edmondson.

Radio Research Board.

The Council for Scientific and Industrial Research in Australia undertakes many activities among which is control of the Radio Research Board, which with the co-operation of the Postmaster-General's Dept., various Universities, etc., conducts radio research.

The following constitutes the Council for Scientific and Industrial Research :—

Executive. Sir George Julius, Kt., B.Sc., B.E., (Chairman), A. C. D. Rivett, Esq., M.A., D. Sc., (Deputy Chairman and Chief Executive Officer), Professor A. E. V. Richardson, M.A., D.Sc.

Chairmen of State Committees. Professor R. D. Watt, M.A., B.Sc. (N.S.W.), Sir David O. Masson, K.B.E., F.R.S., &c. (Vic.), Professor H. C. Richards, D.Sc., (Queensland), Sir Walter J. Young, K.B.E. (Sth. Aust.), B. Perry Esq. (W.A.), P. E. Keam, Esq. (Tas.).

Co-opted. Members. Professor E. J. Goddard, B.A., D.Sc., Professor H. A. Woodruff, M.R.C.V.S., &c.

Secretary. G. Lightfoot, M.A., headquarters 314 Albert St., East Melbourne Vic.

The Radio Research Board has issued five reports to date as follows :—Report No. 1, Bulletin No. 47, issued 1931 ; subjects : 1, Corrections to Field Strength Measurements with Loop Antennae, by W. G. Baker, B.Sc., B.E., and L. G. H. Huxley, M.A., D. Phil (Oxon.). 2. A Radio Field Stength Survey Within 100 Miles of Sydney; by W. G. Baker, B.Sc., B.E., and O. O. Pulley, B. Sc., B.E.

Report No. 2, Bulletin No. 59, 1932 : 1. The State of Polarization of Sky Waves, by A. L. Green, M. Sc., 2. Height Measurements of the Heaviside Layer in the Early Morning, by A. L. Green, M.Sc.

Report No. 3, Bulletin No. 60, 1932 : 1. The Influence of the Earth's Magnetic Field on the Polarization of Sky Waves, by W. G. Baker, B.E., B.Sc., and A. L. Green, M.Sc.

(Radio Research Board.—Cont.)

Report No. 4, Bulletin No. 63, Subject: 1. A preliminary Investigation of Fading in New South Wales, by A. L. Green, M.Sc., and W. G. Baker, B.E., B.Sc., 2. Studies of Fading in Victoria: A Preliminary Study of Fading on Medium Wave-lengths at Short Distances by R. O. Cherry, M.Sc., and D. F. Martyn, Ph.D., A.R.C.Sc. 3. Studies of Fading in Victoria: Observations on Distant Stations in which no Ground Wave is received, by R. O. Cherry, M.Sc., Melbourne 1932.

Radio Research Board, Report No. 5, Bulletin No. 68: Subject: Atmospherics in Australia. 1. by G. H. Munro, M.Sc., A.M.I.E.E., and L. G. H. Huxley, M.A., D. Phil. Melbourne, 1932.

Further particulars concerning the activities of the reports of the Radio Research Board can be obtained from the Secretary, 314 Albert St., East Melbourne, Vic.

RADIO RETAILERS ASSOCIATION OF N.S.W.

15 CASTLEREAGH STREET, SYDNEY.

OBJECTS:

To promote the welfare of members of the Association, and to further their interests by modern scientific methods of co-operation and organisation. To inaugurate and carry out publicity for the popularising of radio by advertising in approved directions and to adopt such other means of publicity as may seem expedient for educating the public to a better knowledge of the advantages, etc., of radio.

To provide a centre of information, instruction and advice on all matters pertaining to the business of members, and generally to do all such other things as are incidental or conducive to the attainment of all the objects of the Association.

This Association was formed at an initial meeting held 25th August, 1932, and the following have been elected provisional officers and committee:—

President, Mr. Nathan (Nicholson's Ltd.); Vice-President, Mr. E. F. Wilks (E. F. Wilks & Co. Ltd.), Committee, Messrs. McEwan, (Winkworths Ltd.), Oswin (Heiron & Smith Ltd.), Wodell (Hazell & Moore Ltd.), and Messrs. Tree (Willoughby) and Russell (Eastwood), Secretary, O.F. Mingay.

Subscription: City Members, £2/2/-, Suburban and Country Members, £1/1/-.

Rates of Postage.

Within the Commonwealth and to Lord Howe Island, Norfolk Island, Papua, the Territory of New Guinea, and the following islands in the Pacific, viz: Bismarck Archipelago (New Britain, New Ireland, New Hanover, Admiralty Islands, etc.), Nauru, Bougainville, and Buka (Solomon Islands).

Letters and Lettercards.—2d. per oz.

Postcards—1½d. each.

Second Class Matter—(a) Commercial Papers, Patterns, Samples and Merchandise, 1d. per 2 oz., (b) Printed Matter (comprising Printed Papers, Circulars and Catalogues, and Books, Periodicals and Newspapers not registered at a General Post Office) 1d. per 4 oz.

NOTE.—Commercial Papers include partly printed routine communications as prescribed, and formal documents such as accounts, invoices, etc.

Printed Matter includes wholly printed communications such at acknowledgments of the receipt of correspondence, orders or remittances, and notifications of the despatch of goods, etc., also catalogues containing samples of material subject to prescribed conditions.

Permit Mail, *i.e.*, large quantities of circular letters posted in sealed envelopes under permit previously obtained—Printed matter rate plus special fee of ½d. per article.

Third Class Mail Matter (comprising books, periodicals and Newspapers registered at a General Post Office for transmission as such).—1d. per 6 oz.

Beyond the Commonwealth.—Letters and Lettercards. To places within the British Empire, and to New Hebrides, Banks and Torres Islands.—2d. per oz.

To all other places.—3d. first oz., 2d. each additional oz.

Postcards.—To places within the British Empire and to New Hebrides, Banks and Torres Islands.—1½d. each.

To all other places—2d. each.

Commercial Papers.—To New Zealand and the islands annexed thereto, and Fiji—1d. per 2 oz.

To all other places.—1d. per 2 oz., with a minimum of 3d.

Printed Matter.—To places within the British Empire, and to New Hebrides, Banks and Torres Islands—1d. per 4 oz.

To all other places.—1d. per 2 oz.

Newspapers.—To New Zealand and the islands annexed thereto, and Fiji—1d. per 6 oz.

To the United Kingdom and Irish Free State.
via France or America.—1d. per 4 oz.
via All Sea Route. —1d. per 6 oz.

To all other places Printed Matter Rates apply.

Samples.—To places within the British Empire, and to New Hebrides, Banks and Torres Islands.—1d. per 2 oz.

To all other places.—1d. per 2 oz., with a minimum of 2d.

Merchandise.—To New Zealand and the Islands annexed thereto, and Fiji only.—1d. per 2 oz.

Small Packets (transmissible to certain countries only).—2½d. per 2 oz., with a minimum of 6d.

Postal Notes.—1/– to 2/6, 1d; 3/– to 5/–, 1½d.; 5/6 to 7/6, 2d.; 10/– to £1, 3d.

Commonwealth.

Telegraph Information.

Urgent Rate Telegrams. Urgent rate telegrams are treated with the utmost expedition at all stages, being given precedence over ordinary rate telegrams.

Ordinary Rate Telegrams. The ordinary rate telegram constitutes the normal telegraph service. The Department aims at giving a uniformly high grade of service in the treatment of this class of telegram.

Press Telegrams. Press telegrams are transmitted at specially low rates.

Lettergrams. Lettergrams are accepted at any hour, at telegraph offices which are open after 7 p.m., for delivery as letters on the following day. Exceptionally low rates—½d. per word with a minimum charge of 1/3d. for 30 words—are applied to these messages.

Multiple Telegrams. A telegram addressed to a number of persons at one telegraph destination is accepted at greatly reduced rates. The sender need prepare only one copy of the telegram and a list of addresses for delivery in any one town or locality served by the same telegraph office. Each addressee receives a separate copy of the telegram.

Reply-Paid Telegrams. The sender of a telegram may prepay the charge for a reply.

Collect Telegrams. The charge for a telegram may be collected on delivery if the sender gives a guarantee.

Acknowledgment of Delivery. The sender may obtain an acknowledgment of delivery.

Local Telegrams. Messages may be lodged for delivery to places within the delivery area of the telegraph office, the charge being 16 words for 9d., each additional word 1d.

Repetition Telegrams. A sender may have his telegram repeated back to him from the office of destination.

Registered Telegraphic Code Address. Telegraph code addresses may be registered, the fee for Commonwealth telegrams being £2 2s. 0d. per annum and for International telegrams 10s. 6d. per annum.

Deposit Accounts for Telegrams. Under the Deposit Account System the charges on telegrams lodged may be paid periodically instead of payment being made for each individual message at time of lodgment.

Transmission of Telegrams by Telephone. Telegrams and lettergrams may be telephoned to a telegraph office for onward transmission. Telegrams addressed to a telephone number will be telephoned to the addressee.

Radiotelegrams. Messages may be lodged at any telegraph office for transmission to vessels at sea, the rates varying from 6d. to 11d. per word.

Telegraph Rates Within the Commonwealth.

Ordinary Telegrams	Town and suburban, or within 15 miles of sending station (within the State).	Other places within the State	Interstate.
Not exceeding 16 words (including address and signature	9d.	1/–	1/4
Each additional word ...	1d.	1d.	1d.

Urgent Rate Telegrams. Double the ordinary rates. Double rates are also charged on Sundays, Christmas Day, Good Friday and after hours.

Lettergrams. Not exceeding 30 words 1/3
Each additional word ..... ½d.
(Double rates on Sundays, Christmas Day and Good Friday.)

To the United Kingdom.

Classification.	Rate per Word. By Cable via Pacific or via Eastern.	Rate per Word. By Wireless via Beam
	s. d.	s. d.
Ordinary rate	2 0	1 8
Urgent rate	6 0	5 0
Deferred	1 0	0 10
Daily letter telegram	0 9 (Minimum charge, 15/–)	0 6 (Minimum charge, 10/–)
Week-end telegrams ...	0 7½ (Minimum charge, 12/6)	0 5 (Minimum charge 8/4)

Picturegrams. Pictures, photographs and documents may be transmitted by the picturegram service between Melbourne and Sydney, the charges for a picturegram 4 in. × 4 in. are 35s. (A grade) and 30s. (B grade); for a picturegram 7 in. × 5 in. the charges are 45s. (A grade) and 35s. (B grade); while the rates for a picturegram 7 in. × 10 in. represent 60s. (A grade) and 40s. (B grade).

Telephone Services and Rates.

Exchange Services.

The minimum annual rental for an exclusive service to any telephone exchange within a radius of 15 miles of the General Post Office, is £5 10s. 0d. where the length of the line is not more than two miles radially from the exchange. If the distance exceeds two miles, an extra charge is made.

For a two-party service the basic rental for each subscriber or telephone connected is £4 7s. 6d. per annum.

The rentals for services connected to country exchanges are lower, and they vary according to the number of subscribers with whom a subscriber may converse without payment of trunk line fees. Details may be obtained from the Telephone Branch or the local Postmaster.

Auxiliary Facilities.

Private branch exchanges, private telephone lines, extension services, fire alarm lines, and burglar alarm circuits are provided, the charges being dependent upon the nature and extent of the service. Full information regarding the facilities obtainable and the rates therefor may be obtained upon application to the Superintendent, Telephone Branch, Melbourne, C.1 (Central 132) and all capital cities.

Local Calls.

Subscribers connected to exchanges in the Metropolitan telephone network may converse with other subscribers in that area for the unit fee of 1¼d. for each effective call. For this fee subscribers may also call subscribers connected to any exchange outside the network, but within a five-mile radius of the calling exchange. The rate for a local call from a public telephone is 2d.

Trunk Line Calls.

Calls on week days are charged for at the rates shown in the following table :—

Radial distances between exchanges or networks not exceeding —	Each **three minutes** or part thereof. (Between 9 a.m. and 6 p.m.) **Day rate.**	(Between 6 p.m. and 9 p.m. and 7 a.m. and 9 a.m.) **Intermediate Rate.**	(Between 9 p.m. and 7 a.m.) **Night rate.**
	s. d.	s. d.	s. d.
10 miles	0 2	0 2	0 2
20 ,, ...	0 4	0 4	0 4
30 ,, ...	0 6	0 5	0 4
40 ,, ...	0 8	0 6	0 4
50 ,, ...	0 10	0 8	0 5
60 ,, ...	1 0	0 9	0 6
80 ,, ...	1 3	1 0	0 8
100 ,, ...	1 6	1 2	0 9
150 ,, ...	2 0	1 6	1 0
200 ,, ...	2 6	1 11	1 3
250 ,, ...	3 0	2 3	1 6
300 ,, ...	3 6	2 8	1 9
350 ,, ...	4 0	3 0	2 0
400 ,, ...	4 6	3 5	2 3
500 ,, ...	5 3	4 0	2 8
600 ,, ...	6 0	4 6	3 0
700 ,, ...	6 9	5 1	3 5
800 ,, ...	7 6	5 8	3 9
900 ,, ...	8 3	6 3	4 2
1000 ,, ...	9 0	6 9	4 6
Each additional 150 miles or portion thereof	1 0	0 9	0 6
INTERSTATE CALLS —			
Melbourne – Sydney	5 3	4 0	2 8
Melbourne – Brisbane	8 3	6 3	4 2
Melbourne – Adelaide	5 3	4 0	2 8
Melbourne – Perth	14 0	10 6	7 0

The rates specified are in addition to the unit call fee.

On Sundays, Christmas Day and Good Friday the rates are equal to those charged on other days, excepting that the normal day rate applies between 7 a.m. and midnight. There is no intermediate rate, and the night rate applies only to calls between midnight and 7 a.m.

Where a call is ordered for connection to a particular person at the required number a person-to-person fee of 3d. on calls of 100 miles or less and 6d. on calls beyond 100 miles is charged.

Calls may be made to residents who are not telephone subscribers. If practicable, the Department will send a messenger to advise the called party that he is required on the telephone. A fee of 3d. is charged when the person resides within the usual radius of free delivery of telegrams; beyond that distance the porterage fees for the delivery of telegrams are charged in addition to the fee of 3d.; alternatively, advice that his attendance is desired at the telephone will be delivered to the resident with his mail matter. The person-to-person fee is charged in each case.

Overseas Radio Telephone Services, as at 27/1/33.

Countries to which telephone service from Australia may be obtained.

Country	Date service was opened	Minimum charge (3 minutes' conversation	Each extra minute	Report charge
		£ s. d.	£ s. d.	££ s. d.
*Argentina (Buenos Aires province)	8/4/31	9 0 0	3 0 0	1 0 0
,, (other towns) ...	8/4/31	9 18 0	3 6 0	1 0 0
Austria	26/5/30	7 4 0	2 8 0	1 0 0
*Balearic Islands (Majorca)	22/7/32	7 7 0	2 9 0	1 1 0
Belgium	14/5/30	6 6 0	2 2 0	14 0
Brazil (Rio de Janeiro) ...	9/9/31	9 0 0	3 0 0	1 0 0
*Canada—				
1st zone	31/10/30	9 0 0	3 0 0	1 0 0
2nd ,, ...	31/10/30	9 12 0	3 4 0	1 0 0
3rd ,, ...	31/10/30	10 4 0	3 8 0	1 0 0
4th ,, ...	31/10/30	10 16 0	3 12 0	1 0 0
5th ,, ...	31/10/30	11 8 0	3 16 0	1 0 0
*Canary Islands	22/7/32	8 2 0	2 14 0	1 6 0
*Ceuta (North Africa) ...	22/7/32	7 10 0	2 10 0	1 2 0
*Cbile	8/4/31	10 16 0	3 12 0	1 0 0
Cuba (Havana)	27/10/30	11 8 0	3 16 0	1 0 0
,, (other towns) ...	27/10/30	12 0 0	4 0 0	1 0 0
Czecho-Slovakia	23/5/30	7 7 0	2 9 0	1 1 0
Danzig (Free City)	22/5/30	7 1 0	2 7 0	19 0
Denmark	16/5/30	7 7 0	2 9 0	1 1 0
*Egypt (certain towns only)	19/9/32	7 4 0	2 8 0	16 0
Finland	20/6/30	7 13 0	2 11 0	1 3 0
France	12/5/30	6 6 0	2 2 0	14 0
Germany	19/5/30	7 1 0	2 7 0	19 0
Gibraltar	28/6/30	7 4 0	2 8 0	1 0 0
Great Britain	30/4/30	6 0 0	2 0 0	12 0
Holland	15/5/30	6 6 0	2 2 0	14 0
Hungary	27/5/30	7 10 0	2 10 0	1 2 0
Irish Free State (Dublin only)	3/2/31	6 6 0	2 2 0	14 0
Italy	21/7/30	7 4 0	2 8 0	1 0 0
Java	23/12/30	6 0 0	2 0 0	12 0
Latvia	1/4/31	7 1 0	2 7 0	19 0
Lithuania	1/8/30	7 1 0	2 7 0	19 0
Luxemburg	22/5/30	6 6 0	2 2 0	14 0
Mexico	27/10/30	12 0 0	4 0 0	1 0 0
New Zealand	25/11/30	3 0 0	1 0 0	6 0
Northern Ireland (and Isle of Man)	30/4/30	6 6 0	2 2 0	14 0
Norway	21/5/30	7 10 0	2 10 0	1 2 0
Poland	22/5/30	7 10 0	2 10 0	1 2 0
Portugal (Lisbon only) ...	5/12/32	7 10 0	2 10 0	1 2 0
Roumania	9/11/31	7 16 0	2 12 0	1 4 0
*South America—				
1st zone	8/4/31	9 0 0	3 0 0	1 0 0
2nd ,, ...	8/4/31	9 18 0	3 6 0	1 0 0
3rd ,, ...	8/4/31	10 16 0	3 12 0	1 0 0
Spain	28/6/30	7 4 0	2 8 0	1 0 0
Sweden	20/5/30	7 7 0	2 9 0	1 1 0
Switzerland	13/5/30	6 18 0	2 6 0	18 0
†Trans-Atlantic Liners ...	1/11/31	7 4 0	2 8 0	16 0
*Uruguay	8/4/31	9 18 0	3 6 0	1 0 0
*U.S.A.—				
1st zone	27/10/30	9 0 0	3 0 0	1 0 0
2nd ,, ...	27/10/30	9 12 0	3 4 0	1 0 0
3rd ,, ...	27/10/30	10 4 0	3 8 0	1 0 0
4th ,, ...	27/10/30	10 16 0	3 12 0	1 0 0
5th ,, ...	27/10/30	11 8 0	3 16 0	1 0 0
6th ,, ...	27/10/30	12 0 0	4 0 0	1 0 0
Vatican State	6/4/31	7 4 0	2 8 0	1 0 0

*See details of zones attached.

†"Majestic," "Olympic," "Homeric," "Empress of Britain," and "Leviathan" whilst at sea.

At present, for calls other than New Zealand and Java, a surcharge of 2/– in the pound, assessed on the total cost of the call, is made to cover exchange.

CANADIAN AND AMERICAN TELEPHONE ZONES.

Canada.

First zone: South and East Quebec, including Montreal and City of Quebec; South-east of Ontario, including Ottawa and Toronto.

Second zone: The rest of Quebec, Nova Scotia, New Brunswick, and Central part of Ontario.

Third zone: The rest of Ontario and Province of Manitoba.

Fourth zone: Provinces of Saskatchewan and Alberta.

Fifth zone: British Columbia.

United States of America.

First zone: States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Delaware, District of Columbia.

Second zone: States of Ohio, Indiana, Illinois, Michigan, Wisconsin, Virginia, West Virginia, North and South Carolina, Georgia, Kentucky, Tennessee.

Third zone: States of Florida, Alabama, Mississippi, Minnesota, North and South Dakota, Iowa, Nebraska, Missouri, Kansas, Arkansas, Oklahoma, Louisiana.

Fourth zone: States of Montana, Wyoming, Idaho, Colorado, Utah, New Mexico, Texas.

Fifth zone: States of Washington, Oregon, California, Nevada, Arizona, and Town of Havana (Cuba).

Sixth zone: Mexico and rest of Cuba.

South America.

First zone: City and Province of Buenos Aires.

Second zone: The remainder of Argentina and the following towns in Uruguay:—Colonia, Montevideo, Rosario, and Colonia Suiza.

Third zone: Chile (Valparaiso, Vina del Mar, and Central Santiago only).

Balearic Islands—Majorca Island only.

Canary Islands —Grand Canary and Teneriffe Islands.

Ceuta —Spanish Morocco.

Egypt —Cairo, Alexandria, Port Said, Assuan, and Luxor.

Beam Wireless—A Great Australian Service.

Spanning the gap between Australia and Great Britain is the longest telegraph service in the world, yet the means of communication are invisible, being an unseen track through the intangible ether.

The Beam differs from other forms of wireless communication inasmuch as it concentrates the rays of energy bearing the message in a particular direction, very much in the same way as a searchlight projects a ray. Such a system has the advantage of conserving the power used and not dissipating it in every direction.

The possibilities of a Beam system were investigated early by Mr. E. T. Fisk, Managing Director of Amalgamated Wireless, who, working in collaboration with the Marchese Marconi on the other side of the world, realised the great advantages of such a method. Indeed it was one of several main objectives towards which Mr. Fisk was directing his scientific and organising ability. Six years ago the Beam was brought into operation by A.W.A.

To Most Parts of the World.

To-day anyone can enter the Beam Offices at Sydney or Melbourne or any Post Office in the Commonwealth and lodge a message via Beam to even the remote places of the earth—to Esthonia or Finland in Europe, Yukon or Alaska in North America, to Porto Rico or San Domingo in the West Indies, Guatemala or Costa Rica in Central America. Day and night messages are being despatched direct by Beam to Great Britain and Canada, whence they are relayed to surrounding countries as required.

It was on April 8th, 1927, that the Beam Wireless Service between Australia and Great Britain was opened for commercial traffic, and on June 16th, 1928, the service from Australia to North America was instituted. The latter service provided not only communication with the New World but also a second link with England and the Continent via the Montreal-London Beam circuit.

From the very beginning the Beam sprang into popular favour, the rates were lowered and to-day about 70% of the total traffic between Australia and England travels via Beam. The reduced charges mean a great saving to the public which up to the end of June last year was estimated at £700,000. Such a sum is a very handsome return upon the Commonwealth Government's investment of £350,000 in Amalgamated Wireless.

Travelling by electrical impulse, the Beam Wireless messages actually bridge the gap between Australia and England in about one-seventh of a second, the messages are usually sent by mechanical means at the rate of about 200 words a minute. The Beam Offices in Sydney and Melbourne are open for traffic day and night.

Automatic Transmissions.

The Beam Wireless transmitting centre in Australia is located near Ballan about 50 miles north-west of Melbourne and the receiving centre is at Rockbank, 30 miles from Ballan. Both stations are connected by special telegraph lines with the Beam Wireless Offices of Amalgamated Wireless at Melbourne and Sydney. At Ballan there are two transmitters. One is used for sending messages to England and the other transmits to Montreal all messages for North and South America. A great deal of the equipment is in duplicate, some in triplicate to insure continuity of service under all conditions. Each station is supervised by a technical staff. The transmission of messages originates at the Beam Offices at the heart of Melbourne or Sydney. The telegraph operators at these centres, working with special telegraph lines to the Beam station, automatically cause the transmitters at Ballan to radiate the messages. Incoming messages from London or Montreal are received at Rockbank and automatically passed on to the telegraph centres at Sydney or Melbourne where they are recorded on tape.

As the messages are lodged at the Post Offices throughout the Commonwealth or at the Beam Offices they are passed on in a continuous stream to telegraphists who are seated at machines resembling typewriters. Actually these machines are high speed automatic perforators. As quickly as an expert types, the messages are transcribed by this machine, but instead of recording them in letters of the ordinary alphabet, the machine punches in the form of a series of small perforations on paper tape about half an inch wide similar to music rolls in player pianos. There is a distinctive series of perforations corresponding to ordinary Morse character to each letter. The rate of transmission is much greater than the rate at which an operator can work a perforating machine, and it is therefore necessary to keep several operators employed punching tape to satisfy the speed of transmission.

The tape after being punched is passed through an automatic transmitter at high speed and the signals are picked up by the Beam receiving station at Skegness, England, or Yamachiche, Canada, where it is recorded by machines.

In addition to the Beam stations, smaller stations or units are required for collecting the outward traffic and feeding it to the main Beam station and also for distributing the inward Beam traffic to other States. These smaller units, known as Beam Feeder transmitters and Beam Feeder receivers, have been installed at practically every Australian capital. Two Beam feeder transmitters are located at Sydney, two at Melbourne and one each at Adelaide, Perth, and Brisbane. These stations transmit traffic direct by wireless to the Beam traffic office, Melbourne, whence it is automatically transmitted overseas via the Ballan transmitting station.

Communication Services of the Postmaster-General's Department

Australia is a land of vast distances with a few widely separated rather densely populated areas of small extent and extensive territories carrying extremely small densities of population.

The area of the Continent is roughly 3 million square miles and its present population is about 6½ millions, 3¼ millions of whom are resident in the six State capital cities. The average distribution of the remainder is therefore only one per square mile. To traverse the boundaries of the Continent one would have to travel 12,000 miles. A mental picture of these conditions is helpful in forming a conception of the nature and magnitude of the problem of providing comprehensive communication services. The problem is mainly one of economics resulting from the necessity to maintain long lines of communication—postal, telegraphic and telephonic—for the transaction of comparatively small volumes of business. Almost anything may be achieved if the cost need not be counted.

The Post Office has managed to establish mail services of so extensive a character that it is doubtful whether there is any locality permanently inhabited by so few as two or three white people which is not systematically served with letter delivery. Neither the telegraph nor telephone can claim to be so far reaching, but as will appear later their ramifications are remarkably extensive.

The internal postal system depends upon scheduled despatches over 27,000 miles of railway and in addition makes use of 5,000 independent road services to localities which have not railway facilities. These road services are maintained under contract conditions and cover 130,000 miles of route. The frequency of the journeys varies in the aggregate from once daily to once a week with a comparatively small percentage extending to once a fortnight or slightly more. It will be realised, therefore, that the journeys during a year would total many millions of miles. Over the road routes mail matter is conveyed by motor vehicle, horsedrawn vehicle, on horse-back, pack-horse, and occasionally by camel. For many miles in the outlying parts roads are not available and somewhat indefinite tracks point the way.

Coastal vessels sailing over the entire circuit of the Continent are also used in the regular transportation of mails.

The air mail services cover roughly 6,000 miles of route, the journeys over which total 907,000 miles per annum.

Mail steamers provide a weekly mail service in each direction between Australia and the United Kingdom, these ships running to schedule so that they may effect connection with railway services and air services at various places both at the terminal ports and at intermediate calling places. Letters are landed at Fremantle and conveyed by rail to Adelaide (1,698 miles), Melbourne (2,181 miles), Sydney (2,771 miles), and Brisbane (3,384 miles).

The articles of mail matter posted in the Commonwealth total 886,800,000 per annum and the incoming items from overseas which require distribution over the whole Continent reaches 44,484,000 per annum.

The telephone system comprises 485,000 telephones and apart from about 14,000 in Tasmania there is almost complete intercommunication over the whole Continent; a subscriber in Cairns, Queensland, can talk to a subscriber in Geraldton, Western Australia, over lines 4,800 miles in length, possibly a world's record for a continuous land-line circuit.

Four hundred million local and 30 million trunk line calls are established annually through 6,000 telephone exchanges by the use of 2½ million miles of wire.

The aerial lines are supported by 25 million insulators carried on 3 million poles.

192,000 telephones are provided with dials and connected to automatic exchanges.

The capital value of the telephone equipment and buildings is £43,000,000.

Direct radio telephone services are established from Australia to the United Kingdom, to New Zealand and to Java. There are few places in the world to which it is impossible to telephone from Australia. Out of a total of 33 million subscribers in the world 92 per cent. are in countries accessible to Australian subscribers and in addition it is possible to telephone to passengers aboard transatlantic liners whilst on their journey between England and the United States.

The telegraph service is conducted from 10,000 offices interconnected by 169,000 miles of circuit. It deals with 15 million telegrams per annum. Like the telephone service it has been completely modernised and uses every device which will aid in securing speedy and accurate service with lessened cost. Automatic direct printing telegraph apparatus is used extensively and long distance circuits, such as Perth to Sydney (2,770 miles), are equipped with this system. The typing of a message on a typewriter keyboard in Perth results in an almost simultaneous replica being produced in Sydney.

Carrier circuits which are derived by impressing a continuous train of moderately high frequency electrical oscillation on a metallic circuit have been established extensively for both telephone and telegraph purposes with great benefits from the technical, traffic and economic aspects. The various technical methods of providing for the simultaneous transmission of a number of messages over one metallic circuit have been exploited to the utmost. As a case in point, over one pair of wires between Sydney and Melbourne 36 telegrams are transmitted by machine printing system simultaneously with a telephone conversation. If the traffic offering were sufficient to warrant more carrying capacity the output could be increased to 88 telegrams and one simultaneous telephone conversation.

Pictures of high quality are also transmitted over 600 miles of carrier circuit between Melbourne and Sydney and it is possible for a photograph of, say, a Melbourne Cup to be available in Sydney within about an hour of the running of the race.

Broadcasting services also are of an extensive character. They are divided into two groups. One comprises the national service—Government owned—the programmes being supplied by the Australian Broadcasting Commission and the technical services by the Post Office, the other consisting of licensed stations operated by private enterprise. There are eight national stations in the capital cities and four in the country areas. The number of regional stations in the country areas will be added to substantially in the near future. These stations form a network designed to provide extensive coverage and on completion of the scheme will be sufficient to serve effectively about 95 per cent. of the total population.

The land line telephone circuits have been equipped to make them suitable for broadcasting transmissions, and any desired grouping of broadcasting stations can thus be arranged for the simultaneous radiation of any particular programme. From the Rockhampton station in Queensland to the Perth station in Western Australia the circuit distance is 3,800 miles and on several occasions programmes have been simultaneously broadcast at these extreme distances with many other of the intermediate broadcasting stations transmitting the same programme at the same time.

The privately owned group consists of 46 broadcasting stations which are distributed in the more densely populated areas of the Commonwealth. Frequently, by mutual arrangements amongst the managements of a number of these stations, extensive simultaneous broadcasting is effected. In a recent instance there were no less than 42 privately owned stations simultaneously transmitting by means of the Post Office telephone trunk system an opera from one of the Melbourne theatres.

At the end of December, 1932, there were 420,000 listeners representing 6.40 per hundred of the population, each of these paying an annual fee of 24/-.

Broadcasting has changed the life of the people in the remote areas who formerly had only infrequent information and news from the cities and the outside world. To-day they are well informed on current events and can enjoy the music from the studios, concert halls and theatres in the cities.

The Post Office in normal times (1929) employs 42,000 people to conduct its postal, telephone, telegraph and radio activities. In the year 1929 its expenditure was £16,755,000 (capital expenditure—£3,878,000); its revenue £12,934,000 and turn-over £133,719,000.

Ages of Population—Australia, 1931 (a).

(Exclusive of full blood Aboriginals.)

Age last Birthday.	31st December, 1931.		
	Males	Females	Persons
0–4	312,635	300,935	613,570
5–9	322,805	313,085	635,890
10–14	305,110	295,880	600,990
15–19	313,700	302,525	616,225
20–24	290,410	269,100	559,510
25–29	266,965	240,405	507,370
30–34	242,665	239,865	482,530
35–39	237,925	241,395	479,320
40–44	229,710	221,620	451,330
45–49	195,595	187,640	383,235
50–54	161,845	156,375	318,220
55–59	132,800	128,870	261,670
60–64	114,635	108,110	222,745
65–69	90,540	86,005	176,545
70–74	60,360	59,045	119,405
75–79	30,125	30,385	60,510
80–84	11,565	13,750	25,315
85–89	3,790	5,225	9,015
90–94	937	1,230	2,167
95–99	150	172	322
100 and over.	20	16	36
Total	3,324,287	3,201,633	6,525,920
6–13	502,415	487,855	990,270
14–20	435,650	418,985	854,635
21–64	1,812,445	1,736,875	3,549,320
65 and over.	197,487	195,828	393,315

(a) Estimate, subject to amendment when Census is taken.

Population and Vital Statistics—Summary, Australia.

Heading.		1921	1930	1931
Population at 31st Dec. (,000 omitted)	Males	2,799	3,304	3,324
	Fem.	2,710	3,172	3,202
	Total	5,509	6,476	6,526
Births	Males	70,039	65,883	61,021
	Fem.	66,159	62,516	57,488
	Total	136,198	128,399	118,509
	Rate	24.95	19.93	18.23
Marriages ...	No.	46,869	43,255	38,882
	Rate	8.59	6.71	5.98
Deaths	Males	30,652	31,148	31,796
	Fem.	23,424	23,424	24,183
	Total	54,076	55,331	56,560
	Rate	9.91	8.59	8.70
Deaths of Children under one year ...	Males	5,111	3,419	2,889
	Fem.	3,841	2,646	2,103
	Total	8,952	6,065	4,992
	Rate	65.73	47.24	42.12
Natural Increase		82,122	73,068	61,949
Rate of Natural increase (a)		15.05	11.34	9.53

Metropolitan Population—Australia and Other Countries.

Metropolis.	Year.	Population.	Percentage on Total of Country.
Canberra (Fed. Cap.) ...		7,100	0.11
Sydney (N.S.W.)... ...		1,256,230	49.89
Melbourne (Vic.) ...		1,030,750	57.60
Brisbane (Q'ld) ...	31st	317,150	32.91
Adelaide (S.A.)	Dec.	324,337	55.45
Perth (W.A.)	1931	209,729	49.74
Hobart (Tas.)		58,270	26.30
Total of above		3,203,566	49.09

Area and Population of Australia.

NOTE.—Population figures for years following 1921 (the last Census year) are substantially correct for Commonwealth and State totals, but figures for divisions of States, distribution by age, &c., should be interpreted with a fairly wide margin for error.

State or Territory. (a)	Year of Formation into separate Colony or Territory.	Present area in Square Miles	Population. (b) 4th April, 1921	Population. (b) 31st March 1932
N.S.W.	1786	309,432	2,100,371	2,526,345
Vic. ...	1851	87,884	1,531,280	1,804,584
Q'ld ...	1859	670,500	755,972	965,934
S.A. ...	1834	38,070	495,160	585,466
W.A.	1829	975,920	332,732	421,562
Tas. ...	1825	26,215	213,780	221,584
N. Ter.	1863 (c)	523,620	3,867	4,550
F.C.T.	1911	940	2,572	9,245
Total	—	2,974,581	5,435,734	6,539,270

(a) The six States with their included Territories were federated under the name "Commonwealth of Australia" on the 1st January, 1901.
(b) Exclusive of full-blood Aboriginals.
(c) Transferred to Commonwealth in 1911.

Estimated Value of Production (a). All Industries—Australia.

,000 omitted.

Industry.	1913	1920-21	1923-24	1924-25	1925-26
	£	£	£	£	£
Agricultural ...	46,162	112,801	81,166	107,163	89,267
Pastoral ...	63,146	90,641	110,216	127,301	113,556
Dairying, etc.	21,682	52,613	42,112	45,190	48,278
Forestry and Fisheries ...	6,626	11,136	11,866	12,357	12,784
Mining ...	25,594	21,675	22,184	24,592	24,529
Manufacturing	57,674	101,778	132,732	137,977	134,25
Total ...	220,884	390,644	400,276	454,580	431,670

Industry.	1926-27	1927-28	1928-29	1929-30	1930-31
Agricultural ...	98,295	84,328	89,440	77,109	70,500
Pastoral ...	111,716	124,554	116,733	84,563	69,499
Dairying, etc.	46,980	50,261	50,717	49,398	43,067
Forestry and Fisheries ...	12,790	12,181	11,617	11,371	8,313
Mining ...	23,939	23,015	19,539	17,912	15,400
Manufacturing	153,634	158,562	159,759	149,184	112,966
Total ...	447,354	452,901	447,805	389,537	319,745

(a) Gross values except for manufacturing. For net values, see Production Bulletin No. 25, Appendix.

Origin of Imports—Australia. Merchandise Only.

Country of Origin.	1929-30. Value.	1929-30. %	1930-31. Value.	1930-31. %
U. Kingdom ...	54,248,339	41.97	23,283,784	39.60
Canada	3,502,421	2.72	1,377,217	2.34
Ceylon	2,125,141	1.64	1,061,478	1.81
India	5,021,449	3.88	3,778,492	6.43
Malay (Brit.)	812,513	0.63	274,894	0.47
New Zealand	1,512,774	1.17	775,034	1.32
Pacific Isles	1,493,354	1.16	707,931	1.20
South Africa	302,879	0.23	89,823	0.15
Other British	867,623	0.67	424,887	0.72
Total British ...	69,886,493	54.07	31,773,540	54.04
Belgium	985,005	0.76	312,023	0.53
China	568,664	0.44	347,641	0.59
France	3,070,645	2.38	1,498,306	2.55
Germany	4,341,678	3.36	1,997,056	3.40
Italy	1,350,849	1.05	658,308	1.12
Japan	4,181,643	3.24	2,379,558	4.05
Netherlands	1,134,921	0.88	631,634	1.07
Netherlands East Indies ...	6,282,653	4.85	4,011,194	6.83
Norway	655,523	0.51	214,440	0.36
Sweden	1,671,786	1.29	822,563	1.40
Switzerland	1,566,721	1.21	926,144	1.58
United States ...	30,313,535	23.45	11,399,005	19.39
Other Foreign ...	3,244,996	2.51	1,819,521	3.09
Total Foreign ...	59,368,619	45.93	27,017,393	45.96
Total Imports ...	129,255,112 (a)	100	58,790,933 (a)	100

(a) The values are in sterling, and exclude outside packages, 1929-30, £1,535,385, and 1930-31, £1,794,965.

Imports of Principal Commodities—Australia.

(Sterling Values.)

Article.	1929-30	1930-31	1931-32 (a)
	£	£	£
Tea	3,298,705	2,245,567	1,365,622
Tobacco and preparations thereof	2,422,648	1,565,636	614,235
Whisky	1,113,512	446,418	183,461
Copra	497,320	97,999	126,519
Socks and stockings ...	792,456	67,312	3,453
Corsets	85,676	17,352	3,422
Gloves	487,869	220,490	225,321
Trimmings and ornaments	721,257	454,967	329,457
Piece Goods—			
Canvas and duck ...	645,828	285,527	251,949
Cotton and linen ...	7,269,915	4,123,204	4,187,332
Silk or containing Silk	5,500,268	3,017,936	2,472,715
Woollen or containing wool	1,178,617	185,222	51,540
Sewing silks, cottons, etc.	873,935	468,591	465,940
Carpets and carpeting	1,343,932	468,461	307,650
Floorcloths and linoleums	796,865	243,601	160,484
Bags and Sacks	2,906,817	2,753,911	1,931,336
Yarns—Woollen	301,829	44,736	35,611
Petroleum spirit, benzine, etc.	7,429,485	4,877,840	3,103,938
Kerosene	1,089,938	707,806	434,723

Manufacturing Statistics Summary, Australia.

,000 omitted.

Particulars.		1920-21	1929-30	1930-31
Number of Factories		17,113	22,700	21,751
Hands Employed	M.	277	308	246
	F.	90	111	93
Total		367	419	339
Wages paid (a)		£62,932	84,717	62,455
Wages paid per employee (c)		£181	211	194
Power and Fuel used ...		£7,692	13,603	10,384
Net h.p. used		464	770	744
Net h.p. used per employee (c)		1.26	1.84	2.19
Raw Materials used ...		£205,866	220,945	162,105
Value of Production ...		£110,434	156,364	118,310
Value of production per employee (c) ...		£301	373	349
Total Value of output ...		£323,992	390,912	290,799
Value of Land and Buildings		£60,831	118,068	112,211
Plant and Machinery ...		£68,655	127,628	124,498

(a) Excluding Working Proprietors. (b) Including Working Proprietors, 14,168 in 1920-21, 17,641 in 1929-30 and 16,705 in 1930-31. (c) Actual number or value.

Commonwealth Income Tax Particulars, 1930-1931.

Income	No. of Taxpayers	Tax Assessed	Amount per Taxpayer	Percentage of Total Tax Assessed
	No.	£	£ s. d.	%
Individuals—				
Under £201	204,875	523,067	2 11 1	3.2
£201 to £500	64,480	934,230	14 9 9	5.8
£501 to £1,000	32,373	1,401,379	43 5 9	8.6
£1,001 & over	25,114	7,766,294	309 4 10	47.9
Total Individuals	326,842	10,624,970	32 10 2	65.5
Companies	7,610	5,586,866	734 3 0	34.5
Total	334,452	16,211,836	48 9 6	100.0

(a) Assessed on imcome for year 1929-30. (Subject to revision).

Deposits per Head of Population.

State or Territory.	At 30th June. 1929	1930	1931	1932
New South Wales ...	34.8	33.2	27.8	28.2
Victoria	41.1	38.9	35.2	36.4
Queensland	26.0	25.4	23.3	23.6
South Australia ...	43.5	41.4	36.7	36.8
Western Australia ...	28.2	28.0	25.8	24.2
Tasmania	27.3	26.4	24.5	25.4
Federal Capital Territory	33.5	32.5	31.8	32.3
Northern Territory ...	11.3	10.3	9.3	10.7
Total	35.4	33.8	29.7	30.2

Savings Banks Deposits.

(Including Commonwealth Savings Bank.)

State or Territory	At 30th June. 1929	1930	1931	1932
	Total Deposits, £,000.			
New South Wales ...	85,728	82.465	69,811	71,518
Victoria	72,707	69,367	63,243	65,781
Queensland	24,076	23,901	22,354	22,946
South Australia ...	25,228	24,012	21,422	21,567
Western Australia ...	11,609	11,729	10,867	10,211
Tasmania	5,812	5,699	5,366	5,586
Federal Capital Territory	279	288	269	275
Northern Territory ...	47	49	43	42
Total	225,486	217,510	193,375	197,926

Imports of Principal Commodities—Australia.

Article.	1929-30.	1930-31	1931-32
	£	£	£
Electrical machinery and appliances	4,583,660	2,334,260	907,545
Electrical materials,cable and wire, covered ...	1,517,817	507,669	274,083
Agricultural machinery ...	443,707	174,942	47,720
Tools of trade	922,499	413,028	303,108
Cutlery	673,658	364,289	195,502
Chassis and Bodies for motor cars and parts	6,794,769	1,005,507	474,750
Iron and Steel—			
Plate and sheet ...	3,713,883	1,336,533	1,034,134
Pipes and tubes ...	1,390,469	461,715	272,696
Rubber and manufactures	1,684,621	682,755	616,324
Timber, undr's'd logs, etc.	2,862,647	641,827	638,655
Crockery & other Household ware	694,740	391,532	259,239
Glass and glassware ...	1,046,109	326,410	223,251
Paper, printing	3,129,705	1,651,410	1,661,603
Stationery, books, etc. ...	2,738,781	1,805,769	1,197,361
Drugs, chemicals, etc. ...	5,082,161	3,069,287	2,661,597
Musical instruments, pianos, etc.	343,242	66,955	26,316
All other articles ...	54,701,980	23,433,169	17,681,243
Total imports ...	131,081,320	60,959,633	44,729,825

(a) Preliminary figures. (b) Exclusive of undressed timber not measured in super. feet. (c) Including Outside Packages, 1929-30, £1,535,385; 1930-31, £1,794,965 and 1931-32, £1,213,151.

Postmaster-General's Department.

(C'wealth Offices, Treasury Gardens, Melbourne, Central 5551): Director-General, H. P. Brown, M.B.E., M.I.E.E.; Deputy Directors: N.S.W., J. W. Kitto; Vic., A. J. Christie; Q'land, A. Little; S. A., E. P. Ramsay; W.A., S. R. H. Roberts; Tas., J. E. Monfries.

Weekly Rates of Wage for a Full Week's Work—31st March, 1932.

(The rates specified are in most cases the minimum rates payable under Awards and Industrial Agreements.)

Occupations	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Bakers ...	128a 6 133a 6	106a 4 115a 6	92a 0 104a 6	85 0 90 0	88a10 92a10	87 6 100 0
Blacksmiths	91a 4	86a 5	101a 4	80a 7	88a10	87a 9
Boilermakers	90a 5	85a 6	97a 8	79a 8	88a10	86a10
Bootmakers—						
Males ...	88a 0	88a 0	88a 0	88a 0	82a 5	88a 0
Females	45a 0	45a 0	44a 6	45a 0	43a 6	45a 0
Bricklayers ...	126a 6	104a 6	109a 6	98a 1	96a10	95a 5
Brassfinishers	82a 4 to 90a 5	78a 4 to 85a 6	97a 8	72a 5 to 79a 8	88a10	79a 8 to 86a10
Cabinetmakers	98a 0	88 8	99a11	85 1	88a10	89 7
Carpenters	125a 0	92a 5	109a 6	87a 5	97a 7	49a 1
Coachmakers						
Compositors	87a 4	87a 4	101a 0	87a 4	93a 7	87a 4
Fitters ..	90a 5	85a 6	97a 8	79a 8	88a10	86a10
French Polishers	123a 6	106a 4	92a 0	85 0	88a10	87 6
Jewellers ...	105a 0 107a 6	85 0	86a 6 91a 6	80 0 88 0	96a 0 96a 0	80 0 80 0
Painters ...	115a10	91a 8	109a 6	90a 2	96a 2	95a 5
Pastrycooks...	106a 6	100 0	102a 0	85 0	92 0 99a 6	83 0
Patternmakers	98a 7	93a 7	103a 0	87a 9	96a 0	94a11
Plasterers ...	132a 0	104a 6	109a 6	98a 1	107a 6	95a 5
Plumbers ...	126a10	99a11	109a 6	97a 2	98a 4	91a 8 113a 8
Saddlers ...	85 6	85 6	85 6	82 0	88 10	85 6
Tailors Order	82a 8	83a 8	83a 8	82a 8	91a 6	83a 8
Tailoresses Order	41a10 46a10	41a10 46a10	41a10 46a10	41a10 46a10	48a 0 57a 5	41a10 46a10
Tinsmiths ...	103a 0	77 5 85 6	91a 2	79 6 86 6	86 0 92 10	91a 8
Wharf labourers	2b1½	2b1½		2b8½	2b1½	2b1½

The hours of labour constituting a full week's work are 48, with the following exceptions :—(a) Forty-four hours per week. (b) Rate per hour.

Weekly Basic Wage—Declarations of State Tribunals.

State	Basic Wage Males	Basic Wage Females	Date of operation	Family Unit for Male Rate
N.S.W.	70 0	38 0	26/8/32	Man, wife, 1 child
Vic. ...	(b)	(b)		(b)
Q'land. ...	74 0	39 0	1/7/31	Man, wife, 3 children
S.A. ...	63 0	31 6	M17/8/31 F4/12/31	
W.A. ...	72 0a	38 11a	10/6/32	Man, wife, 2 children
Tas. ...	(b)	(b)		(b)

(a) Metropolitan area. (b) Not declared Federal rate is followed to large extent.

Weekly Basic Wage Rates (a).

Commonwealth Court of Conciliation and Arbitration at 1/8/1932.

	"Harvester" plus Powers' 3s.	After 10 per cent. reduction.
Sydney	76 0	68 5
Melbourne	70 0	63 0
Brisbane	64 0	57 7
Adelaide	65 0	61 8
Perth	68 6	68 6
Hobart	73 0	65 8
Six Capitals	71 0	63 11

(a) Family unit—man, wife, and three children Female rate generally 54 per cent. of male rate.

Imports of Wireless Receivers, Etc. 1930-31.

ITEM.	N. S. Wales		Victoria.		Queensland		S. Aust.		W. Aust.		Tasmania.		AUSTRALIA.	
	No.	£.	No.	£.	No.	£.	No.	£.	No.	£.	No.	£.	No.	£.
Valves for Wireless Telegraphy or Telephony	499,304	150,066	215,603	54,231	4,885	2,044	9,864	2,732	4,999	1,440	187	63	734,842	210,576
Battery Eliminators	525	983	30	73	6	5	2	6	2	4	—	—	565	1,071
Battery Chargers	84	219	26	10	—	—	—	—	—	—	—	—	110	229
Wireless Parts N.E.I.	—	97,808	—	34,030	—	556	—	2,435	—	1,112	—	146	—	136,087
Wireless Receivers, wholly or partly assembled exclusive of valves, loud speakers, and head phones	—	2,536	—	166	—	70	—	15	—	81	—	—	—	2,868

Imports of Wireless Valves, Radio Apparatus, etc.

July 1st, 1931—June 30th, 1932.

ITEM.	N.S. Wales		Victoria		Queensland		S. Australia		W. Australia		Tasmania		AUSTRALIA	
	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£	No.	£
Valves for Wireless Telegraphy or Telephony	855,443	190,954	174,341	36,731	9,754	2,559	13,882	3,745	4,380	2,034	28	138	1,057,828	236,161
Battery Eliminators	16	30	16	29	151	27	—	—	1	5	—	—	184	91
Battery Charges ...	9	—	127	20	—	—	2	1	—	—	—	—	13	148
Wireless Parts N.E.I.	—	43,865	—	17,720	—	68	—	389	—	965	—	1	—	63,008
Wireless Receivers, wholly or partly assembled exclusive of valves, loud speakers and head phones	—	845	—	266	—	31	—	505	—	7	—	17	—	1,671

Imports of Wireless Valves, Radio Apparatus, etc.

Six Months Ended 31st December, 1932.

Valves for Wireless Telegraphy or Telephony	539,110	135,976	142,438	28,375	12,784	4,241	4,671	1,858	5,850	1,932	17	146	704,870	172,528
Battery Eliminators	15	39	19	38	—	—	—	—	—	—	—	—	34	77
Battery Chargers ...	28	31	—	—	—	—	—	—	—	—	—	—	28	31
Wireless Parts N.E.I.	—	10,060	—	7,420	—	22	—	161	—	414	—	4	—	18,081
Wireless Receivers wholly or partly assembled exclusive of valves, loud speakers and head phones	—	401	—	283	—	—	—	74	—	—	—	—	—	758

Supplied by Commonwealth Bureau of Census and Statistics.
Canberra F.C.T. 14th February, 1933.

Amended Australian Tariff Schedule Effective March 9th, 1933.

In the following Schedules the first duty is British preference tariff and the second general tariff.

180. By omitting the whole of sub-item (E) and inserting in its stead the following sub-item :—

(E) Wireless Receivers, Parts thereof, and Accessories therefor, viz. :—

1. **Chargers, Battery,** .4 ampere to 1 ampere, both inclusive, each 7/—10/–.

2. **Chargers, Battery,** exceeding 1 ampere and up to and including 3 amperes, each 21/—30/–.

3. **Choke Coils,** suitable for use in connection with battery eliminating devices, each 5/—10/–.

4. **Condensers, Fixed Mica,** each 5d.—6d.

5. **Condensers, Variable,** of capacities exceeding .0001 microfarad, but not exceeding .001 microfarad—with gang or drum control—per each Condenser contained therein, 1/6—3/–; without gang or drum control, each 1/6—3/–.

6. **Condensers, Variable, Midget,** of .0001 microfarad capacity or less, each 1/—1/6.

7. **Dials, Vernier,** each 10d.—1/3.

8. **Dials, n.e.i.,** each 1½d.—2d.

9. **Eliminators,** "A" Battery, each 35/—50/–.

10. **Eliminators,** "B" Battery, each 27/6—40/–.

11. **Eliminators,** "BC" and "ABC" Battery. Power Packs, and similar devices, whether imported separately or incorporated in a wireless receiving set, each 40/—60/–.

12. **Resistances, Fixed,** having a resistance value of 2 megohms and over, each 4½d.—6d.

13. **Headphones,** each 2/6—4/–.

14. **Jacks, Phone and Loudspeaker,** each 4d.—6d.

15. **Knobs,** each 1½d.—2d.

16. **Lightning Arresters,** each 4d.—6d.

17. **Loudspeakers and Parts thereof :**—

(a) Loudspeakers, including transformers, each 10/—12/6.

(b) Parts of loudspeakers imported other than in complete loudspeakers, viz. :—

(1) Field Coils, each 2/—3/–.
(2) Field Coil Cores, each 9d.—1/3.
(3) Field Coil Housing, each 1/—1/6.
(4) Cones with or without voice coils, each 1/3—1/9.
(5) Cone Housings, each 1/9—2/3.
(6) N.E.I., other than transformers ad val., 35 per cent. —55 per cent.

Provided, however, that in the case of combinations of any of the above-mentioned parts duty shall be payable in such combinations as though the parts were imported separately.

18. **Plugs, Phone and Loudspeaker,** each 3d.—4½d.

19. **Rheostats, Potentiometers and Variable Resistance,** each 6d.—8d.

20. **Sockets, Valve,** each 3d.—4½d.

21. **Transformers, Audio and Radio,** each 1/9—2/6.

22. **Transformers, Power,** each 10/—15/–.

23. **Power Transformers and Choke Coils,** combined, each 15/— 25/–.

Or as to all the goods covered by paragraphs 1 to 23 of sub-item (E), with the exception of the goods covered by clause 6 of sub-paragraph (b) of paragraph 17, the following rates, if same return a higher duty, viz. : ad val., 35 per cent.—55 per cent.

24. **Parts, n.e.i.,** of wireless receivers, other than cabinets, ad val., 35 per cent.—55 per cent.

25. **Wireless Receiving Sets** wholly assembled, partly assembled or unassembled, excluding cabinets, valves, loudspeakers, headphones, batteries, or any device for eliminating batteries :—

Per valve socket, excluding sockets for valves forming part of any battery eliminating device, 12/6—25/- ; or ad val., 35 per cent.—55 per cent., whichever rate returns the higher duty

Provided, (1) in the absence of valve sockets, the sets shall be charged duty at the above rates on the basis of the number of valves for which they are constructed or designed. (2) In the instance of sets constructed or adapted for use with multiple purpose valves, the sets shall be charged duty equal to that payable on sets having an equal number of unit stages using unit function valves.

26. **Wireless Receiving Sets and Gramophones combined,** excluding cabinets, valves, loudspeakers, head-phones, batteries, or any device for eliminating batteries, each 20/——25/– ; and in addition per valve socket excluding sockets for valves forming part of any battery eliminating device, 12/6 — 25/– ; or as an alternative to the cumulative fixed rates provided above, ad val., 35 per cent.—55 per cent., whichever rate returns the higher duty.

Provided—(1) In the absence of valve sockets the combined sets shall be charged duty at the above rates on the basis of the number of valves for which they are constructed or designed. (2) In the instance of combined sets constructed or adapted for use with multiple purpose valves, the combined sets shall be charged duty equal to that payable on combined sets having an equal number of unit stages using unit function valves.

(G) Storage Batteries and parts thereof, viz :—			
(1) Storage Batteries for wireless receiving sets, whether imported separately or incorporated in or forming part of a wireless receiving set	ad val.	50 per cent.	70 per cent.
(3) Composition parts including containers for storage batteries for wireless receiving sets	ad val.	40 per cent.	60 per cent.
(I) Dry Batteries and Dry Cells of all descriptions whether imported separately or incorporated in any article or appliance—			
(1) Up to and including 1 lb. in weight ... ... each		4d.	6d.
(2) Over 1 lb. in weight per lb.		7d.	10d.
181.			
(A) Electrical Articles and Materials, viz :—			
(2) Valves for wireless telegraphy and telephony including rectifying valves ... each		2s. 3d.	3s. 6d.
or ad val.		20 per cent.	40 per cent.
whichever rate returns the higher duty.			
Division XVI.—Miscellaneous.			
404. Materials and Minor Articles, of a class or kind not commercially produced or manufactured in Australia, for use in the manufacture of goods within the Commonwealth, as prescribed by Departmental By-laws	ad val.	Free	15 per cent.
404A. Materials and Minor Articles, of a class or kind not commercially produced or manufactured in Australia or the United Kingdom, for use in the manufacture of goods within the Commonwealth, as prescribed by Departmental By-laws.		Free.	Free.

Electric Supply Systems Throughout Australia.

The Town or District is given first, then voltage and frequency, followed by number of consumers (abbreviated **Con.**) and area population (abbreviated **Pln.**). The owners or suppliers to the various districts are not shown, as generally the radio industry is chiefly interested in the voltage and frequency and possible business with all-electric or battery sets. Dividing the population figures by four will give a good indication of the number of homes in the area. This list has been compiled at great trouble and cost, and should be the most up-to-date list available. Further particulars will always be supplied on request to the Editor.

ABERDARE, N.S.W., 315/240v. 50c. Con. 620.
ABERDEEN, N.S.W., 480/240v. D.C. Con. 107.
ABERMAIN, N.S.W., 240v. D.C.
ADELAIDE, S.A., Pri. 33,000v. 7,600v. 400/200v. 50c. Con. 77,228 Pln. 377,400.
ALBANY, W.A., 440/220v. D.C.
ALBURY, N.S.W., Pri. 3,300v. Sec. 415/240v. 50c. Con. 2550 Pln. 12,000.
ALDGATE, S.A., 400/200v. 50 c. Con. 110.
ALEXANDRA, Vic., 400/230v. 50c. Con. 211 Pln. 850.
ALLANSFORD, Vic., 460/230v. 50c. Con. 38 Pln. 296.
ALTONA, Vic., 460/230v. 50c. Con. 249 Pln. 1,500.
ALVIE, Vic., 460/230v. 50c. Con. 70 Pln. 150.
AMBLESIDE, S.A.. 400/200v. 50c. Con. 67 Pln. 685.
ANGASTON, S.A., 400/200v. 50c. Con. 213 Pln. 3,177.
ANTHILL PONDS, Tas., 240v. 50c.
APPLECROSS, W.A., 440/250v. 40c.
ARARAT, Vic., 400/230v. 50c. Con. 750 Pln. 5,200.
ARDROSSAN, S.A., 220v. D.C., Con. 114 Pln. 600.
ARIAH PARK, N.S.W., 240v. D.C. Con. 140 Pln. 750.
ARMADALE, W.A., 440/250v. 40c.
ARMIDALE, N.S.W., 415/240v. 50c. Con. 1,000 Pln. 6,000.
ATHERTON, Q'ld., 415/240v. 50c. Con. 256 Pln. 1500
AVOCA, Vic., Con. 170 Pln. 800.
AYR, Q'ld, 440/220v. D.C. Con. 220.
BACCHUS MARSH, Vic., 400 /220v. 50c. Con. 380 Pln. 1,400.
BAGDAD, Tas., 240v. 50c.
BAIRNSDALE, Vic., 400/230v. 50c. Con. 814 Pln. 4,000.
BALAKLAVA, S.A., 400/200v. 50c. Con. 313 Pln. 2,170.
BALLAN, Vic., 400/230v. 50c. Con. 109 Pln. 450.
BALLARAT, Vic., 440/220v. D.C. Con. 6,505 Pln. 41,750. 400/230v. 50c.
BALLINA, N.S.W., 415/240v. 50c. Con. 650 Pln. 5,000.
BALRANALD, N.S.W., 240v. D.C. Con. 196 Pln. 1,000.
BANGALOW, N.S.W., 415/240v. 50c. Con. 180 Pln. 1,200.
BANKSTOWN, N.S.W., 415/240v. 50c. Con. 5,000 Pln. 30,000.
BARCALDINE, Q'ld, 240v. D.C. Con. 250 Pln. 2,000.
BARNAWARTHA, Vic., 460/230v. 50c. Con. 19 Pln. 240.
BARHAM, N.S.W., 400/240v. 50c. Con. 100 Pln. 900.
BARRABA, N.S.W., 240v. D.C. Con. 240 Pln.
BARWON HEADS, Vic., 460/230v. 50c. Con. 153 Pln. 600.
BASSENDEAN, W.A., 440/250v. 40c. Con. 980 Pln. 5,000.
BATHURST, N.S.W., 415/240v. 50c. Con. 1,800 Pln. 10,000.
BAULKHAM HILLS, N.S.W., 415/240v. 50c. Con. 300. Pln. 1,600.
BAYSWATER, Vic., 460/230v. 50c. Con. 82 Pln. 450.
BAYSWATER, W.A., 440/250v. 40c.
BEACONSFIELD, Tas., 340v. 50c. Con. 217 Pln. 150.
BEACONSFIELD, Vic., 460/230v. 50c. Con. 11 Pln. 150.
BEADON POINT, W.A., 220v. D.C.
BEAUDESERT, Q'ld, 480/240v. D.C. Con. 170.
BEAUFORT, Vic., 400/230v. 50c. Con. 200 Pln. 1,400.
BEEAC, Vic., 460/230v. 50c. Con. 103 Pln. 300.
BEECHWORTH, Vic., 400/240v. 50c. Con. 271 Pln. 1,600.
BEGA, N.S.W., 415/240v. 50c. Con. 320, Pln. 2,500.
BELGRAVE, Vic., 400/230v. 50c. Con. 482 Pln. 800.
BELLBIRD, N.S.W., 415/240v. 50c.
BELLINGEN, N.S.W., 415/240v. 50c.
BENA, Vic., 400/230v. 50c. Con. 33 Pln. 800.
BENALLA, Vic., 400/230v. 50c. Con. 682, Pln. 4,000.
BENCUBBIN, W.A., 220 D.C.
BENDIGO, Vic., 400/230v. 50c. Con. 5,216 Pln. 33,720.
BERRIGAN, N.S.W., 415/240v. 50c. Con. 150 Pln. 1,000.
BERRY, N.S.W., 415/240v. 50c. Con. 105.
BERWICH, Vic., 460/230v. 50c. Con. 283 Pln. 650.
BEULAH, Vic., 460/230v. D.C. Con. 125 Pln. 550.
BEVERLEY, W.A., 220v. D.C.
BIRCHIP, Vic., 230v. D.C. Con. 220 Pln. 1,031.
BIRDWOOD, S.A., 400/200v. 50c. Con. 65 Pln. 320.
BIRREGURRA, Vic., 460/230v. 50c. Con. 82 Pln. 400.
BISHOPBOURNE, Tas., 240v. 50c.
BLACKALL, Q'ld, 240v. D.C. Con. 255 Pln. 1,500.
BLACKHEATH, N.S.W., 415/240v. 50c. Con. 510 Pln. 2,500.
BLACKTOWN, N.S.W., 415/240v. 50c. Con. 1250 Pln. 5,000.
BLAYNEY, N.S.W., 415/240v. A.C. Con. 275 Pln. 2,200.
BLYTH, S.A., 400/200v. 50c. Con. 58.
BOGGABRI, N.S.W., 415/240v. D.C. Con. 80.
BOMBALA, N.S.W., 415/240v. 50c. Con. 132 Pln. 1,100.
BOMBO, N.S.W., 415/240v. 50c.
BOOLAROO, N.S.W., 250v. D.C.
BOOLARRA, Vic., 500/230v. 50c. Con. 51 Pln. 685.
BOONAH, Q'ld, 220v. D.C.
BOOROWA, N.S.W., 415/240v. 50c.
BOORT, Vic., 230v. D.C. Con. 231 Pln. 750.
BORDERTOWN, S.A., 400/230v. 50c. Con. 90 Pln. 850.
BORONIA, Vic., 460/230v. 50c. Con. 50 Pln. 700.
BOSTOCK CREEK, Vic., 460/230v. 50c. Con. 24 Pln. 50.
BOTHWELL, Tas., 415/240v. 50c. Con. 135 Pln. 450.
BOULDER, W.A., 440/220v. D.C. Con. 1,100 Pln. 5,800.
BOWEN, Q'ld, 415/240v. 50c. Pln. 3,000.
BOWRAL, N.S.W., 415/240v. 50c. Con. 800 Pln. 3,000.
BOWRAVILLE, N.S.W., 400/230v. 50c. Con. 70 Pln. 800.
BOX HILL, Vic., 400/230v. 50c. Con. 5,600 Pln. 15,000.
BOYA, W.A., 440/250v. 40c.
BRACHNELL, Tas., 240v. 50c. Con. 50.
BRAESIDE, Vic., 400/230v. 50c.
BRIAR HILL, Vic., 460/230v. 50c. Con. 45 Pln. 200.
BRICKENDON, Tas., 240v. 50c.
BRIDGETOWN, W.A., 440/220v. D.C. Con. 210 Pln. 1,200.
BRIDGEWATER, S.A., 400/200v. 50c. Con. 88 Pln. 360.
BRIDGEWATER, Tas., 240v. 50c.
BRIGHTON, Tas., 415/240v. 50c. Con. 171.
BRIGHTON, Vic., 400/200v. 50c.
BRISBANE, Q'ld., 415/240v. 50c. Con. 40,505 Pln. 220,000.
BRINKWORTH, S.A., 400/200v. 50c. Con. 56.
BROADFORD, Vic., 230v. D.C. Con. 200 Pln. 1,000.
BROKEN HILL, N.S.W., 110v. A.C. Con. 3280 Pln. 27,000.
BROOKTON, W.A., 220v. D.C.
BROOME, W.A., 440v. D.C.
BRUCE ROCK, W.A., 440/220v. D.C. Con. 130.
BRUNSWICK, Vic., 400/230v. 50c. Con. 12,000 Pln. 56,000.
BRUNSWICH, W.A., 220 D.C.
BRUTHEN, Vic., 460/230v. 50c. Con. 88 Pln. 580.
BURROWANG, N.S.W., 240v. A.C. 50c. Con. 27 Pln. 80.
BULLI, N.S.W., 415/240v. 50c. Con. 100 Pln. 15,000.
BUNBURY, W.A., 440/220v. D.C. Con. 1,140.
BUNDABERG, Q'ld, 480/240v. D.C. Con. 1,600 Pln. 10,000.
BUNDANOON, N.S.W., 415/240v. 50c. Con. 130 Pln. 450.
BUNYIP, Vic., 460/230v. 50c. Con. 55 Pln. 600.
BURNIE, Tas., 415/240v. 50c. Con. 1,000.
BURRA, S.A. 400/230v. 50c. Con. 90.
BURRADOO, N.S.W., 415/240v. 50c. Con. 56.
BUSSELTON, W.A., 220v. D.C.
BYFORD, W.A., 440/250v. D.C.
BYRON BAY, N.S.W., 415/240v. 50c. Con. 210, Pln. 1,500.
CABRAMATTA & CANLEY VALE, N.S.W., 415/240v. 50c. Con. 580, Pln. 4,000.
CAIRNS DISTRICT, Q'ld., 415/240v. 50c. Con. 2,500 Pln. 10,000.

CALTOWIE, S.A., 400/200v. 50c. Con. 59. Pln.
CAMBERWELL, Vic., 400/200v. 50c.
CAMDEN, N.S.W., 415/240 v.50c. Pln. 2,100.
CAMPBELLTOWN, N.S.W., 415/240v. 50c. Con. 350, Pln. 2,000.
CAMPBELL TOWN, Tas., 415/240v. 50c.
CAMPERDOWN, Vic., 400/230v. 50c. Con. 621, Pln. 3,500.
CANBERRA, F.T.A., 415/240v. 50c. Con. 1,500, Pln. 8,000.
CANNINGTON, W.A., 440/250v. 40c.
CANOWINDRA, N.S.W., 240v. D.C. Con. 350. Pln. 2,000.
CARDUP, W.A., 440/250v. 40c.
CARNARVON, W.A., 220v. D.C. Con. 160 Pln. 750.
CARRUM, Vic., 400/240 50c. Con. 2,500 Pln. 7,500.
CASINO, N.S.W., 415/240v. 50c. Con. 700 Pln. 5,000.
CASTERTON, Vic., 230v. D.C. Con. 265 Pln. 1,900.
CASTLEMAINE, Vic., 400/230v. 50c. Con. 725 Pln. 5,650.
CAVERSHAM, W.A., 440/250v. 40c.
CESSNOCK, N.S.W., 415/240v. 50c. Con. 2,200.
CHAIN OF PONDS, S.A., 400/200v. 50c. Con. 22 Pln. 150.
CHARLEVILLE, Q'ld., 480/240v. D.C. Con. 450, Pln. 3,500.
CHARLTON, Vic., 230v. D.C. Con. 350, Pln. 1.215.
CHELTENHAM, Vic., 400/200v. 50c.
CHILDERS, Q'ld., 220v. D.C. Con. 220, Pln. 2,000.
CHILTERN, Vic., 400/230v. 50c. Con. 110, Pln. 1,500.
CLARE, S.A., 415/240v. 50c. Con. 800.
CLAREMONT, W.A., 440/250v. 40c.
CLARENCE RIVER COUNTY COUNCIL, N.S.W., 415/240v. 50c. Con. 1,707 Pln. 12,000.
CLAYTON, Vic., 460/230v. 50c. Con. 80 Pln. 250.
COBAR, N.S.W., 480/240v. D.C. Con. 160.
COBDEN, Vic., 400/230v. 50c. Con. 140 Pln. 650.
COBRAM, Vic., 230v. D.C. Con. 147 Pln. 850.
COBURG, Vic., 400/230v. 50c. Con. 9,279, Pln. 40,200.
COFF'S HARBOUR, N.S.W., 240v. D.C.
COHUNA, Vic., 230v. D.C. Con. 210.
COLAC, Vic., 400/230v. 50c. Con. 1,170 Pln. 4,950.
COLERAINE, Vic., 230v. D.C. Con. 174, Pln. 900.
COLLIE, W.A., 550/250v. D.C.
COLLINGWOOD, Vic., 400/230v. 50c.
CONDOBOLIN, N.S.W., 415/240v. 50c. Con. 220.
COOLAMON, N.S.W., 415/230v. 50c. Con. 210, Pln. 1,600.
COOLANGATTA, Q'ld., 415/240v. 50c. Con. 800 Pln. 3,000.
COOMA, N.S.W., 240v. D.C. Con. 370 Pln. 2,000.
COONABARABRAN, N.S.W., 415/240v. 50c. Con. 140 Pln. 500.
COONAMBLE, N.S.W., 415/240v. 50c. Con. 360 Pln. 2,500.
COOROW, W.A., 220v. D.C.
COOTAMUNDRA, N.S.W., 415/240v. 50c. Con. 900, Pln. 4,500.
CORAKI, N.S.W., 415/240v. 50c. Con. 150, Pln. 1,300.
COROMANDEL VALLEY, S.A., 400/200v. 50c. Con. 56.
COROROOKE, Vic., 400/230v. 50c. Con. 87, Pln. 150.
COROWA, N.S.W., 415/240v. 50c. Con. 524 Pln. 2,600.
CORRIGIN, W.A., 220v. D.C. Con. 80.
COTTESLOE, W.A., 440/250v. 40c. Con. 3,000.
COTTESLOE BEACH, W.A., 440/250v. 40c. Con. 3,000.
COUTTS CROSSING, N.S.W., 415/240v. 50c.
COWRA, N.S.W., 415/240v. 50c. Con. 725 Pln. 6,000.
COWWARR, Vic., 400/230v. 50c. Con. 68 Pln. 200.
CRAFERS & STIRLING, S.A., 400/200v. 50c. Con. 709.
CRANBOURNE, Vic., 460/230v. 50c. Con. 80 Pln. 300.
CRESSY, Tas., 240v. 50c. Con. 60.
CRIB POINT, Vic., 460/230v. 50c. Con. 62 Pln. 150.
CROOKWELL, N.S.W., 240v. D.C. Con. 234 Pln. 1,500.
CROYDON, Vic., 400/230v. 50c. Con. 476 Pln. 1,800.
CRYSTAL BROOK, S.A., 415/240v. 50c. Con. 220 Pln. 1,100.
CUE, W.A., 220v. D.C.
CULCAIRN, N.S.W., 240v. D.C. Con. 130.
CARNAMAGH, W.A., 440/220 D.C.
CIRCULAR HEAD, Tas., 240v. 50c. Con. 358.
CULLEN BULLEN, N.S.W., 415/240 50c. Con. 60 Pln. 500.
CUNDERDIN, W.A., 220 D.C.
CUNNAMULLA, Q'ld., 240v. D.C. Con. 160.
CYGNET, Tas., 415/240v. 50c. Con. 305.
DALBY, Q'ld., 440/220v. D.C. Pln. 2,300.
DALWALLINU, W.A., 220v. D.C.
DANDENONG, Vic., 400/230v. 50c. Con. 1,189 Pln. 5,700.
DARLINGTON, W.A., 440/250v. 40c.
DARNUM, Vic., 400/230v. 50c. Con. 50 Pln. 100.
DARWIN, Nth. A., 230v. D.C.
DAVENPORT, S.A., 460/230v. D.C. Con. 130 Pln. 1,114.
DAYLESFORD, Vic., 460/230v. D.C. Con. 495 Pln. 3,300.
DEER PARK, Vic., 400/230 50c. Con. 13 Pln. 100.
DELORAINE, Tas., 415/240v. 50c. 280.
DENILIQUIN, N.S.W., 415/240v. A.C. Con. 250.
DENNINGTON, Vic., 460/230v. 50c. Pln. 310.
DERWENT VALLEY RURAL SERVICE, Tas., 415/240v. 50c. Con. 492 Pln. 4,277.
DEVONPORT, Tas., 415/240v. 50c. Con. 1,300 Pln. 6,000.
DIAMOND CREEK, Vic., 460/230v. 50c. Con. 66 Pln. 100.
DIGGERS' REST, Vic., 460/230v. 50c. Con. 19, Pln. 50.
DIMBOOLA, Vic., 460/230 D.C. Con. 494 Pln. 1,500.
DINGLEY, Vic., 460/230 50c. Con 29 Pln. 100.
DONALD, Vic., 230v. D.C. Con. 345 Pln. 1,700.
DONCASTER, Vic., 400/200v. 50c. Con. 350 Pln. 3,200.
DONNYBROOK, W.A., Con. 220v. D.C.
DOOKIE, Vic., 460/230v. A.C.
DORRIGO, N.S.W., 415/240v. 50c. Con. 160 Pln. 1,200.
DOWERIN, W.A., 230v. D.C. Con. 68, Pln. 380.
DROMANA, Vic., 400/230v. 50c. Con. 75 Pln. 350.
DROUIN, Vic., 400/230v. 50c. Con. 171 Pln. 850.
DRYSDALE, Vic., 460/230v. 50c. Con. 70 Pln. 800.
DUBBO, N.S.W., 415/240v. 50c. Con. 2,046 Pln. 10,000.
DUMBLEYUNG, W.A., 220v. D.C.
DUNDAS, N.S.W., 415/240v. 50c. Con. 1,150 Pln. 5,250.
DUNGOG, N.S.W., 415/240v. 50c. Con. 250 Pln. 3,000.
DUNOLLY, Vic., 400/230v. 50c. Con. 105 Pln. 580.
EAGLEHAWK, Vic. 460/230v. D.C. Con. 630 Pln. 4,720.
EAST GRETA, N.S.W., 415/240v. 50c.
ECHUCA, Vic., 400/230v. 50c. Con. 730 Pln. 4,032.
EDITHBURGH, S.A., 200v. D.C. Con. 70.
ELMORE, Vic., 460/230v. D.C. Con. 162, Pln. 700.
ELTHAM, Vic., 460/230v. 50c. Con. 106 Pln. 700.
ERMINGTON and RYDALMERE, N.S.W., 415/240v. 50c. Con. 160 Pln. 2,500.
ESPERANCE, Tas., 240v. 50c. Con. 467.
ESPERANCE, W.A., 220 D.C.
ESSENDON, Vic., 400/230v. 50c. Con. 13,250 Pln. 63,000.
ESTELVILLE, N.S.W., 415/240v. 50c.
EUROA, Vic., 230v. D.C. Con. 403 Pln. 2,300.
EVANDALE, Tas., 415/240v. 50c. Con. 96.
EVELYN, Vic., 400/230v. 50c. Con. 35 Pln. 450.
EXETER, N.S.W., 240v. A.C. 50c. Con. 30, Pln. 120.
EXTON, Tas., 240v. 50c. Con. 25.
FAIRFIELD, N.S.W., 415/240v. 50c. Con. 1,000 Pln. 4,500.
FERNTREE GULLY, Vic., 400/230v. A.C. Con. 168 Pln. 1,200.
FERNY CREEK, Vic., 460/230v. 50c. Con. 16 Pln. 50.
FINGAL, Tas., 240v. 50c. Con. 279.
FITZROY, Vic., 400/230v. 50c.
FOOTSCRAY, Vic., 400/230v. 50c. 10,900 Pln. 51,800.
FORBES, N.S.W., 415/240v. 50c. Con. 600 Pln. 6,000.
FORREST, W.A., 220 D.C.
FOSTER, Vic., 400/230v. 50c. Pln. 650.
FRANKSTON, Vic., 400/230v. 50c. Con. 1,184 Pln. 3,000.
FREELING, S.A., 400/200v. 50c. Con. 120 Pln. 1,000.
FREMANTLE, W.A., 440/250v. 40c. Con. 6,100 Pln. 38,000.
FOROS, S.A., 400/200v. 50c. Con. 4.
GARFIELD, Vic., 460/230v. A.C. Con. 54 Pln. 200.
GAWLER, S.A., 400/200v. 50c. Con. 1,046 Pln. 2,320.
GAWLER RIVER, S.A., 400/200v. 50c. Con. 70.
GAYNDAY, Q'ld., 240v. D.C. Con. 100.
GEELONG, Vic., 400/230v. 50c. Con. 9,624 Pln. 29,700.
GEEVESTON, Tas., 415/240v. 50c.
GEORGETOWN, S.A., 400/200v. 50c. Con. 46.
GERALDTON, W.A., 440/220v. D.C. Con. 840.
GERRINGONG, N.S.W., 415/240v. 50c. Pln. 500.
GILGANDRA, N.S.W., 240v. D.C. Con. 180.
GISBORNE, Vic., 400/230v. 50c. Con. 106 Pln. 770.
GLADSTONE, Q'ld., 480/240v. D.C.
GLADSTONE, S.A., 400/200v. 50c. Con. 211.
GLEN GARRY, Vic., 400/230v. 50c. Con. 17 Pln. 120.
GLEN INNES, N.S.W., 415/240v. 50c. Con. 835 Pln. 5,300.
GLOUCESTER, N.S.W., 415/240v. 50c. Con. 250 Pln. 1,300.
GNOWANGERUP, W.A., 220v. D.C.
GOOMALLING, W.A., 220v. D.C.
GOONDIWINDI, Q'ld., 240v. D.C. Con. 240 Pln. 1,600.
GOOSEBERRY HILL, W.A., 440/250v. 40c.
GORMANSTONE, Tas., 235v. A.C. Con. 150 Pln. 1,000.
GOSFORD, N.S.W., 415/240v. 50c. Con. 450 Pln. 2,000.
GOSNELLS, W.A., 440/250v. 40c.
GOULBURN, N.S.W., 480/240v. D.C. & 415/240v. 50c. Con. 4,500 Pln. 14,500.
GRAFTON, N.S.W., 415/240v. 50c. Con. 1,175 Pln. 4,850.
GREENMOUNT, W.A., 440/250v. 40c.
GREENOCK, S.A., 400/200v. 50c. Con. 32 Pln. 430.
GREEN PONDS, Tas., 240v. 50c. Con. 112 Pln. 600.

GREENSBOROUGH, Vic., 400/230v. 50c. Con. 473 Pln. 930.
GRENFELL, N.S.W., 415/240v. A.C. Con. 260.
GRETA, N.S.W., 240v. 50c. Con. 200 Pln. 2,600.
GUILDFORD, W.A., 440/250v. 50c.
GULGONG, N.S.W., 415/240v. 50c. Con. 190 Pln. 1,000.
GUMERACHA, S.A., 400/200v. 50c. Con. 55 Pln. 550.
GUNDAGAI, N.S.W., 415/240v. 50c.
GUNNEDAH, N.S.W., 480/240v. D.C. Con. 330 Pln. 3,500.
GUYRA, N.S.W., 415/240v. A.C. Con. 130.
GYMPIE, Q'ld., 500v. D.C. 250v. D.C. Con. 750 Pln. 9,000.
HACKHAM, S.A., 400/200v. 50c. Con. 18.
HAGLEY, Tas., 240v. 50c. Con. 30.
HALBURY, S.A., 400/200v. 50c. Con. 7.
HAMILTON, Vic., 230v. D.C. Con. 1,008 Pln. 5098.
HAMLEY BRIDGE, S.A., 400/200v. 50c. Con. 129.
HARVEY, W.A., 220v. D.C.
HASTINGS, Vic., 460/230v. 50c. Con. 192 Pln. 488.
HAY, N.S.W., 415/240v. 50c. Con. 350 Pln. 2,830.
HEALESVILLE, Vic., 400/230v. 50c. Con. 490 Pln. 2,400.
HEATHCOTE, Vic., 230v. D.C. Con. 235 Pln. 1,200.
HEIDELBERG, Vic., 400/230v. 50c. Con. 6044 Pln. 25,500.
HELENSBURGH, N.S.W., 415/240 50c. Con. 125.
HENTY, N.S.W., 240v. D.C. Con. 200.
HEPBURN, Vic., 400/230v. 50c. Con. 132 Pln. 200.
HEYFIELD, Vic., 400/230v. 50c. Con. 133 Pln. 700.
HIGHERCOMBE, S.A., 400/200v. 50c. Con. 63.
HOBART, Tas., 415/240v. 50c. Con. 14,090.
HOLBROOK, N.S.W., 240v. D.C. Con. 220.
HOLMESVILLE, N.S.W., 415/240v. 50c.
HOLROYD, N.S.W., 415/240v. 50c. Con. 3,000 Pln. 17,000.
HOME HILL, Q'ld., 415/240v. 50c. Con. 360 Pln. 3,000.
HOPETOUN, Vic., 230v. D.C. Con. 160 Pln. 800.
HORNSBY, N.S.W., 415/240v. 50c. Con. 3,400 Pln. 20,000.
HORSHAM, Vic., 460/230v. D.C. Con. 1,029 Pln. 5129.
HOUGHTON, S.A., 400/200v. 50c. Pln. 150.
HUGHENDEN, Q'ld., 480/240v. D.C. Con. 180 Pln. 1,500.
HUON, Tas., 415/240v. 50c. Con. 793.
INGLEWOOD, S.A., 400/200v. 50c. Con. 12.
INGLEWOOD, Vic., 230v. D.C. Con. 180 Pln. 1,100.
INNISFAIL, Q'ld., 415/240v. 50c.
INVERELL, N.S.W., 415/240v. 50c. Con. 760 Pln. 5,000.
INVERLOCH, Vic., 110v. D.C. Con. 12, Pln. 120.
IPSWICH, Q'ld., 415/240v. 50c. Con. 4,030 Pln. 20,000.
JAMBUNNA, Vic., 460/230v. 50c. Con. 34 Pln. 400.
JAMESTOWN, S.A., 400/200v. 50c. Con. 379.
JEPARIT, Vic., 230v. D.C. Con. 225 Pln. 800.
JERICHO, Tas., 240v. 50c.
JERILDERIE, N.S.W., 415/240v. 50c. Con. 120 Pln. 720.
JUNEE, N.S.W., 415/240v. 50c. Con. 910 Pln. 3,500.
KADINA, S.A., 220/110v. D.C., Con. 675 Pln. 5,000
KALAMUNDA, W.A., 440/250v. 40c. Con. 1,900.
KALGOORLIE, W.A., 550/220 110v. 40c. Con. 630 Pln. 6,500.
KALGOORLIE, W.A., 440/220 D.C.
KALIMNA, Vic., 460/230v. 50c.
KALLISTA, Vic., 460/230v. 50c. Con. 29 Pln. 150.
KANDOS, N.S.W., 415/240v. 50c. Con. 280 Pln. 2,500.
KANGAROO FLAT, Vic., 400/230v. 50c. Con. 60 Pln. 835.
KANIVA, Vic., 400/230v. 50c. Con. 150 Pln. 600.
KAPUNDA, S.A., 400/200v. 50c. Con. 271 Pln. 1,660.
KATANNING, W.A., 220v. D.C. Con. 600 Pln. 3,000.
KATOOMBA, N.S.W., 415/240v. 50c. Con. 2,000 Pln. 12,000.
KELLERBERRIN, W.A., 220v. D.C.
KELMSCOTT, W.A., 440/250v. 40c.
KEMPSEY, N.S.W., 480/240v. D.C. Con. 630 Pln. 3,500.
KEMPTON, Tas., 240v. 50c.
KENTISH, Tas., 240v. 50c. Con. 319.
KENWICK, W.A., 440/250v. 40c.
KERANG, Vic., 230v. D.C. Con. 550 Pln. 2,750.
KEW, Vic., 400/200v. 50c.
KIAMA, N.S.W., 415/240v. 50c. Con. 200 Pln. 1,600.
KILMORE, Vic., 230v. D.C. Con. 180 Pln. 900.
KILSYTH, Vic., 460/230v. 50v. Con. 32 Pln. 150.
KINGAROY, Q'ld., 480/240v. D.C. Con. 120 Pln. 2,000.
KINGBOROUGH, Tas., 240v. 50c. Con. 607.
KINGSTON, Tas., 230/115v. A.C. 500v. 50c.
KOGARAH, N.S.W., 415/240v. 50c. Con. 23,600 Pln. 100,000.
KOJONUP, W.A., 110v. D.C. Con. 60.
KOLORA, Vic., 460/230v. A.C. Con. 92.
KONGWAK, Vic., 400/230 50c. Con. 18 Pln. 100.
KORONGVALE, Vic., 400/230 50c. Con. 186, Pln. 500.
KONDININ, W.A., 440/220 D.C.
KOONDROOK, Vic., 400/230v. 50c. Con. 60 Pln. 400.
KOORDA, W.A., 220 D.C.
KOOWEERUP, Vic., 230v. A.C. Con. 70 Pln. 500.
KOROIT, Vic., 400/230v. 50c. Con. 239 Pln. 2,000.
KORUMBURRA, Vic., 400/230v. 50c. Con. 555 Pln. 3,000.
KULIN, W.A., 220 D.C.
KURRI KURRI, N.S.W., 415/240v. 50c. Con. 1,000.
KYABRAM, Vic., 400/230v. 50c. Con. 389 Pln. 1,700.
KYNETON, Vic., 400/230v. 50c. Con. 640 Pln. 3,195.
KYOGLE, N.S.W., 240v. D.C. Con. 330 Pln. 1,800.
LAKE GRACE, W.A., 220v. D.C.
LAKES ENTRANCE, Vic., 460/230v. 50c. Con. 146 Pln. 900.
LAMEROO, S.A., 230v. D.C. Con. 45.
LANCEFIELD, Vic., 400/230v. 50c. Con. 251 Pln. 600.
LARA, Vic., 400/230v. 50c.
LARPENT, Vic., 460/230v. 50c. Con. 50.
LATROBE, Tas., 460/230v. 50c. Con. 270 Pln. 1,500.
LAUNCESTON, Tas., 415/240v. 50c. Con. 8,240 Pln. 30,000.
LAURA, S.A., 220v. D.C. Con. 110 Pln. 800.
LAWSON, N.S.W., 415/240v. 50c. Con. 1,700 Pln. 8,000.
LEETON, N.S.W., See Murrumbidgee Irrigation Areas.
LEONGATHA, Vic., 400/230v. 50c. Con. 435 Pln. 1,700.
LEONORA, W.A., 440/220v. D.C.
LEVEN, Tas., 240v. 50c. Con. 615.
LILYDALE, Vic., 400/230v. 50c. Con. 264 Pln. 1,800.
LISMORE, N.S.W., 450/240v. 50c. Con. 1,700 Pln. 8,500.
LITTLEHAMPTON, S.A., 400/200v. 50c. Con. 54 Pln. 355.
LIVERPOOL, N.S.W., 415/240v. 50c.
LOCH, Vic., 460/230 50c. Con. 70 Pln. 300.
LOCKHART, N.S.W., 240v. D.C. Con. 225.
LONGFORD, Tas., 415/240v. 50c. Con. 371.
LONGREACH, Q'ld., 480/240v. D.C. Con. 530 Pln. 5,000.
LONGWARRY, Vic., 400/230v. 50c. Con. 43 Pln. 300.
LORNE, Vic., 230v. D.C. Con. 120 Pln. 250.
LOWER FERNTREE GULLY, Vic., 400/230v. 50c.
LOWER PLENTY, Vic., 460/230v. 50c. Con. 27 Pln. 50.
LOXTON, S.A., 440/220v. D.C. Con. 55.
LYNDOCH, S.A., 400/200v. Con. 48.
MACEDON, Vic., 400/230 50c. Con. 189 Pln. 250.
MACKAY, Q'ld., 415/240v. 50c. Con. 650 Pln. 7,000.
MACKSVILLE, N.S.W., 415/230v. 50c. Con. 180 Pln. 1,200.
MACLEAN, N.S.W., 415/240v. A.C. 265 Pln. 1,600.
MADDINGTON, W.A., 440/250v. 40c.
MAFFRA, Vic., 400/230v. 50c. Con. 483 Pln. 2,000.
MAITLAND, S.A., 230v. D.C. Con. 120.
MALLALA, S.A., 400/200v. 50c. Con. 71 Pln. 365.
MALVERN, Vic., 400/200v. 50c.
MANILLA, N.S.W., 415/240v. 50c. Con. 260.
MANJIMUP, W.A., 220v. D.C.
MANLY, N.S.W., 415/240v. 50c. Con. 6,675 Pln. 26,000.
MANNUM, S.A., 220v. D.C. Con. 105.
MANSFIELD, Vic., 460/230v. 50c. Con. 182 Pln. 650.
MARYBOROUGH, Q'ld., 415/240v. 50c. Con. 1,500 Pln. 12,000.
MARYBOROUGH, Vic., 400/230v. 50c. Con. 1,130 Pln. 5,175.
McLAREN FLAT, S.A., 400/200v. 50c. Con. 35.
McLAREN VALE, S.A., 400/200v. 50c. Con. 99.
MECKERING, W.A., 220v. D.C. Con. 65 Pln. 500.
MEEKATHARRA, W.A., 220v. D.C. Con. 145 Pln. 500.
MELBOURNE, Vic., 400/230v. 50c. Con. 26,527 Pln. 103,400.
MERBEIN, Vic., 400/230v. 50c. Con. 150.
MERREDIN, W.A., 220v. D.C. Con. 200.
MERRIGUM, Vic., 400/230v. 50c. Con. 50 Pln. 200.
MIDDLE SWAN, W.A., 440/250v. 40c.
MIDLAND JUNCTION, W.A., 440/250v. 40c.
MILDURA, Vic., 460/230v. 400/230v. D.C. Con. 1,200 Pln. 6,000.
MILLICENT, S.A., 240v. D.C. Con. 200.
MILTON, N.S.W., 110v. D.C.
MINGENEW, W.A., 110v. D.C.
MINLATON, S.A., 230v. D.C. Con. 100 Pln. 750.
MINYIP, Vic., 230v. D.C. Con. 165 Pln. 700.
MIRBOO NORTH, Vic., 400/230v. 50c. Con. 130 Pln. 600.
MITTAGONG, N.S.W., 415/240v. 50c. Con. 420 Pln. 2,000.
MOE, Vic., 400/230v. 50c. Con. 167 Pln. 400.
MOANA, S.A., 400/200v. 50c. Con. 4.
MONEGEETA, 460/230v. 50c. Con. 13 Pln. 50.
MONTMORENCY, Vic., 460/230v. 50c. Con. 41 Pln. 400.
MONTROSE, Vic., 460/230v. 50c. Con. 98 Pln. 100.
MOONTA, S.A., 230v. D.C. Con. 370 Pln. 2,500.
MOORA, W.A., 220v. D.C. Con. 125.
MOORABBIN, Vic., 400/200v. 50c.

MOOROOPNA, Vic., 400/230v. 50c. Con. 207 Pln. 1,500.
MOOROODUC, Vic., 400/230v. 50c. Con. 3 Pln. 20.
MORDIALLOC, Vic., 400/200v. 50c.
MOREE, N.S.W., 415/240v. A.C. Con. 710.
MORGAN, S.A., 240v. D.C. Con. 55 Pln. 800.
MORNINGTON, Vic., 400/230v. A.C. Con. 594 Pln. 3,250.
MOROWA, W.A., 220v. D.C.
MORPHETT VALE, S.A., 400/200v. 50c. Con. 34.
MORTLAKE, Vic., 400/230v. 50c. Con. 233 Pln. 1,000.
MORWELL, Vic., 400/230v. 50c. Con. 279 Pln. 1,365.
MOSS VALE, N.S.W., 415/240v. 50c.
MOUNT BARKER, S.A., 400/200v. 50c. Con. 247 Pln. 2,180.
MOUNT BARKER, W.A., 220v. D.C. Con. 75.
MOUNT GAMBIER, S.A., 460/230v. D.C. Con. 855 Pln. 5,000.
MOUNT LOFTY, S.A., 400/200v. 50c. Pln. 305.
MOUNT MAGNET, W.A., 110v. D.C.
MOUNT PLEASANT, S.A., 400/200v. 50c. Con. 55.
MUDGEE, N.S.W., 415/240v. 50c. Con. 750 Pln. 3,500.
MULGRAVE, Vic., 400/230v. 50c. Con. 164 Pln. 350.
MULLEWA, W.A., 440/220v. D.C.
MULLUMBIMBY, N.S.W., 415/240v. 50c. Con. 286 Pln. 1,600.
MUNDARING, W.A., 220 D.C.
MURCHISON, Vic., 400/230v. 50c. Con. 100 Pln. 600.
MURGON, Q'ld., 415/240v. 50c. Con. 160.
MURRAY BRIDGE, S.A., 440/220v. D.C. Con. 600 Pln. 4,300.
MURRAYVILLE, Vic., 400/230v. 50c. Con. 80 Pln. 400.
MURRUMBIDGEE IRRIGATION AREAS, 415/240v. 40c. Con. 2,700 Pln. 18,000.
MURRUMBURRAH, N.S.W., 415/240v. 50c. Con. 350 Pln. 3,000.
MURTOA, Vic., 230v. D.C. Con. 296 Pln. 1,140.
MURWILLUMBAH, N.S.W., 415/240v. 50c. Con. 450 Pln. 4,500.
MUSWELLBROOK, N.S.W., 415/240v. 50c. Con. 500 Pln. 3,000.
MYLOR, S.A., 400/200v. 50c. Con. 32.
NAGAMBIE, Vic., 230v. D.C. Con. 150 Pln. 750.
NAIRNE, S.A., 400/200v. 50c. Con. 71.
NALANGIL, Vic., 460/230v. 50c. Con. 61 Pln. 100.
NAMBOUR, Q'ld., 415/240v. 50c.
NANNUP, W. A., 220v. D.C.
NARACOORTE, S.A., 440/220v. D.C. Con. 200.
NAREMBEEN, W.A., 220v. D.C. Con. 50.
NARRABRI, N.S.W., 480/240v. D.C. Con. 410 Pln. 2,600.
NARRANDERA, N.S.W., 415/240v. 50c. Con. 1,000 Pln. 4,000.
NARRE WARREN, Vic., 400/230v. 50c. Pln. 100.
NARROGIN, W.A., 220v. D.C. Con. 730 Pln. 2,500.
NARROMINE, N.S.W., 415/240v. 50c. Con. 230 Pln. 1,200.
NATHALIA, Vic., 460/230v. D.C. Con. 200 Pln. 860.
NATIMUK, Vic., 400/230v. 50c. Con. 105 Pln. 559.
NEERIM, Vic., 400/235v. 50c. Pln. 300.
NEWCASTLE, N.S.W., 415/240v. 50c. Con. 28,406 Pln. 148,204.
NEW GISBORNE, Vic., 460/230v. 50c.
NEW NORFOLK, Tas., 240v. 50c. Con. 628.
NEWRY, Vic., 400/230v. 50c. Con. 30 Pln. 300.
NHILL, Vic., 460/230v. D.C. Con. 400 Pln. 1700.
NILMA, Vic., 460/230v. 50c. Con. 23 Pln. 100.
NOARLUNGA, S.A., 400/200v. 50c. Con. 38.
NOBLE PARK, Vic., 460/230v. 50c. Con. 123 Pln. 500.
NOORAT, Vic., 400/230v. 50c. Con. 62 Pln. 120.
NORTHAM, W.A., 440/220v. D.C. Con. 1,000 Pln. 5,000.
NORTHAMPTON, W.A., 220v. D.C.
NORTHCOTE, Vic., 400/230v. 50c. Con. 10,000 Pln. 40,000.
NORTH FREMANTLE, W.A., 440/250v. 40c. Con. 800 Pln. 4,500.
NORTON SUMMIT &
ASHTON, S.A., 400/200, 50c. Con. 141.
NOWRA, N.S.W., 415/240v. 50c.
NUMURKAH, Vic., 230v. D.C. Con. 300 Pln. 1,350.
NURIOOTPA, S.A., 400/200v. 50c. Con. 162 Pln. 2,475.
NYAH, Vic. 400/230v. 50c. Con. 40 Pln. 600.
NYNGAN, N.S.W., 480/240v. D.C.
OAKLEIGH, Vic., 400/200v. 50c.
OATLANDS, Tas.. 415/240v. 50c. Con. 170.
OCEAN GROVE, Vic., 460/230v. 50c. Con. 38 Pln. 50.
OFFICER, Vic. 460/230v. 50c. Con. 2 Pln. 50.
OLINDA, Vic., 460/230v. 50c. Con. 48 Pln. 250.
ORANGE, N.S.W., 415/240v. 50c. Con. 2,481 Pln. 12,000.
ORBOST, Vic., 230v. D.C. Con. 320 Pln. 2,000.
ORROROO, S.A., 230v. D.C. Con. 200 Pln. 800.
OUYEN, Vic., 230v. D.C. Con. 160 Pln. 950.
OWEN, S.A., 400/200v. 50c. Con. 54 Pln. 795.
PAKENHAM, Vic., 460/230v. 50c. Con. 39 Pln. 400.
PARACOMBE, S.A., 400/200v. 50c.
PARKES, N.S.W., 415/240v. 50c. Con. 920 Pln. 5,000.
PARRAMATTA, N.S.W., 415/240v. 50c. Con. 5,500 Pln. 35,000.
PARATTAH, Tas., 415/240v. 50c. Con. 50.
PENGUIN, Tas., 415/240v. 50c. Con. 150.
PEAK HILL, N.S.W., 415/240v. 50c. Pln. 1,500.
PENRITH, N.S.W., 415/240v. 50c. Con. 650 Pln. 5,000.
PEPPERMINT GROVE, W.A., 440/250v. 40c.
PERTH, Tas., 240v. 50c.
PERTH, W.A., 440/250v. 40c. Con. 30,770, Pln. 137,000.
PETERBOROUGH, S.A., 460/230v. D.C. Con. 810 Pln. 3,500.
PHILIP ISLAND, Vic., 400/230v. 50c. Con. 50 Pln. 1,000.
PIALBA, Q'ld., 415/240v. A.C.
PICTON, N.S.W., 415/240v. A.C. Con. 200 Pln. 1,000.
PINNAROO, S.A., 400/230v. 50c.
PINGELLY, W.A., 220v. D.C. Con. 140.
PINJARRA, W.A., 220v. D.C.
POINT LONSDALE, Vic., 460/230v. 50c. Con. 118 Pln. 700.
POMBORNEIT, Vic., 460/230v. 50c.
POOWONG, Vic., 460/230v. Con. 41 Pln. 200.
PONTVILLE, Tas., 240v. 50c.
PORTARLINGTON, Vic., 460/230v. 50c. Con. 118 Pln. 600.
PORT AUGUSTA, S.A., 440/220v. D.C. Con. 250.
PORT AUGUSTA WEST, S.A., 440/220v. D.C.
PORT FAIRY, Vic., 400/230v. 50c. Con. 256 Pln. 2,000.
PORT KEMBLA, N.S.W., 415/240v. 50c. Con. 600 Pln. 5,000.
PORTLAND, N.S.W., 415/240v. 50c. Con. 500 Pln. 5,000.
PORT LINCOLN, S.A., 415/240v. A.C. Con. 450.
PORT MACQUARIE, N.S.W., 415/240v. A.C. Con. 100
PORT MELBOURNE, Vic., 400/230v. 50c. Con. 2,750 Pln. 12,500.
PORT NOARLUNG, S.A., 400/200v. 50c. Con. 104.
PORT PIRIE, S.A., 400/230v. 50c. Con. 2,400.
PORTSEA, Vic. 400/230v. 50c. Con. 98 Pln. 150.
PRAHRAN, Vic., 400/200v. 50c.
PRESTON, Vic., 400/230v. 50c. 7,500 Pln. 29,200.
PROSERPINE, Q'ld., 415/240v. 50c. Con. 160.
PYRAMID HILL, Vic., 400/230v. 50c. Con. 90,475.
QUAIRADING, W.A., 220 D.C.
QUAMBATOOK, Vic., 230v. D.C. Con. 104 Pln. 500.
QUEANBEYAN, N.S.W., 415/240v. 50c. Con. 1,000 Pln. 6,000.
QUEENSCLIFF, Vic., 400/230v. 50c. Con. 409 Pln. 1,900.
QUEEN'S PARK, W.A., 440/250v. 40c.
QUEENSTOWN, Tas., 220v. 50c. Con. 600.
QUIRINDI, N.S.W., 415/240v. 50c. Con. 370 Pln. 2,500.
QUORN, S.A., 230v. D.C. Con. 270 Pln. 1,500.
RAINBOW, Vic., 230v. D.C. Con. 149 Pln. 900.
REDCLIFFE, Q'ld., 415/240v. 50c.
RED HILL, S.A., 230v. D.C.
RENMARK, S.A., 460/230v. D.C. Con. 380 Pln. 3,000.
REYNELLA, S.A., 400/200v. 50c. Con. 76 Pln. 380.
RICHMOND, N.S.W., 415/240v. 50c. Con. 200 Pln. 3,000.
RICHMOND, Vic., 400/230v. 50c.
RICHMOND, Tas., 240v. 50c. Con. 145.
ROBERTSON, N.S.W., 240v. 50c. Con. 45 Pln. 180.
RIDDELL, Vic., 460/230v. 50c. Con. 17 Pln. 350.
RINGWOOD, Vic., 400/230v. 50c. Con. 607 Pln. 3,000.
ROCHESTER, Vic., 230v. D.C. Con. 372.
ROCKHAMPTON, Q'ld., 415/240v. 50c. Con. 4,430 Pln. 25,000.
ROCKINGHAM, W.A., 110 D.C.
ROMA, Q'ld., 220v. D.C. Con. 600 Pln. 3,000.
ROMSEY, Vic., 400/230v. 50c. Con. 86,600.
ROSEBERY WILLIAMSFORD, Tas., 415/240v. A.C. Con. 112.
ROSEBUD, Vic., 400/230v. 50c. Con. 80,200.
ROSEDALE, Vic., 460/230v. 50c. Con. 72,520.
ROSEWORTHY, S.A., 400/200v. 50c. Con. 30.
ROSS, Tas., 415/240v. 50c.
ROTTNEST, W.A., 220v. D.C. Con. 52.
RUBY, Vic., 400/230v. A.C. Con. 9 Pln. 50.
RUPANYUP, Vic., 230v. D.C. Con. 125 Pop. 700.
RUSHWORTH, Vic., 230v. D.C. Con. 275, Pln. 1,200.
RUTHERGLEN, Vic., 400/230v. 50c. Con. 258 Pln. 160.
RYE, Vic., 400/230v. 50c. Con. 11 Pln. 50.
RYLSTONE, N.S.W., 415/240v. 50c. Con. 170 Pln. 850.
SALE, Vic., 400/230v. 50c. Con. 823 Pln. 4000.
SALISBURY, S.A., 400/200v. 50c. Con. 238 Pln. 795.
SANDRINGHAM, Vic., 400/200v. 50c.
SASSAFRAS AREA, Vic., 400/230v. 50c. Con. 269 Pln. 500.
SCONE, N.S.W., 415/240v. A.C. Con. 370 Pln. 2,000.

SCOTTSDALE, Tas. 415/240v. 50c. Con. 250 Pln. 800.
SEA LAKE, Vic., 230v. D.C. Con. 175 Pln. 600.
SEYMOUR, Vic. 400/230v. 50c. Con. 450 Pln. 2,525.
SHACKLETON, W.A., D.C.
SHEFFIELD, Tas., 480/240v. 50c. Con. 350 Pln. 3,000.
SHELLHARBOUR, N.S.W., 415/240v. 50c.
SHEPPARTON, Vic., 400/230v. 50c. Con. 1,110 Pln. 6,000.
SHERBROOKE, Vic., 460/230v. 50c. Con. 20 Pln. 100.
SILVAN, Vic., 400/230v. 50c. Con. 20 Pln. 200.
SINGLETON, N.S.W., 415/240v. 50c. Con. 950 Pln. 4,500.
SMITHFIELD, S.A., 400/200v. 50c. Con. 22.
SNOWTOWN, S.A., 220v. D.C. Con. 100 Pln. 500.
SOMERVILLE, Vic., 400/230v. 50c. Con. 62 Pln. 200.
SORRELL, Tas., 240v. 50c. Con. 89.
SORRENTO, Vic., 400/230v. 50c. Con. 400, Pln. 500.
SOUTHERN CROSS, W.A., 220v. D.C.
SOUTH GRAFTON, N.S.W., 415/240v. 50c. Con. 460 Pln. 1,550.
SOUTH GUILDFORD, W.A., 440/250v. 40c.
SOUTH MELBOURNE, Vic., 400/230v. 50c.
SOUTH PERTH, W.A., 440/250v. 40c. Con. 2,020 Pln. 5,000.
SOUTHPORT, Q'ld., 415/240v. A.C. Con. 1,100, Pln. 5,000.
SPRINGHURST, Vic., 400/230v. 50c. Con. 17 Pln. 100.
SPRING VALE, Vic., 400/230v. 50c. Con. 259 Pln. 1,250.
STANLEY, Tas., 415/240v. 50c. Con. 140 Pln. 750.
STANTHORPE, Q'ld., 415/240v. 50c. Con. 425 Pln. 2,500.
STAWELL, Vic., 400/230v. 50c. Con. 595 Pln. 5,000.
ST. ALBANS, Vic., 400/230v. 50c. Con. 59 Pln. 600.
ST. ARNAUD, Vic., 400/230v. 50c. Con. 550 Pln. 3,500.
ST. GEORGE, Q'ld., 460/230v. D.C. Con. 75 Pln. 800.
St. KILDA, Vic. 400/200v. 50c.
STIRLING, S.A., 400/200v. 50c.
STRATFORD, Vic., 400/230v. 50c. Con. 96 Pln. 800.
STRATHALBYN, S.A., 220v. D.C. Con. 250 Pln. 1,500.
SUBIACO, W.A. 440/250v. Con. 4,000 Pln. 18,000.
SUNBURY, Vic. 400/230v. 50c. Con. 190 Pln. 1,100.
SUTHERLAND, N.S.W., 415/240v. 50c. Con. 3,000 Pln. 8,000.
SWAN HILL, Vic. 400/230v. 50c. Con. 3,000 Pln. 8,000.
SWAN VIEW, W.A., 440/250v. 40c.
SYDNEY, N.S.W., 415/240v. 50c. Con. 204,246 Pln. 825,750
SYDNEY, N.S.W., 415/240v. 50c. Con. 26,240 Pln. 167,000.
SYMMONS PLAINS, Tas., 240v. 50c.
TAMMIN, W.A., 220 D.C.
TALLEM BEND, S.A., 400/230v. 50c. Con. 75.
TAMBELLUP, W.A., 220v. D.C.
TAMWORTH, N.S.W., 415/240v. 50c. Con. 3,000 Pln. 14,500.
TANUNDA, S.A., 220v. D.C. Con. 150 Pln. 1,200.
TAREE, N.S.W., 415/240v. A.C.
TATURA, Vic., 400/230v. 50c. Con. 252 Pln. 1,300.
TEA TREE GULLY, S.A., 400/200v. 50c. Con. 55 Pln. 1,015.
TEMORA, N.S.W., 415/240v. A.C. Con. 750 Pln. 3,500.
TENTERFIELD, N.S.W., 415/240v. A.C. Con. 700 Pln. 3,000.
TERALBA, N.S.W., 415/240v. 50c.
TERANG, Vic., 400/230v. 50c. Con. 462 Pln. 2,255.
THARGOMINDAH, Q'ld., 220v. D.C. Con. 160 Pln. 300.
THEODORE, Q'ld., 240v. D.C. Con. 23 Pln. 150.
THORNTON, Vic., 460/230v. 50c. Con. 37 Pln. 150.
THREE SPRINGS, W.A., 440/220v. D.C.
TINAMBA, Vic. 460/230v. 50c. Con. 25 Pln. 50.
TOCUMWAL, N.S.W., 415/240v. 50c. 145 Pln. 1,200.
TONGALA, Vic. 400/230v. 50c. Con. 88 Pln. 250.
TOODYAY, W.A., 220v. D.C.
TOOGOOLAWAH, Q'ld., 415/240v. 50c.
TOOMBUL, Q'ld., 415/240v. 50c.
TOONGABBIE, Vic., 460/230v. 50c. Con. 13 Pln. 150.
TOORA, Vic., 400/230v. A.C. Con. 170 Pln. 350.
TOOWOOMBA, Q'ld., 480/240v. D.C. Con. 5,000 Pln. 26,000.
TORQUAY, Vic., 400/230v. A.C.
TOWNSVILLE, Q'ld., 425/240v. 50c. Con. 4,120 Pln. 30,000.
TRAFALGAR, Vic. 400/230v. 50c. Con. 231 Pln. 700.
TRARALGON, Vic., 400/230v. 50c. Con. 519 Pln. 2,300.
TREMONT, Vic., 460/230v. 50c. Con. 41 Pln. 200.
TRENTHAM, Vic., 400/230v. 50c. Con. 120 Pln. 780.
TULLY, Q'ld., 415/240v. 50c.
TUMUT, N.S.W., 415/240v. 50c. Con. 300.
TUNBRIDGE, Tas., 240v., 50c.
TUNCURRY, N.S.W., 415/240v. 50c.
TYABB, Vic., 460/230v. 50c. Con. 30 Pln. 50.
TYERS DISTRICT, Vic., 460/230v. 50c. Con. 51 Pln. 250.
TYRONG, Vic., 460/230, 50c. Con. 18 Pln. 50.
TABLE CAPE, Tas., 240v. 50c. Con. 515.
TWO WELLS, S.A., 400/200v. 50c. Con. 33.
ULMARRA, N.S.W., 415/240v. 50c. Con. 270 Pln. 2,150.
ULTIMA, Vic., 400/230v. 50c. Con. 30 Pln. 250.
ULVERSTONE, Tas., 415/240v. 50c. Con. 580 Pln. 3,000.
UPPER MACEDON, Vic., 400/230v. 50c.
UPWEY, Vic., 400/230v. 50c. Con. 136 Pln. 200.
URALLA, N.S.W., 240v. D.C. Con. 190 Pln. 1,100.
VICTOR HARBOR, S.A., 415/240v. 50c. Con. 504 Pln. 3,500.
VIOLET TOWN, Vic., 400/230v. 50c. Con. 100 Pln. 600.
VIRGINIA, S.A., 400/200v. 50c. Con. 15.
WAGGA, N.S.W., 415/240v. 50c. Con. 3,000 Pln. 10,000.
WAGIN, W.A., 220v. D.C. Con. 415 Pln. 1,500.
WAHGUNYAH, Vic., 400/200v. 50c. Con. 68 Pln. 500.
WAIKERIE, S.A., 415/240v. 50c. Con. 68 Pln. 500.
WALCHA, N.S.W., 480/240v. D.C. Con. 205 Pln. 1,000.
WALGETT, N.S.W., 480/240v. D.C.
WALLAROO, S.A., 415/240v. 50c. Con. 470 Pln. 3,500.
WALLA WALLA, N.S.W., 230v. D.C. Con. 85 Pln. 600.
WALLERAWANG, N.S.W., 415/240v. 50c. Con. 160 Pln. 1,500.
WANGARATTA, Vic., 400/230v. 50c. Con. 839 Pln. 4,300.
WARBURTON, Vic., 230v. D.C. Con. 140 Pln. 1,000.
WARRACKNABEAL, Vic., 400/230v. 50c. Con. 350 Pln. 2,875.
WARRAGUL, Vic., 400/230v. 50c. Con. 514 Pln. 4,700.
WARREN, N.S.W., 415/240v. 50c. Con. 160 Pln. 1,100.
WARRINGAH, N.S.W., 415/240v. 50c. Con. 4,394 Pln. 15,000.
WARRION, Vic., 460/230v. 50c. Con. 10 Pln. 100.
WARRNAMBOOL, Vic., 400/230v. 50c. Con. 1,350 Pln. 8,000.
WARWICK, Q'ld., 440/220v. D.C. Con. 950 Pln. 7,000.
WASLEYS, S.A., 400/200v. 50c. Con. 37 Pln. 340.
WATTLE GROVE, W.A., 440/250v. 50c.
WEDDERBURN, Vic., 400/230v. 50c. Con. 210 Pln. 1,700.
WEE WAA, N.S.W., 415/240v. 50c. Pln. 700.
WELLINGTON, N.S.W., 415/240v. 50c. Con. 640 Pln. 3,500.
WELSHPOOL, W.A., 440/250v. 40c.
WERRIBEE, Vic., 400/230v. 50c. Con. 446 Pln. 1700.
WERRIS CREEK, N.S.W., 415/240v. 50c.
WESTBURY, Tas., 415/240v. 50c. Con. 309.
WEST MAITLAND, N.S.W., 415/240.. 50c.
WESTON, N.S.W., 240v. D.C. Con. 320.
WEST WALLSEND, N.S.W., 220v. D.C.
WEST WYALONG, N.S.W., 480/240v. D.C. Con. 500 Pln. 3,000.
WHITTON, N.S.W., 415/240v. 50c. Con. 40 Pln. 110.
WICKEPIN, W.A., 220v. D.C.
WILLIAMSFORD, Tas., 400/230v. 50c. (See Roseberry, Tas.).
WILLIAMSTOWN, Vic. 400/230v. 50c. Con. 6000 Pln. 20,000.
WILLUNGA, S.A., 400/200v. 50c. Con. 71.
WILUNA, W.A., 440/250v. 50c.
WINCHELSEA, Vic., 460/230v. 50c. Con. 103 Pln. 705.
WINDSOR, N.S.W., 415/240v. 50c.
WINGHAM, N.S.W. 415/240v. 50 Con. 200.
WINTON, Q'ld., 480/240b. D.C. Con. 260 Pln. 1,750.
WODONGA, Vic., 230v. D.C. Con. 216 Pln. 2,300.
WOLLONGONG, N.S.W., 415/240v. 50c. Con. 2,800 Pln. 12,000.
WONGAN HILLS, W.A., 220v. D.C.
WONTHAGGI, Vic., 415/240v. 50c. Con. 1,294 Pln. 6,000.
WOODBURY, Tas., 240v. 50c.
WOODEND, Vic., 400/230v. 50c. Con. 214 Pln. 1,000.
WOODSIDE, S.A., 400-230v. 50c.
WOOLMERS, Tas., 240v. 50c.
WOOL WOOL, Vic., 400/230v. 50c. Pln. 50.
WOORALOO, W.A., 220v. D.C.
WOY WOY, N.S.W., 415/240v. 50c. Con. 450.
WYALCATCHEM, W.A., 220v. D.C.
WYCHEPROOF, Vic., 230v. D.C. Con. 160 Pln. 800.
WYNDHAM, W.A., 220v. D.C.
WYNYARD, Tas., 415/240v. 50c. Con. 460 Pln. 1,400.
WYONG, N.S.W., 415/240v. 50c. Con. 200.
YACKA, S.A., 400/200v. 50c. Con. 45.
YALGOO, W.A., 220v. D.C.
YALLINGUP, W.A., 220v. D.C.
YALLOURN, Vic., 400/230v. 50c.
YANCO, N.S.W., 415/240v. 50c. Con. 2,570 Pln. 14,000.
YARRAGON, Vic., 400/230v. 50c. Con. 77 Pln. 400.
YARRAM, Vic., 400/230v. 50c. Con. 250v. Pln. 1,200.
YARRAWONGA, Vic., 230v. D.C. Con. 338 Pln. 1,650.
YASS, N.S.W., 415/240v. 50c. Con. 310 Pln. 2,000.
YEA, Vic., 400/230v. 50c., Con. 70 Pln. 950.
YINNAR, Vic., 400/230v. 50c. Con. 34 Pln. 150.
YORK, W.A., 220v. D.C.
YORKETOWN, S.A., 220v. D.C. Con. 100.
YOUNG, N.S.W., 415/240v. 50c. Con. 890.
ZEEHAN, Tas., 415/240v. 50c. Con. 200 Pln. 3,000.

Who's Who in Radio.

AARONS, Albert.—Director, Eclipse Radio Pty. Ltd., Melbourne. Founded Eclipse Radio Pty. Ltd. 1926.

AARONS, Saul C.—Director, Eclipse Radio Pty. Ltd., Melbourne. Sales Manager, Corbett Derham Pty. Ltd., 1924. Sales Manager, Tunafone Wireless Pty. Ltd., 1925. Formed Eclipse Radio with Brother May, 1926. Born January, 1900.

ALLSOP, Raymond C.—Chief Engineer, Raycophone Ltd., Trafalgar St., Annandale, N.S.W. M. Inst. R.E. Aust. Licensed experimenter, 1911. Radio operator War Zones, 1916-1918. Laboratory assistant Royal Australian Navy Wireless, Randwick. Considerable short wave experience telegraphy and telephony, Engineer i/c. Constructed and operated 2BL (13/11/23) from beginning of broadcasting to the taking over by Commonwealth Govt. (22/7/29).

ANDERSON, Maurice J.—Sales Manager, Paramount Radio Manufacturing Co., 301 Castlereagh St., Sydney. Commercial Degree A.A.I.I. Amateur exp. till 1929, various radio activities till 1931, joined Paramount Radio at inception. Private address: Bondi. Recreations: Tennis, Motoring, Camping, Ice Skating. Born, March 3rd, 1904.

ANDERSON, Oswald, General Manager Station 2UW, Born Sydney, educated for the most part in Victoria. Began business as junior law-clerk, Melbourne, after three years of law joined T. & G. head office, Melbourne. Served eleven years and occupied many positions of trust, culminating as Chief Superintendent northern part of N.S.W. In 1913 during a visit to England was appointed Chief Demonstrator by Hopkinsons at the Music Exhibition, Olympia. After this associated with many important music functions in England, and during stay there, composed and published some twenty-odd songs, some of which obtained considerable popularity. Returned to Australia, 1915, as representative of English Music and Piano firms, and for next three years, as Concert Entrepreneur for Peter Dawson concerts for the 1916/1918 tours. Joined Palings Ltd., 1919, Departmental Manager Concert Promotor and Executive. First actual participation in Radio Broadcasting, 1923, when organised first broadcasts from a public hall in Australia. With assistance of Mr. Ray Allsop on electrical side, experimental programmes (to which every artist of note in Sydney contributed) were broadcast for many weeks, and this was the small beginning of Paling's station. First commercial association with broadcasting, Dec. 1923 as Manager Farmers (2FC) Broadcasting service. In 1928 appointed Manager 2FC Ltd., 14/8/28 when 2FC and 2BL were merged into the N.S.W. Broadcasting Co. Appointed N.S.W. General Manager. When the Australian Broadcasting Co. was formed, 1929 to provide National programmes, he was again appointed Manager for these extended activities, from which he resigned in March, 1930 to take over the general management of Station 2UW. Is an executive of Federation of Broadcasting Stations, an advisory councillor of Teachers' Conference, and an associate of N.S.W. Musical Association.

AUSTEE, Alexander H.—Manager and Chief Announcer, North-Western Tasmania Broadcasters Ltd., Ulverstone, Tas. Entered Radio, 1925, Leviathan Ltd., Melbourne. Organised first series Community Singing, on North West Coast of Tasmania. Studied Radio Engineering. Musical Knowledge. Private address: Risby Street, Ulverstone. Recreation: Bowls. Born, 1900.

AUSTIN, Ernest A.—Director, Essanay Pty. Ltd., Melbourne. Four years A.I.F. Entered Radio 1921. Works Manager, Radio Corporation, 1925-1928. Formed Essanay Ltd., with Mr. Sweeney, 1928. Born, June, 1880.

APPERLEY, Geo.—Traffic Manager, Beam Wireless, Amalgamated Wireless (A'sia) Ltd., Melbourne. Early training and experience telegraphy, telephony and wireless with N.Z. Govt. Telegraphs. 1910-1912 Wireless Service of British Colonial Government. 1913 joined A.W.A. 1914-1916 Chief of Marconi Wireless School. 1916-1919 A.W.A. Works Manager. 1919-1923 A.W.A. Technical Superintendent and i/c. Patent Dept. 1924, i/c. Beam Wireless Service. Private Address: 409 Glen Eira Rd., Caulfield, Victoria. Born, 24th March, 1887.

BADGERY-PARKER, E. R., Publicity and Sales Promotion Manager, Philips Lamps (A/sia) Ltd., 69 Clarence St., Sydney. Served several years active service A.I.F. After the War appointed General Manager W.N.T. Avery Ltd. for New Zealand in 1927 joined Philips Lamps Ltd., Australian born, 1897.

BAYLEY, Ernest K.—Engineer, Radio and Electrical Department, Henry G. Small & Co., Melbourne. B.E.E. Melbourne University. Junior Member Institute Engineers, Australia. Member Constitutional Club. Educated Wesley College, Melbourne, later obtained Degree Electrical Engineering after four years, Melbourne University. Associated with State Electricity Commission Vic. 1923 to 1925. Spent two years with B.T.H. Rugby, England. Returned Australia, 1927, joined staff Johnson and Phillips as technical assistant until 1930, then present company. Private address: "Tintern," 2 Redan St., St. Kilda, Melbourne. Recreations: Tennis, Golf.

BEAN, Leslie P. R.—Managing Director, Stromberg-Carlson (A/sia) Ltd., 72 William Street, Sydney. A.I.E.E., Mem.I.E.E. (U.S.A.) M.Inst.R.E. Aust. 1904-1919 Electrical Engineer on staff of P.M.G.'s Department. 1919, resigned from Public Service, visited America, returned 1920, founded L. P. R. Bean & Co. Ltd., visited overseas, 1922-23, again in 1926-27. Returned Australia 1927, formed Stromberg-Carlson (A/sia) Ltd., (incorporating L. P. R. Bean & Co. Ltd.), Councillor of Institution of Radio Engineers, Australia. Born 1884.

BEARDSMORE, Gordon C.—Manager, Radio and Hardware Department, David Jones Ltd., Sydney. Councillor, Lawn Tennis Association, Councillor Hard Courts Assn., Vice President Western Suburbs Hard

Courts Assn. Started in electrical trade with F. S. Lee. Later with Lawrence & Hanson, from there to Ramsay Sharp & Co., later to Smith's Radio Store, then started with Harringtons Ltd. and later became Radio Manager. Private address: "Heathbank," Pyrmont St., Ashfield. Recreations: Tennis, Golf, Football. Born, 15th November, 1901.

BEGG, Reginald H.—Proprietor, William Begg & Sons, Melbourne. B.E., Diploma of Electrical Engineering; Associate Member, Institute of Engineers; Fellow S.A. School of Mines; Diploma of Applied Science, Adelaide University. Educated St. Peter's College and Adelaide University. Member of Electrical staff, Adelaide Tramways, 3 years, Assistant Engineer, Australian Metal Co., Melbourne, 2 years, Engineer and Manager, Electrical Machinery Business of Strachan, Murray & Shannon, Melbourne, 8 years. Director Lascelles Parrington Ltd., Melbourne, 5 years. Private address: 7 Henderson Ave., Maloeru S.E.4 Victoria. Recreation: Golf and Swimming. Born 31st March, 1889.

BELL, Ronald A.—Proprietor, R.C.S. Radio, 12 City Road, Sydney. Engaged in Radio & Electrical Engineering since 1919. Joined United Distributors, 1919. Electrical fitting with Ferguson Palin Ltd., Sydney. Later with Stromberg-Carlson Laboratory, then i/c test dept. Airzone Ltd. Rejoined Stromberg-Carlson in designing, testing equipment etc. Private address: 29 Woodland St., Marrickville, N.S.W. Recreation: Angling and fish breeding. Born, 13th January, 1902.

BLUNDEN, Godfrey.—Editor, "Wireless Weekly," Wireless Newspapers Ltd., 60/66 Elizabeth St., Sydney.

BOTTEN, Herbert William, Radio Manager Mick Simmons Ltd. Sydney. Electrical test-room Adelaide Tramways, 1915. Served A.I.F. Palestine, Signals. 1915-1919. Joined wireless industry, 1922 appointed present position, 1924. Born 9/1/1895.

BRASH, Alfred F.—Mng. Dir. M. Brash & Co. Propy. Ltd., 108-110 Elizabeth St., Melbourne Cl. Clubs: Naval and Military, Victoria Golf, Sorrento Golf. Educated Cumloden College & Melbourne University. Amateur Welter-weight Boxing Champion of Victoria, 1906. Served with B.E.F., Italy, 1916-1919. Rank: Captain. Private address: "Lindfield," Mandeville Cr., Toorak. Born, 2/8/81. Recreation: Golf.

BROAD, Archibald Dubour.—Secretary Victorian Radio Association, Queen St., Melbourne.

BROADHURST, Benjamin. Proprietor and Manager, University Radio Co., 22 City Rd., Sydney. Commenced own business with father (soft goods manufacturing 1920). Commenced Radio activity, 1927. Private address: 71 Bruce St., Brighton-le-Sands. Born 5th Oct. 1904. Recreations Motoring and Swimming.

BROKENSHA, Albert F.—Gen. Mgr. R. S. Sampson Brokensha Co. of 971 Hay St., Perth, printers and publishers of "The West Australian Wireless News and Musical World." With printing and publishing industry past thirty years. Past fourteen General Mgr. present position.

BROOKER, Vivian M.—Mgr. and Technical Dir. Broadcasting Dept., Findlay & Wills Broadcasters Pty. Ltd., Launceston, Tas. M. Inst. Wireless Technology (London), M. Inst. R.E. (Aust.) A.I.R.E. (America). Joined staff Amalgamated Wireless, 1917, served 3 years Indian Service. 1920 Long Wave experimental station Koo-We-Rup International observation duty. Operated first commercial short wave station between London and Sydney, November, 1926. Joined Engineering staff, A.W.A., 1927. Private address: "Mandalay," Prospect Hill, South Launceston, Tasmania. Recreation: Reading. Born, 11th Feb., 1899.

BROWN, Andrew F. O. — Secretary, Electrical and Radio Association, N.S.W., Grace Bldg., Sydney. Assistant Secretary Electrical Association, 1923. Appointed Secretary 1928. Recreations: Tennis, golf. Born 25/6/1903.

BROWN, H. P., M.B.E., M.I.E.E.—Director-General Postmaster-General's Department; Commonwealth Offices, Treasury Gardens, Melbourne.

BUCHANAN, N. H.—Chief Technician Zenith Radio Co., 37 Oxford St., Paddington, N.S.W.

BUCKLEY, Vincent James.—Radio Sales Mgr. Bloch & Gerber Ltd., 46-48 York St., Sydney. Private address: "Beuna Vista," Pacific Pde., Tamarama Bay, Bondi.

BURBURY, Eric Alfred.—Engineer B'casting Dept., Amalgamated Wireless (A/sia) Ltd., Sydney. M. Inst. R.E. Aust. Joined A.W.A., 1914, Marine Service. Koo-We-Rup Experimental Station, 1920. 3 months Marconi Works, Chelmsford, England, 1921. 2FC, 2SM and A.W.A. Laboratory since. Private address: 8 Norton Av., Vaucluse. Born, 20/4/94. Recreation: Tennis and Swimming.

BURROWS, Alan Owen.—Proprietor, Miss F. V. Wallace (Wireless Shop), 6-8 Royal Arcade, Sydney, N.S.W. Was President Waverley Radio Club. In present business 6 years. Ex-radio correspondent for "S.M. Herald" and "Sun." Visited America, 1928, to study radio position. Private address: 51 Shepherd Rd., Artarmon. Born, 5th Feb., 1901. Recreations: Journalism and Literature.

BENNETT, A. E.—Managing Director, Station 2GB, Adyar House, 29 Bligh St., Sydney. Commenced business, Sydney, 1922, Public Accountant, A.C.A. (Aust.) August, 1926, established Broadcasting Station 2GB of which he is Managing Director, broadcasts each morning, 10 a.m. along lines of Australian Citizenship. Founded "Who's for Australia" League. Later became Vice-President of "All for Australia" League.

BAKER, Arthur W.—Designing Engineer, Commonwealth Moulding & Electric Company, 240 Princes Highway, Arncliffe. N.S.W. Electrical and Mechanical Engineer. Private address: Chandler Ave., Rockdale, N.S.W. Born, 1893. Recreation: Fishing.

BOLAND, Francis Hamilton.—Electrical Engineer, Technical Dept. Philips Lamps (A/sia) Ltd., 69-73 Clarence St., Sydney. 1915-1918 Dept. of Elec. Engr. & Physics, Sydney Technical College. 1918-1922, attached Dept. of Physics Royal Military College of Australia. Proprietor Electrical Business, Canberra, 1923. Joined Philips Ltd., 1927. Born, 6/1/1888.

CAREY, Alfred J.—Sales Mgr. Radio Division, New System Telephones Pty. Ltd., 276-278 Castlereagh St., Sydney. Private address: 15 Coogee St., Randwick. Born, 18/8/03.

CHANDLER, John Beals.—Mgr. J. B. Chandler & Co. Ltd., 43 Adelaide St., Brisbane. Clubs: Golf and Rotary. Founded 4BC Broadcastion Station, Brisbane. Private address: Swann Rd., Taringa, Brisbane. Recreation: Golf.

CHILTON, Robert Ralph. Engineer University Radio Co., 22 City Rd., Sydney. A.Inst.R.E. (Aust.), Ph. C., M.P.S. Member Radio Society of G.B. Diploma W.I.A., Member A.R.R.L. Apprenticed to electrical engineering trade. Graduated in pharmacy Sydney University. Practised two years in pharmacy then took up research work in television. Appointed chief-instructor Australian Radio College, 1931. and superintendent of same 1933. Private address: Chilton Ave., Wahroonga. Born 9/10/1907.

CLARKE, William G.—Supt. Coastal & Island Radio Services, Amalgamated Wireless (A/sia) Ltd., Sydney. Served O.I.C. Brisbane, Townsville, and Perth Radiotelegraph Stations, 1912-1920. Radio Inspector, Territory of New Guinea, 1921. Completed changeover, New Guinea Radio Service from Commonwealth Control to A.W.A., 1922, and remained in charge until, 1927, when transferred to A.W.A. Head Office, Sydney, as Superintendent Radio Services. Private address: "Delmonte," 146 Carrington Road, Randwick. Born, 5/6/84. Recreations: Motoring and Surfing.

COCHRANE, Arthur Stanley.—Senior Announcer, Council of Churches B'casting Station 2CH, 77 York St., Sydney. Degrees, etc., Nil, except claim to being "The biggest storyteller" in the Commonwealth. Born at an obscure little town in Victoria, Violet Town which can claim no distinction, except that Kelly Gang of Bushrangers operated around its peaceful glades. Educated at local school, and showed no great proficiency at anything except reading. Was always a shining example in this respect, and fostered it, probably by instinct knowing that he would be a Radio announcer when he grew to man's estate. The greater part of his life was spent in Melbourne. Came to Sydney in 1914, and joined Farmer & Co. Ltd., with whom he spent several years. When radio burst upon the astounded World, the company secured the first "A" class b'casting license. An announcer was advertised for, and while 240 odd applicants were being sifted, he was used as a stop gap. Eventually the practically unknown position was offered him, and he accepted, with some misgivings, and so became wedded to the microphone. The union has been a very pleasant one, and in spite of the concentration and exacting nature of the work, he thoroughly enjoys it. It really does not matter about the date of his birth, for as long as he is allowed privilege of conducting his beloved Children's Storytime, he shall never grow old, for the little ones keep him young. Recreations: Radio announcers have no recreations, but the little breaks that he has between Studio Sessions, he spends with his favourite authors, amongst whom Dickens reigns supreme. At the same time he takes a keen interest in all sport, though not indulging in any of them.

COLLOCOTT, Harold.—Branch Mgr. Adelaide Dept., Eclipse Radio Pty. Ltd. Entered radio industry, 1923. 1926, joined Eclipse Radio Pty. Ltd. 1928, apptd. Sydney Mgr. 1930, apptd. Adelaide Mgr.

COLVILLE, Sydney.—Proprietor Colville-Moore Wireless Supplies, Rowe St., Sydney. Licensed operator (experimenter) since 1911. Call sign XQF. First started experiments in Q'ld. Founded Q'ld W.I.A. Honorary position in P.M.G.'s Dept. during war. Look up flying in 1927, for radio development work on 'planes. Appointed Radio Commissioner to Siamese Govt. in 1928. Carried out technical work for British Govt. and various other Govts. in the Pacific. Radio Instructor, Aero Club N.S.W., built Aero Club stations 2FA and 2FB. Honorary Lieutenant Instructor in Navy League. Business in Rowe St., for 11 years. Recreations: Flying, Navy League development.

COURT, T. P.—Design Engineer, Standard Telephones and Cables (A/sia) Ltd., Sydney. Commenced wireless experimenting 1910. Served R.A.N. Transport Service, 1915-1919. Designed and built 3UZ and 3AR (1923-1924). Joined S.T.C. 1925.

CRAIG, Douglas.—Sales Production Mgr., Mead Mfg. Co., 1 Crown Lane, Woolloomooloo. Graduate Marconi School Christchurch, N.Z. 15 years in Radio. Swains Radio Dept. 1923-1930. Suttons Ltd. Stock and Service Mgr. 1931. Mullard Valves, Outside Representative, 1932. Private address: Drysdale Court, Imperial Ave., Bondi. Born, 4/10/1900. Recreation: Fishing.

CRAWFORD, W. T. S.—M.Inst.R.E.Aust., Senior Radio Inspector, Sydney.

DARE, Eric.—Gen. Mgr. The Mullard Radio Company (Aust.) Limited, Head Office, 35 Clarence St., Sydney. Educated Napier Boys High School. Won Junior University Scholarship. Amateur radio transmitter, 1912-13. Left New Zealand at outbreak of War and enlisted A.I.F., 1915. Attached to General Headquarters for Wireless, British Army, 1916, transferred to A.I.F. Headquarters (Wireless), Commissioner Lieutenant Pilot A.F.C., 1918. Attached No. 4 Squadron, later with Army of Occupation in Germany. Joined Experimental Dept. (C.A.V.) C.A. Vandervell, Acton, London, 1920. Proprietor and Editor first broadcasting programme paper in Commonwealth—"Wireless Daily." With Philips, 1926 to June, 1930, as Technical-Commercial and Advertising Manager, taking over Mullard in August, 1930. Private address: 17 Streatfield Rd., Bellevue Hill. Born N.Z., 17th Feb., 1897. Recreations: Swimming and Amateur Wrestling.

DANIEL, Frederick Trevor. Production Mgr. Commonwealth Moulding and Electric Co., 240 Princes Highway, Arncliffe, N.S.W. B.Sc. A.M.I.Mech.E. F.C.L. Born, 1903, Recreations: Tennis, Surfing.

DAVIDSON, George Robert.—Sales Mgr. Radio Dept., H. Hecht & Co., 38 Carrington St., Sydney. Educated at North Sydney High School. 6 years in motor trade. Joined Radio Industry, 1928. Private address: 3 Thompson St., Mosman. Born, 7/7/03. Recreations: Tennis and Swimming.

DAVIES, Frederick George Scot.—Sales Mgr. Raycophone, Harringtons Ltd., 386 George St., Sydney. English Representative Scientific Lighting. "X" Ray and Hospital Shadowless Lighting appliances. Western Electric. Since Introduction Sound Reproducing apparatus to Australia. Also Director Publicity for that

Company for 2½ years. Private address: "Deganury Lodge," Glencoe Rd., Woollahra. Born, 10/3/99. Recreations: Dogs, Shooting, Golf, Tennis.

DAVIS, Albert George.—Sole proprietor A. G. Davis & Co., Wembley House, George St., Sydney. Fellow-Australian Institute of Secretaries. Associate—Chartered Institute of Secretaries (London). Associate—Association of Accountants of Australia. Justice of the Peace—N.S.W., Queensland, South Australia. 17 years practising as Accountant and Secretary. 5 years Distributor radio sets and accessories. Recreations: Motoring, Literature, and Music.

DAVIS, Darelle.—Proprietor Darelle Products, 9 Brisbane St., Sydney. Returned to Sydney to resume residence after 10 years in Hollywood California. Private address: 1 Ithaca Rd., Elizabeth Bay. Born, 1888. Recreations: Motor, Yatching, Fishing and Skating.

DEARMAN, Reginald Vincent.—Chief Accountant, Amalgamated Wireless (A/sia) Ltd., Sydney. Associate Member—Commonwealth Institute of Accountants. Educated, Fort St. High School. Accountancy, 1st place N.S.W. Institute ,June 1924, Final Accounts. Joined Amalgamated Wireless (A/sia) Ltd., January, 1924. 3½ years as Melbourne Accountant. War Service, Enlisted January, 1916. Active Service abroad with 9th Field Company Australian Engineers, A.I.F., (Awarded M.S.M.), July, 1916 to end of War. Private address: 20 Selwyn St., Artarmon. Born, 2/8/1897. Recreations: Tennis, Fishing, Swimming, Gardening.

Den HERTOG, A. — Managing Director, Philips Lamps (A/sia.) Ltd., 69 Clarence Street, Sydney.

DICKIN, Albert Joseph.—Man. Dir. F. Dickin Ltd. 18 Lords Rd., Leichhardt. 4 years President of Furniture Mfrs. Assoc., Justice of the Peace 10 years. Started business of F. Dickin Ltd., with the late Mr. Dickin Senior in Pitt St., Sydney on Oct. 1st., 1889. Became Man. Dir. on March 13th, 1920. Toured world in 1928, investigating latest methods of cabinet manufacture. Private address: 213 Harrow Rd., Bexley. Born 26/7/71. Recreations: Golf, Motoring.

DUFFY, John.—Director and Manager, The Duffy Radio Co. Ltd., 18-20 Martin Place, Sydney. (Regd. Office). Associate, Inst. R. E. (U.S.A.) President Harringtons Radio Club. Chief Engineer, Experimental Radio and Television Station VK2HR Waverley. Commenced Radio as hobby, June, 1920. Four years Service and Radio Manager Home Recreations, Four years Wholesale Radio Manager, Harringtons Ltd. Designer of Duffy Short Wave Transposer. Formed Company to Manufacture Short Wave and Television apparatus, Feb. 1933. Designed and operated equipment for Shortwave Re-broadcasting of Anniversary Day or "Head of River Regatta" with Station 2UW Sydney. Private address: 16 Stanley St., Waverley. Born,. 3rd, June, 1907. Recreations: Swimming and Tennis,

DUKE, Alan S.—Proprietor Alan S. Duke Pty. Ltd. 486 Bourke St., Melbourne. R.A.C.V.. Commenced in Electrical Industry, Siemens, 1912. Considerable experience in Electrical and Radio Industry. Formed own Company March, 1931. Chairman Wholesale Radio Association, 1929-30. 1st President Victorian Radio Association, Oct. 1931 and 32. Chairman Exhibition Committee, 1930-31-32. Born, Jan. 1897. Recreations: Tennis, Swimming.

DUNN, Charles, Radio Manager Noyes Bros. (Sydney) Ltd., Clarence St., Sydney. Born in England. Joined Union Cable Co. Ltd., Dagenham, 1901. Australasian Manager Union Cable Co. Ltd., 1910-1914. Returned England appointed Secretary Union Cable Co. till 1920. Left for Australia, appointed Queensland Manager Noyes Bros. (Sydney) Ltd., 1921-1929. Then appointed Sydney Radio Manager. Prominent member trade association. Honorary Treasurer Electrical Radio Association, N.S.W.

DWYER, Stanley, G.—Secretary, Stromberg-Carlson (A/sia) Ltd., 72 William Street, Sydney. Trained in Accountancy, 1915. Present position, 1929. Born 3/6/96.

EVANS, Clive Walter, General Manager, Widdis Diamond Dry Cells Pty. Ltd., 119 Hawke St., West Melbourne, since 1922. Visited overseas on three occasions in Diamond Battery interests. Served in A.I.F. Air Force; previously trained in electrical engineering.

FISK, Ernest Thomas.—Mng. Dir. and Chairman of Dirs. Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. F. Inst. R.E., A.M.I.E. (Aust.) M. Inst. R.E. Aust. Born at Sunbury-on-Thames, near London, 1886, joined Marconi Co., 1905. Trained and worked in all branches wireless engineering and operating in England, America and other countries. 1909, went to Arctic icefields, demonstrated possibilities of wireless with Newfoundland Sealing Fleet. 1910, on board s.s. "Otranto" exchanged messages with H.M.S. "Powerful" in Sydney Harbour, when "Otranto" was 200 miles North-west of Fremantle, a distance of 1800 miles—a record in those days. Came to Australia, 1911, as representative of Marconi Wireless Telegraph Co. Amalgamated Wireless incorporated, 1913, appointed General Manager with a seat on the Board, three years later became Managing Director. In September, 1918, received first direct wireless telegraphic messages transmitted from England at his station at Wahroonga, N.S.W. August, 1920, gave first public demonstration of broadcasting at Royal Society of N.S.W., Sydney. The establishment of the Beam Wireless Service between Australia and England was largely due to his experimental work and his consistent advocacy with both British and Australian Governments for the adoption of his plans for the service. Wireless Telephone Service between Australia and Homeland mainly due to his experimental work. The prestige of Amalgamated Wireless as one of the foremost wireless companies of the world is due to the broad vision and high executive ability of Mr. Fisk who during the past 20 years has developed wireless in Australia and the Pacific from a national point of view. Mr. Fisk is considered the foremost wireless authority in Australia.

FREEDMAN, Allan Harris.—Sales Mgr., Stromberg-Carlson A/sia Ltd., 72 William St., Sydney. Yale University, B.Sc. Pilot Radio & Tube Mfg. Co. (U.S.A.) 5 years. 1929 present position. Born, 23rd March, 1902. Recreation: Fishing.

FACER, Reginald.—Director Efco Mfg. Co., Ltd., Princes Highway, Arncliffe. Studied Analytical Chemistry, Sydney Technical College, 6 years. Metallurgist,

1917-20. Commenced with father in business of Efco Mfg. Co., Ltd., 1920. Born 12/4/1898.

GERBER, Eugene.—Chairman of Dirs. Bloch & Gerber Ltd., 46-48 York St., Sydney. Private address: 22 Eastbourne Ave., Clovelly. Born, July 10th, 1880.

GODLEY William.—Mgr. Radio Division (resigned February, 1933) Harringtons Ltd., Sydney. First Chairman Wholesaler Section Erda. On leaving school, entered Admiralty Hydrographic Survey Branch, and as a cadet served four years surveying service in British Columbia. Followed by three years in North Queensland and two years in N.W. Australia. Later, a year was spent on Photographic Survey of countries around Mediterranean. Joined Harringtons Ltd., 1912, and had considerable executive experience. Following on country representation, was branch manager Adelaide four years, Brisbane two years and General Manager New Zealand, five years. Returned to Head Office as Sydney Manager in 1928. Private address: 49 Tunstall Ave., Kensington. Born, January, 1882. Recreations: Photography, Gardening, Golf. Educated Tottenham Grammar School, London.

GILMOUR, Norman Stanley.—Proprietor, Lekmek Radio Laboratories, 75 William St., Sydney. M.Inst. R.E. Aust. and Vice-President of the Institution, Millions Club. Amateur Experimenting 1910, Telegraph Branch P.M.G.'s Dept. till 1915, Engineer P.M.G.'S Dept. (N.S.W.), 1915-1922. 1922-1927 Director L.P.R. Bean & Co. Ltd., 1927-31 Director Stromberg-Carlson A/sia Ltd. 1931, founded Lekmek Radio Laboratories. Born, 25/9/1890. Recreations: Swimming and Tennis.

GOSLING, Alex.—Director R. W. Reynolds Ltd., 200 Chalmers St., Sydney.

GREENLEES, Robert James.—Works Manager, Don Electrical Co., 112-16 Salisbury Rd., Camperdown. 1909 assistant electrician. Operating until 1915. Active service, 1915, as signaller Australian Field Artillery. Wounded France, 1918. While convalescent, 1919, studied at Regent St. Polytechnic College, London, Telegraphy and telephony. 1920, secured electrical fitters' certificate, Sydney Technical College. In employ of O'Donnell, Griffin & Co. till 1930, first as fitter, then leading hand, and later shop foreman. Appointed present position, 1930. Obtained radio mechanic Certificate, Marconi School, 1931. Private address: 4 Reims St., Fivedock. Born, 17/12/1895. Recreations: Billiards and Cricket.

GREENWOOD, J. Russell, Electrical Manager, Anthony Hordern & Son, Limited, Sydney. Chairman, Electrical and Radio Development Association, N.S.W.

GRIME, Stanley M.—Assistant Mgr. Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. A.M.I.E. (Aust.) M. Inst. R.E. (Aust.). Apprenticed to electrical engineering, connected with private electric light companies, 1909, appointed City Council Workships, 1916 appointed Works Manager A.W.A., 1922 visited large works in England and on Continent, 1928 appointed Assistant Manager A.W.A., 1931-2 visited U.S.A. as preliminary to establishment of valve manufacturing industry in Australia. Chairman of Radio & Telephone Manufacturers Assen., etc.

GROENEVELD, Y. B. F. J. Chief-engineer Thom & Smith, 55 Dowling St., East Sydney. E.I. (University DELFT, Holland) M. Inst. R. E. Aust. Member NEDERLANDSCH RADIO GENOOTSCHAP. 1920 lecturer Aero and Hydrodynamics Delft University. 1923 Lecturer Radio Telegraphy and Telephony (Delft University). 1925 research department, Philips Radio Laboratories, EINDHOVEN (Holland) engaged in general radio research and design, 1928 chief engineer supervising design, production, and testing. 1930 arrived in Australia to establish Radio factory for Philips Lamps (Aust.) Ltd. 1932 joined Thom & Smith, Chief-engineer.

HARDY, John.—Advertising Mgr. and Buyer R. W. Reynolds Ltd., 200 Chalmers St., Sydney. Private address: 2 Wentworth Rd., Strathfield. Born, 12/8/03. Recreations: Tennis and Swimming.

HARDY, Walter.—Manager and Proprietor Hardy's Radio Store Royal Arcade, Sydney. In radio since 1921. One time member of Kensington Radio Club as Secretary and later President. Hon. Sec. W.I. 12 months. Designs all sets for own business and supervises construction. Private address: Woniora Rd., Hurstville. Born, 24/12/1900. Recreations: Tennis, Swimming and Shooting.

HARRINGTON, John E.—Retail Sales Mgr. Raycophone Radio Sets, Harringtons Ltd., 386 George St., Sydney. Educated Sydney University. Interested in radio since the earliest days, both on experimenting and merchandising sides. Made an extensive post-war visit to America, England and Continent on Radio and other business activities of Harringtons Ltd. Born 20th June, 1902. Recreations: Literature, Music, Golf.

HEALY, Clarence P.—Chief Engineer, Airzone (1931) Ltd. Australia St., Camperdown, Sydney, N.S.W. Bachelor of Electrical Engineering, Melbourne. Graduate Electrical Engineering, Melb. Technical School and Melbourne University. Engineering assistant Victorian Railways, Engineering Instructor in Victorian Senior Technical Schools, Head of Engineering Dept. Collingwood Technical School, Examiner of Radio Patents Commonwealth Patents Office for 12 months prior to joining Airzone Ltd. With Airzone Ltd. since Jan. 1930. 12 months active service with Australian Flying Corps. Private address: 7 Merley Rd., Strathfield, N.S.W. Born, 7th Oct., 1898. Recreation: Tennis.

HOBDEN, Hillstead Inigo.—Radio Manager, Eastern Trading Co. Ltd., 155 Clarence St., Sydney. Member Millions Club. Private address: 9 Denman St., Hurstville. Born, 1893. Recreations: Golf, Motoring.

HOMEWOOD, Walter B.—Dir. & Sales Mgr. Airzone (1931) Ltd., 16 Australia St., Camperdown, Sydney.

HORNER, Ernest Albert.—Mgr. Radio-Electric Works Amalgamated Wireless (A/sia) Ltd., Parramatta Rd., Ashfield. Born Auburn, N.S.W., Apprenticed electrical fitting Tramway Workshops Randwick, March, 1908. Employed by various firms as armature-winder electrical and mechanical fitter. Later re-joined R. & T. Dept. as electrical, loco. steamshed and mechanical fitter. Two years in testing division of Dept. Joined A.W.A. 1918, later Assistant Manager of Works. Appointed Works Manager, 1923. Visited England and United States in 1926, to study manufacture and again visited England in 1932-3 on A.W.A.'s behalf.

HORTON, George Harry.—Man. Dir. G. H. Horton & Co. Ltd., 66 City Rd., Sydney. Member Rotary and Tattersalls Clubs. Director E. F. Wilks & Co. Ltd. Private address : " Roycroft," 20 New South Head Road Vaucluse. Born, 1886. Recreation : Golf.

HOSKING, A. P.—Sales Mgr. Amalgamated Wireless Valve Co. Ltd., 47 York St., Sydney. M. Inst. R.E. Aust. (M.S.B.M.) Dept. Posts & Telegraphs, South Africa, 1906. Beira Mashonaland and Rhodesian Railways, 1911. Dept. of P. & T. Rhodesia, 1913. Joined South Africa Field Telegraph & Postal Corps at outbreak of war, 1914, engaged war service. Australian Coastal Radio Service, 1916. R.A.N. Service, 1916. Coastal Radio, 1922. A.W.A. 1922, Interstate Sales Manager. A.W.A. Valve Co. on formation, 1932. Recreation : Golf, Fishing, Swimming.

HULL, Allan Galbraith.—Technical Editor " Wireless Weekly " Wireless Newspapers Ltd., 60 Elizabeth St., Sydney. Associated with brother Ross A. Hull since 1920, in general radio activities. Technical Editor " Wireless Weekly " since July, 1930. Private address : 69 Baroona Rd., Northbridge. Born, 5/4/05.

HOOKE, Lionel Alfred.—Deputy General Mgr., Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. M.I.R.E. (America) M. Inst. R.E. (Aust.) M.S. B.M. Joined Amalgamated Wireless, 1913, and in 1914, joined Shackelton's Polar Expedition. On return, commissioned in New Zealand Royal Naval Volunteer Reserve, served as commissioned officer in submarine chasers and armed rescue tug patrol. Transferred as pilot to Air Force, subsequently commanding Air Station at Bude. On return to Australia appointed Melbourne office, A.W.A., and later became Melbourne Manager. Transferred to Sydney as Assistant Manager and became Deputy General Manager A.W.A., 1925. 1930-32 travelled Europe and America for A.W.A. investigating world's development in radio. Born, 31/12/1894.

IRVINE, Charles T.—Radio Sales Mgr., Radio Dept., A. G. Healing Ltd., 167 Franklin St., Melbourne. Commenced in Radio 1927. Appointed Sales Mgr. 1929. Born, 26/7/04.

JACK, James Paterson.—Station Engineer, Sport Radio Broadcasting Co. Ltd., 99 Currie St., Adelaide S.A. 2nd Class Washington Certificate. Commenced study radio, 1916. Employed by Marconi Company London, 1917. Left Marconi Company, 1925, to continue radio engineering in New Zealand, 1925 to 1932 interested in short wave work and broadcasting. Appointed present position, January, 1932. Private address : Box 709F G.P.O. Adelaide ,S.A. Born, 3/6/1900.

JENNINGS, R. H. J., Sales-Manager Thom & Smith, 55 Dowling St., East Sydney. Engaged in electrical industry many years and with British General Electric Co. Radio Manager and later Engineering Representative. Visited continent and England 1926. Joined Thom & Smith, November, 1932. Private address 42 Bradley's Head Rd., Mosman. Recreations : Golf, Tennis and Yachting. Born 27/7/1903.

JOHANSSON, Nils Alfred.—Radio Engineer, Beale & Co. Ltd., Trafalgar St., Annandale. Bachelor Science, A. Inst. R.E. (America), M. Swedish Inventors Society. M. Radio Technical Society (Sweden). Formerly of Western Electric Radio Research Dept. (Bell Telephone Laboratories), Swedish Telefunken Co. and allied organisations. Private address : " Trearne," Mitchell St., Bondi. Born, 25/9/1895.

JOHNSON, J. Murray.—Maintenance Engineer, Coastal Radio Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. M. Inst. R.E. Aust. Served apprenticeship with Morris Bros., General Engineers, Sydney. 1911, joined Australasian Wireless Company, engaged erectional work high power stations Sydney and Perth. 1912, joined Commonwealth Radio Service, engaged erectional work at Geraldton and Broome Stations to end of 1913. 1914, transferred to operating staff and stationed at Esperance, Geraldton, Darwin and Adelaide stations. 1923 transferred to Engineering Dept. A.W.A., Sydney. 1932, Appointed present position. Private address : 93 Arabella St., Longueville. Born, 24/11/89.

KINGTON, Hubert.—Editor " The Queensland Radio News," 101 Douglas Chambers, Adelaide St., Brisbane, Q'ld Member of C.T.A. Club. Joined staff Queensland Radio News, 1925 ; appointed Editor, 1930. Joined bedtime story staff at Station 2QG as " Professor Sherbert," 1928 (still broadcasting). Executive officer of several radio and musical organisations. Country representative Messrs. Harringtons Ltd. prior to 1925. Private address : Ithaca St., Kelvin Grove, Brisbane. Recreations : Tennis, Reading and Music.

KNOCK, Donald Brader.—Radio Engineer. Member Flying Corps Association of Australia. Decoration 4th Order of St. George, Russia, 1919. Native of Manchester, England. Educated Wigan Grammar School. Commenced study of radio whilst apprenticed as mechanical engineer. Served in Royal Naval air Service, Observation and Transport in Middle East and Russia. Engineer afloat P. & O. Co., 1921-23. Technical Sales representative Sterling Telephone Co. British Empire Exhibition, 1924. Engineer with B.B.C., 1925. Sales-Engineer Amplion (Australasia) Ltd., 1927. Technical Editor " Wireless Weekly " and " Radio ", 1928-29. Radio Engineer i/c SW Telephony installation Wyndham Meatworks, 1930. Foundation Technical Editor Radio Monthly, 1932. Factory Representative " Radiovision " (Australasia) Ltd., 1932-33 and now Short Wave radio consultant and manufacturing engineer. Owner-operator experimental radio station VK2NO. Private address : 102 Nelson Bay Rd., Bronte, Sydney, N.S.W. Born, 1899. Recreations : Radio, Motoring, Swimming.

LARKINS, Frederick William.—Publicity Manager, Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. Associate of Commonwealth Institute of Accountants. Associate of the Chartered Institute of Secretaries Holder of Diploma in Economics & Commerce (Sydney University). Joined Australasian Wireless Co. Ltd., as Accountant July, 1912, appointed Accountant to Amalgamated Wireless (A/sia) Ltd. on formation July, 1913, until 1923 when he took over duties of Publicity and Advertising Manager on the creation of that section of A.W.A. Activities.

LEVENSON, Joseph.—Proprietor Levenson's Radio, Pitt St., Sydney. 27 years in business in Pitt St., 7 years in radio. Private address : 36 Allison Rd., Kensington. Born, April, 1882. Recreations : Business literature.

LEVINGS, Stanley B.—Workshop Mgr., Werring Radio Co., 213-215 Queensberry St., Carlton N3. In radio trade for five years. Private address : 5 Verdun Grove, Regent. Born, 24/2/12. Recreations : Radio and television experiments.

LINCOLN, Reginald.—General Mgr., Sport Radio B'casting Co. Ltd., (Station 5KA), Currie St., Adelaide S.A. Associated with Radio since 1924, in Eastern States. Appointed Manager Station 5KA in June, 1932. Private address : 81 Fifth Ave., Joslin, Adelaide. Born, June, 1893.

LONG, Henry Charles.—Proprietor, United Radio Distributors, Pomeroy House, York & Barrack Sts., Sydney. 7 Raymond Rd., Neutral Bay.

LOVETT, Leonard.—Owner Radio & Electrical, 81 Bathurst St., Hobart, Tas. Served apprenticeship with Hutchinson & Co. Hobart. Enlisted for active service, Aug. 1914. Returned Dec. 1918. Employed at Electrolytic Zinc Co.'s works 12 months, then commenced own business in Electrical Business. One of the first to enter the Radio field in Hobart. Private address : 37 Alexander St., Hobart, Tas. Born, 1894. Recreations : Tennis, Fishing.

MACLARDY, William John.—Broadcasting Company Manager, London Bank Chambers, 18 Martin Place, Sydney. Founded and Edited "Wireless Weekly," Sydney, 4/11/22. Served in A.I.F. Established 2BL Broadcasting Station September, 1923. Managing Director of 2BL until, 1927. Born, 3/10/1892.

MACKINNEY, Valentine H., F.S.M.C. Born Bayswater, London, 1884. Trained in electrical engineering, specialised in optical research. Several years assistant to Professor Ayrton at City & Guilds College, South Kensington, London. Also assistant at Northampton Institute. Responsible for conversion of House of Commons, London, from gas to electricity. Foundation member of Illuminating Engineering Society, London prior to War, while engaged with Holophane Ltd., London. Arrived in Australia, 1914, on behalf of Holophane Ltd. Joined Philips Lamps (A/sia) Ltd., 1927. Australasian Radio Sales Manager.

MANLEY, Patrick Joseph.—Mng. Dir. Speakers (Australasia) Limited, 70 Clarence St., Sydney. Commenced Victorian Railways, Telegraphy and Telephone Division. 2nd Lieut. Signal Engineers, 1912-14. A.I.F. Signals 1915-1919, Captain Artillery Signals. 1919, Marine Wireless operator. 1923, sales dept. Amalgamated Wireless. (Visited overseas twice on radio business.) 1927, Amplion (A/sia) Ltd., General Mgr. and Director. Founded Speakers (A/sia) Ltd., 1930, with position of Mng. Dir. Private address : " Orielton," Ocean St., Woollahra. Born, 11/9/1894. Recreations : Army signals (Captain 1st Cavalry Signals).

MALONE, James J.—Mem.I.R.E., Chief Inspector Wireless, Postmaster-General's Department, Treasury Gardens, Melbourne.

MARSHALL, Donald.—Proprietor and Gen. Mgr. Paramount Radio Manufacturing Co., 301 Castlereagh St., Sydney. Commenced radio with Messrs. Grose & Daniels and later on own account. Founded " Paramount Radio Mfg. Co." May, 1932. Experimenting since age of 12. Had charge of Fultegraph outfit when first brought to Australia. Private address : Carlingford. Born, 16/4/11. Recreations : Tennis, Motoring, Flying.

MARTIN, Walter Jeffrey.—Manager, Broadcasting Dept., Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. Washington Convention Certificate of Proficiency. Joined Marine Staff Amalgamated Wireless, 1912. Chief Wireless Officer several years, R.M.S. " Niagara," and R.M.S. " Aorangi." May, 1922, published first daily newspaper on " Niagara," that vessel being first British ship in Pacific with own paper. Operated first marine short wave transmitter, breaking world's records by communicating with England, South Africa and South America from the Pacific. 1925, appointed Manager of Wireless Press Dept., September 1931, appointed present position, also acts as Advertising Manager Station 2SM, Sydney. Private address : Manar Flats, Macleay St., Potts Point. Recreations : Tennis, Golf, Motoring.

McDONALD, Arthur Stephen.—Chief Engineer & Assist. Mgr. Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. M.Inst.R.E. (America) and M.Inst. R.E.Aust. Born Castle Donnington, now Swan Hill, Vic. Educated at Public School and Melbourne Technical College. Served apprenticeship in Melbourne engineering firm. Joined Electrical Engineer's Branch P.M.G.'s Dept. 1909. 1911, transferred to Radio Section, and for some years engineer-in-charge of installation of Coastal Radio Stations throughout Australia. On outbreak of War transferred to R.A.N. and engaged in engineering designs. Later appointed inspector R.A.N. Workshops, Randwick. The War over transferred to old position in P.M.G.'s Dept. On transfer of Coastal Radio Stations to Amalgamated Wireless, 1922, appointed Chief Engineer of A.W.A. Following year went to England and Continent made intensive study of broadcasting and trans-ocean telegraphy, visiting the principal broadcasting and high-power stations in England, France and Germany. Since return, in charge of technical activities of A.W.A., including experimental short wave telegraph-telephone working and overseas telephony. Councillor Institution of Radio Engineers.

McEWAN, George Augustus.—Indoor Mgr. C. Winkworth & Son Ltd., 337 George St., Sydney. Member Dee Why Golf Club. Educated Randwick High School. Spent 3 years in S. Australia in piano trade. Continental Player Co., Sydney for 3 years. Joined Winkworth's Manager Gramophone Dept., 1923. 1926, took charge radio dept. Private address : Mowbray Rd., Chatswood. Born, 29/6/1900. Recreations : Golf, Motoring, Swimming.

McNEILL, Thomas Albert Edward.—Chief Engineer, Council of Churches B'casting Co., 2CH, 77 York St., Sydney. 1st Class P.M.G. Certificate, 1918. With Marconi Co., London, Nov. 1918-July, 1927, marine operator. With 2BL Broadcasters Sydney Ltd., and N.S.W. Broadcasting Co., operator Nov. 1927, to July 1929. With P.M.G. Dept. (Broadcasting Division) supervisor 2BL studio, July 1929-Oct., 1931. Appointed Chief Engineer 2CH Oct., 1931. 2CH successfully opened Feb., 1932. Private address : 80 Glenayr Ave., Bondi. Born Feb., 1901. Recreations : Tennis, Cricket.

MEAD, Maxwell.—Proprietor Mead Mfg. Co., 1 Crown Lane, Sydney. Attended Sydney University for LLB. Degree associated with 2FC and 2BL or

chestra's and A.B.C. for a number of years. Member of Melba Williamson Grand Opera Co., 1928. Commenced Radio Manufacture, 1931. Private address: Shelley Beach, Manly. Born, 27/12/05. Recreations: Swimming and Tennis.

MINGAY, Oswald Francis.—Managing Editor and Proprietor "Radio Retailer of Australia," and "Radio Trade Annual," 15 Castlereagh St., Sydney. M.Inst. R.E.Aust. Honorary Secretary Institution Radio Engineers Australia, A.Inst.R.E. (America), Millions Club. Secretary Radio Retailers Assn. Telephone Dept. 10 years. Served A.I.F. Signals 4½ years. In charge reconstruction Charleroi Telephone System (Belgium) after Armistice. 9 months attached British P.O. Resigned from P.O. 1922, appointed Radio Manager, later Director, Burgin Electric Co. Ltd. till, 1925. Radio Manager (N.S.W.) Harringtons Ltd., 1925-6. Managing Director Mingay's Wireless Mfg. Ltd., 1926-27. Radio Mgr. Suttons Ltd. (N.S.W.), 1928-29. Founded Australian Radio Publications, 1930. Principal Australian Radio College, 1930-1933. Private address: 19 Woodside Ave., Lindfield, N.S.W. Born, 1/7/1895.

MITCHELL, George.—Manager Radio Section Martin de Launay Ltd., Sydney & Newcastle. Marconi School of Wireless. Associated with Martin de Launay Ltd., fourteen years. Private address: Hall St., Bondi.

MITCHELL, Stanley Cyril.—Gen. Mgr. Commonwealth Moulding & Electric Company, 240 Princes Highway, Arncliffe, N.S.W. Alderman of Rockdale Municipal Council. Electrical Engineer by profession. 12 years master builder. Alderman, Rockdale Municipal Council. Private address: 240 Princes Highway, Arncliffe, N.S.W. Born 1892. Recreation: Fishing.

MOORE, Eric Boston.—Sales Mgr., Kriesler Radio Co. Ltd., 2-4 Levy St., Chippendale, Sydney. Connected with Motor Industry for many years. Branches into sales organisation with P. & R. Williams Bros. Ltd., 1925, as District Superintendent remained till 1927. Joined A. G. Healing Ltd., 1927, executive staff and in 1929, took over Management Radio division, N.S.W. 1932, joined Kriesler Radio Co. Ltd., Sales Manager. Private address: Fiddens Wharf Rd., Killara. Born 20/10/1901. Recreations: Tennis, Motoring.

MOORE, Eric J. T., Chief Engineer, Stromberg-Carlson (A/sia) Ltd., 72 William Street, Sydney. Educated at Armidale College and Sydney High School. Qualified Royal Naval Examination Electrical Engineering, 1917. 1910, 1911, with Telefunken Company, erecting station A.A.A. 1911-14, P.M.G. Telephone Department. 1914-16, Wireless Operator, Australian Transport. 1916-19, Lieutenant, Royal Naval Air Service. 1923-26, Manager Farmer and Company Ltd., Radio Section, 1926-32, Stromberg-Carlson & Company, Rochester, U.S.A. 1932, returned Australia, present position. Born 12/7/1894.

MOORE, Joseph Sheridan.—General Manager, Hazell & Moore Ltd., 36 Campbell St., Sydney. Articled in Accountancy profession since schooldays. Practised as Chartered Accountant, F.C.A. (Aust.) now on retired list, until 1924, when with brother Mr. E. R. Moore and partner Mr. E. J. Hazell, founded present Company, Hazell & Moore Ltd. Private address: 71 Warners Ave., Bondi. Born 27/12/1895. Recreations: Golf, Swimming, and Motoring.

MORAND, Daniel Francis.—Radio Manager, Harringtons Ltd., 386 George Street, Sydney. Tattersalls Club. 14 years Systems expert, W. C. Penfold Ltd., 1912-26. General Manager in Australia for N.Z. Redwood Forests Ltd., 1926-28. Appointed General Sales Manager, Western Electric Co. Ltd., 1930. And later in charge of credits and sales. Appointed present position, February, 1933. Private address, Hercules St., Chatswood. Recreations, golf, surfing. Born 25/1/1887.

MORGAN, Sydney.—Mng. Dir. 3KZ B'casting Co. Pty. Ltd., 64 Elizabeth St., Melbourne. Member Victorian Institute of Advertising. Associated with advertising activities in Melbourne since, 1917. Dec. 1930, one of founders and Director of 3KZ station. Appointed Mng. Dir., June, 1932. Private address: 19 Nirvana Ave., East Malvern. Born, 1900. Recreations: Tennis, Swimming.

MORSE, Percival Algernon.—Advertising Mgr. "Australian Radio News," Sydney. Advertising Manager, "Brisbane Daily Mail," 1919-1923. Advertising Manager, "Wireless Weekly," 1928-1933. Private address: 48 Kareela Rd., Cremorne. Born, 15/4/92. Recreation: Trout Fishing.

MUIR, David Temple.—Secretary Wireless Newspapers Ltd., 60-66 Elizabeth St., Sydney. Associate Federal Institute of Accountants.

MULHOLLAND, John Leonard.—Melbourne Manager, Amalgamated Wireless (A/sia) Ltd., Melbourne. Rotary Club, Melbourne. President Victorian Radio Association (1932/33). Wireless Officer, s.s. "Katoomba" 28th August, 1911, also served in other ships until appointed Sydney Inspector, A.W.A., February, 1914. N.Z. Manager, July, 1915, until July 1920. Traffic Manager Marine Dept., 1920-22. Assistant Manager A.W.A. Head Office, 1922. Melbourne Manager since April, 1928. Private address: 179 George St., East Melbourne. Born, 19/4/91. Recreations: Golf, Tennis, Bridge.

MURRAY, Gilbert Lang.—Mng. Dir. The Mullard Radio Company (Aust.) Ltd., 35 Clarence St., Sydney. Royal Automobile Club. Tattersall's Club. Australian Golf Club. Appointed Mng. Dir. Mullard Radio Company (Aust,) Ltd., at inception of company May, 1931. Mng. Dir. of Scott & Holladay Ltd., 35 Clarence St., Sydney. Has travelled throughout Australia and New Zealand on numerous occasions and made business trips abroad in 1915, 1920, 1921, 1929, and 1932. Private address: Royal Automobile Club of Australia, 89 Macquarie St., Sydney. Born 13th Apr., 1889. Recreations: Golf and Tennis.

MACLURCAN, Charles Dansie.—Aust. Representative A.C. Cossor Ltd. (Gt. Brit.), 26 Jamieson St., Sydney, Assoc. I.R.E. (America). Foundation Member Wireless Institute Australia, 1910. President 5 years. Original pioneer experimenter, 1910. Commenced regular Sunday Broadcasts, experimental nature 1400-400-250 and ultimately down to 20 metre wave-length. Transmitted Josie Melville's Broadcast, 1923. By arrangement with A.W.A. as a result of experimental activities sailed on S.S. "Tahiti," 1924 to investigate possibilities of low power transmission on 200 metres between Australia and America, results entirely satisfactory. Continued further experiments in short waves and in 1925, proved the success of 20 metre daylight transmission to England on low power. In 1926 and 1927 communicated with all countries on low power short wave amateur apparatus, Visited England and the Continent, 1927-8 and again in 1929. Appointed Australian Representative for Cossor Valves, 1929. Private address: Agnes St., Strathfield, N.S.W. Born, 1891.

NEWMAN, Sydney Moreton.—Radio Engineer, Amalgamated Wireless (A/sia) Ltd., Sydney. Joined A.W.A. Engineering & Research Staff, 1920; associated with following developments: First regular broadcasting service in Australia, 1921. First telephony tests to New Zealand, 1922. First S/W telegraph tests between England and Australia, 1923. First S/W telegraph tests between Australia and England, 1924. First S/W telephony tests between England and Australia, 1925. First S/W telegraph tests between Sydney and Pacific Islands, 1926. First S/W Empire broadcast tests, 1927. First S/W telephony tests between Australia and England, 1928. First S/W telephony service between Australia and England, 1930. First S/W telephony service between Australia and New Zealand, 1930. Private address: 11 Kissing Point Rd., Turramurra, Sydney. Born, 1898. Recreations: Golf, Tennis, Motor Competitions.

NORVILLE, Charles Henry.—Partner, Breville Radio Braefield Bldg., Bourke & Liverpool St., Sydney. M. Inst.R.E. (Aust.) A.I.R.E. (America) Cadet Engineer N.S.W. Railways, 1917-1922. Testing Engineer, N.S.W. Railways Laboratories, 1922-1931. Radio Engineer, Philips Lamps (A/sia) Ltd., 1931-32. Co-partner Breville Radio, 1932-33. 4 years Councillor Wireless Institute of Australia. Hon. Treasurer Institution of Radio Engineers Australia. Private address: 11 Hollywood Crescent, Willoughby. Born Feb., 1902.

O'BRIEN, William J.—Partner, Breville Radio, Braefield Bldgs., Bourke & Liverpool Sts., Sydney. Commenced study of Wireless at Marconi School Melbourne in 1918. Obtained Wireless Operators Certificate and went to sea for about six years on British and American ships. Spent 5 years in America, Sales Manager for wholesale Radio houses. Returned ,Australia, 1929. Manager Radio Dept., Suttons Ltd., and later Sales Manager for Thom & Smith. Commenced above business in Nov., 1932. Private address: "Talofa," Ravenswood Ave., Randwick. Born Aug., 1899.

OSWIN, G. L.—Radio and Sales Manager, Heiron & Smith (Salonola) Ltd., 105 King St., Sydney. Born Tasmania. General Manager Australian Wireless Co. Present position 3½ years. Private address: 60 Awaba St., Mosman. Recreations: Snooker and General Sport.

PARKINSON, Ernest Collins.—Works Production Superintendent, Amalgamated Wireless (A/sia) Ltd., Born Dec., 28th, 1898, Keighley, Yorkshire, England. Educated Salt High Schools, Saltair, Yorkshire, Apprentice J. Parkinson & Son, machine tool makers, Shipley. 5 years Bradford Technical College. Jig and tool machine tool designer, J. Parkinson & Son, 1919-23. Sub-Lieut. R.N. Kit Balloon Section. Active service on convoy work North Sea and Mediterranean. Arrived Australia, 1923. 9 months machine tool designer, Purcell Eng. Co., Auburn. 9 months mechanical draughtsman, Commonwealth Portland Cement Co., Portland, N.S.W. 1924-1929 in charge water meter Department and special machine design, Clyde Eng. Co., Granville. 1929, joined A.W.A. as Works Production Superintendent. Private address: 28 Birnam Grove, Strathfield. Born, 28/12/1898. Recreation: Cricket.

PARRY, William.—Managing Director, Heberholds, Dry Batteries Pty. Ltd., Melbourne. In electrical business, 1909-1924. Dec. 1924, entered Radio Trade. Jan. 1932, founded Heberholds Dry Batteries. Born Jan. 1888.

PARMITER, Ernest Albert, Governing Director, Acorn Pressed Metal Co. Ltd., 46 Maithieson St., Camperdown, N.S.W. Arrived in Australia, 1909, served First Light Horse, A.I.F. and Indian Mule Corps, Warrant Officer. Joined Ausmetoy Ltd., 1920, as Works Manager. Founded present company, September 1930. Private address 27 Thorn St., RYDE. Recreations motoring, shooting, surfing. Born 27/1/1891.

PHILLIPS, William H. C.—Marine Superintendent, Amalgamated Wireless (A/sia) Ltd., Sydney. M.Inst. R.E.Aust. Appointed telegraphist Queensland railways, later transferring to Postal Dept. Joined A.W.A. December, 1911, as marine operator. During war served on s.s. "Katoomba." Returned to Australia, 1919, later becoming Marine Inspector for A.W.A., appointed Marine Superintendent, 1924. Private address: 9 Ocean St., Kogarah. Born, Cairns, N.Q., 12/3/92.

PLOWMAN, Claude.—Mng. Dir. Airzone (1931) Ltd., 16 Australia St., Camperdown, Sydney.

PRICE, John Clarey.—Proprietor own business, Perry House, Elizabeth St., Brisbane. A.M.I.E. (Aust.). Commenced radio in Brisbane, 1922. Telephone Engineer P.M.G.'s Dept., 1913. Studied Electricity City and Guilds, London. Born, Oct. 5th, 1884. Recreation: Fishing, golf.

PRENTICE, John M., (Uncle Jack) Chief Announcer 2UW. Born in Victoria, obtained scholastic training at Ballarat and Melbourne University; began life on father's farm. Graduated to commercial and journalistic career in Victoria and elsewhere. Spent three years in Public Service. Started with 2BL, 1924, and has served as announcer or guest announcer in the four principal cities of New Zealand, in Hobart, Melbourne, Brisbane, Adelaide, and Perth. Musical director of 2UW since 1928 and talks on Foreign Affairs at least twice weekly. A globe-trotter with a taste for strange places and queer languages, and also served with distinction in the World War, receiving two decorations, including **Order of the Crown of Belgium,** and mentioned twice in despatches. Has a wide knowledge of music and a recognised authority on Wagnerian music-drama as well as being a first-class exponent of the modernists such as Debussy and Ravel. In private life Mr .Prentice is an omnivorous reader of biography, memoirs and political history, and has mastered most of the war literature in two or three languages. Mr. Prentice is sufficiently cosmopolitan to feel equally at home in Sydney, Cairo, London or Paris, and yet remains at heart a thorough going Australian with a great belief in the future of the Commonwealth.

RAZ, Otto.—Director, Bloch & Gerber Ltd., 46-48 York St., Sydney. Private address: 14 Russell Ave., Lindfield.

READ, Leonard Leo (Uncle Ben 4QG.)—Managing Dir. Printers and Stationers Dept. The Read Press (Pty.) Ltd., Adelaide St., Brisbane. Served 8 years apprecticeship, W. H. Wendt & Co., Printers, Brisbane. Salesman, Jackson & O'Sullivan, 2 years, 1918-1919. In business on own account over 12 years. Entertained Children at 4QG for 7 years most of that period in an honorary capacity. Private address: Robinson Rd., Eagle Junction. Born, 18/10/1894. Recreations: Golf, Fishing and Reading.

REES, M. W.—Mng. Dir. Smith Sons & Rees, 30-32 Wentworth Ave., Sydney. Royal Automobile of Aust. C.T.A. Founded own business under name of M. W. Rees Ltd., 1917. August, 1920, a fusion of interests with S. Smith & Sons (M.A.), London was effected and Mr. Rees became Mng. Director of the combined concern. Private address: 37 Bundarra Rd., Bellevue Hill, Sydney. Recreations: Motoring and golf.

RENSHAW, Phil.—Supervising Engineer, State Monier Pipe Works, Bond St., Sydney. A.M.I.E.Aust. M. Inst.R.E.Aust. Educated Fort St. Model School. Commenced wireless experimenting, 1910. Joined W.I.A., 1911. Held office continuously for 21 years Hon. Secretary for 12 years. Radio Experimenter 2DE. Has never professionally associated with Radio but engaged in Civil Engineering since 1907, when he started as a lad with Gummow Forrest & Co. Ltd. Private address: "Waimea," 6 Lord St., Roseville. Born, 3/11/1891. Recreations: Motoring, Surfing, Bridge, Fishing.

REYNOLD, J. Howard.—Sales Mgr. R. W. Reynolds Ltd., 200 Chalmers St., Sydney. Club. C.T.A. Private address: 46 Beresford Rd., Strathfield. Born, 11/6/1910. Recreations: Swimming and Tennis.

REYNOLDS, Robert W.—Mng. Dir. R. W. Reynolds Ltd., 200 Chalmers St., Sydney. Studied Electrical Engineering and Chemistry Perth University. 1923 Joined Sir George Julius' Laboratory. Founded firm of R. W. Reynolds. 1924. Private address: 8 Moore St., Strathfield. Born, 1895. Recreations: Motor driving, Golf and wireless.

ROSE, Frederick Antoine.—Factory Mgr. Beale & Co., Trafalgar St., Annandale. Assoc.M.Inst.C.E. Private address: 25 Denning St., Coogee. Born, 1884.

SALMON, S. J.—Director & Manager, The Lawrence and Hanson Electrical Co. Ltd., 172 William St., Melbourne. Active interest in Radio Trade Organisations in Victoria since inception. Recreations: Golf.

SANDEL, Otto.—Proprietor, Otto Sandel's Radio, Oxford St., Woollahra, N.S.W. Member R.C.A.A. Light Car Club. Sydney Bicycle & Motor Club. Commenced in radio, 1922. Secured Amateur Operator's license. Later changed to "B" class license. Owned and operated Station 2UW for approximately six years, (three years as amateur, and three years as "B" Class). Formed 2UW into limited company in 1927, and later sold to Palings' Ltd. Started in Woollahra as retailer and retail manufacturer. Won Wakefield Cup (motoring) for 1931. Private address: 281 O'Sullivan Rd., Bellevue Hill. Born 2nd Oct. 1905. Recreation: Motoring.

SCHULTZ, Leonard N.—Engineer in Charge, Theosophical Broadcasting Station Ltd., 29 Bligh St., Sydney. M.Inst.R.E. Aust. Commenced in radio, 1921, with Radio Company Ltd., Loftus St., later joined United Distributors Ltd., as testing experimental engineer for a period of three years during which was employed on construction and testing of original 2KY and 2GB. Toured U.S.A. and Europe, 1928. Studying broadcasting. Returned and joined 2GB as Engineer in Charge, since then rebuilt 2GB throughout, also built and installed 4BH Brisbane. Private address: "Billabong," Lagoon St., Narrabeen. Born, Sept. 24, 1906. Recreation: Flying.

SCOVELL, Alexander J. W.—Chairman of Directors, Widdis Diamond Cells Pty. Ltd., 119 Hawke St., West Melbourne.

SCOVELL, Alexander McKenzie.—Manager, N.S.W., Widdis Diamond Dry Cells Pty. Ltd., Dalgety Rd., Millers Point, Sydney. Joined Widdis Organisation, 1927. Appointed Manager Sydney Factory, 1932. Born, June 22nd, 1910.

SEARSEN, Edward Michael.—Radio Sales Mgr., Electricity Meter Manufacturing Co. Ltd., Joynton Ave., Waterloo. Graduated from marine service to radio sales. Private address: 63 Henrietta St., Waverley. Born, 16/2/1901.

SHAW, Ernest Heywood.—Founder and editor of "The W.A. Wireless News." Joined staff of R. S. Sampson Brokensha Co., prior to 1929. Published the "West Australian Wireless News & Musical World," Sept., 1929. Mr. Shaw is editor, Technical Editor and Advertising Manager. An experienced radio experimenter, dating back to days of old "Quench Gap Spark Transmitters." Enlisted at Blackboy Hill, W.A., 1914, saw service on Gallipoli as an original Anzac, thence to France, where later he was detailed to special service, returning to Australia in 1920.

SHORE, Francis Thornell.—Sales Mgr. Radio and Electrical Dept., A. J. Aucher Ltd., 14 Spring St., Sydney. Overseas Factory Representative Radio, Electrical and Motor lines. Private address: "Bellevue," Morra Cres., Randwick. Born, 23/7/1900.

SIMPSON, Alfred John.—Instrument Design Engineer and Partner Express Universal Instrument Co., 5 Tinana St., Haberfield, N.S.W. Stromberg-Carlson, 1924. Private address: 5 Tinana St., Haberfield. Born, 28/6/10. Recreations: Motoring, Shooting.

SLADE, Charles William.—Radio Engineer, Proprietor, Croydon Radio, Lang St., Croydon. Holds English P.M.G. Certificate 1st Class. 15 years radio experience in British Navy, 1909 to 1924. 3 years Technical editor of "Wireless Weekly," 1925 to 1928. Radio and Technical Editor Daily Telegraph, 1928-1929. Radio Engineer Keogh Radio Ltd., 1929-1930. Commenced business at home, speciality-Superheterodynes, Private address: Lang St., Croydon. Born, 22/5/1894.

SMALL, Charles A.—Chief Technician Radio & Service Dept., Henry G. Small & Co., 374 Post Office Place, Melbourne, C.1. Experience, Engineering Course, Swinburne Technical College. Metropolitan Vickers Elec. Co. Carroll & Grunden. Auto & Electrical Engineers. Electric Equipment Manufacturers, Sth. Melbourne. Private address: 313 Riversdale Rd., Camberwell, Victoria.

SMALL, Henry G.—Manager, Henry G. Small & Co., 374 Post Office Place, Melbourne C.1., A.M.I.E. Aust. A.S.T.C. Lic. A.S.E.C.V. Educated Kalgoorlie. West Australian School of Mines. Swinburne Technical College. Experience Kalgoorlie Municipal Electric Light Station, Kalgoorlie Light and Power Corporation. Melbourne Electric Supply Co. British Insulated & Helsby Cables. Electric Railway Dept. Metropolitan Vickers Electrical Co. Ltd. Private address: 16 Rathmines Rd., Auburn, E.3., Vic.

SMITH, John Edwin, partner, Thom & Smith, (TASMA) 55 Dowling St., East Sydney. 1912-16 apprentice electrical instrument maker Western Electric London, 1916-23, telephone experimental shop Siemens Bros. London. 1924-29 Foreman tool-room, Stromberg Carlson (Sydney) 17/12/29 founded Thom & Smith with Mr. Fred. Thom, Private address Jamieson Ave., Manly. Recreations, Golf, Fishing, Surfing.

STEWART, Frederick Harold, M.P.—Governing Director, 2CH Broadcasting Co., 77 York St., Sydney. Won Federal Parramatta Election, 1930, promoted to Cabinet rank within 8 months. 20 years an officer of N.S.W. Railways. Resigned to undertake subdivisional and transport activities culminating in development of the Metropolitan Omnibus & Transport Co. of which founder and governing Director. Director Associated Newspapers Ltd. A founder & Chairman of Australian National Airways. Chairman N.S.W. Woollen and Felt mills. Private address: 223 Burwood Rd., Burwood. Born 14/8/84. Recreation: Bowls and music.

SWEENEY, Walter.—Director, Essanay Pty. Ltd., Melbourne. M.I.R.E.U.S.A. Engineer Marconi Co., 1907-1912. W/T. P.M.G.'s Dept. 1912-1916. W/T. Inspector Navy, 1916-1917. A.I.F. 1917. Representative in Australia for Radio Communication Co., 1924-5. Formed Essanay 1928. Born, Jan., 1887.

TAIT, J. M.—Radio Mgr., British General Electric Company Ltd., 104 Clarence St., Sydney. Member I.R.E. (Aust.) Educated Sydney Grammar School. 5 years Dalgety's Ltd. Joined British General Electric Co., Jan., 1920 as assistant and later in charge of Telephone section. Sent to England, 1925, for general experience at Peel Conner Telephone works, Coventry. Returned Sydney, 1926. 1931, in charge of Radio & Telephones Dept. Born. 11/12/1899.

TAYLOR, John Peebles.—Sales Mgr.—Commonwealth Moulding & Electric Company, 240 Princes Highway, Arncliffe, N.S.W. Served in A.I.F. Engaged in Radio selling and advertising for past 14 years. Private address: 7 Poate Rd., Centennial Park, N.S.W. (Major Army Signals). Born, 1895. Recreations: Tennis and Surfing.

TAYLOR, John T.—Gen. Mgr. 2CH Broadcasting Co., 77 York St., Sydney. Commercial experience with H. J. Heinz Co., U.S.A. in different states of Australia. Joined present Company at inception (Feb. 1932) as Adv. Mgr., appointed Gen. Mgr. October, 1932. Private address: 18 Kulgoa Rd., Bellevue Hill. Born 1904. Recreations: Golf, Surfing.

THOMAS, Oscar.—Manager, Radio Dept., F. Tritton (Pty.) Ltd., 260 George St., Brisbane, Q'ld.

THOM, Frederick William Parkes, partner Thom & Smith (TASMA), 55 Dowling St., East Sydney. Mem. Inst. R. E. Aust. Assoc. I.R.E. (U.S.A.). Councillor Institution Radio Engineers, Australia. Apprentice electrical fitter 27/1/20-25/3/25, A.W.A. 1925-1929 production and radio engineer Stromberg-Carlson, Aust. Ltd. 17/12/29 founded with Mr. J. E. Smith, the firm Thom & Smith. Private address 9 Bancroft Ave., Roseville, recreations, Golf, Surfing, Fishing. Born 11/7/1904.

THORRINGTON, Albert Leonard.—Advisory Service Engineer Express Universal Instrument Co. 5 Tinana St., Haberfield. M.I.R.E. (Aust.) Associated with radio since, 1923, commercially since 1925. June, 1932, formed Express Universal Inst. Co. Private address: 14 Harrington St., Marrickville. Born 15/8/06. Recreations: Photography, Motoring.

TRACKSON, Philange S.—Mng. Dir. Trackson Bros. Ltd., 157-159 Elizabeth St., Brisbane. Assoc. M.I.R.E. (Aust.) Assoc. M.I.E.E. London. Private address: "Norvic," 102 Racecourse Rd., Ascot, Brisbane.

TREE, Ernest E.—Proprietor, Tree Radio-Electric Co., 128 Willoughby Rd., Crows Nest. Assoc. M. Inst. R.E. Aust. Captain Singer Car Club N.S.W. Councillor Radio Retailers Assn. N.S.W. Born, 1904.

TURNER, Arthur Rex.—Mgr. Radio Dept., E. F. Wilks & Co. Ltd., 124 Castlereagh St., Sydney. R.A.C.A Aust. Motor Yacht Squadron. R.M.Y.C. 13 years in E. F. Wilks & Co. Early 1926 went to England and Continent (9 months) returning as manager Radio & Phonographs Dept. Private address: 16 Buena Vista Ave., Clifton Gardens. Born, 1/3/02. Recreations: Motoring, Golf and Speed Boat Racing.

VAUGHAN, Clifford Walter.—Manager, Don Electrical Co., 112-16 Salisbury Rd., Camperdown. Joined O'Donnell, Griffin & Co., 1921, apprenticed as electrical fitter in 1922, technical representative from 1927 till 1928, assistant to Works Manager, 1928 till 1930, transferred to Don Electrical Co. in 1930 as Manager. Private address: 182 Queen St., Ashfield. Born, 21/7/07. Recreations: Tennis and Billiards.

WADHAM, Kevin.—Mgr. Radio Dept. & Electrical Dept. A. G. Healing Ltd., 151-159 Pirie St., Adelaide. Member W.I.A. VK5KW. Civil Service (3 years). Production department Paroso Ltd., Radio Manufacturers & Dealers Adelaide. Later transferred to Melbourne Branch as country organiser and general sales work. Returned to Adelaide when Melbourne Branch sold out to Louis Coen. Left this Company after 2 years and commenced with H. C. McKenzie & Co., radio dealers, leaving after period of 2 years to enter business on own account. Joined present company, March, 1927 in capacity of Manager of Radio Dept. Recently taken over new Electrical Dept. Private address: 83 Moseley St., Glenelg S.A. Born, Oct., 1904.

WALKER, Harold Christie.—Consulting Accountant, Company Manager & Secretary, "London Bank Chambers," 18-20 Martin Place, Sydney. Assoc. Commonwealth Institute of Accountants. Was one of the first to engage in radio trade in Australia as General Manager, Harringtons Ltd. Took prominent part in early organisation of trade, chairman of Radio Interests Ltd.

assisted materially in securing Royal Commission, re Radio and settling royalty question satisfactorily—Visited America, 1929-30, on return appointed Managing Director, Harringtons Ltd., and Raycophone Ltd. Resigned, 1932, to commence practice as Consulting Accountant and to organise several Radio manufacturing activities. Private address: 99 Bellevue Rd., Bellevue Hill, Sydney. Born, 7th Dec., 1889. Recreations: Golf.

WALTER, R. P.—General Manager, Ever-Ready Co. (Grt. Brt.) Ltd., 40 Marshall Street, Sydney.

WELSH, Charles O.—Director since 1931. Eclipse Radio Pty. Ltd. Born, March, 1892.

WETLESS, A. P. J.—Proprietor, Wetless Electric Manufacturing Co., 281 King Street, St. Peters. Electrical Engineer, Specialised in condenser manufacture since 1923.

WILSON, John Francis.—Secretary & Assistant Manager, Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. A.C.I.S., Member Inst. R.E. Aust. Educated St. James College and Sydney University. Joined M.W.T. Co. in 1909, as Marine Operator. Engaged on construction work and ship fitting in Brazil, Sth. Africa and Canada. Joined Australian branch in 1911, and been with A.W.A. since inception of Company. Appointed Secretary A.W.A. in 1917 and Assistant Manager in 1918. Recreations: Tennis, Swimming.

WINKWORTH, Leslie Herbert.—Director, C. Winkworth & Son Ltd., 337 George St., Sydney. Committee Carnarvon Golf Club, Hon. Sec. Barrier Reef Big Game Fishing Club. Life Member Haberfield Rowing Club also Union Old Oarsmen, Associate Member Royal Zoological Society, Marine Life Section; Haberfield Music Club Committee. Educated Sydney Boys High School. Commenced business career with Makower McBeath Pty. Silk Merchants. Joined father in business, 1912, as Piano Importers. 1919, entered into control of business on retirement of C. R. Winkworth (father) with brother Herbert C. Winkworth as partners. Traded as C. Winkworth & Son. Pianos Players Gramophones. In 1924, became Director of new Company C. Winkworth & Son Ltd. Nominal Capital £50,000. In 1925 opened 337 George St. Extended also Annandale premises twice. Increased capital to £100,000. Travelled America, Europe, England, Canada, 1926, for new agencies. Private address: "Kowong," Crescent St., Dobroyde Point, Haberfield. Born, 1892. Recreations: Music, Game Fishing, Marine Life. Zoology Golf, Flying, Shooting, Boxing, Australian Art, Rowing.

WING, William, J. J.—Sales Mgr. Amalgamated Wireless (A/sia) Ltd., 47 York St., Sydney. Born and educated in England. Joined Marconi School, England, 1911. Operator s.s. "Empress of Ireland," and a number of White Star and Allan Liners. Joined Commonwealth Radio Service, 1913, served in Melbourne, Perth, Sydney, Thursday Island, and Cooktown Radio Stations. Joined Commercial side of A.W.A. 1923, and appointed Sales Manager, 1924. Has been prominently associated with radio trade organisations.

WINTER, William Francis.—Director Heberholds Dry Batteries Pty. Ltd., Melbourne. Entered radio in 1922. 1931 visited Great Britain and Europe to investigate battery situation. 1932 Formed Heberholds. Born, 1903.

WERRING, Oscar Carl.—Proprietor, Radio Dept. Werring Radio Co., 213-215 Queensberry St., Carlton N.3. Private address: 874 Burke Rd., South Camberwell, S.E.6. Phone Haw. 4875. Born. 3/8/1906. Recreation: Billiards.

WHITE, Frederick Richard.—Works Mgr. Raycophone Ltd., Cr. Booth & Trafalgar Sts., Annandale. 8 years Electrical Trades & Diploma Course Sydney Technical College. 14 years Amalgamated Wireless in following positions:—5 years apprenticeship. 3 years Assistant Engineer. 3 years Assistant Works Manager. 9 months Acting Works Manager. Works Manager James Manufacturing Co. (New Systems Telephones) 3 years Works Manager Raycophone. Private address: 5 Abbotslee Flats, Warners Ave., Bondi. Born, 1900.

WODELL, Frank E.—Manager Radio & Electrical Dept., Hazell & Moore Ltd., 36 Campbell St., Sydney. Balgowlah Golf Club. 6 years wholesale leather business 20 years motor car business. 10 years of which were as employee of General Motors, 3 of which were as Australasian Representative. About 4½ years in Sydney Radio with 3½ years Interstate Sales Ltd. as Managing Director, one year as Departmental Manager of Hazell & Moore Ltd. Private address: "Clybucca," Wanganella St., Balgowlah. Born, 8/3/1883. Recreations: Golf, Motoring, Trout Fishing, and Camping.

WYLES, David Grieve, M. Inst. R. E. Aust., Mem. I.R.E. (U.S.A.) Served engineering apprenticeship Forwood, Down & Co. Ltd., joined Amalgamated Wireless, 1914. Visited Europe, Great Britain, 1922-23, investigating radio behalf A.W.A. Appointed Chief-Engineer Station 2BL Sydney, 1925. Later appointed engineer National Electric Co. N.Z. Joined Philips Lamps (A/sia) Ltd., Sydney as technical manager, 1929.

Fundamentals of Electricity as applied to Radio Servicing.

While most people connected with the radio trade, even though not engaged on the technical side, have a fair general idea as to the meaning and usage of common radio and electrical terms, it will be just as well (so as to fix ideas easily and definitely when the remainder of this section is being digested) to briefly set down the fundamentals on which all technical ability is founded.

Electric pressure measured in volts is analogous to the water pressure tending to force water out through a tap. As we can cut off the water with a tap so we can cut off the flow of electricity with a switch, providing that both are effective and do not leak.

Electric current is measured in amperes, which expresses the amount or quantity flowing per second. A thousand milliamperes (abbreviated m.A.) are equivalent to one amp. The resistance of a circuit is exactly what its name implies, the opposition offered by a circuit to the passage of a current. This opposition wastes a certain quantity of electrical energy which is converted into heat and light. Power is the amount of electrical energy used *per second,* or the rate of consumption. The ohm, is defined as the resistance of a circuit through which a pressure of one volt will force a current of one ampere and the power dissipated in this circuit is taken as unity or one watt.

Ohm's Law.

In the formulae below
E = Voltage
I = Current In amps.
R = Resistance in ohms.
W = Power in watts.

Ohm's law may be stated as three formulae although actually all three mean exactly the same thing:

$I = E/R$ (1)
$E = IR$ (2)
$R = E/I$ (3)

The power dissipated may be obtained from the following:

$W = EI$ (4) or I^2R (5) or $E\,2/R$ (6)

Resistor Replacements.

Suppose we have to place a voltage dropping resistor for the plate supply of the oscillator tube of a superhet that we are called in to service. The power pack voltage on measurement proves to be 320, the oscillator tube is a 56 and no grid bias is provided. The recommended plate voltage for a 56 as an oscillator is 90 and the plate current at zero grid bias is 11.2 m.A. This means that the resistor has to drop the plate voltage from 320 to 90, i.e., by 230 volts.

With a voltage drop *across the resistor* of 230 volts and a current of 11.2 m.A. flowing, the required resistance is found to be $\frac{230}{.0112}$ or 20,600 ohms. The power dissipated is $230 \times .0112$ or 2.6 watts. A 20,000 ohm resistor to dissipate a little over 2½ watts thus fills the position nicely.

Accuracy.

Suppose, however, that a case occurs in which it is necessary to replace a resistor which must for some reason be quite accurate but is an odd size. One example where trouble is continually occurring suggests itself in the direct coupled type of set, particularly those of the first vintage when resistors were not so reliable as to-day. Suppose that we want a 2,350 ohm resistor to carry 15 m.A. While it is quite easy to order a special resistor, this takes time, so that it is often a far better proposition to insert two resistors in series, in this case one of 2,000 ohms and one of 350 ohms. We can most conveniently calculate the power rating for the resistors from the formula

$$W = I^2 R \qquad (5)$$

not forgetting to divide the milliamps by 1,000 to put I in amps. This gives us 4.5 watts for the 2,000 ohm resistor. While the total resistance of a number of resistors in series is given simply (as above) by adding the respective resistances the case of a number in parallel or in a complicated network is not so simple. If two equal resistors are connected in parallel, the resulting overall or effective resistance is half that of each taken separately; if three, then one third and so on (See Fig. 1).

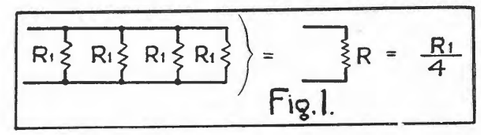


Fig. 1.

Resistors in Parallel.

In general if there are n resistors each of resistance R,

$$\text{Effective Resistance} = \frac{R}{n} \qquad (7)$$

Each resistor will carry an equal share of the total current flowing into the bank of resistors. If the individual resistances are not equal but are of values R_1 and R_2 (Fig. 2) then the effective resistance R is given by

$$R = \frac{R_1 R_2}{R_1 + R_2} \qquad (8)$$

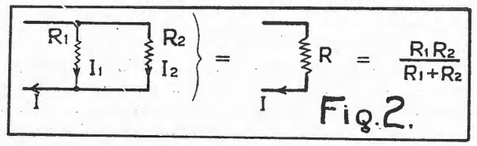
If we put $R_1 = R_2$ this boils down to $\frac{R_1}{2}$ On the other hand if we have more than two resistors R is given by

$$R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots} \qquad (9)$$

Unequal resistors carry unequal currents. In the case of two, each current is directly proportional to the

value of the other resistor. Referring to Fig. 2,

$$I_1 = I\frac{R_2}{R_1 + R_2} \qquad (10)$$



Safe Current.

Suppose we have a 5,000 ohm 10 m.A. and a 3,000 ohm 15 m.A. resistor in parallel to give 1875 ohms for a D.C. amplifier. What total current will this combination then pass without burning up ? Reversing formula (10) we have

$$I_1 = I\frac{R_1 + R_2}{R_2} \qquad (11)$$

and we find that the total current which flows when the maximum rated current 10 m.A. I_1, is flowing in the 5,000 ohm resistor, is given by

$$I = 10 \times \frac{8000}{3000} = 26.6 \text{ m.A.}$$

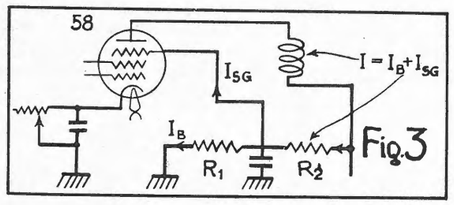
When I_2 is its maximum or 15 m.A. then

$$I = 15 \times \frac{8000}{5000} = 24 \text{ m.A.}$$

It is thus not safe to exceed the lower of these two figures, 24 m.A. The combination given above is an efficient one since each resistor is carrying practically its maximum rated current (at a total current of about 24 m.A. of course). If we had used a 25 m.A. resistor for one the combination would be inefficient and more expensive.

Screen Voltage Supply.

Another case which often crops up is the calculation of the correct resistance to drop the pack voltage for the screens of s.g. valves. Referring to Fig. 3 one of the usual methods of supplying screen voltage is shown. First let us fix a suitable value for the bleed current I_B flowing through R_1. If we choose a value of 20,000 ohms for R_1, and since there is a drop across R_1 equal to the screen voltage of 100, then the current flowing through R_1 is 5 m.A.



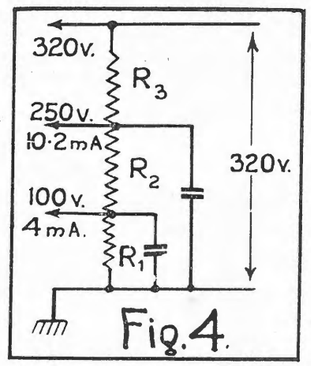
The screen current of a '58 is 3.0 m.A., so that the current flowing through R_2 is equal to the sum of these two or 8.0 m.A. If the pack voltage is 300 (on load) this necessitates a drop of 200 volts across R_2. Substituting these values in formula (3), R_2 is found to be 25,000 ohms. If we want to supply several tubes the calculations are similar but a larger bleed current is desirable, for as the volume control in the cathode leads of the variable mu tubes is turned down, the screen current will diminish and consequently the voltage across R_1 increases. This is, however, counteracted to some extent by the fact that the cathode becomes more positive with respect to chassis and the increase in actual screen volts (from cathode to screen) is lessened.

Voltage Dividers.

The design of the voltage divider shown in Fig. 4 is illustrated in the table below. The procedure follows that given above. A bleed current of 10 m.A. through R_1 is our initial assumption.

Section	Current (m.A.)	Voltage Drop	Resistance (Ohms)
R_1	10	100	10,000
R_2	14	150	10,700
R_3	24.2	70	2,900
Total	—	320	23,600

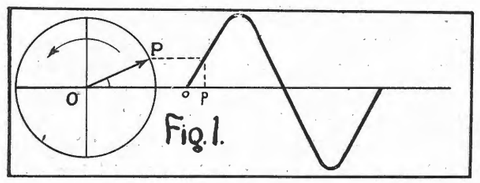
A 25,000 ohm divider set at 10,600, 11,300 and 3,100 would be suitable. It is however, usually more convenient to adjust voltage dividers after installation in a set, measurements being taken with a high resistance voltmeter.



Alternating Currents.

An alternating current is one which periodically changes its direction by passing from a maximum in one direction to a maximum in the other direction and back again. This process completes one cycle and the frequency of an alternating current is the number of cycles occurring per second. The simplest or sinoidal form of alternating current is shown in Fig. 1 in the form of a sine wave, and is obtained from the rotating radius OP, one revolution or 360° corresponding to one cycle. All A.C. currents are not sinoidal, many having a very distorted wave form. It is, however, always possible to express any periodic waveform as the sum of a fundamental sine wave and a number of harmonic or multiple frequency sine waves.

Output valves are rated to give so many watts output with a certain percentage of harmonics present — e.g. type 89's in a "B" class output stage will deliver 2.5 watts allowing 5% total harmonic distortion and 3.5 watts allowing 8% total harmonics.



All the formulae and examples given above on D.C. flowing through resistors apply equally well to the passage of A.C., provided that the resistors are non-inductive. However, all circuits contain at least a small, amount of inductance and capacity, and thus Ohms Law has to be modified by substituting for the resistance R an analogous quantity known as the impedance and denoted by Z. Ohm's law for A.C. states that

$$I = E/Z \qquad (12)$$
$$E = ZI \qquad (13)$$
$$Z = E/I \qquad (14)$$

Inductance.

Inductance is the property of a circuit which tends to retard the flow of a current when an E.M.F. is established and to retard the decay of an already existing current if the E.M.F. is removed. Thus in the flow of A.C. through an inductance the current will always **lag** behind the voltage by an amount (the phase difference) which is equal to a quarter cycle or 90° for a pure inductance and is less than 90° when resistance is present. Suppose that we wish to determine whether a certain filter choke has an inductance of 30 or 50 henries. This may be done by measuring the current which passes when a known A.C. voltage is applied across the choke. The reactance X_L in ohms of an inductance is given by

$$X_L = 2\overline{\pi}\ fL \qquad (15)$$

L being in henries.

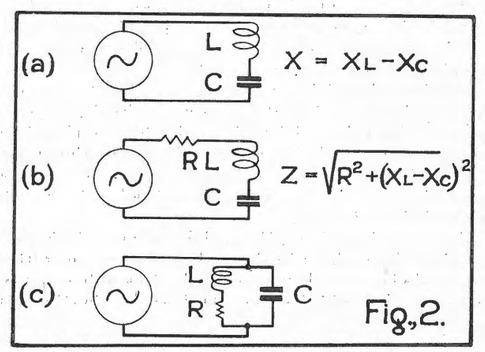
The impedance Z in ohms is given by

$$Z = \sqrt{R^2 + X_L^2} \qquad (16)$$

where R is the resistance in ohms of the choke. If R is less than 1000 ohms it may be neglected in comparison with X. If the choke is placed across the 240 volt 50 cycle mains its inductance will be

$$L = \frac{.76}{I} \qquad (17)$$

I being the current read on a 0-100 A.C. milliammeter. A 30 henry choke should pass 25 m.A. and a 50 henry choke 15 m.A.



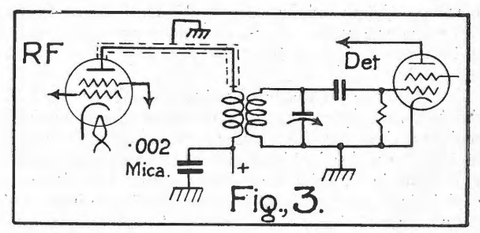
Capacity.

Capacity is the property of a circuit which tends to retard the building up of a voltage across a circuit due to a current which suddenly commences to flow. For this reason the current through a capacity will always **lead** the voltage by 90° for a pure capacity or by some angle less than 90° when resistance is present. Due to these facts equations (4)-(6) do not hold for A.C. The reactance X_c in ohms of a condenser is given by

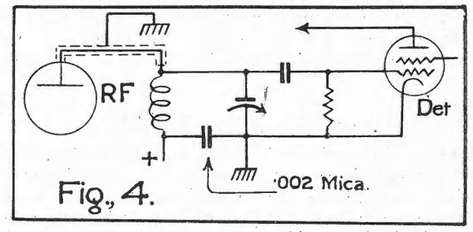
$$X_c = \frac{10^6}{2\pi f C} \qquad (18)$$

C is in microfarads and 10^6 represents 1,000,000. A 1 mfd. condenser has a reactance of 3,200 ohms at 50 cycles, so if connected across the 240 volt mains a current of 75 m.A. will flow. This provides a ready means of testing unknown paper condensers provided they are able to withstand 240 V. A.C.

Suppose we strike a short wave T.R.F. set in which the plate lead from the R.F. valve has been shielded by earthed copper braid to prevent interaction where it passes near a grid lead (this would only occur in a badly designed set). See Fig. 3. The owner complains



of poor sensitivity, particularly on the lower wavebands. The capacity between lead and braid is of the order of 30 mmfd. At a frequency of 15,000 k.c. (20 metres) this has a reactance of 350 ohms and provides quite an effective bypass for the R.F. A cure would be to change to the circuit of Fig. 4 in which the stray capacities really become portion of the tuning condenser. The internal plate to screen capacity of the R.F. valve also acts in somewhat the same fashion.



Resonance.

Resonance occurs in a tuned circuit when $X_c = X_L$ (see equations 15 and 18). The resonant frequency of a circuit is given by

$$f = \frac{159}{\sqrt{LC}} \quad \text{kilocycles.}$$

L being in microhenries and C in microfarads.

The impedance of the series tuned circuit in Fig. 2 (b) decreases as resonance is approached and at resonance

is equal to the R.F. resistance of the coil. For ordinary commercial tuning coils this is of the order of 7 to 20 ohms, being several times the D.C. resistance. The impedance of the parallel tuned circuits in Fig. 2 (c) increases as resonance is approached and at resonance is equal to L/RC ohms, L being in microhenries and C in microfarads. A low resistance is thus desirable for the highest gain. The wavelength at which a circuit resonates is given by

$$\lambda = 1885 \times LC \text{ metres}$$

L being in microhenries and C in microfarads.

Bibliography.

Those wishing to further their knowledge of A.C. circuits and their properties will do well to refer to Ghirardi "Radio Physics Course" 1932 ch. 11 and Kemp "The Alternating Current Circuit" ch. I.-IV. in particular. The question of resolving a waveform into a sinoidal wave and its harmonics is dealt with in Pidduck "A Treatise on Electricity," and Carslaw "Fourier Series."

Practical Service Methods.

Service work continues to play an increasingly important part in the radio dealer's sphere of activity, and, properly run, can be made to form a very profitable side line in any retail business.

This section of the Annual aims rather at covering the broad principles of radio servicing than at dealing with any particular models of commercial receivers. However, the principles dealt with here, together with the experience gained in practice, will provide the mental equipment necessary for the servicing of practically any receiver.

The following is intended rather for the radio dealer who is naturally called upon at times to service faulty receivers, than for the regular serviceman who is either efficient, or will gain his efficiency through some College or in the hard school of experience. On the other hand it is quite possible that some little points in the following would be of value even to the most experienced serviceman.

It has been said that radio servicing is just common sense, and, given the necessary ground work, this is undoubtedly so. Below will be described a system of trouble shooting with the minimum of tools and apparatus.

It cannot be stressed too highly that haphazard methods of circuit testing will not pay in the long run. Once in a while the hit or miss man makes a hit, but as a rule this kind of guessing wastes an enormous amount of time. The systematic worker can solve any problem, no matter how difficult, because he eliminates one possibility after another until he has definitely located the fault.

Diagnosis of the Trouble.

The service engineer is really a radio doctor. The symptoms of the case must be obtained from the owner of the set, and these often give a direct lead as to the nature of the fault. If, however, such immediate diagnosis is impossible, systematic testing must be resorted to, although knowing the symptoms, the area over which tests have to be made can often be very considerably reduced.

We may divide all testing into two classes, the one by means of instruments, the other visual and aural. A judicious combination of the two is necessary. As a rule, the first thing we consider is audible symptoms, e.g., no speech or music from the loudspeaker. Following this we consider the visual symptoms, e.g., the valves may not light. Following these preliminary tests which may or may not definitely indicate the trouble, but which will certainly narrow it down to some portion of the receiver, we must test by means of instruments, e.g., we test the voltage from plate to chassis of the power valve.

Considering first the audible symptoms, these may be listed under eleven heads as follows :—

(1) No speech or music from the loudspeaker.
(2) Volume weak on all stations.
(3) Volume weak only on distant stations.
(4) Signals wavering, rising and falling volume.
(5) Noisy reception.
(6) Interference from electrical devices.
(7) Howling, regardless of tuning dial operation.
(8) Whistling and squealing.
(9) Humming with A.C. receivers.
(10) Poor tone quality, distortion.
(11) Lack of selectivity, interference from unwanted stations.

Considering each of these headings in more detail, and by the application of visual methods, it will usually be possible to reduce our field of search.

(1) No Speech or Music from the Loudspeaker.

Even though no station may be audible, a familiar rushing noise may be present, indicating that at least the last stage is functioning correctly. No sound at all indicates no plate current for the last valve, trouble in the speaker coupling transformer or choke, or in the speaker itself. In most tubes the glow from the filament is visible. However, if this is not so, check the A battery if one is used. With an A.C. receiver, examine the primary circuit of the power transformer. See that the power plug is making good contact in the socket, and that all switches are on. All fuses and connections should be examined. Finally the primary winding should be tested for an open circuit. If only some of the valves light, these should be replaced by similar types if available, after sandpapering the prongs of the old valve, to ensure that it is not merely a loose connection. If the new valves do not light, the sockets are probably at fault.

The next check is on the aerial and ground circuits. See that the aerial wire is really connected and that the lead-in is not broken. Check the ground in a similar manner. The lightning arrester may be shorting the

aerial direct to earth. Most sets in the metropolitan area will bring in signals with either the aerial or ground disconnected, but seldom with both disconnected. This, of course, only applies when the power valve tests O.K.

A rough test for the plate circuit of each valve consists of taking the valve out of its socket for an instant with the receiver in operation. As each valve is removed, there should be a snap or click heard from the speaker. The sound from the speaker will become weaker and weaker as you remove valves closer to the aerial, further from the speaker. If one valve can be removed and replaced without causing any sound in the speaker, there is trouble in that valve's plate circuit, and no plate current, or only a very small current is flowing. It is then a case of checking back along the plate circuit until you come to the power unit or voltage divider.

If all the plate circuits test O.K., the next step is to test the grid circuits. In some receivers it is possible to reach either a grid terminal or some wire connected to it. Then, with the receiver switched on, this point should be touched with a moist finger tip or any piece of metal, which should produce a click from the speaker, provided that grid circuit is in good order. If it is impossible to reach any exposed terminal or connection in the grid circuit, the valve may be pulled partly out of its socket, but not far enough to break the contact between prongs and socket contacts. A bent wire will then usually reach the grid prong.

Failure to produce any sound with this test indicates a grounded or shorted grid circuit. An open grid circuit will still allow the click from the speaker, and can be located only by testing the grid circuit for continuity.

(2) Volume weak on all Stations.

This may be due in the case of a new set, to an unsatisfactory location, e.g., in a steel frame building with an indoor aerial, or in a district where reception is poor.

In the case of sets which have previously operated satisfactorily, the first test is that of trying a valve known to be good in each socket. The valves may not light with full brilliancy. If any are dim the filament, heater or A battery voltage should be checked. In many cases the aerial may have become disconnected or corroded. This is easy to check. All terminal connections will need checking to ensure that they are tight and clean.

The plate and grid bias voltages should be measured to make sure that they are not too low and too high respectively for the type of valves being used. If some novice has been trying to line up the gangs on the tuning condenser, they are almost certain to be lined up incorrectly. A new rectifier valve in the power supply may increase the plate voltages, while on the other hand the line voltage may be too low.

Another very common fault is an open circuit in the secondary of either an audio or radio frequency transformer. Again, the biasing resistor in the grid circuit of one valve may be open or burnt out. Further testing for continuity, etc., is necessary in this case.

(3) Volume weak only on Distant Stations.

In the case of a new receiver, some salesman may have told the owner that distant stations would all come in like locals, while the set is actually incapable of bringing in interstate stations at good volume. However, it is quite possible that the owner does not know how to operate the controls properly, and with a little instruction from the serviceman, his troubles will disappear. In many such cases the location, insulation, etc., of the aerial will be found to be at fault. Again, a poor valve in the R.F. amplifier or in the detector socket, will prevent the set from being properly sensitive to weak signals.

(4) Signals Wavering.

Rising and falling volume. Signals received from a distant station are almost sure to be affected by the phenomemon of fading. For a few minutes the transmission is loud, then weakens more or less rapidly, and at times even disappears entirely for a short time, and all this without any change in the receiver controls. While automatic volume control is a partial cure for this, it must be remembered that A.V.C. introduces an almost equally pernicious effect. When the signal fades and the control automatically increases the amplification of the receiver, the background noise will be considerably increased. If, however, the signals from local stations also rise and fall in volume, there is some defect either in the receiver or in the power supply.

In the case of a battery-operated receiver, the most likely source of trouble is a run down A or B battery. With A.C. receivers, fluctuations in line voltage are rarely bad enough to make this effect appear. If the volume rises and falls when the operator's hand is brought near the receiver, the ground is likely to be disconnected. Possibly as the volume changes, the filaments or heaters of the valves will alter in brightness. Such changes indicate defective valves, or poor jcints in the filament or heater wiring.

(5) Noisy Reception.

In this section will be considered only noises which might be classified as rattling, scratching, clicking or rasping. The most common cause for these noises is a loose or dirty connection, and can be checked by shaking or tapping the receiver. Each joint should then be gone over in turn. Even though soldered joints may appear perfect, they may be causing a high resistance due to corrosion. The contacts in valve sockets, on controls and all terminals, are other points of suspicion. A pipe cleaner is very effective in cleaning the dust from between the plates of variable condensers.

A regular clicking noise (motor-boating) indicates an open grid circuit or a defective grid leak. Quite often such noises are caused by a defective bypass condenser or audio frequency coupling unit.

(6) Interference from Electrical Devices.

The symptoms and cures applicable in this case will be found to be fully covered in another part of the technical section.

(7) Howling Regardless of Tuning Dial Operation.

This type of noise is known as an audio howl, and is frequently caused by a microphonic valve in which the

elements vibrate due to the sound waves from the speaker. This trouble most frequently occurs in the detector valve or in the first audio stage. The tone of the howl will be altered or stopped by touching the defective valve. Sometimes an alteration in filament voltage is effective in curing this trouble. Again, placing the loudspeaker further away, or turned away from the receiver, may effect a cure. Speakers mounted in the cabinet should be supported in padding or cushioning.

(8) Whistling and Squealing.

This trouble may be divided into two classes, high pitched whistles and low pitched growls or squawks. A high pitched whistle which appears as the volume control is turned up, or which becomes worse as the receiver is tuned to a high broadcast frequency, is caused by oscillation and high frequency feedback. If the receiver is of the old neutrodyne or other balanced type, faulty balancing adjustments are indicated. Oscillation may be caused by a disconnected ground or by a high resistance in this lead, by too high a plate voltage on the R.F. valve, or by ungrounded shields, particularly coil and valve cans. Some receivers make use of grid suppressors which are simply resistances connected in series with the grid circuit. Should one of these resistors become short circuited, oscillation will occur. A detector grid leak of too high a resistance will cause squealing.

In the case of superheterodynes, if the grid leak of the oscillator valve is of too high a value, or has become open circuited, a continuous squeal takes place, becoming worse at the high frequency end of the band. Again, defective R.F. chokes, open-circuited, or disconnected bypass condensers in plate circuits, screen circuits, cathode circuits, or control grid circuits, will allow oscillation. The trouble may be sometimes cured by lowering the filament or heater voltage on the R.F. valves, although to do this, it is generally necessary to lower the voltage on all valves. It is, however, undesirable to use a lower filament voltage than the rated.

Low pitched howls, squawking, or motor-boating, are caused by feed back occurring in the audio end of the receiver. This trouble very often results from defects in the power supply units. If the bypass condensers connected across the various taps on the voltage divider, or from various points in the resistance network used to obtain lower voltages, become disconnected or open circuited, such feedback will result. High resistance joints in the plate circuit will also be a source of this trouble. A high resistance or run down B battery allows feedback from the output of the audio stage to the detector, or to the first audio valve. If the plate current for several valves is drawn from a single tap without adequate filtering and bypassing, such feedback will occur, but this is a fault in the original design of the receiver, and is thus seldom found.

(9) Humming with A.C. Receivers.

A disconnected or high resistance ground may cause a hum, as also may disconnected or ungrounded shielding. If the cord to the power socket runs close to any portion of the receiver, or parallel with the speaker cord, it may cause an induction hum. In other cases reversing the plug in the light or power socket will effect a cure. If the aerial runs close to power lines, or if there is a high resistance joint somewhere in the aerial-earth circuit, the hum tendency is almost sure to be worse. The detector plate voltage may have become too low, as this is a possible source of hum. A defective rectifier valve or an open circuited filter condenser can introduce a very bad hum.

If the hum can be heard with the speaker disconnected, it is being caused by loose laminations in the power transformer or filter choke, or else by the iron and steel cases with which these components are sometimes shielded. Incorrect location of audio transformers or filter chokes, will sometines cause these components to pick up a certain amount of hum, either from the power transformer or the A.C. wiring in the receiver.

Hum may also be caused by an open grid circuit, by an open circuited bias resistor, or by an open circuited bypass condenser. If the secondary winding of the power transformer is open circuited on one side, or if the filter choke is short circuited, this will increase the hum greatly. In some receivers hum may be reduced by grounding one side or a centre tap from the heater circuits.

(10) Distortion.

It is, of course, necessary to assume that the receiver was capable of good quality output in the first place. Old valves, particularly in the last audio stage, will cause distortion when their emission falls off. At the same time a decrease in volume will be apparent. If the output stage uses two valves in push pull, their mutual conductances should be reasonably close to the same value. Again, something may have happened to upset the plate, grid or filament voltages of the valves. Plate voltages too low, grid biases either too low or too high and filament or heater voltages too low, will cause considerable loss of tonal qualities. An excessive amount of hum will nearly always cause distortion of the low notes.

In some cases a certain amount of feedback, while not sufficient to cause motor-boating, will impair the tone of the receiver. Condensers or resistors placed across the secondary windings of audio transformers to prevent whistling, will cause too great a reduction of the high notes, unless they are of the correct value. Open circuited or defective bypass condensers at any point in a receiver will cause harshness of tone and a reduction of volume. Defects in bias resistors or partially open grid circuits will cause distortion.

(11) Lack of Selectivity.

Normally the selectivity of a receiver will depend on the design and the aerial-earth circuit used with it. A smaller or better located aerial will usually help in increasing the selectivity. If the trimmers on the tuning condenser gang have become unbalanced, this will almost certainly cause a loss in selectivity.

Cross talk or cross modulation may be caused by old R.F. valves, e.g., the substitution of 235's in the place of the older 224's as R.F. amplifiers, will often be effective in curing cross modulation. Cross modulation is, of course, due to the modulation from a nearby station impressing itself on the carrier wave, which is present in the grid circuits of the various valves when the receiver is tuned to another station.

Occasionally the owner of the set is at fault, for instance, if he uses the tuning control as the volume control, the selectivity will naturally suffer. If, however, the trouble is in the original design of the receiver, little can be done except to completely rebuild the receiver.

We have just considered trouble finding as related to visual and audible symptoms, but the modern tendency in service work is to depend less and less on these methods, and to work more with certain testing instruments and equipment. Of these the voltmeter and ohmmeter are certainly the most important. With these and other instruments separately or combined in a set analyzer, it is possible to obtain results far more quickly.

Radio Service Equipment.

The importance of the right equipment in modern service cannot be over-estimated. Undoubtedly there are many so-called service-men at present engaged in alleviating troubles of radio set owners who have neither the requisite modern equipment for rapid servicing nor any great knowledge of how it can be employed to so enormously reduce the time spent diagnosing any particular trouble.

Roughly we may divide the requisite service equipment into two sections, first the tools and material ; secondly, instruments. Of course in addition to these there are many little gadgets which do not come under either of the headings above. Another rather obvious division of the very large field of equipment with which we are dealing is into portable and non-portable. The first part may be said to represent that equipment which the serviceman carries with him in his bag when on a visit to a refractory receiver. The second class is that equipment, mainly instruments, which will be employed only in the workshop and not usually, if ever, taken to an outside job.

In dealing with the equipment it will be found convenient for the purposes of this article to divide the subject into four heads, namely :—

(1) Small Radio Dealers.

The equipment of a small radio dealer must be such that he can handle small repairs such as the location and replacement of certain faulty components ; the testing and replacing of valves, etc. For this he will need very little equipment beyond that which the serviceman would usually carry with him in his bag. For this reason the equipment listed under this head merges into that listed under the next, namely :—

(2) Field Equipment.

Under this heading we consider the ordinary tools, material and instruments which it is advisable to carry when possible. For instance, the competent use of an analyser actually in the home of the set owner clearly impresses the fact upon him that the serviceman knows his business. At times of course it may be found inconvenient or unnecessary to carry such an instrument. For example, by means of a conversation over the phone beforehand, the trouble may be recognised without actually seeing the receiver. Field equipment is, of course, not only carried by service staff attached to small radio dealers, but also by outside employees of a large firm. For this reason section (2) merges into section (3).

(3) Large Dealers, Etc.

In the case of a larger concern, it stands to reason that more equipment can be afforded than by the small radio dealer. In this category might be listed such equipment as a modulated oscillator and an output meter. Further it is probable that the workshop attached to a large firm will be better equipped than that of a small undertaking. Such items as electric hand tools may quite well come under this heading. We find that as the size of a company increases there is a distinct tendency to separate the two functions of workshop and test room. The laboratories attached to a large manufacturing firm are never directly connected with the workshop. This brings us to the fourth division.

(4) Factory, Laboratory, etc.

It will not be necessary to deal very exhaustively with the equipment which falls under this heading. As the work conducted in a laboratory is mainly directed towards research for design of receivers or equipment it hardly comes under the classification of service at all. At the same time for the sake of completeness it is necessary to devote a few words to this side of the subject. While signal generators and kindred equipment would not be used for service, it is quite fair to state that oscillators for checking the matching of coils or the sections of a condenser gang may quite well come under the heading of service equipment.

Service By Dealers.

As our section (1) includes also section (2) we will first consider these two headings together. It is essential that even small radio dealers should have some sort of valve checker and/or analyser. While it is quite possible to service receivers without resorting to the use of an analyser, one instrument that will be absolutely necessary is a *voltmeter*. While perhaps an ohmmeter is not necessary even in these enlightened days of servicing, if the serviceman does not make use of an analyser it is unquestionably necessary. Fortunately combination volt-ohmmeters are readily obtainable in a convenient form.

One item very necessary to the serviceman for testing whether the receiver gives any output from the detector stage is a *pair of phones*. On the service bench this could quite well be replaced by an old type of small horn speaker. It goes without saying that an electric soldering iron with a good grade of non-corrosive cored solder (preferably resin) is indispensable where any repairs have to be effected.

Tools.

The obvious tool associated with any radio man is a pair of pliers. At least two pairs will be necessary, a large pair for fairly heavy work and a small pair of long nosed cutting pliers. In addition, a pair of side cutters will be found very useful for cutting off wires close to terminals or in corners. At least two sizes of screwdriver should be carried and preferably three. A coping saw will serve all the uses of a hack-saw, while being more convenient in certain positions. A small flat file will come in very handy for rubbing up small surfaces. But at the same time a small three cornered file can be used not only for filing small flat surfaces but also for filing nicks.

The much abused pen knife can be made to serve the purpose of practically any tool.

Drilling holes in metal will require a small hand drill with a selection of drills. These should include the sizes 1/8, 5/32, 3/16, 5/16. It is an easy matter to keep all tools sharp and a little attention in this direction will save much time and temper. The bradawl or a similar spiked tool is very handy in dealing with woodwork. Of the material which should be carried by the serviceman, probably the most frequently used is hook-up wire and $\frac{1}{8}$ inch bolts and nuts.

Wood screws andi nsulating staples are invaluable when first installing the set, but are not perhaps so necessary on a service call. A generous quantity of 2 mil. spaghetti should be carried. Dial lamps will never be amiss in the serviceman's kit. The amount of work to replace one of these lamps is often incredible. Condensers should be carried in the kit ; probably the most used values will be found to be .00025, either .5 or 1 mfd. and 8 mfd. electrolytic. One or two resistors should be carried, as a frequent source of trouble will be found to be burnt out *plate resistors in the detector circuit*. One watt type in 100,000 ohms and $\frac{1}{4}$ meg. resistances should be suitable. It is rather hard to definitely state any particular value of resistors, but probably 400, 15,000 and 25,000 would be found most useful.

It is undeniable that in many cases the serviceman has to work inside what is usually a very dark cabinet. Even when the chassis is removed from the cabinet it is very often difficult to see clearly into every little corner, particularly if the receiver is of the midget type. For this reason a *flashlight* is of the most essential items in the serviceman's kit. At the same time one that is almost equally useful and perhaps rather unusual is a *small mirror*. The most convenient form is a dentist's mirror, which is mounted on the end of a rod some 6 inches long. With this it is possible to see underneath a network of resistors, a bank of condensers, etc., at the same time reflecting the light from the serviceman's torch wherever it is desired. Probably the most useful style of torch is a small tubular one. Finally a small piece of fine emery or sandpaper could be used to touch up small surfaces or to remove the enamel insulation from wires.

Modulated Oscillator.

The problem confronting s small dealer in equipping himself with a certain amount of service equipment, is essentially very different from the man who starts out with the idea of providing service only. In many cases the equipment of such a purely service business will be far more comprehensive than that of even a large radio concern who are perhaps more concerned with selling than with servicing receivers. The competent service business should include among their equipment a *modulated oscillator* which will tune at least over the whole of the broadcast band, together with a wave-length range which covers the intermediate frequency used in superhets. The *oscillator* should be associated with some kind of an *output meter*. This does not necessarily mean a copper oxide rectifier plus voltmeter type of instrument but may quite well consist of a valve voltmeter employed to measure the A.C. voltage developed across the output of receivers under test.

The construction of such an oscillator is relatively simple. It may be modulated either by 50 cycle A.C. or by the audio oscillation generated by another or the same valve. Some precaution should be observed with shielding. A complete metal can enclosing the whole of the oscillator should be included in the design. The circuit of such an oscillator drawing its plate supply from the 240 volt mains without rectification is shown in Fig. 1. Since the plate voltage is A.C. the output will be modulated at 50 cycles. The switching arrangement shown provides a larger coil to tune to 175 K.C. for matching intermediate stages of superhets. The R.F. chokes provided in the 240 volt leads are a very necessary precaution.

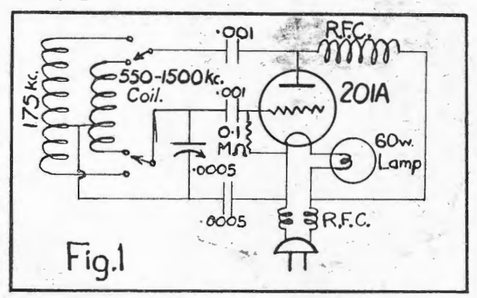


Fig.1

When measuring the voltage developed across the output of the receiver it is very often undesirable to leave the loudspeaker running at full blast. For this reason a plug should be provided to which is connected a choke having the same resistance as the field of a dynamic speaker, namely 2,500 ohms. Of course, in the case of a field coil fed by the full voltage, it is unnecessary to substitute a choke ; this is the case with 7,500 ohm. field coil. An impedance or choke of the correct value should be provided in place of the primary of the output transformer. The correct figure for pentode outputs is 20 henries. These may be mounted on a small base, provided with two terminals or a jack to which the output meter is connected. It should be noted that the field coil is usually connected to the filament of a plug. A suitable output meter of the valve voltmeter type should consist of a low impedance valve coupled to the output circuit as in the ordinary resistance coupling method, by means of a small condenser and a low value grid leak, and biased so that no plate current flows. When an A.C. voltage is developed

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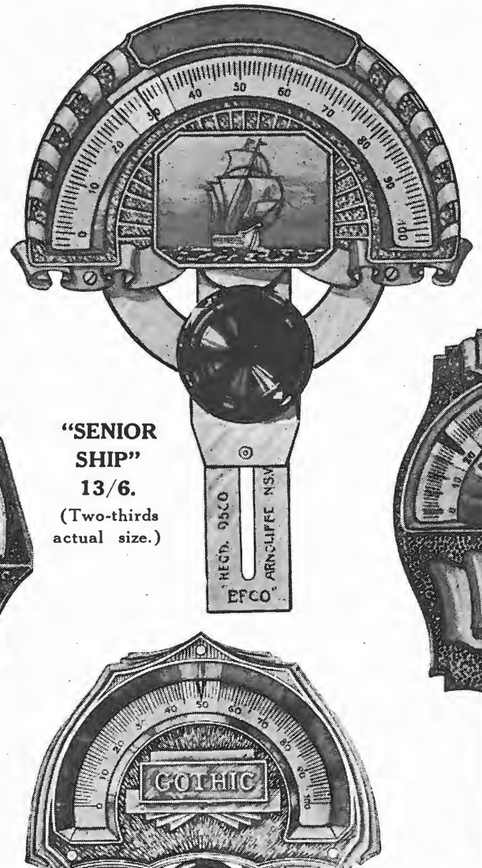

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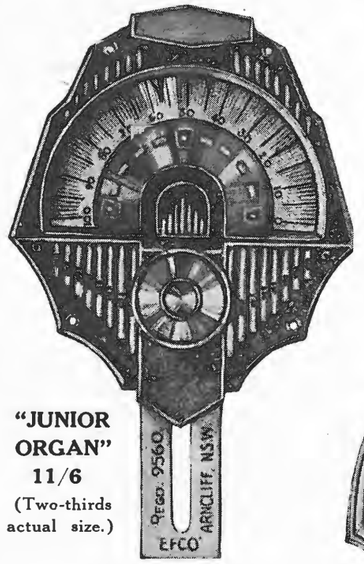

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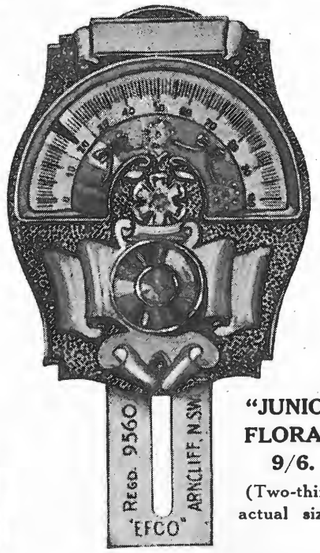

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ALL SIZES of spindles provided for.

CLOCKWISE and ANTI-CLOCKWISE Scales.

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"THE DIAL PEOPLE"

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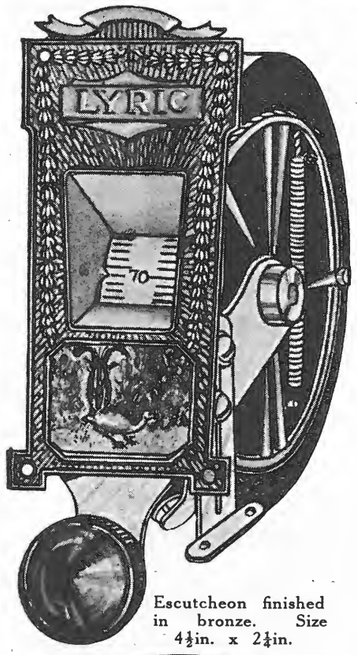

Escutcheon finished in bronze. Size 4½in. x 2¼in.

"LYRIC."
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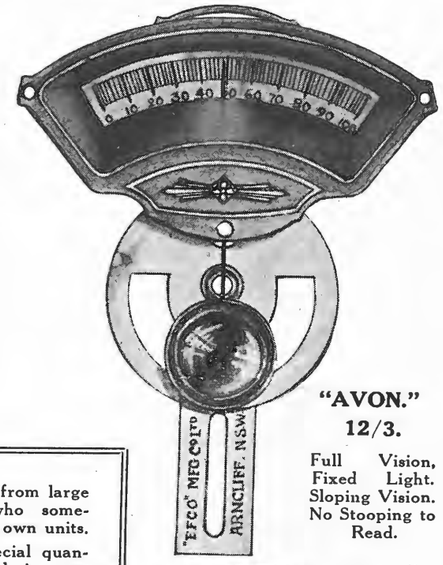
Suitable for SHORT or LONG wave reception in the one cabinet. Panel showing Lyre Bird can be removed and individual customer's design inserted, also name placed above in panel. Available in clockwise or anti-clockwise movements. Scale in TAN or OPAQUE WHITE.

WE invite enquiries from large manufacturers who sometimes make their own units.

We will quote on special quantities and exclusive designs as we are concentrating on this class of manufacture.



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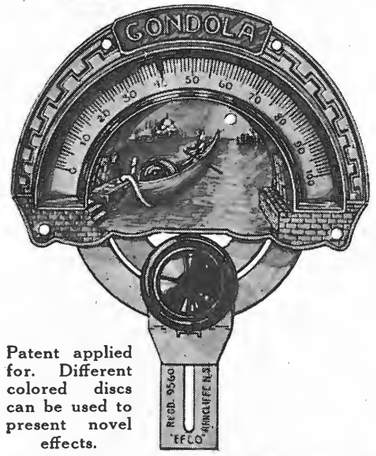
Full Vision, Fixed Light. Sloping Vision. No Stooping to Read.



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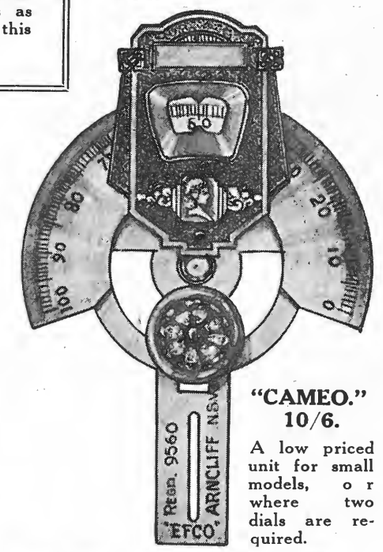
The travelling light **"Effect"** is obtained by a travelling disc of celluloid which executes an optical illusion of spot light tuning.



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A low priced unit for small models, or where two dials are required.

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on the grid, a certain amount of plate current will flow and the readings of plate current can be calibrated against the A.C. input voltage. In many cases this will be found to be unnecessary as only comparative readings are desired.

A 25 watt lamp provides approximately the correct resistance when used as a dummy field coil but of course it has no filtering action so when used with very sensitive sets with the volume control turned well on the hum in the output is liable to upset readings. In this case resort must be had to the substitution of a choke, or the loudspeaker must be left connected.

The provision of a small testing board embodying a 240 volt neon lamp, a pair of flexible leads with insulated picks makes a very handy piece of equipment, for continuity testing. It should be remembered that the neon will light if connection is made through a condenser though continuity would not be shown in testing with D.C.

It is obvious that our well equipped serviceman in a business devoted purely to serviceing or the service workshop of a large firm will have in stock larger numbers and varieties of such components as condensers, resistors, etc. More tools will be available and hence more intricate and thus costly and remunerative jobs may be tackled.

In the laboratory of a concern manufacturing short wave receivers or converters, the use of a short wave oscillator for matching and testing is essential. Either tapped or plug-in coils are suitable for covering the wave band and the device may be either roughly calibrated say to within about 2% or more accurately to within about $\frac{1}{2}$ or $\frac{1}{4}$ of 1% by making use of harmonics from the broadcast frequency. The frequencies of the broadcast stations should be plotted on a graph and those which fall on an even curve may be employed by working a local oscillator at zero beat with them and utilising the harmonic of the local oscillator to beat against the short wave oscillator which is thus calibrated. In addition to this standard frequency schedules in the amateur wave band are also available, transmitted by stations in U.S.A.

The application of a frequency meter would naturally come in laboratory work. When an accurately calibrated signal generator is used for taking sensitivity and selectivity curves on a receiver it may sometimes be found necessary to check against a frequency meter. Similarly, of course, a signal generator and its associated equipment are naturally classed as laboratory equipment. The use of resistance and condenser bridges is confined almost entirely to laboratories.

The use of A.C. meters appears to be restricted to a much smaller sphere than that in which it could be profitably employed, although an A.C. meter can be used (usually not with any great accuracy) for measurement of D.C. currents and potentials. In some instruments however the A.C. and D.C. scale calibrations are identical.

Calculation and Use of Shunts and Multipliers.

It is to be observed that all indicating meters having only two connections to the external circuit are fundamentally current measuring instruments. The current flowing through the meter is the prime reason for the deflection of the indicator.

However, we may calibrate the meter scale so that the needle deflection will accurately read ohms, volts, microfarads, etc., or any one of the electrical factors which if varied would create a change in current flow provided the other characteristics of the circuit would remain constant.

Let us consider a D.C. milliammeter (O–1) which gives full scale deflection when 1 milliampere flows through the meter. We desire to use this meter as a multirange voltmeter having scales (0–10) (0–100) (0–500) and (0–1000) volts respectively. The resistance of many such meters in commercial use ranges from 20 to 50 ohms. In the extreme case considering a meter of 50 ohms resistance the voltage drop across the meter at full scale current would be, according to Ohms Law, 50 x .001 or 0.05 volts.

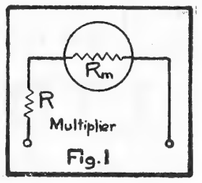

Fig.1

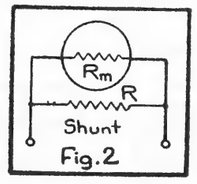

Fig.2

Referring to figure 1 we see that the meter can be used as a 0–10 voltmeter if a resistance or multiplier is connected in series with it.

The value of this resistance is such that practically the whole of the voltage drop will occur across it. If a voltage drop of more than 1/20 volt is impressed across the meter it will go off scale and probably be damaged. Further this small drop of 1/20 volt can be quite neglected in calculations for the requisite resistance as it is negligible in comparison with the total voltage. Thus the resistance must be of such value that if 1 milliampere of current (which is full scale deflection of the meter) flows through it the voltage across the resistance will be 10 volts. Figure 1.

If a 0–10 milliammeter was used in place of the 0–1 the multipliers in each case would of course be only 1/10 of their respective values in the previous example. This would also apply to the scale multiples. However, the 10 mil meter would consume appreciable current in itself and may in certain circuits introduce a considerable error particularly where the resistance of the multiplier is not considerably higher than the voltage supply system. Moreover, the regulation of the voltage supply system may be seriously affected when it is called upon to supply an additional 10 milliamperes to operate the voltmeter which would perhaps introduce a large error.

This emphasizes the importance of a high resistance voltmeter ; in the first example the resistance was 1000 ohms per volt while in the second instance it was only 100 ohms per volt. For the proper degree of accuracy

on the grid, a certain amount of plate current will flow and the readings of plate current can be calibrated against the A.C. input voltage. In many cases this will be found to be unnecessary as only comparative readings are desired.

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The provision of a small testing board embodying a 240 volt neon lamp, a pair of flexible leads with insulated picks makes a very handy piece of equipment, for continuity testing. It should be remembered that the neon will light if connection is made through a condenser though continuity would not be shown in testing with D.C.

It is obvious that our well equipped serviceman in a business devoted purely to serviceing or the service workshop of a large firm will have in stock larger numbers and varieties of such components as condensers, resistors, etc. More tools will be available and hence more intricate and thus costly and remunerative jobs may be tackled.

In the laboratory of a concern manufacturing short wave receivers or converters, the use of a short wave oscillator for matching and testing is essential. Either tapped or plug-in coils are suitable for covering the wave band and the device may be either roughly calibrated say to within about 2% or more accurately to within about $\frac{1}{2}$ or $\frac{1}{4}$ of 1% by making use of harmonics from the broadcast frequency. The frequencies of the broadcast stations should be plotted on a graph and those which fall on an even curve may be employed by working a local oscillator at zero beat with them and utilising the harmonic of the local oscillator to beat against the short wave oscillator which is thus calibrated. In addition to this standard frequency schedules in the amateur wave band are also available, transmitted by stations in U.S.A.

The application of a frequency meter would naturally come in laboratory work. When an accurately calibrated signal generator is used for taking sensitivity and selectivity curves on a receiver it may sometimes be found necessary to check against a frequency meter. Similarly, of course, a signal generator and its associated equipment are naturally classed as laboratory equipment. The use of resistance and condenser bridges is confined almost entirely to laboratories.

The use of A.C. meters appears to be restricted to a much smaller sphere than that in which it could be profitably employed, although an A.C. meter can be used (usually not with any great accuracy) for measurement of D.C. currents and potentials. In some instruments however the A.C. and D.C. scale calibrations are identical.

Calculation and Use of Shunts and Multipliers.

It is to be observed that all indicating meters having only two connections to the external circuit are fundamentally current measuring instruments. The current flowing through the meter is the prime reason for the deflection of the indicator.

However, we may calibrate the meter scale so that the needle deflection will accurately read ohms, volts, microfarads, etc., or any one of the electrical factors which if varied would create a change in current flow provided the other characteristics of the circuit would remain constant.

Let us consider a D.C. milliammeter (0–1) which gives full scale deflection when 1 milliampere flows through the meter. We desire to use this meter as a multirange voltmeter having scales (0–10) (0–100) (0–500) and (0–1000) volts respectively. The resistance of many such meters in commercial use ranges from 20 to 50 ohms. In the extreme case considering a meter of 50 ohms resistance the voltage drop across the meter at full scale current would be, according to Ohms Law, 50 x .001 or 0.05 volts.

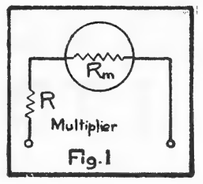


Fig.1

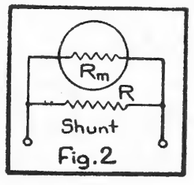


Fig.2

Referring to figure 1 we see that the meter can be used as a 0–10 voltmeter if a resistance or multiplier is connected in series with it.

The value of this resistance is such that practically the whole of the voltage drop will occur across it. If a voltage drop of more than 1/20 volt is impressed across the meter it will go off scale and probably be damaged. Further this small drop of 1/20 volt can be quite neglected in calculations for the requisite resistance as it is negligible in comparison with the total voltage. Thus the resistance must be of such value that if 1 milliampere of current (which is full scale deflection of the meter) flows through it the voltage across the resistance will be 10 volts. Figure 1.

If a 0–10 milliammeter was used in place of the 0–1 the multipliers in each case would of course be only 1/10 of their respective values in the previous example. This would also apply to the scale multiples. However, the 10 mil meter would consume appreciable current in itself and may in certain circuits introduce a considerable error particularly where the resistance of the multiplier is not considerably higher than the voltage supply system. Moreover, the regulation of the voltage supply system may be seriously affected when it is called upon to supply an additional 10 milliamperes to operate the voltmeter which would perhaps introduce a large error.

This emphasizes the importance of a high resistance voltmeter ; in the first example the resistance was 1000 ohms per volt while in the second instance it was only 100 ohms per volt. For the proper degree of accuracy

in radio work a 1000 ohm per volt voltmeter will be quite suitable.

To use the 0–1 milliammeter as a higher scale milliameter, it is necessary to provide a shunt as in Figure 2. In this case it is essential to know accurately the resistance of the meter. Assume that it has a resistance of 27 ohms and that we want to have a scale reading of (0–10) (0–50) (0–100) (0–500) milliamperes.

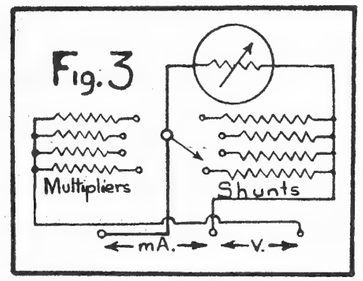
Referring to Figure 2 it is evident that to use the meter for 0–10 mA. measurements the meter would carry 1/10 of the total current and the shunt 9/10 or the shunt resistance would be 1/9 of the meter resistance. If the meter resistance was 27 ohms the shunt resistance would be 3 ohms: correspondingly the shunt resistance for use as an 0–50 milliammeter 1/49 x 27 = .551 ohms. For 0–100 and 0–500 scales the shunt resistance must be 0.2727 ohms and 0.0541 ohms respectively.

The general formula is

$$R = \frac{Rm \times Im}{I - Im}$$

where R = resistance of shunt in ohms.
Rm = resistance of meter in ohms.
Im = full scale current for meter.
I = full scale current for new calibration.

By having a multiple switch as shown in Figure 3, one meter can be used as a voltmeter or milliammeter at any desired range. The accompanying chart shows the resistance of the shunt or multiplier as the case may be.



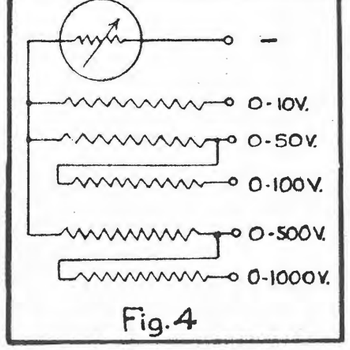
It should be noted that each of the multipliers must be of large enough capacity to carry 1mA. without unduly heating and thus changing in value.

Shunt and Multiplier Values.

27 Ohm (0–1) Milliammeter.

Scale.	Use as.	Resistance in Ohms of Multiplier or Shunt.		Multiply Old scale by
0–10	Voltmeter	10,000	M	10
0–50	,,	50,000	M	50
0–100	,,	100,000	M	100
0–250	,,	250,000	M	250
0–500	,,	500,000	M	500
0–1000	,,	1,000,000	M	1000
0–10	Milliammeter	3	S	10
0–50	,,	0.551	S	50
0–100	,,	0.272	S	100
0–500	,,	0.0541	S	500
	35 Ohm (0–1.5)	Milliammeter.		
0–15	Voltmeter	10,000	M	10
0–150	,,	100,000	M	100
0–750	,,	500,000	M	500
0–15	Milliammeter	3.89	S	10
0–75	,,	0.714	S	50
0–150	,,	0.354	S	100
0–750	,,	0.0701	S	500

The circuit is also shown in Figure 4 of a multi range voltmeter in which the multipliers are not separate units but are made up by addition. This helps to get away from the cost of a 1 meg. 1mA. resistor.



Power Supply for Receivers.

In the opening days of broadcast receptions all receivers obtained their power supply from batteries. Then came the introduction of the " B " Battery eliminator. In many cases this unit also supplied the " C " voltages. Finally came the introduction of the all-electric receiver.

Considering in detail the " B " Supply system of either an eliminator or a complete receiver we can divide it into four sections namely the power transformer; the rectifier; the filter and the voltage divider system. The power transformer consists of a number of windings over a laminated iron core. The various secondary windings are necessary to supply the requisite filament current for each valve in the receiver, in addition to the high voltage which is rectified and smoothed to provide the plate current.

Although in the very early days it was customary for experimenters and others to design and build their own power transformers, this practice cannot be recommended to-day when reputable and efficient makes of transformers are availa ble at such a low cost. To approach the efficiency of these in the home-built trans-

former would necessitate extremely complicated and laborious design considerations.

One of the most important features in a transformer is the necessity for good regulation for the ability to supply the rated voltages under a heavy load. While this is usually taken care of by the manufacturer no transformer should be called upon to supply more than its rated current. Transformers should be provided with an earthed static shield between primary and secondary to assist in the elimination of power line interference. This is usually connected to the core so that it will be automatically grounded to the chassis on mounting the transformer.

Good insulation between the primary and any other portion of the transformer is extremely necessary. Further, any condensers connected to the 240 volt mains should be of a high rating because any breakdown in this portion of the circuit may be fraught with danger to life and property. It is desirable that taps be provided on the primary to allow for differences in line voltages.

The Rectifier.

While by far the greater majority of rectifiers are of the valve type these are to some extent (particularly in England) being replaced by metallic or copper oxide rectifiers. The valve type of rectifier may be either of half or full wave construction. Practically all rectifier valves to be found in receivers are of the full wave type embodying two separate filament and plate assemblies in the one envelope.

In explaining the action of rectification it should be remembered that a rectifier of any kind presents a different resistance depending on which direction current is made to flow through the device. In the case of the rectifiers (either metal or valve) used in a receiver, an appreciable amount of current can only be passed in one direction.

Metal Rectifiers.

Metal rectifiers are usually employed to give full wave rectification in what is known as a voltage doubler circuit. No centre-tap on the transformer is necessary as with the usual full wave valve rectifying circuit, which is also shown. Further information on the use of metal rectifiers for any purpose can be obtained from a Westinghouse booklet entitled "The All-Metal Way, 1933."

Mercury Vapour Rectifiers.

The latest type of valve rectifier is what is known as the mercury vapour type. Mercury is introduced into the envelope at the time of manufacture and as a result of the low pressure is present in gaseous form. Due to the liberation of electrons from the filament these gas particles become ionized thus forming a low resistance path from filament to plate across which a practically constant voltage drop of about 15 volts occurs. For this reason extremely high efficiency together with good regulation is made possible.

Filters.

By means of the rectifier we have succeeded in converting the A.C. current supplied by the power transformer to a pulsating direct current which is still unsuitable for use as the plate power in a receiver. It must now be smoothed or filtered by a combination of large chokes and condensers. The usual arrangement of these consists of one condenser on each side of a choke of about 20 to 30 henries. The condensers serve to store up energy during the instants when the voltage supplied by the rectifier is greater than the average, while during the instants when this voltage is below the average it gives up some of its stored energy acting as a reservoir of power somewhat in the manner of a fly-wheel.

Due to the high inductance of the choke it presents a high impedance to the A.C. ripple voltage which may be considered as superimposed on the steady D.C. current. The second condenser is more necessary as a low impedance for any audio frequency which may find its way back into the power supply than as a reservoir.

At the same time it should not be lost sight of that the choke also acts in some measure as a reservoir of power. In this case the energy is stored and given out by the fluctuating magnetic field of the choke. The normal practice to-day is to use 8 mfd. electrolytic condensers and the field coil of the dynamic speaker as the power choke. The plate current flowing also energises the field coil. In the case of ordinary power chokes a sufficiently large air gap should be provided to prevent saturation of the core.

Voltage Divider Systems.

These may be divided into two sections, those in which a large number of separate and untapped resistors are used and those in which tappings are taken from a large voltage divider. The first system has been considered in the introduction to the Service Section where several examples showing the method of calculating the correct value for the resistors are given. An example showing the calculation of a voltage divider was also given in this section.

D.C. Eliminators.

Due to the fact that there is a large ripple from the commutator of a D.C. generator the voltage from D.C. mains cannot be used to directly supply the plate power of a receiver. A suitable filter circuit would consist of two condensers and a choke connected as for the filtering of an A.C. power pack. In some cases considerably smaller condensers may be employed as very often the commutator ripple is of quite a high frequency. The voltage divider system is also identical.

When measuring the voltages in a receiver a high resistance voltmeter must be employed as usually the D.C. resistances across which the voltmeter is connected are very high and the current drawn by the meter will appreciably affect the voltage distribution. For instance in measuring the grid bias by connecting the voltmeter between grid and cathode terminals of a valve, the resistance of the grid leak is likely to be several times

that of the voltmeter and in consequence the bias indicated will be less than half the actual operating bias. The usual practice is to employ a meter having a resistance of 1,000 ohms per volt. This draws a current of 1 mA. when reading full scale.

Automatic Bias.

Automatic bias may be drawn from tappings on a voltage divider or by using separate resistors in the cathode circuit of each valve. The correct value of resistance may be easily calculated by dividing the required bias by the total current flowing in the cathode circuit and multiplying the result by 1,000 to allow for the fact that the current is expressed in milliamperes. In the case of pentode and screen grid valves the total current flowing is the sum of the plate and the screen currents.

Occasionally the bias for the output valve is obtained by putting the power choke or field coil in the negative lead and utilizing the whole or portion of the voltage drop across it. In this case the current flowing is the total plate and screen current drawn by the whole receiver.

Phonograph Pick-ups.

Sound is recorded on phonograph records by means of small variations in the grooves of the record. When a pickup is run over a record the resulting vibrations of the needle are used to generate an EMF whose frequency and wave form correspond exactly to the pitch and the timbre of the original recorded note. Pickups are usually of the magnetic type (*i.e.*, they employ a permanent magnet) and may be either rubber-damped or oil-damped. The performance of the latter type is far superior although it is correspondingly more expensive.

Volume Control.

Volume control is normally effected by a potentiometer of from 50, to 500,000 ohms connected across the pickup with the output connected to the variable section.

Needle scratch is due to the slightly rough edges of the groove. It can be practically eliminated by the connection across the pickup of a choke of 200 mH. and a condenser of .006 mfd. in series.

Connection to the Receiver.

In the older type of receiver the pickup is usually connected across the primary of the first audio transformer. In more modern receivers where only one audio stage is employed it is necessary to connect the pickup in the grid circuit of the detector valve. A switching arrangement to cut out the radio section of the receiver and also to alter the bias on the detector valve to a suitable value when working was an amplifier, is necessary.

Further discussion on this vast subject and on that of public address system will be found in Ghirardi, " Radio Physics Course," Chapter 30. The book is obtainable at any large book stall handling technical literature, or from the publisher of this Annual.

Servicing Auto Radios.

In the majority of cases servicing of auto radios will consist of eliminating interference. It must be understood that sometimes the ordinary faults which will occur in any chassis will be present in the auto radio. In connection with the elimination of interference it should be noted that the first essential is a correctly installed aerial.

There are three widely used methods of installing an aerial in a car, first by the use of a piece of fine mesh copper gauze inserted in the roof of the car. With this method it is important to notice that the aerial lead-in should be shielded with copper braid, bonded to the car's chassis. It is of course, impossible to use this when the car roof is of metal. In that case one of the two following methods must be employed. A length of wire may be run several times from side to side of the car on stand-off insulators mounted below the floor boards. Again, the lead-in should be shielded by grounded braid. An alternative to this method consists in mounting the aerial at least three inches above the roof by means of stand-off insulators. The aerial should run around three sides of the car and the shielded lead-in pass through a water tight inlet. If any type of B battery eliminator operated from the 6 volts supply is employed it should be completely shielded by a metal case grounded to the chassis.

The Suppression of Interference.

Naturally, since there are several circuits in the electrical system of the car which are frequently being made and broken a certain amount of interference will result. It is easy to see that the ignition circuit is the chief offender in this regard. The frequently recurring spark is equivalent to a very high frequency oscillator. It stands to reason that the longer the lead connected to the high tension side of the ignition system, the lower the nominal frequency of the interference will be. Together with a greater radiating surface, this will mean increased interference and correspondingly greater difficulty of suppression.

Fitting small suppressors at the top of each spark plug is often effective. These consist of small resistors several thousand ohms in value. However another spark is continually occurring in the distributor between the rotor and the contact leading to each plug. These contacts should be clean and smooth and the gap correctly adjusted. Even in the type where there is no air gap, dirty or uneven contacts can cause serious interference.

Although it is not such a serious source of interference the make and break occurring between the brushes and commutator segments on the generator may cause interference. Usually cleaning the brushes and the commutator surface will ensure that no interference

results. In a great many makes of cars the suppressors supplied with an auto radio set together with the shielded lead-in will be sufficient to suppress any interference to a very reasonable level. If this is not the case it will be necessary to instal either by-pass condensers or radio frequency chokes. Where by-pass condensers are installed the bonding lead to the frame should be such that the effective length of the electric circuit to the main portion of the car chassis is small. Of course, before installing any by-pass condenser permanently, the set should be tested for interference with the by-passes connected in position temporarily. Either 1 or 0.5 mfd. condensers will be suitable.

By-Pass Systems.

The most usual position for a by-pass condenser will be on either side of the ammeter and on the leads from the generator. These should be placed as close to the generator as possible. Where a roof aerial is used it may be necessary to by-pass the dome light but where the aerial is located beneath the floor board it may be necessary to by-pass or choke the light to the tail-light. A suitable choke consists of 20 turns of 18 gauge wire wound on a three-inch former.

In other cases a similar choke placed in the high side of the power wires (usually the positive side of the A battery will prevent the interference entering the receiver through the battery wires.

Pipe lines or controls entering from the engine compartment frequently carry interference. To test for this, one finger should be placed on the aerial terminal of the receiver, when a great increase of noise will be heard if the hand is placed near such a radiating object. Any such line should be bonded to the frame. If the ignition coil is found to be mounted on the dashboard the coil and associated leads through to the engine compartment should be shielded and effectively earthed. Reversing the low tension leads to the ignition coil may perhaps reduce interference. Again, shielding the leads from the coil to the distributor may prove effective or in some few cases shielding the low tension lead from the coil to the breaker.

It is obvious that all the foregoing remedies will never be needed on any one car and only those necessary should be employed. In every case the suppressors should be installed at each spark plug and in the common lead as near to the distributor head as possible.

It has not been thought necessary to include any instructions for by-passing the starter as this is used so infrequently. Where noise originates from other sources than the electrical system of the car, it will probably be found to be due to the aerial making intermittent contact with metal portions of the car frame, defective valves or sockets, defective components or loose and high resistance joints and connections.

Portable Receivers.

There are no doubt a few portable receivers still in existence which gave satisfactory service initially, but which after a few months' use, developed such faults as permanent squealing and other evidences of unstable operation. The problem of servicing one of these receivers is hardly a pleasant one. Leaving out of the question ordinary faults, such as breakages, faulty parts etc., the most frequent trouble is instability caused by the high internal resistance of the B battery which is common to all plate circuits.

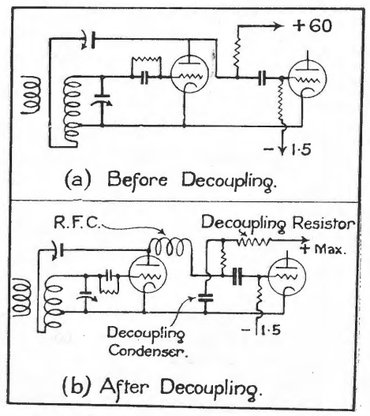
While a temporary remedy is to replace the B battery by a new one with a low internal resistance, this cure is hardly permanent. In many of the receivers of this type, which are of unknown manufacture, no precautions whatsoever are employed to prevent back-coupling.

The first thing to suggest itself as a cure for this trouble, is the decoupling of one or more of the plate circuits. For a start decoupling the plate circuit of the detector valve is likely to prove most beneficial. Instead of feeding the detector from an intermediate tapping on the B battery, say +45, the detector plate current is drawn from the maximum voltage of the battery and dropped by the decoupling resistor. The correct value for this resistor, of course, depends on the current taken by the valve, and the amount by which it is necessary to drop the maximum voltage of the B battery. If a 90 volt B battery is employed, then the decoupling resistor should drop this to about 45 or 50 volts. Naturally of course, the value of the resistor is not at all critical, and anything near the calculated value will work quite well.

If decoupling the detector plate circuit does not cure the trouble, the next valve to try is the first audio.

If however, partial or complete decoupling does not get rid of the unwanted noise, the cause may be that R.F. energy is reaching the audio amplifiers. In this case a good R.F. choke in the plate lead of the detector valve should be included, while possibly stopping resistors of about 100,000 ohms may be connected in series with the grid leads on each audio valve. A good value for the decoupling condenser as shown in the Fig. is 2 mfd. In some cases a condenser of about .001 mfd. between the plate of the last valve and the B- will help.

It is of course, advisable to test with a partially discharged B battery to simulate the conditions obtaining in practice some time after the first installatiou of the set. While the heading applies to portables, it should be realised that these cures may be applied to any battery set which is showing evidence of instability.



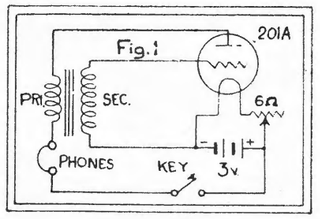
A Meterless Valve Tester.

While the valve tester described here may not be quite the ideal from many points of view, it is however, a distinct advance on many other types because it represents good service for practically no initial outlay. Of course in the majority of testers, 90% of the cost is represented by the meters involved. However, in the tester described below, 90% of the cost will be represented by the batteries, audio transformer, and variable resistors.

As will be seen from the circuit, the indicating device is a pair of headphones, an item which is available in every dealer's shop. The required readings are obtained from the setting of one of these variable resistors.

The Circuit.

Considering first the simple circuit of Fig. 1, which represents an audio oscillator, wherein no B battery is used the plate return being taken to the positive side of the filament battery, we see that the primary of an audio transformer is used as the reaction coil. The secondary of the transformer is connected in the grid circuit, the grid return being taken to the negative side of the filament.



If the primary is connected in the right direction, the valve will oscillate at an audible frequency, which will be heard in the headphones connected in series with the plate lead. If however, a poor valve has been inserted, it will not oscillate, and no sound will be heard in the headphones. However, if a small B battery is inserted and gradually increased in voltage the valve will eventually commence to oscillate.

In this way we see that the goodness of a valve may be measured by smallness of the plate voltage which will just make the valve oscillate, compared to a valve of the same type which is known to be good.

Application of the Principle.

In the circuit of the tester as shown in Fig. 2 it will be seen that a 3 volt A battery, which consists of a pair of 1.5 volt dry cells, is employed in conjunction with a 4½ volt C battery. In order to vary the plate voltage, a rheostat having split tappings at equal distances apart, is shunted across the A and B batteries in series. The plate voltage may thus be adjusted from zero to plus 7½ volts in 10 equal steps, measuring from the negative side of the filaments. It will be seen that in a heater type valve, the cathode is connected to the negative side of the heater.

Three sockets are utilized, allowing the testing of 4, 5 and 6 pin valves. If desired, of course, it would be an easy matter to insert a 7 pin socket, but this is hardly warranted by the small number of 7 pin valves yet in use. It will be noticed that the potentiometer tappings are numbered from 1 to 10, as we go down from 7.5 to 0 volts on the plate. In this way the better valves will give a higher reading for the last tapping on which they will oscillate. It would, of course, be quite legitimate to employ a continuously variable potentiometer fitted with a dial or a knob and scale. The potentiometer is designated R3 in both schematic diagram and photograph.

The filament rheostat, R2, appearing on the left hand side of the panel, is used to apply suitable filament voltage to each different type of valve. It should be noted that this is not necessarily the correct operating filament voltage, but rather one at which poor valves will give a reading below about 4 on the scale of R3. In any further calibration work, this point should be carefully noted.

Use of the Switches.

For testing 2 volt valves, an additional series filament resistor, R1, may be placed in circuit by shifting switch No. 2 to the off position. This inserts an extra 10 ohms in series with the filaments. Switch No. 1 is the on-off switch for the whole tester.

Two-way switches Nos. 3 and 4 are placed in their correct respective positions for different types of valves, as indicated in the table. Switch No. 3 is connected to the grid terminal of the 4 and 5 pin sockets. In the case of 4 element valves, the screen grid is connected to this prong and it is thus necessary to connect this prong to the plate instead of the grid lead. With switch No. 3 in position "P," this prong is thus connected to the plate, and the screen grid clip, shown in the left centre of the photograph, is used to connect the grid which goes to the cap on the top of the valve.

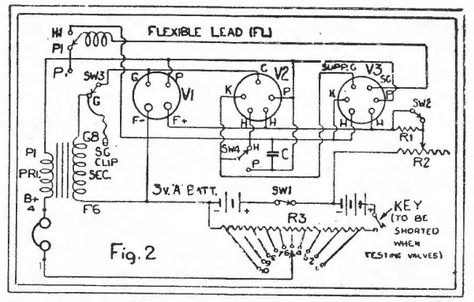
In the "G" position switch No. 3 connects the grid terminals to the secondary of the transformer, and is normally used in this position.

Switch No. 4 is used for testing pentodes in which the screen grid returns to the cathode terminal on the socket. Normally, of course, when switch No. 4 is in the "H" position, the cathode is returned to the negative side of the heater. When, however, switch No. 4 is thrown to position "C," the cathode terminal on the socket, which will be the lead from the screen grid of a pentode, is connected direct to the plate terminals. A condenser "C" is connected across the terminals of this switch, or virtually from plate to the negative side of the A battery.

Adjusting the Note.

In the photograph as shown, "C" appears on the lower right of the panel. While a variable condenser has been used in the model shown in the photograph, there is no reason why this should not be replaced by a fixed mica condenser of .00025 mfd. capacity. Its function is to adjust the note obtained until a suitable working value for all types of valves is arrived at.

It should be noticed that in the 6 pin socket the cathode terminal is connected to the negative side of the heater. On the other hand, when testing 6 pin valves, switch No. 4 may be used to connect the suppressor grid terminal to either negative heater or plate. In addition, a further flexible lead running from the screen grid terminals on the 6 pin socket, is arranged so that it may be connected to either the plate or to the negative side of the heater. A refinement of the model, as shown in the photograph and circuit diagram, would be the inclusion of a third 2-way switch to eliminate the somwehat inconvenient changing over from one clip to another of this flexible lead. Eight terminals appear on the panel of which 2 only are normally used, those at the upper right to which the 'phones are connected. The 4 terminals along the lower edge of the panel are for the connection of external batteries, although normally, these will be self contained. A further use for these terminals is when either 3 or 4.5



volts is necessary for some purpose, when the requisite supply may be drawn from these terminals. The two terminals at upper left are in series with the B battery supply leads, and are normally shorted. If, however, it is desired to use the instrument as an audio oscillator for Morse code practice, a key may be connected to these two terminals.

Testing.

Varying any of the controls will alter the pitch of the note which is heard in the 'phones, but this is not at all important, as long as it is fairly well up in the audible scale. If it is so low in frequency as to appear like motor-boating, it will be necessary usually to alter the condenser C or the filament rheostat R2, so that a respectable note is obtained. On the other hand, all similar types of valve must be tested with the same setting of every control except R3.

If there is any variation in any of the controls except R3, when testing similar types of valves, the comparison would not be a fair one, and may cause the acceptance of poor valves or the rejection of a good valve.

Construction.

It is almost unnecessary to go into any details over the construction of the tester, which is simplicity itself. Of course, many people will have their own little variations on this design, possibly in the way of mounting the batteries, or in placing the lower half of the tester in a wooden box. The A battery which consists of 2 1.5 volt cells each mounted horizontally below the sub-panel, being held in place by two straps, one at each end, which pass round the two cells and are tightened by means of bolts up on to the sub-panel.

The transformer employed in this model is a variable ratio, in which the terminals, P1, B + 4, M6, and G8 are used. If another type of transformer is used, which seems likely as the type specified is not obtainable on the market, although quite often found in the junk box beneath the work bench, it is possible that the B+ lead on the transformer may have to be connected to the plate of the sockets. At the same time it should be noted that the calibration chart will not hold for a different type of transformer, and further that new settings of the rheostat R2, will probably be necessary.

Calibrating.

If another type of potentiometer or rheostat is employed, the total resistance values given in the list of parts below should be adhered to. Further, the scales should be divided into 10 divisions each, unless a complete recalibration is desired.

The business of calibrating the tester is decidedly a laborious one, and this is perhaps its main disadvantage. It should be noted that it is very necessary to engrave or mark by some means on the panel, the position of the four switches. Guesswork in this matter is too liable to lead the user into error.

If so desired in place of the fixed mica condenser recommended for "C," a variable may be used mounted behind the panel where it is not likely to be knocked out of adjustment. A compression type would of course, be the most suitable.

Comparative Testing.

While the practice of testing valves under actual operating conditions, i.e., with normal filament and plate voltages, is almost universal, this should not be considered as a tacit admission that it is the only satisfactory method. In many other engineering testing processes, it has been found too costly or too cumbersome to actually test the article or product under actual working conditions. For this reason many tests are carried out under specified conditions which do not approach the working conditions. Hence the results are not directly comparable, but by either experiment or theory the results obtained can be made to indicate whether the piece under test would be satisfactory in actual practice.

For instance, in testing paper condensers, it has been found that the life is very often inversely proportional to the seventh power of the voltage applied across the condenser. So, by applying a higher voltage than the rating, the condensers may be made to break down after a life of perhaps 2 or 3 hundred hours. From results obtained for a number of these condensers, the actual life under the rated voltage may be quite simply calculated.

In the same way, by actual experiment, we are enabled by means of the results obtained on this tester under abnormal voltages, to differentiate between good and poor valves. In some ways the test described here falls into line with the mutual conductance test. At the same time it also fulfils some of the requirements of an actual operating test. For this reason it can be made just as satisfactory as the more usual and far more complicated tests.

Good Features.

The extreme portability and low cost of this apparatus are features which commend it particularly to the small dealer or serviceman. A tester can be built in which the A supply is furnished from the power mains. Referring to Fig. 3, we see that the heavy A battery is dispensed with, and a small 2.5 volt transformer is employed in its stead.

Conversion to A.C.

In place of the 4½ volt C battery, a small type 9 volt C battery is employed for the B battery. While the 2.5 volts on the filament of the valve, in place of the three volt A battery, may not seem sufficient, it should be remembered that most small transformers under a light load give a considerably higher voltage than their rating. It will be thus quite easy to adjust the filament temperature to the correct value by means of the rheostat R2, and the resistance R1. In other details the circuit is almost identical with that of Fig. 2, except that the flexible lead connected to the screen grid terminal of the 6 pin socket has been replaced by a two-way switch. A convenient position on the panel for SW5 would be immediately below SW3. No switch is provided in the primary of the transformer, this being merely plugged in and out of a 240 volt socket.

It should be remembered that the same pair of phones should be employed every time the tester is used. If this is not done the readings of R3 will be thrown out. In the normal operation of the tester, the switches will be thrown to their normal positions. These are :—

SW1 On
SW2 on
SW3 to G
SW4 to H
SW5 or flex P1.

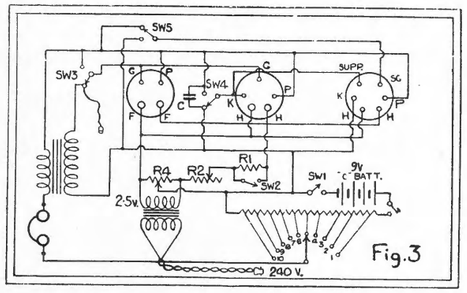


Fig.3

The rheostat is set at the position indicated on the chart for the valve under test. With the dial of R3 at tap No. 10, this potentiometer is slowly turned toward tap No. 1 until an audio howl is heard in the phones. If a valve is good it will start oscillating at about tap No. 9 ; if however, the valve is poor, then the plate voltage must be increased to a relatively high value to make the tube oscillate. For example, if it has to be moved to tap No. 2, then the valve is poor, and should be rejected.

It should be noted that heater type tubes should be allowed sufficient time to warm up. In most cases this will be longer than when in normal use in a receiver since the filament voltage will be lower than the rated. Similar type tubes of different make, may give slightly different readings on this tester. It should be noted that if a shorted valve is inserted it will do no harm whatsoever to the tester, although in the more complicated type of tester using several expensive meters, either a fuse or a meter will be almost sure to be blown.

List of Parts.

1—10 ohm fixed resistor, 2 watts, R1.
1—6 ohm rheostat, R2.
1—1000 ohm potentiometer, 10 taps, R3.
1—.00025 mfd. condenser, C.
1—Acme transformer, type 3A2.
2—On-off switches.
2—(or 3) S.P. D.T. toggle switches, SW3, SW4, (SW5).
2—1.5 volt dry cells.
1—4.5 volt C battery.
1—pair of telephone receivers.
Suitable panels and fittings.
1—4 prong socket.
1—5 prong socket.
1—6 prong socket.

Valve Chart for Meterless Valve Tester.

Type of Valve	All Switches Normal (M) unless otherwise noted.	Setting of R2	Reading of R3 When Valve is		
			Good	Weak	Reject Below.
01A	Normal				
	FL to P1	10	10–5	4–3	3
12A	Normal	10	10–6	5–4	4
22	SW. 3 to P. clip on cap	1	10–5	5–4	4
24	SW. 3 to P clip on cap	7	10–5	4–3	3
26	Normal	6	10–6	5–4	4
27	Normal	About 1.5V	10–5	4–3	3
30	SW. 2 off	1	10–5	4–3	3
31	SW. 2 off	10	10–6	5–4	4
	SW. 2 off				
32	SW. 3 to P clip on cap	1	10–4	3–2	2
33	SW. 2 off				
	SW. 4 to P	10	10–5	4–3	3
	SW. 2 off				
34	SW. 3 to P clip on cap	4	10–4	3–2	2
35	SW. 3 to P clip on cap	7	10–5	4–3	3
45	Normal	6	10–7	6–4	4
46	SW. 4 to P	6	10–7	6–4	4
47	SW. 4 to P.	6	10–7	6–4	4
51	SW. 3 to P	7	10–5	4–3	3
55	Clip on cap				
Triode	SW. 4 to H FL to H	4	10–5	4–3	3
55 Diode Plate–1 Plate–2	Same as for a Triode	4	Switching SW. should stop signal Switching FL to P1 should stop signal		4 to P
56	Normal	6	10–5	4–3	3
57	Clip on cap				
	SW. 4 to P	4	10–5	4–3	3
58	Clip on cap	4	10–5	4–3	3
	SW. 4 to P				
71A	Normal	10	10–6	5–4	4

Turn to page 205 for illustration of Meterless Tester.

The Computation of Decibels.

The decibel, so often used in the work of audio amplification, transmission and reproduction, is simply the ratio between the loudness of any two signals. 10 decibels "up" on a signal means that the power has been increased tenfold ; 10 decibels "down," that it has been divided by 10. Apart from this figure of 10 decibels, the steps up or down in power are not equal to the gain or loss in decibels, but the peculiarities of this method of rating are based on sound physiological and engineering reasons.

The decibel, as a mathematician would instantly see from the table given here, is a logarithmic unit (the number of decibels is represented by ten times the common logarithm of the ratio of change in energy). This is accounted for by the fact that a signal after amplification to an energy level a million times greater does not sound a million times louder, but only 60 times louder.

Since the sound energy of the reproducer should be approximately in proportion to the electrical power output ; and since the electrical power is measured by "voltage times current," the power varies as the square of the voltage (or current). Therefore, the ratio of energy change corresponding to 10 decibels is equal to the ratio of voltage (or current) change, corresponding to 20 decibels. Put in another way, this means that a voltage gain of 7 is equivalent to an energy gain of 49, both of these being equivalent to nearly 17 decibels up.

Any signal strength may be taken as the base (or zero) in computing relative intensity. However, for voice transmission measurements, 6 milliwatts (1.73 volts across a 500 ohm line) is a standard used by engineers. The ratio of change in power and in voltage (or current) corresponding to any number of decibels, may be quickly found from the following table. For instance, to ascertain the output energy from an amplifier with a gain of 30 db., multiply the input energy by the factor in the energy column which is opposite 30 db. This particular example gives us an energy gain of 1,000.

Again, suppose we want to design an amplifier for recording on a celluloid record. For this purpose the required level at the cutting head is about +36 db. or 36 db. above the standard level given above. The input level from the usual type of carbon microphone is about —36 db. Where a succession of gains and losses is expressed in decibels, the total gain is obtained by adding all the successive figures together. As the level has to be raised 36 db. from the microphone to reach the standard level, and a further 36 db. from the standard level in order to effectively operate the cutting head, an amplifier with a gain of 72 db. is necessary. Referring to the table, we see that an amplifier with a voltage gain of about 4,000 is necessary. A good 3 stage transformer coupled job would suit the purpose.

Decibels.

Energy.	Voltage	Number	Energy.	Voltage.
"Up"			"Down"	
1.26	1.12	1	0.794	0.891
1.59	1.26	2	.631	.794
2.00	1.41	3	.501	.708
2.51	1.59	4	.398	.631
3.16	1.79	5	.316	.562
3.98	2.00	6	0.251	0.501
5.01	2.24	7	.1999	.447
6.31	2.51	8	.158	.398
7.94	2.82	9	.126	.355
10.00	3.16	10	.100	.316
12.59	3.55	11	.079	0.282
15.85	3.98	12	.063	.261
19.96	4.47	13	.050	.224
25.12	5.01	14	.040	.200
31.62	5.62	15	.032	.178
39.81	6.31	16	.025	0.158
50.12	7.08	17	.020	.141
63.10	7.94	18	.016	.126
79.43	8.91	19	.013	.112
100.00	10.00	20	.010	.100
125.9	11.22	21	.0079	.089
158.5	12.59	22	.0063	.079
199.6	14.13	23	.0050	.071
251.2	15.85	24	.0040	.063
316.2	17.78	25	.0032	.056
398.1	19.96	26	.0025	.050
501.2	22.39	27	.0020	.047
631.0	25.12	28	.0016	.040
794.3	28.18	29	.0013	.035
1,000.0	31.62	30	.0010	.032
1,259	35.48	31	.0008	.028
1,585	39.81	32	.0006	.025
1,996	44.67	33	.0005	.022
2,512	50.12	34	.0004	.020
3,162	56.23	35	.00032	.018
3,981	63.10	36	.00025	.016
5,012	70.80	37	.00020	.014
6,310	79.43	38	.00016	.013
7,943	89.13	39	.00013	.011
10,000	100.00	40	.00010	.010
12,590	112.2	41	.00008	.0089
15,850	125.9	42	.00006	.0079
19,960	141.3	43	.00005	.0071
25,120	158.5	44	.00004	.0063
31,620	177.8	45	.000032	.0056
39,810	199.6	46	.000025	.0050
50,120	223.9	47	.000020	.0045
63,100	251.2	48	.000016	.0040
79,430	282.0	49	.000013	.0036
100,000	316.0	50	.000010	.0032
1,000,000	1,000	60	.000001	.001
10,000,000	3,162	70	.0000001	.0003
100,000,000	10,000	80	.00000001	.0001
1,000,000,000	31,620	90	.000000001	.00003
10,000,000,000	100,000	100	.0000000001	.0001

Valve Data.

Unquestionably the valve is the heart of a radio receiver and upon its correct choice and operation the efficiency of the whole set is dependent. The following data pages will enable intelligent design and replacement calculations to be carried out. The valves are divided into six main classes to facilitate quick reference.

Variable-Mu Valves. The use of this type of valve is standard practice for R.F. amplifiers and the first detector of a superhet. In R.F. amplifiers, of course, we include the I.F. stages of a superhet. The great advantage of this type is its provision for an almost distortionless and exceedingly effective form of variable-bias volume control. In addition cross-modulation and other evils present when the fixed-bias S.G. valve is used, are practically non-existent. In all cases (except where "B" batteries are the source of supply) the screen voltage should be maintained at its constant optimum value throughout the range of control-grid bias. A series resistor for voltage dropping is absolutely useless. The screen should always be bypassed by a good quality paper condenser of about 0.1 mfd. capacity, as should also the cathode be bypassed to earth across the automatic bias potentiometer. In the case of most battery sets where the screen is led to a low voltage tap, the screen bypass may be omitted but the cathode bypass is still necessary. Using modern screened coils of low dynamic resistance a simple relation exists enabling us to calculate the stage gain. The stage gain is given by the product of the dynamic resistance of the coil in ohms and the mutual conductance of the valve in amps. per volt. It should be noted that the g.m. is usually given in m.A. per volt or else in micromhos. In the case of transformer coupled R.F. stages the reflected impedance of the secondary is used. The reflected impedance is equal to the dynamic resistance of the secondary circuit divided by the square root of the turns ratio. Further information on this will be found in the section devoted to formulae.

For example, a 58 valve of mutual conductance, 1600 micromhos per volt at -3 volts bias feeding a coil of dynamic resistance 60,000 ohms, would give a stage gain of $60{,}000 \times 1{,}600 \times \frac{1}{1{,}000{,}000}$ or 96.

The above formula applies only when the load impedance of the coupling device is small compared to the plate impedance of the valve. It should be remembered that doubling the stage gain of any one R.F. stage will raise the power output level of the receiver by 6 decibels, an amount which is just audible.

In particular when using the 58 or similar type, very thorough screening of the valve is essential. While the 58 and similar types are actually pentodes, they are not shown in the pentode section, as this is devoted to output valves.

Screen Grid Valves. The main use for this type of fixed-bias valve is restricted to grid or plate detection in straight sets or the second detector of a superhet. The screen volts should always be obtained from a resistance network across the high voltage supply or from a voltage divider and should be bypassed. This, of course, does not apply to battery sets.

Miscellaneous Valves. In this section are listed the triodes whose plate impedances are greater than 7,000 ohms. From this section we may choose valves for leaky-grid and power-grid detection and for the first audio stage. For power grid detection a valve with a plate impedance between about 8,000 and 17,000 ohms should be chosen. The grid bias figures in this section refer to amplifying conditions and not to detection.

Output Valves. The maximum undistorted output is the energy developed in the load given in the following column when the valve is supplied with its full operating voltages. The figures given are for a maximum content of 5 per cent. second harmonic which is generally accepted as an unobjectionable amount. The load figures refer to the impedance offered by the speaker at about 256 cycles (middle C).

In the case of an output choke and condenser the effect of these may be usually neglected. When an output transformer is used the reflected impedance of the secondary circuit (or voice coil) is used. This is further explained in the section on speaker matching.

Grid biases are worked out for D.C. conditions except in the case of those A.C. valves which have directly heated filaments, in which case a bias voltage increment of fil. volts $\div \sqrt{2}$ has been added. The values given for the automatic bias resistors hold approximately for plate voltages below the maximum.

Pentode Valves. Only output pentodes are listed in this section, the R.F. pentodes being listed in the first two sections. The constants given are very similar to those of the output series. It is necessary to adhere to the load values much more strictly than with triodes in order to prevent distortion, and as third harmonic distortion is more likely to occur than second, the power output values have been worked out for a maximum of 5% of the former.

Rectifying Valves. In this section the figures for the output refer to the voltage developed across a 4 mfd. condenser, which is the standard condition for the various currents listed.

The various letters in the last column refer to the following :—

X	UX base.	E	English 4 pin base.
Y	UY base.	O	English 5 pin base.
6	6-pin base.	M	Can be obtained metallized.
7	7-pin base.	G	Metallized Golden Series.

Variable-Mu Valves.

Type		Filament		Max. Plate Voltage	Optimum Screen Voltage	Grid Bias		Average Plate Current (mA.) at Min. Bias.	Mutual Conductance (μ mhos) at Min. Bias.	Mutual Conductance μ mhos) at Max. Bias.	Base.
		Volts	Amps			Min.	Max.				
Arcturus	34	2.0	.06	180	67.5	3	22.5	2.8	620	15	X
	139A	6.3	0.3	180	90	3	30	4.5	1000	10	Y
	551	2.5	1.75	250	90	3	35	6.3	1110	20	Y
	58	2.5	1.00	250	100	3	50	8.2	1600	2	6
Cossor	235C	2.5	1.75	250	90	3	35	6.3	1050	20	Y
	58C	2.5	1.00	250	100	3	50	8.2	1600	2	6
	220VSG	2.0	0.2	150	80	0	15	5.0	1600	50	XE
	MVSG	4.0	1.0	200	100	1.5	35	7.8	2500	60	O
Ken-Rad	234	2.0	.06	180	67.5	3	22.5	2.8	620	15	X
	235	2.5	1.75	250	90	3	35	6.5	1050	20	Y
	239	6.3	0.3	180	90	3	30	4.5	1000	10	Y
	44	6.3	0.3	250	90	3	—	6.5	1050	—	Y
	58	2.5	1.00	250	100	3	50	8.2	1600	2	6
Mullard	PM235	2.5	1.75	250	90	3	35	6.5	1050	20	Y
	PM58	2.5	1.00	250	100	3	50	8.2	1600	2	6
	PM12V	2.0	0.15	150	90	0	15	5.0	750	5	XE
National Union	234	2.0	.06	180	67.5	3	22.5	2.8	620	15	X
	235	2.5	1.75	250	90	3	35	6.5	1050	20	Y
	239	6.3	0.3	180	90	3	30	4.5	1000	10	Y
	58	2.5	1.00	250	100	3	70	8.2	1600	2	6
Osram	MY235	2.5	1.75	250	90	3	35	6.3	1050	20	Y
	PS2	2.0	0.1	150	70	0	9	5.0	1250	40	XE
	VMS4	4.0	1.0	200	80	2	40	9.0	2100	40	YO
	VDS	16.0	0.25	200	80	2	40	8.0	2100	40	YO
Philips	PH234	2.0	.06	135	67.5	3	22.5	2.8	600	15	X
	PH235	2.5	1.75	250	90	3	50	6.5	1100	20	Y
	PH239	6.3	0.3	180	90	3	30	4.5	1000	10	Y
	PH58	2.5	1.00	250	100	3	50	8.2	1600	2	6
	E445	4.0	1.1	200	100	2	40	6.0	1200	—	GY
	E455	4.0	1.00	200	100	1.5	40	3.0	2000	5	GY
Radiotron	RCA234	2.0	.06	180	67.5	3	22.5	2.8	620	15	X
	RCA235	2.5	1.75	250	90	3	35	6.5	1050	20	Y
	RCA239	6.3	0.3	180	90	3	30	4.5	1000	10	Y
	RCA 58	2.5	1.00	250	100	3	50	8.2	1600	2	6

Screen-Grid Valves.

Type		Filament		Max. Plate Voltage	Optimum Screen Voltage	Average Plate Current (m.A.)	Amplification Factor	Plate Impedance (Ohms)	Mutual Conductance (μ mhos.)	Base
		Volts	Amps							
Arcturus	122	15.0	0.35	135	30	1.0	400	700,000	570	Y
	124	2.5	1.75	250	90	4.0	600	570,000	1050	Y
	132	2.0	.06	135	67.5	1.6	580	1,150,000	505	X
	136A	6.3	0.3	180	90	3.1	370	350,000	1050	Y
	57	2.5	1.00	250	100	2.0	Over 1500	Over 1.5 meg.	1225	6
Cossor	224C	2.5	1.75	250	90	4.0	615	600,000	1025	Y
	215SG	2.0	0.15	150	80	2.5	330	300,000	1100	MXE
	220SG	2.0	0.2	150	80	—	320	200,000	1600	X
	410SG	4.0	0.1	150	80	—	200	200,000	1000	X
	610SG	6.0	0.1	150	80	—	200	200,000	1000	X
	41MSG	4.0	1.0	200	80	0.8	1000	400,000	2500	MYO
	MSG/HA	4.0	1.0	200	100	2.1	1000	500,000	2000	MY
	MSG/LA	4.0	1.0	200	100	5.2	750	200,000	3750	MY
	MS/Pen A	4.0	1.0	200	100	9.0	R.F. Pentode		4000	MY
Ken-Rad	224	2.5	1.75	250	90	4.0	615	600,000	1025	Y
	232	2.0	.06	135	67.5	1.4	580	1.15 meg.	505	X
	236	6.3	0.3	180	90	3.1	370	350,000	1050	Y
	57	2.5	1.00	2	100	2.0	1500	1.5 meg.	1225	6

Screen-Grid Valves.

Type		Filament Volts	Filament Amps	Max. Plate Voltage	Optimum Screen Voltage	Average Plate Current (m.A.)	Amplification Factor	Plate Impedance (Ohms)	Mutual Conductance (μ mhos.)	Base
Mullard	PM224A	2.5	1.75	250	90	4.0	600	570,000	1050	Y
	PM57	2.5	1.00	250	100	2.0	1500	1.5 meg.	1225	6
	PM12A	2.0	0.18	150	90	2.75	500	330,000	1500	MXE
	PM12	2.0	0.15	150	75	4.5	200	180,000	1100	MXE
	PM14	4.0	.075	150	75	1.5	200	230,000	870	XE
	PM16	6.0	.075	150	75	1.75	200	200,000	1000	XE
	S4V	4.0	1.0	200	75	0.85	1000	909,000	1100	MYO
	S4VA	4.0	1.0	200	110	2.5	1000	500,000	3000	MYO
	S4VB	4.0	1.0	200	110	4.5	750	300,000	3600	MYO
	SG20	20.0	0.18	200	100	2.5	—	—	2500	MYO
National Union	224A	2.5	1.75	180	90	4	400	400,000	1000	Y
	232	2.0	.06	180	67.5	1.7	780	1.2 meg.	650	X
	236	6.3	0.3	180	90	3.1	370	350,000	1050	Y
	57	2.5	1.00	250	100	2	1500	1.5 meg.	1225	6
Osram	MY224	2.5	1.75	180	75	4.0	420	400,000	1050	Y
	S21	2.0	0.1	150	70	2.0	220	200,000	1100	MXE
	S22	2.0	0.2	150	75	2.5	350	200,000	1750	MXE
	MS4	4.0	1.0	200	70	2.5	550	500,000	1100	MYO
	MS4B	4.0	1.0	200	80	3.4	1120	350,000	3200	MYO
	DS	16.0	0.25	200	70	2.5	550	500,000	1100	MYO
	DSB	16.0	0.25	200	80	3.4	1120	350,000	3200	MYO
Philips	PH224A	2.5	1.75	250	90	4	615	600,000	1000	Y
	PH232	2.0	.06	180	67.5	1.7	780	1.2 meg.	650	X
	PH236	6.3	0.3	135	67.5	1.4	580	1.15 meg.	500	Y
	PH57	2.5	1.00	250	100	2.0	1500	1.5 meg.	1200	6
		—	—	—	—	0.1	(biased detector)			—
	E452T	4.0	1.0	200	100	3	1000	300,000	3000	GY
	E442S	4.0	1.0	200	60	3	200	200,000	1000	YO
	E442	4.0	1.0	200	100	1.5	1000	830,000	1200	YO
	A442	4.0	.06	150	75	2.8	—	—	800	X
	A642	6.0	.06	200	100	4.0	—	—	700	X
	E444 (Diode-Tetrode)	4.0	1.0	200	25	0.3	3000	—	3000	G6
		—	—	—	65	3.2	1000	300,000	—	—
Radiotron	UX222	3.3	0.132	135	67.5	3.3	290	600,000	480	X
	UY224A	2.5	1.75	275	45	0.1	(biased detector, 5 V.neg.)			
		—	—	250	90	4.0	615	600,000	1025	Y
	RCA232	2.0	0.06	180	67.5	1.7	780	1.2 meg.	650	X
	RCA236	6.3	0.3	180	90	3.1	370	350,000	1050	Y
	RCA57	2.5	1.00	250	100	2.0	Over 1500	Over 1.5 meg.	1225	6
		—	—	275	100	0.1	(biased detector, 6V. neg.)			

Miscellaneous Valves.

(Including such types as may be used for detection or in the first audio stage).

Type		Filament Volts	Filament Amps	Plate Impedance (Ohms)	Amplification Factor	Mutual Conductance (μ mhos).	A. Max. Plate Volts	B. Grid Bias (for A).	Average Plate Current (for A and B) (m.A.).	Base
Arcturus	101A	5.0	0.25	10000	8.0	800	135	9.0	3.0	X
	126	1.5	1.05	7000	8.2	1170	180	13.5	7.4	X
	26	15.0	0.35	9000	10.5	1165	90	1.5	4.5	X
	127	2.5	1.75	9250	9.0	975	250	21.0	5.2	Y
	28	15.0	0.35	9000	10.5	1165	90	1.5	7.5	Y
	130	2.0	.06	12500	9.7	795	90	4.5	2.4	X
	137A	6.3	0.3	10000	9.0	900	180	13.5	4.7	Y
	55	2.5	1.0	7300	8.3	1100	250	20.0	8.0	6
		(Duplex Diode Triode)								
	56	2.5	1.0	9500	13.8	1450	250	13.5	5.0	Y
				(Detector)	—	—	250	20	0.2	—
	85	6.3	0.3	8300	8.3	1000	250	20.0	7.0	6
		(Duplex Diode Triode)								
Wunderlich "A"		2.5	1.0	10300	9.25	900	250	16.5	7.0	Y or 6
Wunderlich "A"		6.3	0.4	10300	9.25	900	250	16.5	7.0	6
		*Both Grids tied together. For Detector ¼ to 1½ meg. leak.								

Miscellaneous Valves.

(Including such types as may be used for detection or in the first audio stage.)

Type		Filament Volts	Filament Amps	Plate Impedance (Ohms)	Amplification Factor	Mutual Conductance (μ mhos.)	A Max. Plate Volts	B Grid Bias (for A)	Average Plate Current (for A and B) (m.A.)	Base
Cossor	227C	2.5	1.75	9000	9.0	1000	135	9.0	4.5	Y
	210RC	2.0	0.1	50000	40.0	800	150	1.5	0.85	XE
	210HF	2.0	0.1	15800	24.0	1500	150	3.0	1.6	MX
	210 Det.	2.0	0.1	13000	15.0	1150	150	—	—	MX
	210LF	2.0	0.1	10000	14.0	1400	150	4.5	4.8	X
	210DG	2.0	0.1	3400	2.7	800	100	Double Grid		X
	410RC	4.0	0.1	60000	40.0	660	150	1.5	0.6	X
	410HF	4.0	0.1	20000	20.0	1000	150	3.0	1.1	X
	410LF	4.0	0.1	8500	15.0	1760	150	4.5	4.5	X
	610RC	6.0	0.1	60000	50.0	830	150	1.5	0.75	X
	610HF	6.0	0.1	20000	20.0	1000	150	3.0	3.0	X
	610LF	6.0	0.1	7500	15.0	2000	150	4.5	6.2	X
					Indirectly Heated Valves.					
	41MRC	4.0	1.0	19500	15.0	2500	200	2.0	2.7	YO
	41MHF	4.0	1.0	14500	41.0	2800	200	3.0	3.0	Y
	41M.L.F.	4.0	1.0	7900	15.0	1900	180	5.5	9.0	Y
	41MDG	4.0	1.0	40000	10.0	250	200	Double Grid		MO
Ken-Rad	201A	5.0	0.25	10000	8.0	800	175	9.0	3.0	X
	226	1.5	1.05	7000	8.2	1170	180	13.5	7.4	X
	227	2.5	1.75	9000	9.0	1000	180	13.5	5.0	Y
	230	2.0	.06	13000	9.3	700	90	4.5	1.8	X
	237	6.3	0.3	10000	9.0	900	180	13.5	4.7	Y
	48	30.0	0.4	10000*	28.0	2800	95	20.0	47.0	6
	55	2.5	1.0	7500	8.3	1100	250	20	8.0	6
	56	2.5	1.0	9500	13.8	1450	250	13.5	5.0	Y
	85	6.3	0.3	8300	8.3	1000	250	20	7.0	6
	KR20 (90)	2.5	1.0	10000†	14.0	1400	250	—	3.5	6
	KR22 (92)	6.3	0.4	10000†	14.0	1400	250	—	3.5	6
		*Output †Double	Tetrode. Grid Detect	Screen Voltage 95. or. Plate	Resistor 10	0000 ohms.				
Mullard	AC3 (226)	1.5	1.05	7600	8.3	1100	135	10.0	5.5	X
	PM1A	2.0	0.1	41600	50.0	1200	150	—	1.0	XE
	PM1HF	2.0	0.1	23500	18.0	800	150	4.5	1.5	XE
	PM1HL	2.0	0.1	14000	28.0	2000	150	3.0	2.0	X
	PM1LF	2.0	0.1	12000	11.0	900	150	7.5	3.4	XE
	PM2DX	2.0	0.1	10000	19.0	1900	150	4.5	4.0	XE
	PM3	4.0	0.075	13000	14.0	1050	150	6.0	2.8	XE
	PM4DX	4.0	0.1	7500	15.0	2000	150	6.0	2.5	XE
	PM5X	6.0	0.075	14700	17.5	1200	150	4.5	2.0	XE
	PM1DG	2.0	0.1	Double Grid Detector.		800	80	—	—	Y
					Indirectly Heated Valves.					
	PM55	2.5	1.0	7500	8.3	1100	250	20.0	8.0	6
	PM56	2.5	1.0	9500	13.5	1450	250	13.5	5.0	Y
	PM227	2.5	1.75	9000	9.0	1000	135	9.0	4.5	Y
	904V	4.0	1.0	34000	75.0	2200	200	2.0	3.0	MYO
	354V	4.0	1.0	10000	35.0	3500	200	4.0	4.0	MYO
	244V	4.0	1.0	9000	24.0	2800	200	5.5	5.0	Y
	HL20	20.0	0.18	14000	25.0	2500	200	3.5	4.0	MY
National Union	227	2.5	1.75	9000	9.0	1000	135	9.0	4.5	Y
	230	2.0	.06	10300	9.3	900	180	13.5	3.1	X
	237	6.3	0.3	10000	9.0	900	180	13.5	4.7	Y
	55	2.5	1.0	7500	8.3	1100	250	20.0	8.0	6
	56	2.5	1.0	9500	13.5	1450	250	13.5	5.0	Y
	85	6.3	0.3	8300	8.3	1000	250	20	7.0	6
Osram	MY227	2.5	1.75	9000	9.0	1000	180	9.0	4.5	Y
	H2	2.0	0.1	35000	35.0	1000	150	1.5	1.0	MXE
	HL2	2.0	0.1	18000	27.0	1500	150	3.0	1.8	MXE
	H210	2.0	0.1	50000	35.0	700	150	7.5	—	XE
	HL210	2.0	0.1	23000	20.0	870	150	3.0	2.0	MXE
	L210	2.0	0.1	12000	11.0	920	150	6.0	4.0	XE
	H410	4.0	0.1	60000	40.0	670	150	1.5	—	XE
	HL410	4.0	0.1	30000	15.0	830	150	1.5	—	XE
	L410	4.0	0.1	8500	15.0	1770	150	3.0	—	XE
	H610	6.0	0.1	60000	40.0	670	150	1.5	—	XE
	HL610	6.0	0.1	30000	30.0	1000	150	1.5	—	XE
	L610	6.0	0.1	7500	15.0	2000	150	4.5	—	XE
	MH4	4.0	1.0	11100	40.0	3600	200	3.0	4.5	MYO
	MHL4	4.0	1.0	8000	20.0	2500	200	6.0	7.0	MYO
	DH	16.0	0.25	10800	40.0	3700	200	3.0	6.0	MYO
	DG2	2.0	0.2	3750	4.5	1200	100	Double Grid		YO

Miscellaneous Valves.

(Including such types as may be used for detection or in the first audio stage).

Type		Filament Volts	Filament Amps	Plate Impedance (Ohms)	Amplification Factor	Mutual Conductance (μ mhos).	A. Max. Plate Volts	B. Grid Bias (for A).	Average Plate Current (for A and B) (m.A.).	Base
Philips	PH56	2.5	1.0	9500	13.8	1450	250	13.5	5.0	6
	PH227	2.5	1.75	9000	9.0	1000	180	13.5	5.0	Y
	PH230	2.0	.06	13000	9.3	700	90	4.5	1.8	X
	PH55	2.5	1.0	7500	8.3	1100	250	20.0	8.0	6
	PH85	6.3	0.3	7500	8.3	1100	250	20.0	8.0	6
	E424	4.0	1.0	7000	24.0	3500	200	6.0	6.0	GY(O
	E438	4.0	1.0	25300	38.0	1500	200	3.0	2.5	MY
	A409	4.0	.06	7500	9.0	1200	150	9.0	3.5	X
	A415	4.0	.08	7500	15.0	2000	150	4.5	3.0	X
	A425	4.0	.06	20800	25.0	1200	150	3.0	0.8	X
	A435	4.0	.06	70000	35.0	500	150	0	1.4	X
	A630	6.0	.06	20000	30.0	1500	150	1.5	0.7	X
	A635	6.0	.06	22300	35.0	1500	150	0	1.2	X
Radiotron	WD11	1.1	0.25	15500	6.6	425	90	4.5	2.5	WD4P
	WX12	1.1	0.25	15000	6.6	440	135	10.5	3.0	X
	UV199	3.3	.063	15500	6.6	425	90	4.5	2.5	V
	UX199	—	—	—	—	—	—	—	—	X
	UX201A	5.0	0.25	10000	8.0	800	135	9.0	3.0	X
	UX226	1.5	1.05	7300	8.3	1150	180	14.5	6.2	X
	UY227	2.5	1.75	9250	9.0	975	250	21.0	5.2	Y
		—	—	Biased Detector		—	250	30.0	0.2	—
	RCA230	2.0	0.06	10300	9.3	900	180	13.5	3.1	X
	RCA237	6.3	0.3	10000	9.0	900	180	13.5	4.7	Y
		—	—	Biased Detector		—	135	15.5	0.2	—
	UX240	5.0	0.25	150000	30.0	200	180	3.0	0.2	X
	RCA55	2.5	1.0	7500	8.3	1100	250	20.0	8.0	6
	RCA56	2.5	1.0	9500	13.8	1450	250	13.5	5.0	Y
		—	—	Biased Detector		—	250	20.0	0.2	—
	RCA85	6.3	0.3	8500	8.3	975	180	13.5	6.0	6
		—	—	7500	8.3	1100	250	20.0	8.0	—
	RCA841	7.5	1.25	63000	30.0	450	425	6.0	0.7	X
	RCA864	1.1	0.25	12700	8.2	645	135	9.0	3.5	X
	RCA865	7.5	2.0	200000	150.0	750	500	12.5	18.0	X
		Oscillator.	Grid-Cur	rent 5mA.		—	750	30.0	50.0	—
	R.C.A.868	Photo-Tub	e. Window	0.9 sq. in.	Load 0.1-5	Meg. 90			0.02	X
		Static Sens	itivity : 55	microamps	per lumen.	Gas μ = 7				

Output Valves.

Type		Filaments Volts.	Filaments Amps.	Plate Impedance. (Ohms)	Mutual Conductance (μ mhos)	A Max. Plate Volts	B Grid Bias (for A).	C Average Plate Curr. (for A and B) (mA.).	D Max. Undistorted Output (for A, B & C) (mW.).	E Optimum load (for D) (Ohms)	F Automatic Bias Resistance (for A, B & C)	Base
Arcturus	012A	5.0	0.25	5000	1700	180	13.5	7.6	260	10800	—	X
	145	2.5	1.5	1670	2100	275	56.0	36.0	2000	4600	1500	X
	46	2.5	1.75	2380	2350	250	35.0	22.0	1250	6400	1500	Y
		—	—	Class "B"		300	0	4.0	16000	1300	0	—
		—	—	Pair of	valves	400	0	6.0	20000	1450	0	—
	150	7.5	1.25	1900	2000	350	63.0	45.0	2400	4100	1400	X
		—	—	1800	2100	450	84.0	55.0	4600	4350	1500	—
	59	2.5	2.00	Class "A"		250	28.0	30.0	1250	500†	930	7
		—	—	Class "B"		400	0	15.0	20000	1500*	—	—
	071A	5.0	0.25	1850	1620	180	40.5	20.0	700	5350	—	X
	89	6.3	0.4	3000	1570	160	20.0	17.0	300	7000†	1170	6
		—	—	Class "B"		180	0	3.0	2500	3400*	—	—
		—	—	—	—	—	—	—	3500	2350*	—	—
	110	7.5	1.25	5000	1600	425	39.0	18.0	1600	10200	2100	X
		†Screen & Supp. tied to plate. Class "A" triode.										
		*Screen tied to	control grid. Supp. tied to	plate.								
Cossor	245C	2.5	1.5	1750	2000	250	50.0	34.0	1600	3900	1500	X
	171AC	5.0	0.25	1850	1620	180	40.5	20.0	700	5350	—	X
	215P	2.0	0.15	4000	2250	150	7.5	10.0	150	9000	—	XE

Output Valves.

Type		Filaments		Plate Impedance. (Ohms)	Mutual Conductance (μ mhos)	A Max. Plate Volts	B Grid Bias (for A).	C Average Plate Curr. (for A and B) (mA.).	D Max. Undistorted Output (for A, B & C) (mW.).	E Optimum load (for D) (Ohms)	F Automatic Bias Resistance (for A, B & C)	Base
		Volts.	Amps.									
Cossor	220PA	2.0	0.2	4000	4000	150	4.5	11.0	150	9000	—	X
	220P	2.0	0.2	4000	2000	150	9.0	11.0	170	9000	—	X
	230XP	2.0	0.3	1500	3000	150	16.5	22.0	450	3500	—	X
	425XP	4.0	0.25	2000	3500	150	10.5	20.0	330	5000	500	X
	410P	4.0	0.1	4000	2000	150	9.0	11.0	170	9000	—	X
	415XP	4.0	0.15	1500	3000	150	16.5	22.0	450	3500	—	X
	625P	6.0	0.25	2500	2800	200	12.0	25.0	650	6000	500	X
	610P	6.0	0.1	3500	2300	150	9.0	11.0	150	8000	—	X
	610XP	6.0	0.1	2000	2500	150	15.0	24.0	400	4500	—	X
	4XP	4.0	0.6	1200	4000	200	23.0	45.0	1000	2800	500	X
	680P	6.0	0.8	6000	920	400	40.0	25.0	1000	12000	1600	X
	680XP	6.0	0.8	2750	1100	400	125	25.0	2500	5700	5000	X
				Indirectly Heated A.C. Valves.								
	41MP	4.0	1.0	2500	7500	200	7.5	24.0	1250	3000	320	Y
	41MXP	4.0	1.0	1500	7500	200	12.5	40.0	2000	2000	300	Y
Ken-Rad	112A	5.0	0.25	5000	1700	180	13.5	7.6	260	10800	—	X
	231	2.0	0.13	4950	760	135	22.5	6.8	150	9000	—	X
	245	2.5	1.5	1750	2000	250	50	30.0	1600	3900	1500	X
	46	2.5	1.75	24000	2350	250	33	22.0	1200	6400	1500	Y
		—	—	Class " B "		300	0	4.0	16000	1300	0	—
	250	7.5	1.25	1800	2100	450	84	55.0	4600	4350	1500	X
	59	2.5	2.00	Class " B "		400	0	15.0	20000	1500	0	7
	171A	5.0	0.25	1850	1620	180	40.5	20.0	700	5350	—	X
	89	6.3	0.4	3000	1570	160	20.0	17.0	300	7000†	1170	7
		—	—	Class " B "		180	0	3.0	6000	2350	0	—
	210	7.5	1.25	5000	1600	425	39.0	18.0	1600	12000	2100	X
Mullard	PM245	2.5	1.5	1750	2000	250	50	30.0	1600	3900	1500	X
	AC4 (171A)	5.0	0.25	1850	1620	180	40.5	20.0	700	5350	—	X
	PM2A	2.0	[0.2	3600	3500	150	6.0	8.0	200	8000	—	X
	PM2	2.0	0.2	4400	1700	150	[12	7.0	150	9000	—	XE
	PM202	2.0	0.2	2000	3500	150	13	14.0	350	4000	—	X
	PM252	2.0	0.4	1900	3700	150	11	17.0	320	4000	—	XE
	PM4	4.0	0.1	4000	2000	150	8	10.0	170	9000	—	XE
	PM254	4.0	0.2	2150	3000	200	21	15.0	400	4000	—	XE
	PM6	6.0	0.1	3550	2250	150	9.0	10.0	150	8000	—	XE
	PM256	6.0	0.25	1850	3250	250	27	20.0	800	5000	—	XE
	ACO64	4.0	1.0	2000	3000	200	21	20.0	750	4300	1050	X
	ACO44	4.0	0.7	1150	3500	200	32	30.0	1000	2300	1070	X
	DO/20	7.5	1.1	2000	2500	425	66	40.0	4000	5000	1650	X
	DO/25	6.0	1.1	800	3750	400	112	63.0	5000	4000	1780	X
	DO/60	6.0	4.0	1000	3500	500	95	120.0	11000	1500	800	X
	DO/75	10.0	2.0	2000	6000	1000	55	75.0	18000	6000	730	X
				Indirectly Heated Valves.								
	164V	4.0	1.0	4850	3300	200	8.5	9.0	270	1300	950	YO
	104V	4.0	1.0	2850	3500	200	12	17.0	600	6000	700	YO
National Union	231	2.0	0.13	4100	925	135	22.5	8.0	185	7000	—	X
	245	2.5	1.5	1750	2000	250	50	34.0	1600	3900	1500	X
	46	2.5	1.75	24000	2350	250	33	22.0	1200	6400	1500	Y
		—	—	Class " B "		300	0	4.0	16000	1300	0	—
	59	2.5	2.0	Class " A "		250	28	30.0	1250	5000	930	7
		—	—	Class " B "		400	0	15.0	20000	1500	0	—
	89	6.3	0.4	3000	1570	160	20.0	17.0	300	7000†	1170	6
		—	—	Class " B "		180	0	3.0	2500	2400*	0	—
		—	—	—	—	—	—	—	3500	2350*	0	—
				†Screen & Supp. tied to plate. Class " A " triode. *Screen tied to control grid. Supp. tied to plate.								
Osram	MX245	2.5	1.35	1900	1850	250	50	34.0	1600	3900	1560	X
	P215	2.0	0.15	5000	1400	150	12.0	9.0	150	12000	—	XE
	LP2	2.0	0.2	3900	3850	150	6.0	7.0	150	7000	—	XE
	P2	2.0	0.2	2150	3500	150	10.5	19.0	300	4500	—	XE
	P240	2.0	0.4	2500	1600	150	24	17.0	400	5000	—	XE
	P410	4.0	0.1	5000	1500	150	11	8.0	150	10000	—	XE
	P425	4.0	0.25	2300	1950	150	16.5	17.0	250	4600	—	XE
	ML4	4.0	1.0	2860	4200	200	8.5	25.0	650	7000	350	YO
	PX4	4.0	1.0	830	6000	250	34	48.0	2500	3200	750	XE
	PX25	4.0	2.0	1265	7500	400	31.0	63.0	5500	3200	530	XE
	DL	16.0	0.25	2660	4500	200	8.0	25.0	600	7000	400	YO

Output Valves.

Type		Filaments		Plate Impedance. (Ohms)	Mutual Conductance (μ mhos)	A Max. Plate Volts	B Grid Bias (for A)	C Average Plate Curr. (for A) and B) (mA.)	D Max. Undistorted Output (for A, B & C) (mW.)	E Optimum load (for D) (Ohms)	F Automatic Bias Resistance (for A, B & C)	Base
		Volts	Amps									
Osram	P610	6.0	0.1	2500	2300	150	10	7.5	200	7000	—	XE
	P625	6.0	0.25	2400	2500	250	26	24.0	900	6400	1100	XE
	P625A	6.0	0.25	1600	2300	200	30	28.0	1600	3200	1560	XE
	LS5	5.25	0.8	6000	800	400	40	26.0	650	12000	1540	XE
	LS5A	5.25	0.8	2750	910	400	112	33.5	3000	5500	3380	XE
	LS6A	6.0	2.0	1300	2300	400	91	63.0	5000	3250	1450	XE
	DA60	6.0	4.0	835	3000	500	135	125	10000	2300	1100	XE
Philips	PH231	2.0	0.13	4950	760	135	22.5	6.8	185	7000	3000	X
	PH245	2.5	1.5	1750	2000	250	50	34.0	2000	4000	1450	X
	PH46	2.5	1.75	2380	2300	250	33	22.0	450	6400	1500	Y
		—	—	Class "	B "	400	0	6.0	16000	1300	0	—
	PH250	7.5	1.25	1800	2100	450	84	55.0	5000	4350	1500	X
	E406	4.0	1.0	1000	6000	250	24	48.0	2000	4000	500	X
	E409	4.0	1.0	3000	3000	150	9	12.0	—	—	750	X
	A609	6.0	.06	6000	1500	150	9	4.0	—	—	—	X
	A615	6.0	.08	6250	2400	150	4.5	4.0	—	—	—	X
	B403	4.0	.015	2000	1500	150	30	15.0	—	—	—	X
	B405	4.0	0.15	2500	2000	150	18	8.0	—	—	—	XE
	B406	4.0	0.1	4300	1400	150	15	7.5	—	—	—	X
	B409	4.0	0.15	4500	2000	150	9	6.5	—	—	—	X
	E408N	4.0	1.0	1800	4500	400	34	30.0	2000	—	—	X
	F410	4.0	2.0	1250	8000	550	36	45.0	6200	—	—	XE
	B605	6.0	0.12	2800	1800	150	18	9.0	—	—	—	X
	C603 (171A)	6.0	0.25	1500	2000	180	40	18.0	—	—	—	X
	C606	6.0	0.25	1850	3350	250	25	24.0	—	—	—	X
Radiotron	UX112A	5.0	0.25	5300	1600	135	9.0	6.2	115	8700	—	X
	UX120	3.3	0.13	6300	525	135	22.5	6.5	110	6500	—	X
	UX210	7.5	1.25	5000	1600	425	39.0	18.0	1600	10200	2100	X
	RCA231	2.0	0.13	3600	1050	180	30.0	12.3	375	5700	—	X
	UX245	2.5	1.5	1750	2000	250	50.0	34.0	1600	3900	1500	X
	RCA46	2.5	1.75	2380	2350	250	33.0	22.0	1250	6400	1500	Y
		—	—	Class "	B "	300	0	4.0	16000	1300	0	—
		—	—	Class "	B "	400	0	6.0	20000	1450	0	—
	RCA48	30.0	0.4	10000	2800	125	22.5	50.0	2500	2000	—	6
	UX250	7.5	1.25	1800	2100	450	84.0	55.0	4600	4350	1500	X
	RCA59	2.5	2.0	2400	2600	250	28.0	26.0	1250	5000	" A " Triode	7
		..." A "	Pentode	40000	2500	250	18.0	35.0	3000	6000	400	—
		" B "	Triodes	—	—	400	0	13.0	10000†	6000	0	—
	UX171A	5.0	0.25	1850	1620	180	43.0	20.0	700	5350	2150	X
	RCA79	6.3	0.6	Class "	B "	180	0	7.5	5500	7000	0	6*
				Valves	in one e	nvelope.	Input 3	80 m.W.				
	RCA89	6.3	0.4	3000	1570	180	20.0	17.0	300	7000	" A " Triode	6
		" A "	Pentode	82500	1635	180	18.0	20.0	1500	8000	780	—
		" B "	Triodes	—	—	180	0	3.0	2500†	2400	0	—
	RCA842	7.5	1.25	2500	1200	425	100	28.0	3000	8000	3500	X

* Tetrode. †per valve.

Directly Heated Valves.

When considering the grid swing on a directly heated valve, it is important to note that the grid should never swing positive with respect to any point on the filament. The grid return is, of course, taken to the centre tap of the A.C. voltage which is used to heat the filament. This means, that at some instant one end of the filament is a certain amount negative with respect to the grid return. The grid should never be allowed to swing positive with respect to this point on the filament. For example, consider a valve with a 2.5 volt filament supply and with the grid bias 16.5 volts negative with respect to the centre tap. The peak value of 2.5 volts r.m.s. is approximately 3.5 volts. Thus the peak value of the voltage which might exist between the centre tap and one end of the filament is half this.

In any calculations we cannot allow a grid swing of more than 16.5 minus 1.75, or 14.75 volts. It is easily seen that the valve mentioned in the example is a type 47, so that in this case the maximum grid swing is further limited by the distortion which would occur. In the case of a 247 the curved characteristic limits the grid swing 12.5 volts, on the assumption that a 5% content of harmonics in the output is tolerable.

Pentode Valves.

Type	Filament		Mutual Conductance (μ mhos)	A Max. Plate Voltage.	B Max. Screen Voltage.	C Grid Bias (for A, and B)	D Average Plate Current (for A B & C) (mA.)	E Average Screen Current (for A, B & C) (mA.)	F Max. Undistorted Output (for A, B & C) (Milliwatts)	G Optimum Load (for F) (Ohms)	Automatic Bias Resistance (for A, B & C) (Ohms)	Base
	Volts.	Amps.										
Arcturus												
133	2.0	0.26	1400	135	135	13.5	14.5	3.0	650	7000	—	Y
138A	6.3	0.3	975	135	135	13.5	9.0	2.5	525	13500	1170	Y
GA	5.0	0.25	2000	180	180	10	25	7.5	800	7000	300	Y
PZ(247)	2.5	1.5	2500	250	250	16.5	32.5	7.2	3000	7000	400	Y
PZH	2.5	2.0	3000	250	250	16.5	33.5	8.0	3500	7000	400	6
59	2.5	2.0	2220	250	250*	18.0	35.0	9.0	2500	7000	400	7
89	6.3	0.4	1635	180	180*	18.0	20.0	3.0	1500	8000	780	6
	*Suppr	essor Gri	d tied to	cathode.	Class "	A " pent	ode.					
Cossor												
247C	2.5	1.75	2500	250	250	16.5	31.0	6.0	2500	7000	440	Y
220HPT	2.0	0.2	2500	150	150	4.5	8.0	1.5	500	17000	—	XE
230PT	2.0	0.3	2000	150	150	15.0	14.0	—	4000	10000	—	X
415PT	4.0	0.1	2000	150	150	9.0	17.0	3.0	900	7500	—	XY
615PT	6.0	0.15	2000	150	150	15.0	14.0	3.0	380	10000	—	XY
PT41B	4.0	1.0	2250	400	400	40.0	30.0	6.0	3600	8000	1100	O
MP/PEN	4.0	1.0	4000	250	250	12.0	30.0	6.0	2000	10000	300	Y
Ken-Rad												
233	2.0	0.26	1400	135	135	13.5	14.0	3.0	650	7000	—	Y
238	6.3	0.3	975	135	135	13.5	9.0	2.5	525	13500	1170	Y
41	6.3	0.65	1800	167.5	167.5	12.5	16.5	3.5	1200	11000	625	6
42	6.3	0.65	2200	250	250	16.5	34.0	6.5	3000	9000	400	6
47	2.5	1.75	2650	250	250	16.5	32.0	7.5	2500	7000	400	Y
59	2.5	2.00	2220	250	250*	18.0	35.0	9.0	3000	7000	400	7
89	6.3	0.4	1635	180	180*	18.0	20.0	3.0	1500	8000	780	6
KR5	6.3	0.3	2100	165	165	11.0	17.0	3.5	1200	8000	530	6
KR25 (95)	2.5	1.75	2200	250	250	16.5	34.0	6.5	3000	9000	400	6
	*Suppr	essor Gri	d tied to	cathode.	Class "	A " pent	ode.					
Mullard												
PM247	2.5	1.75	2500	250	250	16.5	32.0	7.5	2500	7000	400	Y
PM243	2.5	0.6	1500	300	200	20.0	25.0	5.0	1500	8000	670	—
PM22A	2.0	0.2	2500	150	150	4.5	9.5	2.0	500	15000	—	Y
PM22	2.0	0.3	1300	150	150	10.0	15.0	4.0	600	8000	—	XYE
PM24A	4.0	.275	2000	300	200	22.5	20.0	3.5	1900	10000	950	YO
PM24	4.0	0.15	1750	150	150	12.0	20.0	5.0	500	10000	—	XYE
PM24B	4.0	1.0	2100	400	300	40.0	30.0	7.0	3000	8000	1080	—
PM24D	4.0	2.0	4000	500	200	35.0	50.0	9.0	10000	7000	600	Y
PM24M	4.0	1.0	3000	250	250	18.0	30.0	7.5	3000	8000	500	Y
Pen 4 V	4.0	1.0	3000	250	200	10.0	35.0	7.0	2000	8000	250	YE
National Union												
233	2.0	0.26	1450	135	135	13.5	14.5	3.0	700	7000	—	Y
241	6.3	0.65	1800	167.5	167.5	12.5	16.5	3.5	1200	11000	625	6
42	6.3	0.65	2200	250	250	16.5	34.0	6.5	3000	9000	400	6
247	2.5	1.75	2500	250	250	16.5	31.0	8.0	2500	7000	400	Y
59	2.5	2.0	2220	250	250*	18.0	35.0	9.0	3000	7000	400	7
89	6.3	0.4	1635	180	180*	18.0	20.0	3.0	1500	8000	780	6
	*Suppr	essor Gri	d tied to	Cathode.	Class "	A " pent	ode.					
Osram												
MY247	2.5	1.5	2500	250	250	16.5	32.0	7.5	2500	7000	400	Y
PT2	2.0	0.2	2500	150	150	4.5	6.5	1.9	500	17000	—	YO
PT425	4.0	0.25	2000	150	150	7.5	15.0	—	—	—	—	YO
PT4	4.0	1.0	2850	250	250	16.0	32.0	8.0	2500	7500	420	YO
MPT4	4.0	1.0	3000	250	200	11.0	32.0	5.0	2000	8000	300	YO
PT25	4.0	2.0	4000	400	200	22.0	62.5	10.0	10000	6000	330	YO
PT625	6.0	0.25	1850	250	200	15.0	26.5	7.0	1500	7000	540	YO
DPT	16.0	0.25	3000	200	200	10.0	40.0	6.5	2000	8000	230	YO
Philips												
PH247	2.5	1.75	2500	250	250	16.5	32.0	7.5	2500	7500	400	Y
PH233	2.0	0.26	1500	135	135	13.5	14.0	3.5	700	7000	750	Y
PH238	6.3	0.3	975	135	135	13.5	9.0	2.5	525	13500	1170	Y
E443H	4.0	1.1	3000	250	250	15.0	36.0	—	—	7500	—	Y
E443N	4.0	1.0	2700	250	250	39.0	48.0	9.0	—	6000	700	Y
C243	2.0	0.27	1500	150	150	15.0	17.0	—	—	—	—	XY
D243	2.5	0.6	1500	300	200	20.0	25.0	—	—	—	—	XY
B443	4.0	0.15	1500	200	150	16.0	12.0	—	—	—	—	XEO

Pentode Valves.

Type	Filament		Mutual Conductance (μ mhos)	A Max. Plate Voltage.	B Max. Screen Voltage	C Grid Bias (for A, and B)	D Average Plate Current (for A B & C) (mA.)	E Average Screen Current (for A, B & C) (mA.)	F Max. Undistorted Output (for A, B & C) (Milliwatts)	G Optimum Load (for F) (Ohms)	Automatic Bias Resistance (for A, B & C) (Ohms)	Base
	Volts.	Amps.										
Philips												
C443	4.0	0.25	1500	300	200	22.0	22.0	—	—	—	—	YO
F443	4.0	2.0	4000	550	200	39.0	45.0	6.5	—	—	750	YO
C643	6.0	0.25	1500	300	200	20.0	21.0	—	—	—	—	X
Radiotron												
RCA233	2.0	0.26	1450	135	135	13.5	14.5	3.0	700	7000	—	Y
RCA238	6.3	0.3	975	135	135	13.5	9.0	2.5	525	13500	1170	Y
RCA41	6.3	0.4	1850	180	180	13.5	18.5	3.0	1500	9000	625	6
RCA247	2.5	1.75	2500	250	250	16.5	31.0	6.0	2500	7000	400	Y
RCA59	2.5	2.00	2500	250	250*	18.0	35.0	9.0	3000	6000	400	7
RCA89	6.3	0.4	1635	180	180*	18.0	20.0	3.0	1500	8000	780	6

*Suppressor Grid tied to Cathode. Class " A " pentode.

Rectifying Valves.

Type		Filament		A.C. Volts per Plate (R.M.S.)	D.C. Output		Other Characteristics	Base
		Volts.	Amps.		Volts.	Current (mA.)		
Arcturus	180	5.0	2.0	350	—	125	—	X
		—	—	400	—	110	—	—
		—	—	550	—	135	With 20H Choke	—
	181	7.5	1.25	700	—	85.0	Half-Wave—	X
	82	2.5	3.0	500	—	125	Volt. Drop 12V.	X
	83	5.0	3.0	500	—	250	,, ,, 15V.	X
Cossor	280C	5.0	2.0	400	350	110	—	X
		—	—	550	—	135	With 20H Choke	—
	612BU	6.0	0.4	250	280	50	Full-Wave	XE
	44SU	4.0	0.4	200	230	20	Half-Wave	E
	442BU	4.0	2.5	350	350	120	Full-Wave	X
Ken-Rad	280	5.0	2.0	450	—	125	—	X
	281	7.5	1.25	700	—	85	Half-Wave	X
	82	2.5	3.0	500	—	125	Max. Peak Volts 1400 & 400mA.	X
	83	5.0	3.0	500	—	250	,, 1400 & 800	X
	KR1	6.3	0.3	350	—	50	Half-Wave Htr. Type. Merc. Vap.	X
Mullard	PM280	5.0	2.0	400	—	110	—	X
	DU10	4.0	1.0	250	—	75	Half-Wave	XE
	DU2	4.0	1.0	250	—	75	Ful,-Wave	XE
	DW2	4.0	1.0	250	250	60	,, ,,	XE
	DW3	4.0	2.0	350	320	120	,, ,,	X
	DW4	4.0	2.0	500	500	120	,, ,,	X
	DW6	4.0	4.0	1000	1000	120	,, ,,	XE
	DW15	7.5	0.6	500	—	60	,, ,,	X
National Union	280	5.0	2.0	400	—	110	—	X
	82	2.5	3.0	500	—	125	Max. Peak Volts. 1400 & 400mA.	X
Osram	MX280	5.0	2.0	350	—	125	—	X
		—	—	400	—	110	—	—
	U8	7.5	2.4	500	—	120	Full-Wave	XE
	U10	4.0	1.0	250	270	60	,, ,,	XE
	U12	4.0	2.5	350	320	120	,, ,,	XE
	U14	4.0	2.5	500	540	120	,, ,,	XE
	GU1	4.0	3.0	1000	1000	250	Half-Wave M.V.	XE
Philips	PH280	5.0	2.0	400	—	110	—	X
		—	—	550	—	135	With 20H Choke	—
	PH281	7.5	1.25	750	—	110	Half-Wave	X
	PH82	2.5	3.0	500	—	125	Merc. Vap.	X

Rectifying Valves.

Type		Filament		A.C. Volts per Plate (R.M.S.)	D.C. Output		Other Characteristics	Base
		Volts	Amps		Volts	Current (mA.)		
Philips	1561	4.0	2.0	500	—	120	Full-Wave	X
	505	4.0	1.0	400	—	60	Half-Wave	3-pin
	506	4.0	1.0	300	—	75	Full-Wave	XE
Radiotron	UX280	5.0	2.0	350	—	125	—	X
		—	—	400	—	110	—	—
		—	—	550	—	135	With 20H Choke	—
	UX281	7.5	1.25	700	—	85	Half-Wave	X
	RCA82	2.5	3.0	500	—	125	Max. Peak Volts. 1400 & 400mA.	X
					Volts Drop Across Valve 15V.			
	RCA83	5.0	3.0	500	—	250	Max. Peak Volts 1400 & 800mA.	X
					Volts Drop Across Valve 15V.			X
	RCA866	2.5	5.0	Max. Peak Volts 7500V. Max. Peak Current 600mA. Approx. Volts Drop 15V. Half-Wave Merc. Vap.				

Valve Formulae.

Plate Conductance $g_p = \frac{di_p}{de_p}$

Plate Resistance $r_p = \frac{1}{g_p}$

Transconductance $g_m = \frac{di_p}{de_g}$

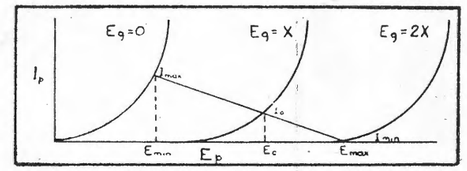
Amplification Factor $= \frac{g_m}{g_p} = g_m r_p$

$U.P.O. = \frac{1}{8} (I_{max} - I_{min}) (E_{max} - E_{min})$

% Second Harmonic Distortion =

$$\frac{\frac{I_{max} + I_{min}}{2} - I_o}{I_{max} - I_{min}} \times 100 = \frac{\frac{E_{max} + E_{min}}{2} - E_o}{E_{max} - E_{min}} \times 100$$

These formulae hold when g_m is expressed in micromhos and r_p, in megohms.



Pentodes.

$$Rp = \frac{E_{max} - E_{min}}{I_{max} - I_{min}}$$

$$U.P.O. = \frac{1}{32} \left(\overline{(I_{max} - I_{min}} + 1.414 \overline{I_x - I_y)} \right)^2 R_p$$

% Second Harmonic Distortion

$$= \frac{I_{max} + I_{min} - 2I_o}{(I_{max} - I_{min}) + 1.414 (I_x - I_y)} \times 100$$

% Third Harmonic Distortion

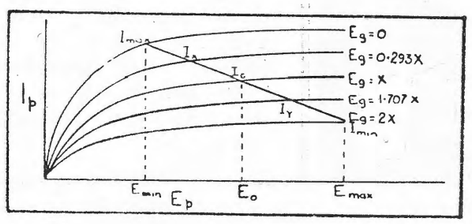
$$= \frac{I_{max} - I_{min} - 1.414 (I_x - I_y)}{I_{max} - I_{min} + 1.414 (I_x - I_y)} \times 100$$

% Total Distortion

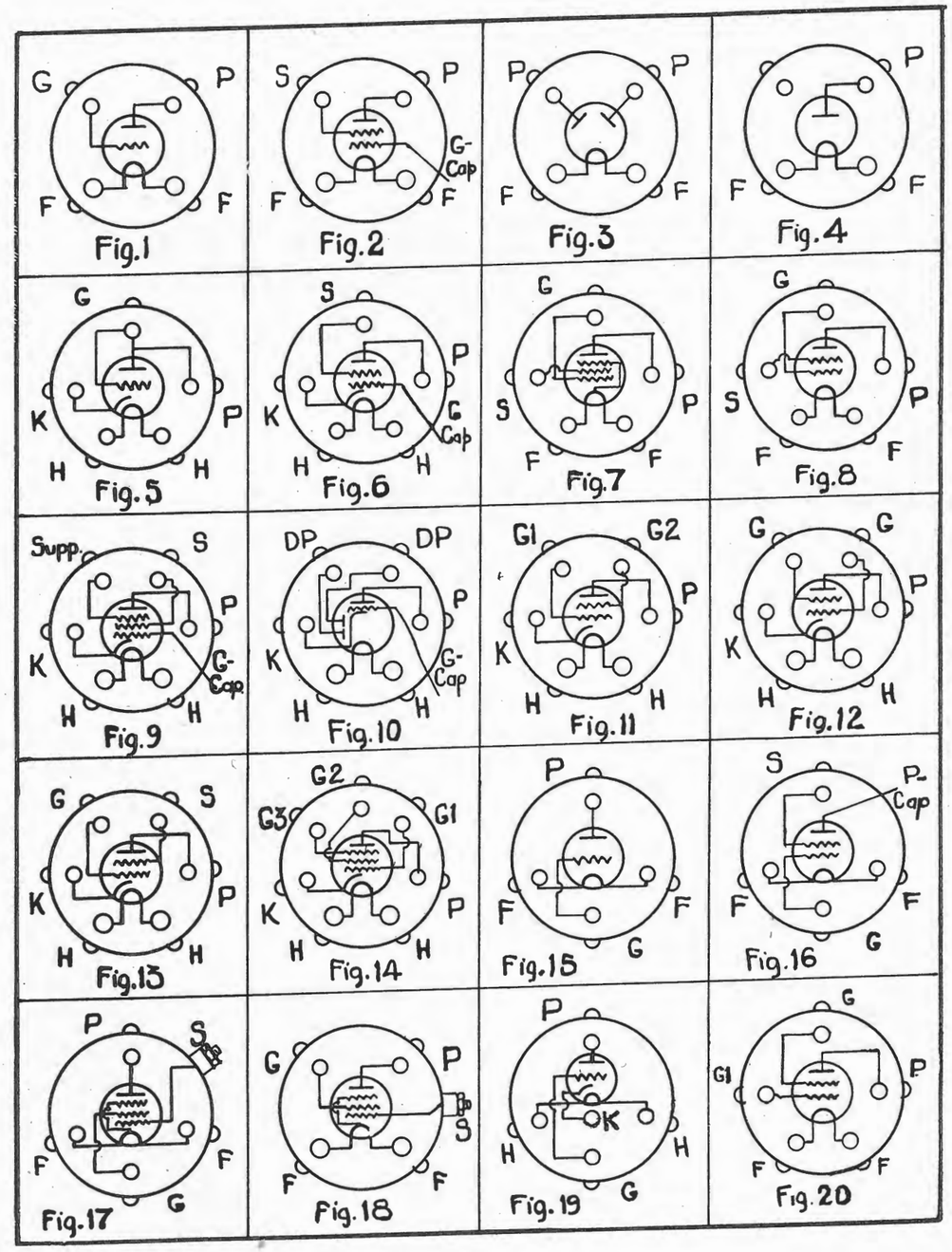
$= \sqrt{(\%2nd\ Harmonic\ Distortion)^2 + (\%3rd\ Harmonic\ Distortion)^2}$

Filament Power.

Tube Type.	Power (Watts).
24 27 35 45 46 47	4.5
55 56 57 58	2.5
80	10



Top View Valve Socket Connections.



Valve Socket Connections.

Referring to the diagrams of the valve socket connections shown in Figs. 1-20 the types embodying the various connections shown are listed below.

The letters in the various diagrams refer to the following terms :—

G1, Grid No. 1; G2, Grid No. 2.
G3, Grid No. 3; G, Control Grid.
S, Screen Grid; Supp, Suppressor Grid.
P, Plate; K, Cathode.
F, Filament; H, Heater.
DP, Diode Plate.

Fig. (1) 112A, 120, 171A, 201A, 210, 226, 230, 231, 240, 245, 250, 199. Fig. (2) 222, 232, 234. Fig. (3) 280, 82, 83. Fig. (4) 281. Fig. (5) 227, 237, 56. Fig. (6) 224A, 235, 236, 238, 239, 44. Fig. (7) 233, 247. Fig. (8) 46. Fig. (9) 57, 58, 89. Fig. (10) 55, 85. Fig. (11) 41, 42. Fig. (12) Double Grid Detector. (KR20, KR22). Fig. (13) 48. Fig. (14) 59. Fig. (15) English 4 pin base. All battery operated triodes. Fig. (16) English 4 pin base with cap on top. Battery operated, screen grid valves. Fig. (17) English 4 pin base with terminal on side. Battery operated pentodes. Fig. (18) UX base with terminal on side. Battery operated pentodes. Fig. (19) English 5 pin base. Indirectly heated triodes. In screen grid valves plate transfers to top and screen to P terminal. Fig. (20) Double grid detector. (PM1DG).

N.B. It is to be particularly noted that all English and Continental screen grid valves (excepting American replicas) have the plate connection on the metal cap situated on top of the valve with the screen connection taken to what is normally the plate pin on the base. This holds good no matter whether English 4 or 5 pin bases or UX-or UY-type bases are employed.

Prefixes.

The prefixes milli-, micro- and micromicro- denote that the term to which they are attached (e.g. amps or farads) must be divided by 1,000 or 1,000,000 or 1,000,000,000,000 respectively, e.g., one milliamp is $\frac{1}{1000}$ amps., while a condenser of .0005 mfd capacity may be spoken of as a 500 mmfd. condenser. Milli- is denoted by m. and micro- should be denoted by the Greek letter "mu" but is usually printed as m. due to the printer's limitations. The prefixes kilo- and meg- or mega- denote that the term to which they are attached (e.g., volts or ohms) must be multiplied by 1,000 or 1,000,000 respectively, e.g., one megacycle is 1,000,000 cycles. They are denoted by K. and M. respectively.

Multiples and Their Symbols.

Multiple	Name	Symbol
1,000,000	Mega	M
1,000	Kilo	K
100	Hecto	—
.001	Milli	m
.000,001	Micro	μ

Literal Symbols—Valve Notation.

The following system of notation is accepted by the R.M.A. as standard in the United States and as such is worthy to be followed. The use of a simplified standard practice in this and similar matters cannot be too strongly encouraged. The small letter "r" is used to denote resistance. Thus r_p indicates the plate resistance of a valve. The letter "p" is called a subscript and defines which particular resistance the "r" is referring to.

In a similar manner subscripts are added to the letters E and I which denote voltages and currents, to form E_f, E_g, E_p for the filament, grid and plate voltages respectively. When current and voltage vary with time (e.g. the a-c input of voice frequencies to the grid of an output valve) lower-case letters are used for the instantaneous values and capital letters for constant values. Further the R.M.S. value is designated by a capital.

The letter g denotes conductance, the reciprocal of resistance. The mutual conductance of a valve is thus g_m. The letter C denotes capacity.

Quantity.	*Symbol.*
Grid potential	E_g, e_g
Grid current	I_g, i_g
Grid conductance	g_g
Grid resistance	$r_g = \frac{1}{g_g}$
Grid bias voltage	E_c
Plate potential	E_p, e_p
Plate current	I_p, i_p
Plate conductance	g_p
Plate resistance	$r_p = \frac{1}{g_p}$
Plate supply voltage	E_b
Emission current	I_s
Mutual conductance (slope)	g_m
Amplification factor	μ (mu) $= \frac{g_m}{g_p}$
Filament terminal voltage	E_f
Filament current	I_f
Filament supply voltage	E_a
Grid-plate capacity	C_{gp}
Grid-filament capacity	C_{gf}
Plate-filament capacity	C_{pf}
Grid capacity	$C_g = C_{gp} + C_{gf}$
Plate capacity	$C_p = C_{gp} + C_{pf}$
Filament capacity	$C_f = C_{gf} + C_{pf}$

Although at first the above table may seem complicated, a few moments consideration will always show the logical reason for the selection of any particular symbol. The importance of being familiar with the terminology of radio cannot be overestimated.

Specific Resistances of Metals and Alloys at Ordinary Temperatures.

Substance	Specific Resistance Microhms per cm.	Relative conductance	Substance	Specific Resistance Microhms per cm.	Relative conductance
Aluminium	2.94	54	Lead	20.8	6.64
Brass	6-9	26-17	Manganin	43	3.7
Climax	87	1.83	Mercury	95.7	1.66
Cobalt	9.7	16.3	Molybdenum	4.8	33.2
Constantan	49	3.24	Nickel	10.5	11.8
Copper, annealed	1.59	100	Nichrome	110	1.45
Ger. Silver (18X)	30-40	5.3-4	Platinum	10.8	14.6
Iron, pure	9	17.7	Silver	1.5	106
Iron, wrought	13.9	11.4	Tungsten	5.4	28.9

The Care and Maintenance of Accumulators.

While present day accumulators, thanks to the manufacturer, are practically trouble free, there are several little details to which attention must be paid in their care and maintenance if the most efficient operation is desired.

They may be divided into three classes :
(1) Radio "A" Batteries.
(2) Car, used as "A" batteries for automotive radio.
(3) Accumulator "B" Batteries.

It is essential that a new or replacement cell should be given its correct initial charge. Fortunately this is usually attended to by the makers, so it is only necessary to fill the cells with sulphuric acid of the specific gravity (Sp. Gr.) recommended by the makers and allow to stand for at least four hours when it will be ready for service. A light freshening charge is desirable at this stage. Information as to correct specific gravity, level of acid and charging rate, may be had from the maker's catalogues if it does not accompany the battery. The acid should never be allowed to fall to a level which exposes the plates to the air while if filled brimful the cell will probably overflow on recharging. Unless acid has been spilt, only distilled water should be added to top up to the correct level. If however, acid has been spilt, the amount lost should be replaced by acid of the same Sp. Gr.

After charging, all moisture or acid should be carefully wiped off the tops and cases of batteries with a damp cloth, and it is desirable to grease exposed lead parts with *pure vaseline* to prevent corrosion. Indications of full charge are several and are listed in their order of importance.

Sp. Gr. of the Acid. This remains constant when further charged above the full charge and may vary from 1.220 to 1.300, being usually higher for small batteries.

Voltage of Each Cell. With charging current on, this is from 2.65 down to 2.3 for old cells.

Gassing. A sulphated cell will gas throughout its charge, but the gassing which indicates a full charge comes off in much larger bubbles.

Colour of Plates. Fully charged, the positive plate is a dark chocolate and the negative a slate grey.

Battery testers consisting of a voltmeter and a shunt which draws a certain current from the battery are useful in ensuring that the voltage is measured in the "on load" condition. A freshly charged battery should show from 2 to 2.05 volts which gradually drops to 1.85 volts at the end of the discharge period.

Sulphation consists of a white deposit on the plates and is also indicated by a low Sp. Gr. and a loss of capacity. It is caused by undue demands on the battery when almost discharged or long standing in a discharged state. It may often be removed by emptying, filling with a solution made of half a pound of chemically pure caustic potash in two quarts of water and charging at a low rate, then discharging and again charging. The second time it should not be discharged although it should give a voltage reading of six. The caustic solution which has now become potassium suphate, is removed by standing the battery overnight while filled with pure water. Then new acid and a full charge completes the process. When mixing new acid for batteries it is important to add the acid to the water and stir with a glass rod. If water is added to concentrated sulphuric acid (also known as oil of vitriol) a dangerous explosion is liable to occur due to the intense heat generated. A table for mixing is given below. Concentrated acid has a Sp. Gr. of 1.835.

Acid Mixing Table.

Sp. Gr. Required	Water Parts by Volume.	
1.300	24.7	
1.290	26.0	
1.280	27.5	To be mixed with 10 parts by volume of concentrated sulphuric acid.
1.270	29.0	
1.260	30.0	
1.250	32.2	
1.240	34.0	
1.230	36.0	
1.220		

It is to be noted that when operated at a higher temperature, the maximum permissible Sp. Gr. is lower, otherwise a shortened life is the result. Messrs. Exide Batteries give the following figures for their batteries :

When Battery Is	In N.S.W., Vic., S.A. & Tas.		In Q'land, W.A. and N.T.	
	Sp. Gr.	Max. Temp.	Sp. Gr.	Max. Temp.
Fully Charged	1.250 (1.240-1.260)	110°F.	1.220 (1.210-1.230)	125°F.
Half discharged	1.180 (1.170-1.190)	"	1.150 (1.140-1.160)	"
Fully discharged	1.120 (1.110-1.130)	"	1.090 (1.080-1.100)	"

The Sp. Gr. should always be measured with a reliable hydrometer.

Accumulator "B" Batteries.

The main points in the care of accumulator "B" batteries are identical with those given above. The charging rate should never exceed .25 amps. and the electrolyte should be kept up to the right level. It is especially injurious to allow these small cells to stand for any length of time in a discharged state.

If the cells are not going to be used for some time, they should be given a full charge and preferably emptied of electrolyte. This applies also to larger accumulators, when storing.

Charging Plants.

The type and size of plant which is installed will be governed entirely by the amount of charging which is to be done. Where direct current mains are available charging can be accomplished by one of two systems. The simpler is to insert an appropriate series resistor to cut down the current to the required value. In practice this would consist of some sort of rheostat or possibly open framework of wire, connection to which could be made by means of clips. Direct charging from the mains is not an economical proposition unless a large number (more than 50 say) of cells have to be charged and even in this case the charging current will have to be regulated so as not to ruin the smallest cell in circuit. A suitable motor generator set will charge these batteries in parallel and prove a far more economical installation despite its higher initial cost.

However in the majority of instances supply is A.C., in which case we can class the suitable plants under five heads.

(*i*) *Rotating machinery, e.g., motor generators, motors driving dynamos, synchronous rectifiers*; (*ii*) *Vibrating rectifiers*; (*iii*) *metal rectifiers*; (*iv*) *valve rectifiers*; (*v*) *mercury arc rectifiers.*

The cost of upkeep and attention to the last three named are very low since there are no moving parts, and replacements of the rectifying units are rare, providing that they are operated within their rating. In any class of charging equipment it is important not to overload any portion of the apparatus. A good motor generator set will give long service with little attention beyond regularly oiling or greasing the bearings and cleaning the commutator and brushes; this last item being particularly important to ensure efficient running of the plant. The contacts of vibrating rectifiers also need a regular touching up. With mechanical rectifiers it is essential to instal an automatic cut-out similar to that on a car so that if the generator stops running (on the failure of the line voltage or for some other reason) the batteries will not discharge back through the generator.

It is necessary to employ external rheostats to adjust the various charging rates needed. One convenient and inexpensively made form takes the shape of an open wooden framework with small button insulators across which are stretched a number of resistance wires either taut or slightly spiralled. Connection is made to one end of each and the desired resistance is tapped off with battery clips on each wire. Information as to resistance and current carrying capacity is available in the tables to be found elsewhere.

Special Care Necessary.

No apparatus should be placed near the cells during charging on account of the corrosive fumes. For the same reason it is dangerous to approach the cells with a naked light as portion of the fumes (hydrogen and oxygen) form a highly explosive mixture. Always switch off the charging current when disconnecting cells as it is quite possible that a spark on breaking circuit will ignite the fumes. Any acid which burns on skin, should be immediately neutralised by an alkali, ammonia being very convenient. Even if washed under a tap drops of acid on clothes will continue to rot and darken the cloth. Again ammonia is indicated (immediately) before washing. A systematic system of time keeping and charging currents should be adopted to avoid over—or under—charging and harm to the batteries.

It is to be noted that the S.A.A. rules for the installation of battery chargers not exceeding 1200 volt-amps input rating are identical with those for radio sets.

Use of Radio "B" Batteries.

"B" Batteries should be installed in a cool, dry place. Heat quickly dries up the active material contained in the cells, while moisture is both injurious to the insulation between adjacent cells and causes the zinc containers to be dissolved more quickly. Many people send a boy to do a man's work, by using light duty B batteries to operate a powerful radio receiver. Even though the initial outlay is greater, a heavy duty battery, costing perhaps twice as much, will last more than twice as long. In addition, the operation and tonal qualities of the set will not fall off so markedly as the battery runs down if the heavier type of batteries are employed.

Light duty batteries are rated for discharge currents up to 6 milliamperes. Heavy duty batteries are rated for discharges up to 16 milliamperes; while super-service or triple duty B batteries should be employed for a current drain of 25 milliamperes or over.

For excessively heavy current draw it is economical to instal a bank of accumulator B batteries. B batteries are tested by their voltage, using a high resistance voltmeter, both on and off load. Too great a variation between the two figures means that the battery should be replaced.

Wavelength—Frequency Chart.

Kilocycles to Metres.

In using this table it is important to note that Kilocycles may be read in the second column against metres in the first, e.g., while 630 kc. is given as 475.9 metres from the same line we may read off that 630 metres is 475.9 kc.

Kc.	M.	Stn.	Kc.	M.	Stn.	Kc.	M.	Stn.	Kc.	M.	Kc.	M.	Kc.	M.
500	599.6		990	302.8		1255	239.0		1800	166.6	7000	42.83	12,200	24.58
510	587.9		1000	299.8	4GR	1260	238.0	3WR	1900	157.8	7100	42.23	1 2,300	24.38
520	576.6		1005	298.4		1265	237.1		2000	149.9	7200	41.64	12,400	24.18
530	565.7		1010	296.9	3HA	1270	236.1	2SM	2100	142.8	7300	41.07	12,500	23.99
540	555.2		1015	295.4		1275	235.2		2200	136.3	7400	40.52	12,600	23.80
550	545.1		1020	293.9		1280	234.2	3TR	2300	130.4	7500	39.98	12,700	23.61
560	535.4	2CO	1025	292.5	2UE	1285	233.3		2400	124.9	7600	39.45	12,800	23.42
570	526.0		1030	291.1		1290	232.4	4BK	2500	119.9	7700	38.94	12,900	23.24
580	516.9	7ZL	1035	289.7		1295	231.5		2600	115.3	7800	38.44	13,000	23.06
590	508.2		1041	288.0	5PI	1300	230.6	3BA	2700	111.0	7900	37.95	13,100	22.89
600	499.7		1045	286.9		1305	229.7		2800	107.1	8000	37.48	13,200	22.71
610	491.5	3AR	1050	285.5	2CA	1310	228.9	5AD	2900	103.4	8100	37.01	13,300	22.54
620	483.6		1055	284.2		1315	228.0		3000	99.94	8200	36.56	13,400	22.37
630	475.9		1060	282.8	4MB	1320	227.1	2MO	3100	96.72	8300	36.12	13,500	22.21
635	472.2	5CK	1065	281.5		1325	226.3		3200	93.69	8400	35.69	13,600	22.04
640	468.5		1070	280.2	2KY	1330	225.4	4RO	3300	90.86	8500	35.27	13,700	21.88
650	461.3		1075	278.9		1335	224.6		3400	88.18	8600	34.86	13,800	21.73
660	454.3		1080	277.6	3SH	1340	223.7	2XN	3500	85.66	8700	34.46	13,900	21.57
665	450.9	2FC	1085	276.4		1345	222.9		3600	83.28	8800	34.07	14,000	21.42
670	447.5		1090	275.1		1350	222.1	3KZ	3700	81.03	8900	33.69	14,500	20.68
680	440.9		1095	273.9		1355	221.3		2800	78.90	9000	33.31	15,000	19.99
690	434.4	6WF	1100	272.6	7LA	1360	220.4		3900	76.88	9100	32.95	15,500	19.34
700	428.3		1105	271.4		1365	219.6		4000	74.96	9200	32.59	16,000	18.74
710	422.3		1110	270.1	2HD	1370	218.8		4100	73.13	9300	32.24	16,500	18.17
720	416.4	2YA	1115	268.9		1375	218.1		4200	71.39	9400	31.90	17,000	17.64
730	410.7	5CL	1120	267.7		1380	217.3	4BH	4300	69.73	9500	31.56	17,500	17.13
740	405.2		1125	266.5	2UW	1385	216.5		4400	68.14	9600	31.23	18,000	16.63
750	399.8		1130	265.3		1390	215.7	2GN	4500	66.63	9700	30.91	18,500	16.21
760	394.5	4QG	1135	264.2	6ML	1395	215.0		4600	65.18	9800	30.59	19,000	15.78
770	389.4		1140	263.0		1400	214.2	3GL	4700	63.71	9900	30.28	19,500	15.38
780	384.4		1145	261.9	4BC / 3YB	1405	213.4		4800	62.46	10,000	29.98	20,000	14.99
790	379.5		1150	260.7		1410	212.6		4900	61.19	10,100	29.69	20,500	14.63
800	374.8	3LO	1155	259.6	2WG	1415	211.9	2KO	5000	59.96	10,200	29.39	21,000	14.28
810	370.2		1160	258.5		1420	211.1		5100	58.79	10,300	29.11	21,500	13.95
820	365.6		1165	257.4		1425	210.4	3AW	5200	57.66	10,400	28.83	22,000	13.63
830	361.2		1170	256.3	4TO	1430	209.7		5300	56.57	10,5 00	28.55	22,500	13.33
840	356.9		1175	255.2		1435	209.0	2WL	5400	55.52	10,600	28.28	23,000	13.04
850	352.7		1180	254.1	3DB	1440	208.2		5500	54.51	10,700	28.02	23,500	12.76
855	350.7	2BL	1185	253.1		1445	207.5		5600	53.54	10,800	27.76	24,000	12.49
860	348.6		1190	252.0	4MK	1450	206.8		5700	52.60	10,900	27.51	24,500	12.24
870	344.6		1195	251.0		1455	206.1		5800	51.69	11,000	27.26	25,000	11.99
880	340.7	6PR	1200	249.9	5KA	1460	205.4		5900	50.82	11,100	27.01	25,500	11.76
890	336.9	7HO	1205	248.9		1465	204.7		6000	49.97	11,200	26.77	26,000	11.53
900	333.1		1210	247.8	2CH	1470	204.0		6100	49.15	11,300	26.53	26,500	11.31
910	329.5	4RK	1215	246.8		1475	203.3		6200	48.36	11,400	26.30	27,000	11.10
920	325.9		1220	245.8	6KG	1480	202.6	2AY	6300	47.59	11,500	26.07	27,500	10.90
930	322.4	3UZ	1225	244.8		1485	201.9		6400	46.85	11,600	25.85	28,000	10.71
940	319.0		1230	243.8		1490	201.2		6500	46.13	11,700	25.63	28,500	10.52
950	315.6	2GB	1235	242.8		1495	200.6		6600	45.43	11,800	25.41	29,000	10.34
960	312.3	5DN	1240	241.8		1500	199.9	3AK	6700	44.75	11,900	25.20	29,500	10.16
970	309.1	3BO	1245	240.9	2NC	1600	187.4		6800	44.09	12,000	24.99	30,000	9.99
980	303.9		1250	239.9		1700	176.4		6900	43.45	12,100	24.78	60,000	4.99

Speaker Matching.

While many people would cheerfully go and connect any speaker to any output valve, the importance of matching the impedance of the speaker with that of the output stage cannot be too highly stressed. If these two do not bear a certain relation to one another distortion will certainly appear, in all probability affecting both the upper and lower registers. Further a certain output valve or combination of valves will give its maximum power only when working into a certain impedance, usually termed the load impedance. The correct value of this depends, of course, upon the characteristic curve of the valve, but with normal types of power valves, it can be taken at about twice the plate impedence of the valve.

In very small output valves this figure may be as low as 1.5. On the other hand with larger valves with plate dissipations of 10 watts or more, the load impedance may quite well be three times the plate impedance. The plate dissipation should not be confused with the A.C. power output, as it really represents the amount of heat actually dissipated within the valve. It is obtained by multiplying the mean plate current by the plate voltage.

Moving Iron Speakers.

In this type of speaker, absolutely accurate matching is not essential for good results, nor indeed is it possible over the whole range of frequencies. In such a speaker the impedance rises and falls greatly with the applied frequency, so it is easy to see that with a certain output valve feeding a moving iron speaker, the two will be correctly matched only when certain frequencies are being reproduced. As the maximum power transference from valve to speaker occurs when the load impedance is optimum, these frequencies will be accentuated in the reproduction of the receiver. If, for instance, the load impedance at 1200 cycles is the optimum value for the particular output valve, then the band of frequencies around 1200 will be accentuated, and the general tone will appear high. At the same time the lower notes will be particularly reduced.

A satisfactory compromise is obtained if the impedance of the speaker at about 256 cycles per second or middle C is taken as the matching impedance, and a suitable output valve or transformer thus chosen. The impedance of most commercial moving iron speakers at 250 cycles lies between about 3,500 ohms and 6,000 ohms.

Moving Coil Speakers.

Moving coil speakers are very much more susceptible to matching inaccuracies than those of the moving iron type. The majority of low impedance moving coil speakers are supplied with transformers to suit either a pentode or other popular type of output valve. In this connection it should be noted that the load impedance of a moving coil speaker is due to three factors—the coil resistance, the coil reactance, and the equivalent motional capacity which is due to the damping exerted on the vibrating cone by the surrounding air. In most cases, however, the impedance of the moving coil is sensibly constant over the range of audio frequencies.

It is thus a simple matter to find mathematically the correct ratio for the output transformer for any impedance moving coil speaker. The formula for this calculation is :—

$$n = \sqrt{\frac{2\,R_a}{Z_s}}$$

Where R_a = plate impedance
Z_s = average impedance of speaker.
2 = assumed factor (see above).

In the case of a high impedance moving coil, the average impedance can be taken as twice the D.C. resistance. With low impedance coils, the impedance is generally 1 to 1.5 times the D.C. resistance. E.g., suppose we have a moving coil speaker with a voice coil resistance of 16 ohms. We may take the voice coil impedance at 24 ohms, and if we wish to match this to an output valve of 2,400 ohms impedance, the correct transformer ratio is :—

$$\sqrt{\frac{4800}{24}} = \sqrt{200} = 14$$

Consider another example in which a low impedance moving coil has to be matched to a push-pull output stage. Suppose the moving coil has an average impedance of 12 ohms, and the valves have each an impedance of 1,600 ohms. Then the effective plate impedance is twise this or 3,200 ohms. The correct turns ratio is therefore :—

$$\sqrt{\frac{3200 \times 2}{12}} = 23$$

As mentioned above, taking twice the plate impedance of the valve as the load impedance is only useful for general work. Far better results are obtained graphically by the use of what is known as a 5% distortion scale in conjunction with the plate current characteristic curve of the output valve in question. This curve should not be confused with the more usual characteristic curve of grid volts against plate current. As a rule in the characteristics of output valves the manufacturers will indicate the correct load impedance.

Pentodes.

These same rules apply only in part when pentodes are used. The pentode valve has a very high plate impedance compared with that of an output triode. However, under normal working conditions a pentode behaves somewhat as a triode with a plate impedance of about 3,000 ohms. Thus, we have some explanation of the fact that a pentode is usually worked into a load impedance of about 7,000 ohms. Some of the Continental pentodes are designed to work into impedances slightly higher than this. If, however, the impedance of the output circuit is considerably more than this, as for instance, when the speakers are disconnected from the secondary of the output transformer, then under certain conditions excessive peak voltages may

be developed across this output circuit, resulting either in damage to the valve or to the output device.

All this means that the load impedance into which a pentode works should never be greater than 10,000 ohms.

While working a pentode into this impedance implies that a certain amount of distortion is present, more in fact than with a triode of equal A.C. power output, it must be born in mind that the pentode achieves this with considerably lower plate voltages and currents. In calculating the correct step-down ratio for an output transformer, we do not employ the formula given above, but in place of the term "$2R_a$," we substitute the figure 7,000.

In other cases, where the impedance cannot match exactly, it is better to have the load impedance higher than the optimum value than lower, for less distortion occurs. This is explainable by considering the load line as drawn on the characteristic, plate volts-plate current. If the load impedance is low, this line will be more nearly vertical, and a smaller swing in plate volts will bring the operating point down on to the curved portion of the characteristic.

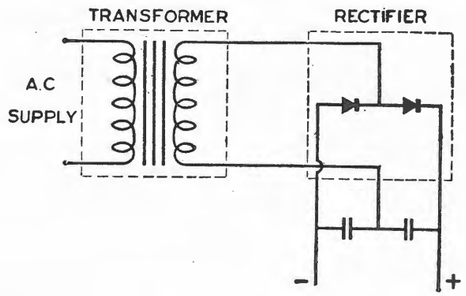
These remarks about matching the load of an output valve, also apply to any valve in a radio receiver, R.F. amplifier, detector, or first audio stage. It is, of course, hard to obtain a load impedance which matches at all well with that of a screen grid valve, but if full advantage is to be taken of the enormous amplification factor, this phase of the matter has to be considered.

Metal Rectifiers.

One of the earliest types of rectifier invented was the electrolytic in which the action of rectification causes a periodical chemical change to occur. These were mainly of the wet type but some were later developed in which the rectifying action took place at the surface between two dissimilar substances, both dry. Of this class were such rectifiers as the dry plate magnesium-copper sulphide pair. However, due to the fact that chemical changes do occur, the life of such units is comparatively short.

In the copper oxide-copper rectifier the unit does not consist of a series of plates but rectification takes place at a surface separating a copper disc from a film of oxide which has been produced by suitable treatment. The advantages claimed for this rectifier are long life, robust construction, no filament heating losses and a high capacity to carry overloads such as momentary short-circuits.

The metal rectifier is usually connected in a voltage doubling circuit such as that shown in the Fig. employing two reservoir condensers of about 4 mfd. capacity. Considering the action of this circuit it is seen that it consists of two half-wave rectifiers, each in series with a condenser, and each operating on opposite half-cycles. During the half-cycle in which one rectifier operates the condenser in series with it becomes charged. Hence, during the next half-cycle, when the other rectifier allows current to pass, we have the charge in this condenser in series with the rectified voltage. Thus we obtain an output voltage greater than the input voltage. During this half-cycle, the other condenser is being charged, so that on each half-cycle we have



the rectified voltage in series with the charge in the condensers.

In addition these condensers carry out a certain amount of smoothing. One rather bad effect due to this hook-up is the poor regulation obtained (*e.g.*, the output from one type of metal rectifier used in this circuit falls from 500 volts at no load to 300 at the full load of 60 mA.)

Metric Conversion Tables.

1 inch	=	2.54	centimetres
1 foot	=	30.48	,,
1 mile	=	1.6093	kilometres
1 centimetre	=	.3937	inches
1 metre	=	3.2803	feet
1 kilometre	=	.6214	miles
1 sq. in.	=	6.4516	sq. cms.
1 sq. cm.	=	.155	sq. in.
1 cub. in.	=	16.39	c.c.
1 c.c.	=	.061	cub. in.
1 litre or 1000 c.c.	=	1.76	pints
1 oz.	=	28.35	grammes (g)
1 lb.	=	.4536	kg.
1 kg.	=	2.2046	lb.

Fuses.

The fusing currents are for wires mounted horizontally.

	Fusing Current	1 amp.	3	5	10	20	50
Tin	S.W.G.	37	28	24	21	18	13
Copper	S.W.G.	47	41	38	33	28	22

Convenient Approximate Relations.

1 yard	1 metre, less 10%
2 lb.	1 kilogram, less 10%
2 galls.	10 litres, less 10%
1 ton	1000 kg., less 2%

Radio Inductive Interference Elimination.

Practically everyone is acquainted with the annoying interference which at times spoils our radio reception. This may roughly be divided into two classes— (1) Natural, (2) Man-made. The first class occurs during redistributions of the electrical state of the atmosphere or the magnetic state of the earth, and is usually known as static. Static is particularly bad during the summer months and can never be entirely eliminated, although it may sometimes be reduced by the use of a smaller aerial or a directional aerial such as a loop. Even though the static may be very bad on interstate stations, it is usually possible to listen with enjoyment to local stations unless a thunderstorm is passing directly overhead, when it is advisable to connect the aerial directly to earth. In many cases it is possible to eliminate or greatly reduce the man-made interference. By this type of interference is meant artificial disturbances generated by electrical machinery or apparatus, very often when operating in a defective state.

Such interference may be eliminated by preventing the generation of the noise energy or by absorbing it at some point in its path to the set. We will confine our remarks to the elimination of high-frequency interference, as any hum in the speaker due to low frequency ripples (usually multiples of 50 cycles) can almost invariably be eliminated by more efficient filtering. High frequency interference usually consists of highly damped and hence very broadly tuned waves similar to the old spark type of transmission, and may arrive at the set by direct conduction through the power mains or by radiation from some portion of the power mains as from an aerial and consequent pick-up by the receiving aerial. The latter type of interference may be recognised by the great diminution in strength which occurs when the aerial is disconnected from the set.

Defective Power System.

Very frequently the noise energy is generated by some portion of the power system when in a defective state. Such interference may be readily tracked by the "Interference Indicator" described below or in fact by any portable battery set of sufficient sensitivity. The obvious remedy in such cases is to rectify the fault in the apparatus.

Much valuable data on the location and suppression of interference is contained in the circulars issued by the P.M.G.'s Department entitled "Radio Inductive Interference, No. 1" and "Suppression of Radio Inductive Interference, Nos. 2 and 3." The whole field of interference from electrical machinery is covered very concisely in a paper (No. 137) of the Institution of Post Office Electrical Engineers (Great Britian) by Col. A. S. Angwin entitled "Interference with Wireless Reception Arising from the Operation of Electrical Plant."

Very often intermittent noises may be caused by a defect in the wiring system such as the following :—

A loose plug in a power point.

A lamp making poor or intermittent contact with the pins in the socket.

Poor or intermittent contact between the fuse wire and its terminals in a fuse block.

Defective cords to radiators, irons, etc.

Poor or intermittent contact across the contacts of a switch.

Poor or intermittent contact in the bonding between conduits.

Intermittent contact between telephone earth wires and conduits, etc.

Such intermittent contacts are often noticeable when a passing vehicle or someone walking about shakes the house.

In such cases the remedy is to rectify the fault. some cases the faulty connection may occur outside the house wiring when it becomes the job of the supply authority to remedy it.

Interfering plant may be listed as under :—

(*a*) *Motors and generators, both A.C. and D.C. types.*
(*b*) *Battery charging rectifiers.*
(*c*) *H.F. Medical apparatus.*
(*d*) *Flashing signs, electric ovens and heating pads.*
(*e*) *Neon signs.*
(*f*) *Lifts.*
(*g*) *Tramways and trolley buses.*
(*h*) *Mercury arc rectifiers.*

The suppression of H.F. noises is carried out by the insertion of coils (really R.F. chokes) in series with the leads coming from the source of interference (e.g., a small motor) and the short circuiting of the spurious oscillations by a condenser, or as is more common the separate bypassing of each lead to earth. This method, in effect, also provides a short-circuit for the oscillations through the two condensers in series. Special Hydra condensers for the elimination of interference may be obtained consisting of two sections in series together with a third condenser of high breakdown voltage connected as shown in Fig. 1 (a). This small capacity also limits the flow of A.C. current to earth to less than

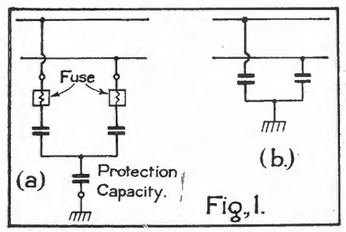


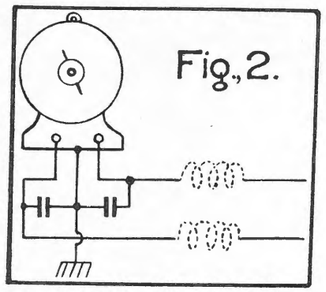
Fig. 1.

one milliamp when used on A.C. mains. When this small capacity is not inserted the earth lead should be very well grounded as a "dry" ground with a considerable current flowing through it may itself readily cause an annoying form of noise.

Thus the circuit of Fig. 1 (b), is really only suitable for D.C. mains and if any breakdown occurs the house fuses will blow. Hydra condensers are supplied with the arrangement of Fig. 1 (a) done up in one can, in 2 x 2 mfd. and 2 x 0.1 mfd. sizes. Much valuable data is contained in a booklet on interference elimination by the Hydra-works people.

Motors and generators may be quietened as in Fig. 2 by connecting the bypass unit across the armature leads as close as possible to the machine. Choke coils as shown dotted it may also help the bypass in preventing the unwanted oscillations from reaching the power line.

Interference from motors does not usually extend further than 50 yards. With small machines it is often sufficient to connect the bypass centre-tap to the frame without earthing this lead. In fact earthing is sometimes even a disadvantage. Interference arising from battery charging plants is usually caused by direct radiation from the plant and batteries under charge. One arrangement which effectively cured a rotary rectifier plant consisted of a centre tapped bypass to earth across the mains together with 0.1 mfd. condenser across the low voltage output brushes and a filter after the high voltage output brushes consisting of a 4 mfd. condenser, a 100 microhenry choke in each lead and a further 0.25 mfd. condenser.



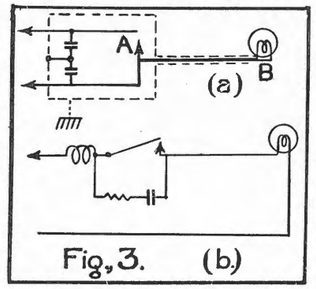
Medical Equipment.

The interference from high frequency medical apparatus is particularly pernicious but fortunately such plants are not common.

In this type of equipment which is sometimes known as ultra-violet ray or diathermy apparatus, long wave damped oscillations are generated by shock excitation of an oscillatory circuit and then stepped up to a high voltage by a transformer, one end of whose secondary is connected to the electrode to be applied to the patient. The other end is connected conductively or capacitively to the mains. Thus the high frequency current, usually of a wavelength between 2,000 and 5,000 metres flows through the patient and his capacity to earth back into the mains through their capacity to earth. The most effective method of cure is to isolate the secondary circuit by providing an insulated metal plate to which one end of the secondary is connected above which the patient may stand. The insertion of bypass condensers across the mains seems to improve matters but little.

Flashing Signs.

The interference from flasher signs takes the form of a " plop " each time the flashing device (usually a thermostat) operates. The interference is radiated from the lead from flasher to lamp marked AB in Fig. 3 (a). The cure shown in Fig. 3 (a) consists of shielding the flasher and associated bypass and running lead covered wire to the lamp with the lead covering securely bonded to the shield.



An alternative method is shown in Fig. 3 (b), consisting of an R. F. chokeis series with the line and a quench circuit across the contacts of the flasher. The choke should be mounted as close as possible to the flasher and the values of C and R have to be chosen suitably for the conditions. R may quite well be a small 5,000 ohm. potentiometer, while C may range from 0.1 to 1 mfd.

Neon Signs.

Occasionally neon signs are operated from R.F. currents somewhat after the style of the diathermy apparatus mentioned above. Usually these are small and are used only in positions where the high voltage would be too dangerous if low frequency was used. In some cases the insulation of some portion of the high voltage secondary circuit across which the neon tube is connected, may be defective, and then leakage currents will flow to earth setting up interference. The remedy is obviously to repair the fault.

In some districts, particularly the more industrialized it will often be found that there is such a multiplicity of electrical equipment nearby that bypassing and isolation by R.F. chokes is impracticable. In such cases radiation and pickup from the actual house wiring may be minimised by inserting a high frequency filter in the mains where they enter the house. This may consist of that shown in Fig. 2 with chokes of about 600 microhenries inserted if necessary. Other remedies include the erection of a counterpoise earth, a change in the orientation of the aerial or the use of a screened lead-in. Ordinary lead covered lighting cable may be used for the lead-in with the aerial (which should be erected well away from the house and any power lines) connected to the core and the sheath earthed. A condenser of about .0001 mfd. capacity should be inserted between the lead-in and the aerial terminal of the set to decrease the apparent capacity to ground of the lead-in. If an aerial coil with a high impedance primary is employed, a step up transformer with about 200 turns on the secondary and a ratio of about 10 to 1 should be employed.

Temperature.

10° Centigrade = 50° Fahrenheit.

So that the following simple formulae will be found convenient :—

°F = 50 + 9/5 (°C — 10)
°C = 10 + 5/9 (°F — 50)

An Interference Indicator.

While it is all very well to instal a R.F. line filter at the terminals of a nearby refrigerator which may seem a likely source of trouble, it is just as well to be absolutely sure that the refrigerator in question is really the offending machine. This can be decided by means of an " Interference Indicator." A still more valuable use for the interference indicator lies in the tracking down of unknown sources of interference. Any sensitive and portable receiver may be employed as an interference indicator but naturally one designed especially for the job will be superior.

Below is described an interference indicator by Thorrington which appeared in the Radio Review for October, 1931. It consists of a very broadly tuned four valve receiver with 1 R.F., detector and 2 audio stages. The output may be fed either to a pair of headphones or to a copper oxide rectifier type of output meter. The Weston output meter consists essentially of a high resistance voltmeter (0-3 V.) of 1 milliamp. movement in series with the copper oxide rectifier. It is built into a separate small box which may be removed from the suitcase when needed for external use.

Referring to the circuit diagram, we see that no provision for an earth is made and normally no aerial is used either, although a few inches may be attached to provide extra pick-up in addition to that given by the grid coil of the R.F. tube. The R.F. stage is coupled to the detector by an untuned transformer. Suitable specifications for this transformer would be 50 turns for the primary and 150 to 200 turns for the secondary on 1½ inch tubing with 26 to 30 gauge wire.

The pick-up or R.F. grid coil is wound on a form constructed by bolting two spider web formers ½ inch apart with a bakelite washer. The grid coil consists of 56 turns of 26 gauge D.S.C. wire. The optimum number of turns for the reaction coil is best found by experiment. In the original model 25 turns of 30 gauge D.S.C. wire were used wound in between the two formers. The outside end of the grid coil goes to the filement.

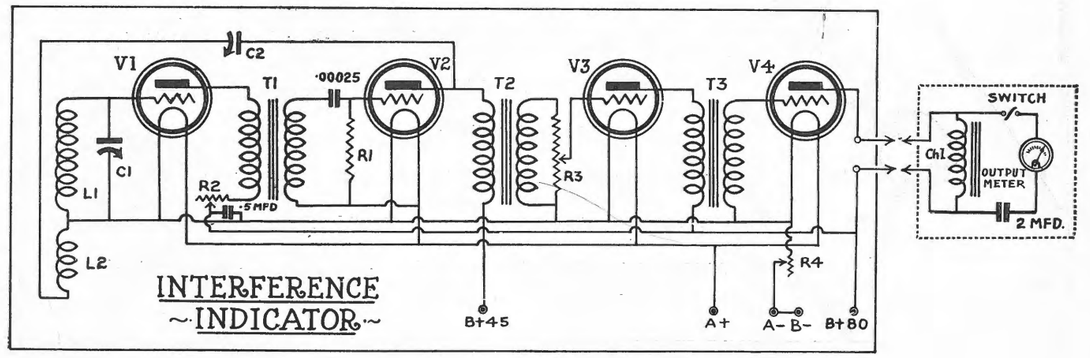
The output control R3 is used in conjunction with the output meter to give more definite and sensitive indications to change in volume than are possible when using the headphones. For this purpose is should be fitted with a 2 inch dial and a pointer. The original apparatus used a Centralab tapered 500,000 ohm. potentiometer in this position. The resistance R2 may be set to ensure that the R.F. stage does not oscillate.

As two volt valves are used with a three volt supply, care should be taken not to turn up too far the filament rheostat R4. In operation the phones are plugged in and the indicator tuned until the interference is heard at its loudest. The output control should be retarded until the noise is barely audible before switching in the output meter which can be so easily damaged by too great a signal level. When tuned to a broadcast station the needle of the meter will fluctuate in accord with the modulation. Usually, however, interference is of a consistent nature so that the needle of the meter will not fluctuate very greatly.

The control should be advanced until the output meter is reading near the middle of the scale. On carrying the indicator nearer to the source of interference, the control will have to be retarded to retain the same output voltage while if it is carried away from the source it will have to be advanced to maintain the output constant. After a few weeks' experience it will be found an easy job to track down practically any type of interference, particularly as each type has its own peculiar tone as heard in the headphones.

Parts Used in Interference Indicator.

C_1	.0005 tuning condenser.
C_2	17 plate midget.
V_1	Philips A225 or similar.
V_2, V_3, V_4	Philips A209 or similar.
R_1	2 megohms.
R_2	0-250,000 ohms.
R_3	0-500,000 ohms potentiometer.
R_4	30 ohm rheostat.
L_1 L_2, T_1	as described.
Ch_1	Output choke.



S.A.A. Wiring Rules.

(As Applied to Radio.)

The Standards Association of Australia has drawn up a set of rules covering all electrical and radio installations known as the "S.A.A. Wiring Rules." In New South Wales the Fire Underwriters Association and the Supply Authorities have adopted these rules, and in most of the other Australian States either the S.A.A. rules have been adopted or the rules in force are practically the same.

The portion of these rules affecting radio aerial and earth installations and also in connection with radio and other sound reproducing equipment connected to electric light and power mains is quoted below :—

"Antennae" Exterior to Buildings.

1681. (a) **Location.** Antennae, counterpoises and stay wires exterior to buildings shall not pass over or under aerial, electric light or power wires, nor shall they be so located that failure of either antenna, counterpoise, stay wire, or of the abovementioned electric light or power wires could result in a contact between the antenna, counterpoise and/or stay wires and such electric light or power wires.

Antennae, counterpoise and their supports shall be constructed and installed in a strong and durable manner, and shall be so located as to prevent accidental contact between antenna or counterpoise wires, and light or power wires, or the wires of the Postmaster-General's Department or Fire Brigade, by sagging or swinging.

(b) **Size of Cables.** Antenna and counterpoise conductors shall be stranded, and if of copper, shall be hard drawn and shall be of cross sectional area not less than that shown in Table VIII.

The stress in such conductors shall not exceed 25,000 lbs. per sq. in.

Conductors of metals other than copper may be used provided that their breaking strength is not less than that of the copper conductors for the following given spans. Span (between supports) not exceeding 120 ft. minimum size 3/.036 in. (3/20) exceeding 120 ft. mimimum size 7/.036 in. (7/20).

1682. **Location.** Antennae within buildings shall be so placed and constructed that they cannot come into contact with wires or apparatus (other than the radio receiving set) connected to the electric light or power supply. Such portions of the antennae as are within reach of the radio set shall be insulated wires of not less than 600 megohm grade.

Connections to Radio Receiving Sets.

1683. (a) **Leading in Wires.** (1) Leading in wires shall be of copper, copper-clad steel or other approved metal, which does not corrode excessively and shall, in no case, be smaller than 1/.044 in. (1/18). (2) Inside buildings, the leading-in wires shall be covered with insulation of not less than 600 megohm grade. (3) Leading-in wires, both inside and outside of buildings, shall not come nearer than 12 in. to electric light or power wires, unless separated therefrom by a continuous and firmly fixed non-conductor with a well maintained permanent separation. The non-conductor shall be in addition to any insulation on the wire.

(4) Leading-in wires shall enter a building through a non-combustible, non-absorptive insulating bushing, so arranged as to prevent the entry of moisture. Each leading-in wire shall be provided with a protective device (lightning arrester) of approved pattern, which shall be fixed outside the building. The protective device shall be mounted on a non-combustible base, away from inflammable material and shall provide an air gap not exceeding 0.005 in. between aerial and earth connections. (5) The use of an antenna earthing switch is desirable, but does not obviate the necessity for the protective device required by paragraph (4) of this rule. Such switch, if separate from the protective device, may be placed within the building, and, if installed, shall, in its closed position, form a shunt around the protective device. Where situated within reach of the radio receiving equipment, such earthing switch shall be of the all-insulated type.

(6) If cut-outs are used in the antenna circuit they shall be placed so that they cannot interrupt the circuit from the antenna to ground.

(b) **Earthing leads.** Permanent earthing conductors (exclusive of flexible earthing leads attached to porable sets) shall be of stranded copper, and shall not be smaller than 7/.029 in. (7/22). They shall, in all respects, conform with provisions of section 17 with respect to earthing, but shall be insulated cables, the insulation being 600 megohm grade.

Section 17. Earthing Precautions.

1721. **Resistance.** The earthing system used shall be such that the combined resistance of the earthing lead and of the earthing system itself shall be low enough to permit the passage of the current necessary to operate the fuse, circuit breaker, or the earth leakage release of the circuit breaker protecting the circuit. The earthing lead shall be as short as possible.

1722. **Earth System.** All earthing leads shall be taken direct without a break to an effective earth. If connected to a water supply system they shall be connected as close as practicable to the point of entry of the supply system into the building, to a section of water pipe of sufficient size to carry the maximum current likely to flow to earth under extreme faulty conditions. Where an effectively earthed water supply system is not available, a galvanised iron water pipe or pipes, as required by the authorised inspector, of not less than ¾ in. internal diameter shall be driven vertically into the ground to such a depth as to insure adequate contact with the moist sub-soil. The minimum buried length of the driven pipe shall be 4 ft. Alternatively, an earth plate or plates approved by the authorised inspector may be used.

1723. (a) **Position of earth wire.** The earth wire shall be placed in such a position and attached to the pipes or plates in such a manner that it cannot be accidentally damaged or cut.

(b) **Buried earthing wires.** Where an earthing lead is buried, it shall be protected in the same manner as insulated cables, installed under similar conditions.

1724. **Prohibited Connections.** Sprinkler pipes, or pipes conveying gas, hot water, or an inflammable liquid shall not be used as an earthing system.

Earthing Leads.

1733. **Accessibility.** All connections of the earthing lead to the installation and to the earthing system itself, shall be readily accessible.

1734. **Earth Clips.** Where an earthing lead is connected to a pipe a substantial earth clip, which firmly grips and makes good contact with both the metal section and the earthing lead, shall be used. Earth clips shall be made of incorrodible metal not less than No. 18 S.W.G. in thickness, and if made in one piece shall be not less than $\frac{3}{4}$ in. wide, and if made in 2 pieces shall be not less than 1 in. wide.

1736. (a) **Removal of paint, etc.** Paint, enamel compound and other non-conducting material shall be removed from the surface of contact between it and the earth lead so attached.

(b) **Connection.** The end of all earthing leads which have 7 or more strands shall be provided with soldering sockets or otherwise connected in accordance with rule 1238.

(c) **Soldering fluxes.** Soldering fluxes containing acid or other corrosive substances shall not be used.

Electricity from Supply Mains.

1684. (a) **Connection.** Electricity from supply mains shall only be conveyed to radio receiving sets through permanent wiring or through a proper authorised outlet such as a wall plug and socket.

(b) **Flexible Cords.** All flexible cords used for connection to the supply side of radio appliances shall be of circular type and class A (High insulation) as specified in rule 1221, and shall be taken direct on to suitably protected terminals on the appliance or connected thereto by means of a contact socket.

1221. Class A. High Insulation flexible cords shall be insulated in one of the following two ways :—

(i) Each conductor, which shall be composed from plain copper wire, shall be lapped with cotton and insulated with two layers of pure rubber overlapped with cotton.

(ii) Each conductor, which shall be composed of copper wires, effectively and uniformly coated with tin free from all impurities, shall be insulated with one layer of pure rubber and two layers of vulcanising rubber.

1684. (c) **Cord Grips and Bushings.** Flexible cord shall enter metal frames only through holes which are bushed by durable insulating bushings permanently fixed into position and cord grips or other approved means shall be provided to relieve the strain from the connecting terminals.

(d) **Terminals.** Exposed live terminals or contacts, directly connected to the supply mains or energised to a pressure exceeding 100 volts directly or indirectly from the supply mains. shall not be used.

Where the maximum voltage at any terminals exceeds 100 volts, such terminals shall be of the insulated pattern and shall have the extreme voltage distinctly marked upon them. Such terminals, unless within the receiving set, shall be protected by a cover.

(e) **Switches.** All switches used on the supply connections to radio receiving sets shall be of ample capacity for the current to be carried, and of suitable design for the supply voltage. Only switches of approved pattern shall be used for this purpose.

(f) **Transformers.** All transformers, including those in battery chargers, eliminators, etc., connected to supply circuits shall have independent primary and secondary windings, not connected with one another and suitable high insulation between windings.

(g) **Earthing.** Where the receiving equipment is operated by electricity from the supply mains and is used in situations where accidental contact with earth is possible, metal containing cases and exposed metal frames shall be effectively earthed.

Where used in situations where accidental contact with earth is not possible, such metal cases and exposed metal frames shall not be earthed.

Metal covers and frames of transformers shall be provided with special terminals for this purpose. Such earthing terminals shall be distinctly marked " Earth."

(h) **Danger Notice.** Every radio receiving set which is operated by connection to the electricity mains shall be provided with a suitably worded danger notice, which shall be permanently fixed on the inside of the lid, door or cover by which access is obtained to the interior of the set. This danger notice shall draw attention to the fact that the set is operated from electric light or power mains at a pressure which may be dangerous, and shall contain a warning to the user that no adjustments or alterations shall be made to the interior portions of the apparatus unless the set is disconnected from these mains.

Special Appliances.

1672. (a) **Limiting voltage.** Radio equipment shall not be connected direct to circuits of a voltage more than 5 per cent. above the operating voltage for which they were designed and manufactured.

(b) **Reduction of voltage.** No portable appliance, battery charger with exposed live terminals or appliance such as those mentioned in Clause A, shall be connected to supply mains through a resistance, auto-transformer or any appliance for reducing the pressure other than a double wound transformer or motor generator."

Aerial Wires.

Antennae is the plural of the word " antenna " which is another name for aerial. The wire gauges given in brackets are the approximate equivalents of the diameter in inches specified in the rules. For example 3/.036 in. means three strands of wire having a diameter. of 0.036 inches, equivalent to No. 20 standard wire gauge.

The wire insulation referred to as " 600 megohm grade " is a vulcanised rubber covering with an outer braid coloured black or red. It is the kind of wire used by electricians in the wiring of houses for electric light and power. The term " 600 megohm " refers to the resistance of the insulation to leakage currents through it from the wire to the outside for a piece of

the cable one mile long under certain conditions. Notice that the lead-in must not come within 12 inches of electric light or power wires unless special precautions are taken. This is a rule which should always be kept in mind, as it is very easily violated when installing lead-ins and indoor aerials.

The whole of the rules governing radio installations is given here for convenient reference. " Cutouts " mentioned in rule 1683 (vi) (b) are merely fuses which may be included in some forms of lightning arresters.

The Earth Wire.

The 7/22, 600 megohm wire specified for earthing a radio set is very thick and unwieldy ,and it is best to keep it out of sight as far as possible by leading it out of the building as near as possible to the set.

Rule 1721 is practically certain to be complied with if the size of the wire and manner of earthing specified are in order. Notice particularly that driven pipe grounds must be of galvanised pipe not less than $\frac{3}{4}$ in. inside diameter, and the minimum depth in the ground not less than 4 ft.

Care should be taken that the earth wire is protected against possible mechanical damage. The specifications for the earth clamp should be kept in mind when buying these small devices. Most clamps do not comply with these requirements.

Rule 1736 (b) should not be overlooked. Earth leads for radio have 7 strands, and the bared ends must be rendered solid, either be soldering or by the use of a cable socket or lug such as is used in electrical work.

Power Connections.

The kind of flexible cord to be used for connection to the power socket must be rubber-insulated and further protected mechanically either by tough rubber compound (known as " Cabtyre flex ") or by compounded hemp, cotton, or jute with a hard cord braiding (known as " workshop flex "). The size of the conductor should be 40/.0076 in. (40/36). Note that an insulating bushing must be used where the cord enters a metal frame or chassis of the receiver, and that the connecting terminals must be relieved of mechanical strain. Both these details are important from every point of view.

Rule 1684 (d), (g), (h) mainly concerns the designer of receivers, but should be carefully noted so that the man making an installation can be assured of the receiver complying with the rules in these respects.

Inductive and Capacitive Reactances.

The following tables give the reactances of coils and condensers at various frequencies. It should be noted that the ripple frequency of 50 cycles after *full*-wave rectification is 100 cycles.

Inductance (Henries)	Reactance in Ohms at Various Frequencies.				
	Audio & Power Freq. (cycles).			Radio Freq. (K.c.)	
	50	100	3,000	175	1,000
250	78,000	157,000	4,700,000	—	—
50	15,700	31,000	940,000	—	—
30	9,400	18,800	560,000	—	—
20	6,300	12,600	380,000	—	—
15	4,700	9,400	280,000	—	—
1	310	630	18,800	1,100,000	6,300,000
.1	31	63	1,880	110,000	630,000
.01	3.1	6.3	188	11,000	63,000
200 Micro H.	.063	.126	3.8	220	1,260

Capacity in Mfds.	Reactance in Ohms at Various Frequencies.				
	Audio & Power Freq. (cycles)			Radio Freq. (K.c.).	
	50	100	3,000	175	1,000
.00003	—	—	180,000	30,000	5,300
.0001	—	—	530,000	9,100	1,600
.00025	—	—	210,000	3,600	640
.0005	—	—	106,000	1,800	320
.001	3,200,000	1,600,000	53,000	910	160
.006	530,000	260,000	8,900	150	27
.01	320,000	160,000	5,300	91	16
.1	32,000	16,000	530	9.1	1.6
.5	6,400	3,200	106	1.8	.32
1	3,200	1,600	53	.91	.16
2	1,600	800	26	.45	.08
4	800	400	13	.23	.04
8	400	200	6.5	.11	.02
25	125	63	2.1	.04	.01

It is to be noted that the capacity between plate lead and earth in a screen grid valve (inter-electrode plus circuit) is of the order of .00003 mfd.

Wire Tables.

B.E.S.A. STANDARD SIZES OF ANNEALED COPPER WIRES.

Superseded S.W.G. Size	Standard Diameter		Calculated Sectional Area		Weight per. 1,000 yards Pounds	Standard Resistance at 60° F.		Current rating Amperes @
	Inch	M/m.	Square Inch	Square M/m.		Per 1000 yds. Ohms	Per lb. Ohms	1,000 per Sq. Inch
50	**.0010**	**.0254**	**.0000007854**	**.0005067**	**.009083**	**30570**	**3365000**	**.0008**
49	.0012	.0305	.0000011310	.0007297	.013079	21230	1623000	.0011
48	**.0016**	**.0406**	**.000002011**	**.0012972**	**.02325**	**11941**	**513500**	**.0020**
47	.0020	.0508	.000003142	.002027	.03633	7642	210300	.0031
46	**.0024**	**.0610**	**.000004524**	**.002019**	**.05232**	**5307**	**101440**	**.0045**
45	.0028	.0711	.000006158	.003973	.07121	3899	54750	.0062
44	**.0032**	**.0813**	**.000008042**	**.005189**	**.09301**	**2985**	**32090**	**.0080**
43	.0036	.0914	.000010179	.006567	.11772	2359	20040	.0101
42	**.0040**	**.1016**	**.000012566**	**.008107**	**.14533**	**1910.5**	**13146**	**.0126**
41	.0044	.1118	.000015205	.009810	.17585	1578.9	8979	.0152
40	**.0048**	**.1219**	**.000018096**	**.011675**	**.2093**	**1326.7**	**6340**	**.0181**
39	.0052	.1321	.00002124	.013701	.2456	1130.5	4603	.0212
38	**.0060**	**.1524**	**.00002827**	**.018241**	**.3270**	**849.1**	**2597**	**.0283**
37	.0068	.1727	.00003632	.02343	.4200	661.1	1574.0	.0363
36	**.0076**	**.1930**	**.00004536**	**.02927**	**.5246**	**529.2**	**1008.7**	**.0454**
35	.0084	.2134	.00005542	.03575	.6409	433.2	676.0	.0554
34	**.0092**	**.2337**	**.00006648**	**.04289**	**.7688**	**361.2**	**469.8**	**.0665**
33	.0100	.2540	.00007854	0.5067	.9083	305.7	336.5	.0785
32	**.0108**	**.2743**	**.00009161**	**.05910**	**1.0594**	**262.1**	**247.4**	**.0916**
31	.0116	.2946	.00010568	.06818	1.2222	227.2	185.87	.1057
30	**.0124**	**.3150**	**.00012076**	**.07791**	**1.3966**	**198.80**	**142.35**	**.1208**
29	.0136	.3454	.00014527	.09372	1.6800	165.27	98.37	.1453
28	**.0148**	**.3759**	**.00017203**	**.11099**	**1.9895**	**139.55**	**70.14**	**.1720**
27	.0164	.4166	.0002112	.13628	2.443	113.65	46.52	.2112
26	**.018**	**.4572**	**.0002545**	**.16417**	**2.943**	**94.35**	**32.06**	**.2545**
25	.020	.5080	.0003142	.2027	3.633	76.42	21.03	.3142
24	**.022**	**.5588**	**.0003801**	**.2453**	**4.396**	**63.16**	**14.366**	**.3801**
23	.024	.6096	.0004524	.2919	5.232	53.07	10.144	.4524
22	**.028**	**.7112**	**.0006158**	**.3973**	**7.121**	**38.99**	**5.475**	**.6158**
21	.032	.8128	.0008042	.5189	9.301	29.85	3.209	.8042
20	**.036**	**.9144**	**.0010179**	**.6567**	**11.772**	**23.59**	**2.004**	**1.0179**
19	.040	1.0160	.0012566	.8107	14.533	19.105	1.3146	1.2566
18	**.048**	**1.2192**	**.0018096**	**1.1675**	**20.93**	**13.267**	**.6340**	**1.8096**
17	.056	1.4224	.002463	1.5890	28.48	9.747	.3422	2.463
16	**.064**	**1.6256**	**.003217**	**2.0755**	**37.20**	**7.463**	**.2006**	**3.217**
15	.072	1.8288	.004072	2.6268	47.09	5.897	.12523	4.072
14	**.080**	**2.0320**	**.005027**	**3.2429**	**58.13**	**4.776**	**.08216**	**5.027**
13	.092	2.3368	.006648	4.2888	76.88	3.612	.04698	6.648
12	**.104**	**2.6416**	**.008495**	**5.4805**	**98.24**	**2.826**	**.02877**	**8.495**
11	.116	2.9464	.010568	6.8183	122.22	2.272	.018587	10.568
10	**.128**	**3.2512**	**.012868**	**8.3019**	**148.82**	**1.8657**	**.012537**	**12.868**
9	.144	3.6576	.016286	10.5071	188.34	1.4741	.007827	16.286
8	**.160**	**4.0640**	**.02011**	**12.9717**	**232.5**	**1.1941**	**.005135**	**20.11**
7	.176	4.4704	.02433	15.6958	281.4	.9868	.003507	24.33
6	**.192**	**4.8768**	**.02895**	**18.6792**	**334.8**	**.8292**	**.002476**	**28.95**
5	.212	5.3848	.03530	22.7734	408.2	.6801	.0016661	35.30
4	**.232**	**5.8928**	**.04227**	**27.2730**	**488.9**	**.5679**	**.0011617**	**42.27**
3	.252	6.4008	.04988	32.1780	576.8	.4814	.0008345	49.88
2	**.276**	**7.0104**	**.05983**	**38.5990**	**691.9**	**.4013**	**.0005800**	**59.83**
1	.300	7.6200	.07069	45.6037	817.5	.3396	.0004155	70.69
1/0	**.324**	**8.2296**	**.08245**	**53.1921**	**953.5**	**.2912**	**.0003054**	**82.45**
2/0	.348	8.8392	.09511	61.3643	1100.0	.2524	.0002295	95.11
3/0	**.372**	**9.4488**	**.10869**	**70.1202**	**1256.9**	**.2209**	**.00017574**	**108.69**
4/0	.400	10.1600	.12566	81.0732	1453.3	.19105	.00013146	125.66
5/0	**.432**	**10.9728**	**.14657**	**94.5638**	**1695.1**	**.16379**	**.00009663**	**146.57**
6/0	.464	11.7856	.16909	109.0921	1955.5	.14198	.00007260	169.09
7/0	**.500**	**12.7000**	**.19635**	**126.6769**	**2271.0**	**.12227**	**.00005385**	**196.35**

NICKEL CHROME RESISTANCE WIRE.

Size S.W.G.	Approximate Resistance per 1,000 yards. Standard Ohms. 200° C.	400° C.	600° C.	Approximate Amperes at— 200° C.	400° C.	600° C.	Weight per 1,000 yards. lbs.
16	452	494	538	7.1	12	18	37.6
17	591	646	703	6.0	9.6	14	28.9
18	802	879	957	4.3	7.7	11	21.2
19	1154	1266	1378	3.7	5.7	8.4	14.8
20	1426	1590	1700	3.2	4.7	6.8	12.0
21	1809	1978	2151	2.7	4.2	6.2	9.41
22	2360	2583	2820	2.2	3.5	5.1	6.71
23	3237	3535	3860	1.8	2.8	4.1	5.31
24	3828	4187	4555	1.6	2.4	3.3	4.46
25	4732	5061	5505	1.4	2.1	3.1	3.69
26	5720	6250	6870	1 1	1.9	2.6	2.98
27	6890	7535	8400	1.0	1.6	2.4	2.48
28	8460	9250	10070	.93	1.4	2.0	1.95
29	10000	10950	11920	.78	1.3	1.8	1.69
30	12040	13170	14320	.68	1.1	1.6	1.42
31	13760	15040	16370	.61	.88	1.3	1.246
32	15880	17360	18900	.55	.80	1.2	1.076
33	18530	20250	22050	.50	.72	1.1	.924
34	21880	23920	26100	.43	.63	.93	.781
35	26250	28700	31500	.37	.56	.83	.651
36	32200	35070	38380	.32	.49	.72	.532
37	40100	43800	49000	.29	.43	.63	.424
38	51400	56300	61270	.21	.34	.49	.3318
39	68500	74900	81500	.17	.26	.39	.250
40	80200	87900	95700	.16	.24	.35	.212

EUREKA RESISTANCE WIRE.

Current Necessary to Maintain Given Temperature Rise. Wire Coiled in Air With Free Radiation.

Size S.W.G.	Diam. Inch.	M/m.	Amperes for a Temperature rise of 100° C.	200° C.	300° C.	Resistance per 1,000 yards at 60°F. Ohms.	Weight per 1,000 yards lbs.
8	.160	4.06	33.0	52	58.5	33.5	233.5
9	.144	3.65	26.0	43	50	41.3	189.0
10	.128	3.25	22.8	36	41.5	52.3	149.2
11	.116	2.94	19.0	30	35.5	63.7	122.8
12	.104	2.64	16.8	24.	29.5	79.3	98.6
13	.092	2.33	12.7	20	24.2	101.3	77.1
14	.080	2.03	9.5	15	19.5	133.9	58.4
15	.072	1.82	7.4	12.6	16.8	165.3	47.3
16	.064	1.62	6.0	10.4	14.3	209.4	37.4
17	.056	1.42	5.3	8.8	11.3	273.3	28.6
18	.048	1.21	4.3	7.0	9.1	371.8	21.0
19	.040	1.01	3.7	5.5	6.8	535.6	14.6
20	.036	.91	3.0	4.7	5.9	661.3	11.8
21	.032	.81	2.8	4.0	5.0	837.2	9.35
22	.028	.71	2.2	3.2	4.1	1093	7.15
23	.024	.60	1.8	2.6	3.3	1487	5.24
24	.022	.55	1.5	2.3	2.8	1770	4.41
25	.020	.50	1.25	2.0	2.5	2142	3.64
26	.018	.45	1.00	1.7	2.1	2645	2.96
27	.0164	.41	.90	1.5	1.9	3186	2.46
28	.0148	.37	.76	1.4	1.6	3914	2.00
29	.0136	.34	.68	1.2	1.5	4634	1.69
30	.0124	.31	.59	1.0	1.3	5575	1.40
31	.0116	.29	.52	.90	1.00	6370	1.23
32	.0108	.27	.47	.81	.95	7350	1.06
33	.0100	.25	.42	.74	.85	8571	.912
34	.0092	.23	.37	.64	.75	10128	.771
35	.0084	.21	.33	.56	.65	12149	.644
36	.0076	.19	.28	.48	.57	14840	.526
37	.0068	.17	.26	.43	.51	18536	.421
38	.0060	.15	.19	.31	.40	23808	.328
39	.0052	.13	.16	.26	.31	31696	.246
40	.0048	.12	.15	.24	.28	37184	.210
41	.0044	.11	.14	.21	.26	44268	.176
42	.0040	.10	.13	.18	.23	53564	.146
43	.0036	.09	.11	.17	.20	66136	.118
44	.0032	.08	.10	.14	.17	83664	.093
45	.0028	.07	.08	.13	.15	108648	.072
46	.0024	.06	.07	.10	.12	148764	.053
47	.0020	.05	.05	.08	.10	214284	.036
48	.0016	.040	.04	.060	.075	334000	.023
49	.0012	.030	.03	.045	.055	595000	.013
50	.0010	.025	.02	.030	.040	855000	.009

Standard Colour Coding for Resistors.

In the RMA (American) standard coding, ten colours are assigned to the figures as shown in the following table :

Figure	Colour	Figure	Colour
0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Gray
4	Yellow	9	White

The body (A) of the resistor is coloured to represent the first figure of the resistance value. One end (B) of the resistor is coloured to represent the second figure. A band, or dot (C) of colour, representing the number of ciphers following the first two figures, is located within the body colour. The two diagrams illustrate two interpretations of this standard method of coding resistance value.

Examples :—	A		B		C	
10 ohms	Brown	(1)	Black	(0)	Black	(No Ciphers)
200 ohms	Red	(2)	Black	(0)	Brown	(One ,,
3,400 ohms	Orange	(3)	Yellow	(4)	Red	(Two ,,
40,000 ohms	Yellow	(4)	Black	(0)	Orange	(Three ,,
44,000 ohms	Yellow	(4)	Yellow	(4)	Orange	(Three ,,

A leading Australian manufacturer is endeavouring to have the following colour code for resistors adopted as standard in Australia. It is printed in the hope of furthering this laudable effort.

The nine coloured circles indicatethe figures one to nine. The coloured squares indicate—according to the same scheme, the number of ciphers which follow the figures.

EXAMPLE : O = 100,000 ohms.
Brown Green

The Brown circle indicates the figure 1, the Green square indicates that five ciphers follow. Decimals are indicated by a dot.

EXAMPLE : .O = 0.1 ohms.
Brown

Colour	CIRCLE Figures	SQUARE Ciphers
BROWN	= 1	= 0
RED	= 2	= 00
ORANGE	= 3	= 000
YELLOW	= 4	= 0000
GREEN	= 5	= 00000
BLUE	= 6	= 000000
VIOLET	= 7	= 0000000
GREY	= 8	———
WHITE	= 9	———

Comparative Table of Wire Gauges.

No.	British Standard Gauge S.W.G.	American Gauge A.W.G. or B. & S.	No.	British Standard Gauge S.W.G.	American Gauge A.W.G. or B. & S.
	Diam. Ins.	Diam. Ins.		Diam. Ins.	Diam. Ins.
7/0	.500	—	23	.024	.0226
6/0	.464	—	24	.022	.0201
5/0	.432	—	25	.020	.0179
4/0	.400	.4600	26	.018	.0159
3/0	.372	.4096	27	.0164	.0142
2/0	.348	.3648	28	.0148	.0126
0	.324	.3249	29	.0136	.0113
1	.300	.2893	30	.0124	.0100
2	.276	.2576	31	.0116	.0089
3	.252	.2294	32	.0108	.0080
4	.232	.2043	33	.0100	.0071
5	.212	.1819	34	.0092	.0063
6	.192	1.620	35	.0084	.0056
7	.176	.1443	36	.0076	.0050
8	.160	.1285	37	.0068	.0045
9	.144	.1144	38	.0060	.0040
10	.128	.1019	39	.0052	.0035
11	.116	.0907	40	.0048	.0031
12	.104	.0808	41	.0044	——
13	.092	.0720	42	.0040	——
14	.080	.0641	43	.0036	——
15	.072	.0571	44	.0032	——
16	.064	.0508	45	.0028	——
17	.056	.0453	46	.0024	——
18	.048	.0403	47	.0020	——
19	.040	.0359	48	.0016	——
20	.036	.0320	49	.0012	——
21	.032	.0285	50	.0010	——
22	.028	.0253			

Melting and Boiling Points of Common Substances.

Substance	Melting Point °C	Melting Point °F	Boiling Point °C	Boiling Point °F
Aluminium ...	657	1115	1800	3270
Copper	1083	1982	2310	4190
Iron	1530	2790	2450	4440
Lead	327	620	1525	2755
Tin	232	449	2270	4115
Zinc	418	785	918	1685
Beeswax ...	61	142	—	—
Stearin	71	160	—	—
Paraffin Wax,				
Soft ...	38–52	100–126	350–390	660–735
Hard ...	52–56	126– up	390–430	735–805

Whitworth Threads.

Diam.	Diam. at Bottom of Thread.	Threads per inch.	Diam.	Diam. at Bottom of Thread.	Threads per inch.
1/4 in.	.186	20	1 1/4 in.	1.067	7
3/8 in.	.295	16	1 1/2 in.	1.286	6
1/2 in.	.393	12	1 3/4 in.	1.494	5
5/8 in.	.508	11	2 in.	1.715	4 1/2
3/4 in.	.622	10	2 1/2 in.	2.180	4
1 in.	.840	8	3 in.	2.634	3 1/2

Drills for Tapping and Clearing B.A. Sizes.

B.A. Size.	Tapping (ins.).	Clearing (ins.).
0	13/64	17/64
1	11/64	7/32
2	5/32	13/64
3	9/64	3/16
4	1/8	5/32
5	3/32	1/8
6	5/64	5/64
8	3/64	5/64

Standard Times.

Referred to Greenwich Time.

Great Britain, France, Portugal, Belgium, Spain, Ireland	Greenwich time
Austria, Denmark, Germany, Italy, Norway, Switzerland	,, ,, 1 hour fast
British South Africa, Egypt, Turkey	1 1/2 or 2 hours fast
Japan	9 hours fast
Australia	8, 9 1/2 or 10 hours fast
New Zealand	11 1/2 hours fast
Canada and United States	4, 5, 6, 7 or 8 hours slow.

Dielectric Strengths.

Material	Volts per mm.
Bakelite	6, to 30,000
Glass	8,000
Paraffin	12,000
Micanite	40,000
Ebonite	30,000
Porcelain	10,000
Empire Cloth	10,000
Presspahn	5,000
Fibre	3, to 16,000

Two sharp points in air 10 inches apart will flash over at about 100,000 volts.

To obtain volts per mil divide the figures given above by 39.

To obtain volts per 1/16 inch multiply the figures given above by 1.6.

Dielectric Constants.

Material.	K	Material.	K
Ebonite	2.7 – 2.9	Resin	1.8 – 2.6
Glass, crown	5 – 7	Shellac	3 – 3.7
,, hard	7 – 9	Silica, fused	3.5 – 3.6
,, flint	7 – 10	Sulphur	3.6 – 4.3
,, mirror	6 – 7	Vaseline	2.2
Ice (–2° C)	93.9	Oil, castor	4.6 – 4.8
Indiarubber	2.1 – 2.3	,, Olive	3.1 – 3.2
Marble	8.3	,, Paraffin	4.6 – 4.8
Mica	5.7 – 7	,, Vaseline	1.9
Paper, dry	2 – 2.5	Water	81
Paraffin wax	2 – 2.3	,, =36 m.	3.32
Pitch	1.8	,, =12 m.	2.79
Porcelain	4.4 – 6.8	Air 0° C.	1.000586
Quartz	4.5	,, 20° C.	1.000576

Gases all have a value of "k" near to one while a rise in temperature causes a fall in "k." The dielectric constant is also known as the specific inductive capacity or S.I.C.

Units and Their Symbols.

(Used after numerical values.)

	Unit of	Symbol
Ampere	Current	A
Coulomb	Quantity	C
Farad ...	Capacity	F
Henry ...	Inductance	H
Joule ...	Energy	J
Ohm ...	Resistance	Ω
Volt ...	Electromotive Force ...	V
Watt ...	Power	W

International Symbols of Quantities.

Acceleration of gravity	g
Angles	α β 8
Capacity	C
Conductance	G
Current	I
Dielectric constant	k, ε
Difference of potential	V
Efficiency	η
Electromotive force	E
Energy or work	W
Flux density (electrostatic)	D
Flux density (magnetic)	B
Frequency	f
Impedance	Z
Intensity of magnetisation	J
Length	l
Mass	m
Magnetic field	H
Magnetic flux	Φ
Magnetomotive force	*
Mutual inductance	M
Permeability	μ
Phase displacement	φ
Power	P
Quantity of electricity	Q
Reactance	X
Reluctance	S
Resistance	R
Resistivity	ϱ
Self-inductance	L
Susceptibility	K
Temperature	T
Time	t
Work	A

*Symbol yet to be fixed.

Units and Their Equivalents.

This table shows the relation between electrical and mechanical units. It enables any conversion to be made.

One ft.-lb.	= 1 lb. raised 1 foot high.
One B.Th.U.	= 1 lb. of water raised 1° F.
,,	= 778.8 ft.-lb.
,,	= 1,005 joules.
,,	= 0.252 kilogram calories.
One H.P. Hour	= 0.746 kw. hour.
,,	= 1,980,000 ft.-lb.
,,	= 2,545 B.T.U.'s.
One kw. hour	= 1,000 watt hours.
,,	= 1.34 H.P. hours.
,,	= 3,412 B.T.U's.
,,	= 2,654,200 ft.-lb.
,,	= 3,600,000 joules.
One H.P.	= 746 watts.
,,	= 0.746 kw.
,,	= 33,000 ft.-lb. per minute.
,,	= 550 ft. lb. per second.
,,	= 2,545 B.T.U.'s per hour.
,,	= 42.4 B.T.U.'s per minute.
,,	= 0.707 B.T.U.'s per second.

Decimal Equivalents of Sixteenths.

1	sixteenth	= .0625
2	,,	= .125
3	,,	= .1875
4	,,	= .25
5	,,	= .3125
6	,,	= .375
7	,,	= .4375
8	,,	= .5
9	,,	= .5625
10	,,	= .625
11	,,	= .6875
12	,,	= .75
13	,,	= .8125
14	,,	= .875
15	,,	= .9375

Inches and Fractions as Decimal Equivalents of One Foot.

Inches.	Fraction.			
	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
0	.0000	.0208	.0417	.0625
1	.0833	.1042	.125	.1458
2	.1667	.1875	.208	.229
3	.250	.270	.291	.312
4	.333	.354	.375	.395
5	.416	.437	.458	.479
6	.500	.520	.541	.562
7	.583	.604	.625	.645
8	.666	.687	.708	.729
9	.750	.770	.791	.812
10	.833	.854	.875	.895
11	.916	.937	.958	.979

Handy Factors.

π	3.14159
π^2	9.8696
$\pi/4$	.7854
$1/\pi$	.3183
1 radiam	57.3°
e	2.718
$\log_{10}e$	2.3026

Symbols and Abbreviations.

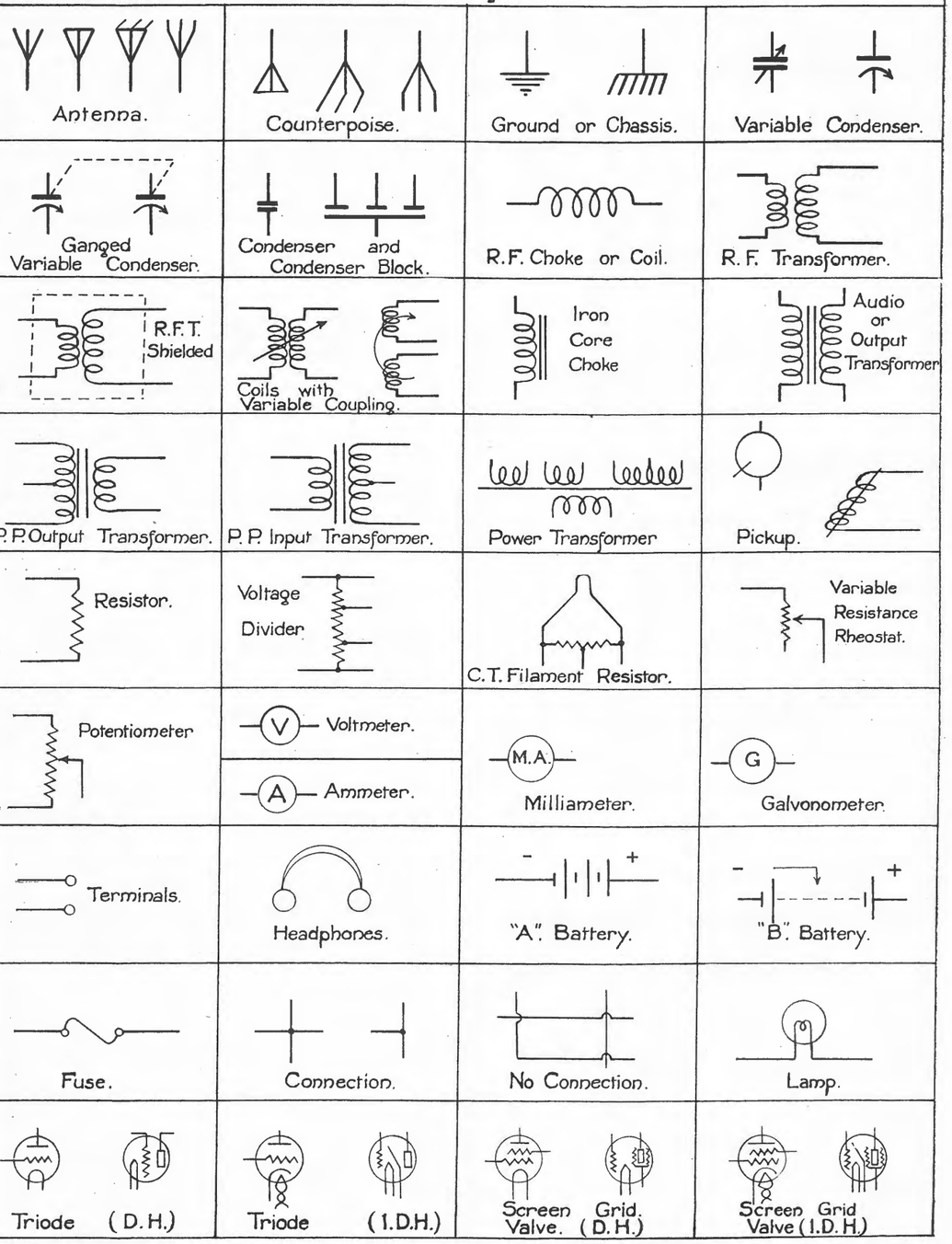
In the radio language (in many cases a closed book to the man in the street) there naturally occur many symbolical representations both pictorial and literal, which are in the nature of a shorthand. It is unfortunate that there is no universally accepted standard in this regard but certain symbols have become universally recognised through long usage. The pictorial and graphical representations of components shown here may be accepted as the custom in Australia. In some cases, of course, there are a number of different symbols for the same part, and here each one will be found.

Many literal symbols or abbreviations given in the table below are internationally accepted while the remainder are those adopted as standard by the R.M.A. in the United States. Many of the abbreviations are given in lower-case letters and should, of course, be capitalised in the same way as ordinary words which are used to begin a sentence, etc. A two-word adjectival expression should contain a hyphen in the abbreviation. The Greek letter μ is sometimes written "mu." The nouns "alternating current" and "direct current" will, of course, often be seen abbreviated a.c. and d.c., while amp. is a common abbreviation for ampere.

The adjectival expressions which according to the R.M.A. standard should be abbreviated with a hyphen are commonly written in Australia as two letters each followed by a full stop, but at the same time it would be desirable to follow the American system in this connection for the sake of standardisation.

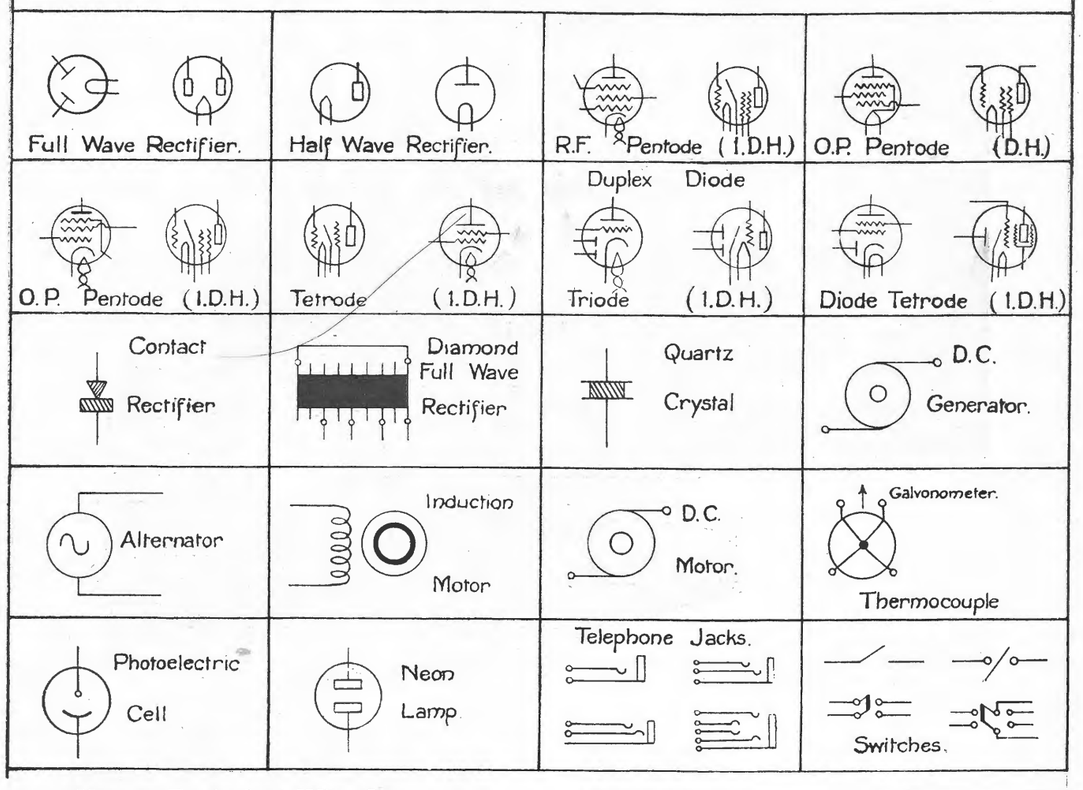
Term.	*Abbreviation or letter-symbol.*
Alternating-current (adjective)	a.c.
Alternating current	spell out
Ampere	a
Antenna	ant.
Audio-frequency (adjective)	a-f.
Continuous waves	CW
Cycles per second	~
Decibel	db
Direct-current (adjective)	d-c
Direct current	spell out
Electromotive force	e.m.f.
Frequency	f
Ground	Gnd.
Henry	H
Intermediate-frequency (adjective)	i-f
Interrupted continuous waves	ICW
Kilocycles (per second)	kc
Kilowatt	kw
Megohm	MΩ
Microfarad	μf
Microhenry	μh
Micromicrofarad	$\mu\mu$f
Microvolt	μv
Microvolt per meter	μv/m
Millivolt per meter	mv/m
Milliwatt	mw
Ohm	Ω
Power Factor	p.f.
Radio-Frequency (adjective)	r-f.
Volt	v

Radio Symbols.



SEE PREVIOUS PAGE FOR EXPLANATION OF SYMBOLS.

Radio Symbols.



Nearest Equivalent Wire Gauges.

S.W.G.	Nearest Equivalent	S.W.G.	Nearest Equivalent	S.W.G.	Nearest Equivalent B. & S.
7/0	4/0	13	11	31	29
6/0	4/0	14	12	32	29
5/0	3/0	15	13	33	30
4/0	3/0			34	31
3/0	2/0	16	14	35	32
2/0	0	17	15		
0	0	18	17	36	32
		19	18	37	33
1	1	20	19	38	34
2	1			39	36
3	2	21	20	40	36
4	3	22	21		
5	4	23	22	41	37
		24	23	42	38
6	5	25	24	43	39
7	5			44	40
8	6	26	25	45	40
9	7	27	26		
10	8	28	27	46	40
		29	27	47	40
11	9	30	28	48	40
12	10			50	40

An Explanation of Superheterodynes.

The superheterodyne receiver has been resurrected in the last year or two with the object of overcoming some of the difficulties which are present in the ordinary type of tuned R.F. receiver. Before considering the superheterodyne principle in detail, it is desirable to review briefly the T.R.F. system.

In the T.R.F. type of receiver a number of tuned amplifier circuits are adjusted to the frequency of a required station by means of a gang condenser operated by a single dial. It is obvious that all these tuned circuits will have to track accurately with each other from a frequency of about 550 to about 1500 K.C. In addition any band pass or preselector circuits which are sometimes introduced before the first R.F. stage, will introduce further complications in the tracking if they are to be adjusted correctly over the whole range of frequencies. Further, apart from any tracking difficulties, a comparatively low gain per stage is obtained.

Due to the resultant instability *if* a high gain per stage is designed for, trouble will be experienced with self-oscillation. For this reason it is not possible to make use of the most efficient coils, so that a gain per stage of 40 or 50 is rarely exceeded in a T.R.F. receiver, even when screen grid valves are employed.

Many other troubles will be found, more particularly that of varying gain over the frequency spectrum. In the ordinary type of R.F. transformer the field of the primary will be considerably greater at higher frequencies so that higher voltages will be induced into the secondary at the higher frequency end of the scale. This is not such a serious objection as it may seem at first sight, for R.F. transformers may be obtained in which the primary consists of a bobbin or honeycomb wound choke, in some cases not even coupled to the secondary, which resonates at a frequency slightly below the broadcast spectrum, *i.e.* about 450 K.C. Coupling is obtained mainly by means of a small capacity usually introduced by a single turn around the top of the secondary. Due to the lower reactance of the coupling capacity at higher frequencies, an increasing amount of energy is fed into the grid circuit of the R.F. stage as the frequency is increased. On the other hand, due to the resonance of the primary choke, an increasing amount of energy is fed to the grid circuit as the frequency is decreased from about the middle of the scale. By this means a response curve, which rises at both ends of the frequency scale, is obtained. However, even this system has the disadvantage of an apparently poor response at the middle of the broadcast spectrum.

The Superheterodyne System.

In a superheterodyne receiver, instead of amplifying the R.F. signal at its own particular frequency, by means of tuned circuits which must each be adjusted to that particular frequency, the signal frequency is changed to a certain lower and fixed frequency, so that it can be amplified by means of a fixed tuned amplifier. This lower frequency is called the intermediate frequency, and the amplifier, the intermediate or I.F. amplifier.

The various signals induced in the aerial are fed to either an R.F. amplifier in the superhet at the original frequency, which is usually employed for the purposes of selectivity rather than amplification, or perhaps straight to the first detector, or so-called modulator valve. It is in one of the circuits associated with this valve that the incoming signal is mixed with a stead signal or oscillation generated locally. This loca oscillator generates energy at a frequency which differs from the incoming signal frequency by a fixed amount, equal to the frequency at which the intermediate amplifier operates.

The mixing of these two oscillations causes a beat frequency which is selected and amplified by the I.F. amplifier. This signal at the beat or intermediate frequency, is modulated by the same envelope or audio frequencies as the incoming signal.

After intermediate amplification, this beat frequency is rectified or demodulated by the second detector, and amplified at audio frequency before passing to the loud-speaker. It should be noted that the use of an R.F. amplifier stage ahead of the first detector is not at all necessary for the sake of sensitivity, but if the receiver is to be operated anywhere close to a powerful station, trouble may be experienced with cross-modulation, unless this stage is inserted. On the other hand, by suitable design, cross-modulation may be eliminated even when employing only a single tuned circuit between the aerial and the first detector.

Advantages.

The superheterodyne tuner has two distinct advantages which the T.R.F. receiver can never possess. In the super, so-called " arithmetical " selectivity is obtained. This is to be explained later. In addition, the amplification occurs at a comparatively low and fixed frequency, normally 175 K.C. in most modern superheterodynes. For this reason, each I.F. stage can be designed to give a gain of about 60 tousing 80, screen grid valves. Of course, in exceptionally well designed receivers, this figure will be far surpassed. About half this gain is obtained per stage in a T.R.F. receiver. Further, it is possible to so design the I.F. circuits, that almost square top tuning is obtained. This means a high degree of selectivity and at the same time no appreciable side band cutting.

While T.R.F. receivers can be built to be just as sensitive as superheterodynes, and just as selective, it is far harder to avoid sideband cutting over the whole of the broadcast range. In fact, a T.R.F. receiver, equally sensitive with as superheterodyne, will probably give better results on far distant stations, since if both are well designed, the T.R.F. receiver will have a slightly lower noise level.

On the other hand, this does not outweigh the more numerous advantages of the super.

The Occurrence of Beat Frequencies.

To understand the phenomenon of beat frequencies, it is first desirable to consider the occurrence of beats with regard to sound waves. If we strike the note middle C on the piano, we hear a note with a frequency of 256. If now a second note is struck with a frequency of 252, so that both strings are vibrating at the same instant, we will hear a note which is slightly different from either of the two component tones and which regularly swells and diminishes at the rate of four times per second. The figure 4 is obtained as the difference between the two component frequencies, viz., 256 and 252. The actual frequency of the tone which is heard is not strictly a frequency at all, since it varies slightly. It is, however, approximately equal to the mean of the two frequencies, or 254.

In addition, a weak vibration with an amplitude equal to the sum of the two components, will be present, but probably not audibly.

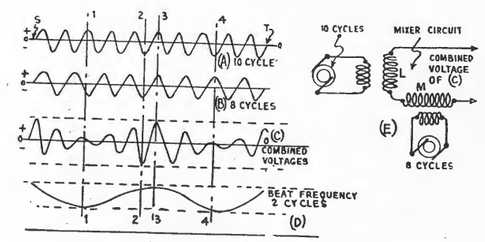
This same phenomenon occurs when two alternating currents of slightly different frequencies are mixed or imposed upon each other in any circuits. E.g. referring to Fig. 1, a circuit will be seen in which oscillations of 100 cycles and 80 cycles per second are mixed. On the left hand side of the diagram will be seen the graphical representation of what is occurring in the mixing circuits. Reading down from the top the hundred cycle sine wave is first represented, then the 80 cycle. The third graph C, represents the combined voltage output when these two oscillations are mixed. It is easily seen that the amplitude of the resultant oscillations is varying slowly as shown in the fourth graph. The rate of variation is easily seen to be 20 times per second, or the difference between the original frequencies.

In combining the two voltages graphically as shown, the procedure is extremely simple. Starting at the point S, through which the vertical labelled "O" passes, the voltage of each alternator is zero. Hence, the resultant voltage is also zero. Referring next to the vertical labelled "1," the voltage from the 100 cycle alternator is at its maximum positive value, while that from the 80 cycle alternator is at a negative value of about two thirds of its maximum. The combined resultant of these two is thus a positive voltage having a value of one third of the maximum amplitude.

Considering next the vertical labelled "2," it will be seen that both waves are very nearly at their maximum negative values. Thus, the resultant is a negative voltage which has a value practically double that of the amplitude of each individual wave.

Half a cycle later, considering the vertical "3", both waves have their maximum positive value, so that the resultant has its maximum positive value at the same instant. At the vertical "4" the voltage is again practically cancelled.

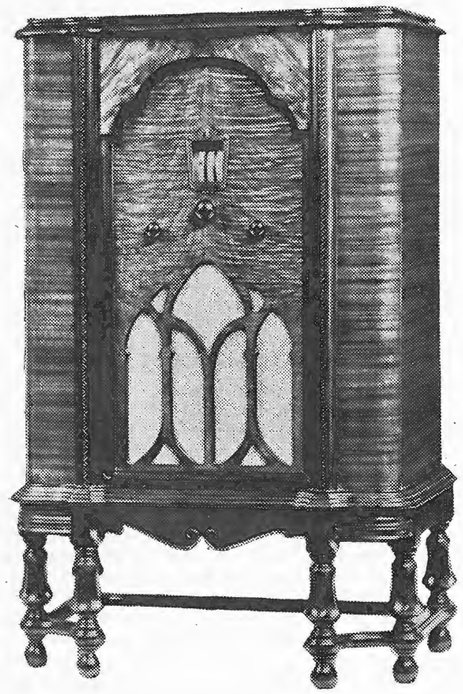
With the fourth graph labelled D the envelope of the value of the amplitude of the combined voltage has been drawn and it is easy to see that this is a current wave of frequency 20 cycles.



The Principle Applied to Superheterodynes.

Considering now an actual example of the beat action which occurs in the superhets, suppose that we wish to receive the signal from a broadcasting station transmitting on a frequency of 1,000 K.C. Further suppose that this is being modulated by a constant frequency 2,000 cycle note from the studio. We will assume that the intermediate amplifiers are tuned to a frequency of 175 K.C. as this is the case of the majority of superhets. The desired signal is picked up and transferred to the grid circuit of first detector stage, either immediately or through an R.F. amplifier and here it is mixed with the steady A.C. voltage produced by local oscillator in the receiver. This circuit or the grid circuit of the first detector valve is known as the mixer circuit.

Since our intermediate amplifiers are adjusted to a frequency of 175 K.C. the oscillator will have to operate on a frequency of either 1175 K.C. or 825 K.C. For various reasons it has been found preferable to use the higher of these two frequencies. Actually in the mixer circuit we have present a constant oscillation frequency 1175 and an oscillation of frequency 1,000 K.C. modulated at 2,000 cycles. These will combine as we have seen above and produce a quasi-frequency of 1087.5 K.C. which is itself modulated at the beat frequency or 175 K.C. Further since one of the original components was modulated at 2,000 cycles the complete resultant will also be modulated at 2,000 cycles. We have thus an oscillation at radio frequency which is modulated by a complex wave of frequency 175 K.C. This somewhat complicated voltage is, of course, applied to the grid of the first detector valve, which, demodulates the complex wave by the ordinary operation of a detector valve. By reason of the square law characteristic of the first detector valve and the fact that a circuit tuned to 175 K.C. is present in the plate circuit, the modulated 175 K.C. oscillation present in the plate circuit after detection is selected and passed on usually by the ordinary method of inductive coupling to the intermediate amplifier.



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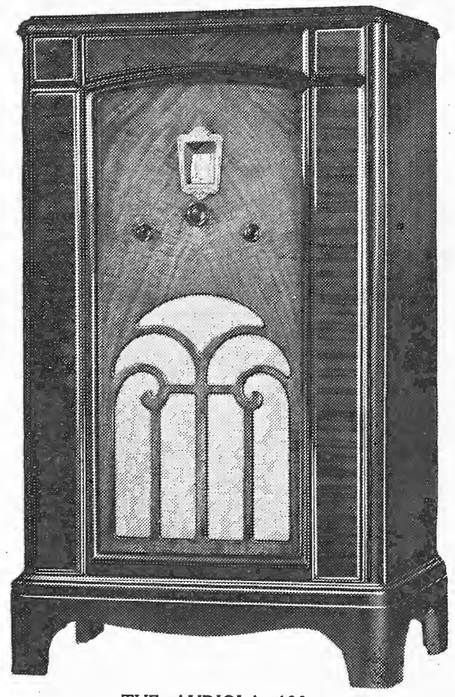

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Sensitivity.

The output or 175 K.C. voltage from the first detector depends upon a number of things. Going back from the plate circuit of the first detector we see first that the output is dependent upon the efficiency of the first detector as a rectifier. While it is justly claimed that the grid leak and condenser method of detection is more sensitive than the bias detector it has other disadvantages which usually debar it from use. Perhaps the chief of these is the trouble which is experienced with the tracking using a grid leak and condenser type of first detector. Further with the use of a small condenser with a high value grid leak as used for the purpose of gaining sensitivity the constant oscillator voltage present in the grid circuit very easily overloads the valve and quite upsets the normal operation. For example switching the oscillator on and off will cause a large variation in plate current of the first detector. This disadvantage does not occur when a bias detector is used.

It is obvious that the intermediate frequency output depends upon the amplitude of the quasi-frequency wave, which has a frequency of 1087.5 K.C. in our example. It has been found mathematically that for a given amplitude of the signal wave that the largest quasi-frequency oscillation is obtained when the amplitude of the local oscillation is exactly equal to that of the incoming signal. While it is very inconvenient to adjust the amplitude of the oscillation fed into the mixer circuit it should be so arranged in the first place that it will be at least comparable with the usual value of received signals. Probably the optimum value for the local oscillation is somewhere in the neighbourhood of 2-5 volts. In the specification for a type 58 valve used as a first detector with automatic bias of about 10 volts it is definitely stated that the amplitude of the oscillation produced in the mixer circuit and applied to the grid of this 58 type valve should not exceed 10 volts. The reason for this is that if the grid swings positive distortion will occur, various spurious and harmonic frequencies being generated. These will give rise to various squawks or howls and other evidences of unstable operation when tuning the receiver.

It is very desirable that the oscillator voltage produced in the mixer circuit should be constant over the whole tuning range of the receiver. Various methods of introducing this locally generated voltage into the mixer circuit are employed. It may be coupled inductively by a coupling coil placed somewhere in the grid circuit ; by mutual inductance between the mixer circuit and one of the coils associated with the oscillator ; by means of a high resistance and a small capacity in series ; by means of the screen grid of the first detector ; or by means of a small coil in the cathode circuit. Probably the two most generally employed are by mutual inductance and by a small coil in series with the cathode circuit of the first detector.

It is important that all the oscillator circuits should be well shielded in order to prevent radiation which might be picked up on nearby receivers and which might cause interference with other broadcast stations. This shielding is necessary for another reason, namely, that if there are stray couplings between the oscillator and other tuned circuits the presence of a powerful oscillation will react on the tuning of these other circuits and cause unstable operation of the receiver. It is desirable that the oscillation generated should be as free from harmonics as possible for these are a source of whistles when tuning the receiver. This may be taken care of by using a reasonably low plate voltage and attending to certain points so that the oscillator valve is not overbiassed. With automatic bias this is easily arranged for but with the more usually employed grid leak and condenser method of providing bias for the oscillator it is desirable that a low value of grid leak should be employed. Further this prevents any trouble from the too violent oscillation of the local valve causing it to set up an audio howl which is transferred to the first detector. It should be noticed that this so-called howling of the oscillator is much worse at the higher frequency end of the band and is usually not present at all at the lower frequency end of the tuning range.

Image Frequency.

The problem of eliminating image frequency effects is a decidedly real one and quite a large drawback to the superheterodyne receiver. It is caused by the following. Since the frequency of the beat produced is equal to the difference between the frequencies of the carrier wave and the local oscillator, it is clear that for this setting of the oscillator frequency there is a signal frequency both above and below this setting. Two stations may be received while the oscillator frequency remains the same. Thus, if for some reason or other when we are receiving a signal on 1000 K.C. with the oscillator of course tuned to a frequency of 1175 K.C., there should be present in the mixer circuit a carrier wave of frequency 1350 it is obvious that this will beat with the local oscillator and any modulation will be transferred to the intermediate amplifier, since 1350 is removed from the oscillator frequency by 175 K.C. Further, if the oscillator was set at 825 K.C. to receive the 1000 K.C. signal then any signal with a frequency of 650 K.C. would also be passed on to the intermediate amplifier. In the first case 1350 K.C. is the image frequency. In the latter case 650 K.C. is the image frequency. The name image may be explained as follows. A person two feet in front of and looking into a mirror will see an image that is apparently two feet behind the mirror. Considering the oscillator frequency as the mirror or central frequency we have a real signal frequency which is receivable on one side of the oscillator frequency and at an equal interval on the other side there is the image frequency. Further, it is also possible that when two signals in the broadcast band are separated by the frequency of the intermediate amplifier and both are present in the mixer circuit one will serve to heterodyne the other and the modulation of both stations will appear in the output of the receiver. A signal of frequency 1035 K.C. could heterodyne with one of frequency 1210 K.C. to produce this effect.

To get around this problem of image frequency it is necessary to provide a sufficient degree of selectivity between the aerial and the grid of the first detector valve. This may be done in a number of ways ; by the insertion of a tuned R.F. stage ; by the use of a band-pass filter ; by very loose coupling of the aerial or by a combination of these methods. To prevent any bad effect due to the image frequency it is necessary to reduce the intensity of the interfering signal where it

appears in the first detector circuit so that it is less than one five-thousandth of the wanted signal. Thus the main purpose of any tuned circuit ahead of the mixer is to provide a very high degree of selectivity with regard to signals which are removed by quite a large amount from the signal frequency. Interference from signals on adjacent frequencies of the order of 10 K.C. difference from the signal frequency can most easily be reduced by suitable design of the intermediate amplifier.

Arithmetical Selectivity.

Consider the reception of a signal on 1235 K.C. with an interfering signal at 1245 K.C. The beat frequency from the wanted signal will be 175, while that from the interfering signal will be 165. While on the original frequencies the percentage difference in the two frequencies is only 0.8%, it is approximately 5.7% by the time the two signals have reached the intermediate amplifier and the relative selectivity problem is approximately seven times simpler for the 175 K.C. I.F. amplifier than for the T.R.F. circuit of equal selectivity. Further consider a signal on 600 K.C. with an interfering signal at 610. The percentage difference between these two frequencies is 1.6% while that between the resulting intermediate frequency is still 5.7%. It is thus seen that the selectivity on the superheterodyne with regard to adjacent channels remains constant over the whole of the tuning range of the receiver and this is known as the arithmetical selectivity.

The I.F. Amplifier.

Some slight explanation of why the usual intermediate frequency is 175K.C. may be justified. It is found that if either the second or third harmonic of the intermediate frequency falls within the broadcast band, then trouble may be experienced due to feedback from the output of the second detector which will naturally contain quite a large amount of second and third harmonics of the intermediate frequency. At certain points of the tuning range the first detector will be tuned to these harmonic frequencies and if there is any leak between the two circuits very unstable operation may result. Further, the intermediate frequency is a compromise between amplification and freedom from image interference. Considered on the score of amplification, the lower the intermediate frequency the better, whereas for freedom from image frequency interference, the higher the better. Obviously 175 K.C. is a very fair compromise.

The job of the I.F. amplifier is to amplify bands of frequencies not more than 10 K.C. wide, that is to say, 5 K.C. on either side of the nominal intermediate frequency. Usually the stages are coupled together by means of a tuned transformer. Since the primary and secondary circuits are tuned this represents a very simple and effective method of providing what is, virtually, a band-pass tuner for the intermediate amplifier. Two circuits tuned to the same frequency and coupled by a certain amount of mutual inductance will show a resonance curve comprising two peaks separated by an amount which depends on the mutual inductance and other circuit constants. By suitably choosing these dimensions the resonance curve can be made to approximate a flat top, 10 K.C. wide which is, of course, the unobtainable ideal. For the sake of stability these intermediate transformers are usually shielded. The usual type of I.F. transformers employs two honeycomb coils of small dimensions tuned by small trimmer condensers which are adjustable to the correct setting.

Detector.

Since the input to the second detector is likely to be very large some type of power detection should be employed. This means that either a suitably biased valve or else a grid leak and condenser type of rectifier employing a suitably small value of grid leak should be designed for. In some receivers, particularly those employing a smaller number of valves the second detector feeds directly to the loudspeaker. In this case the second detector is usually a pentode valve of the output type biased by means of a suitably higher voltage.

Combined Mixer-Oscillator.

With regard to this it may be said that trouble is very often experienced unless these circuits are correctly designed and adjusted. On the other hand they are possibly worth the trouble on account of their lower cost and they can undoubtedly be made to operate with an equally fine performance.

The first detector usually employed in this case is a screen grid valve *not* of the variable mu type (e.g. type 57) with its grid circuit tuned to the signal frequency and a circuit tuned to the requisite oscillator frequency, coupled to plate or cathode circuits. On account of the problem of correct tracking the bias type of detector is usually employed. Surprisingly good results can be achieved by a simple receiver employing only three valves beside the rectifier. A valve such as type 57 is used as a combined mixer-oscillator, a type such as the 58 as the intermediate amplifier and an output detector employing some such valve as the 247.

Ganging the Controls.

If an ordinary type of ganged condenser is employed to tune both signal frequency and oscillator circuits it is found that the oscillator frequency will not track, that is to say, it will not differ by a constant amount from the signal frequency. This is overcome in a very ingenious manner by employing what is known as a pad circuit arrangement. This usually takes the form of a condenser in series with the tuning section which may be adjusted initially to the correct value and then left untouched. This is, of course, in addition to the usual trimmer in parallel with the tuning section which is, of course, found built in with the gang. In explanation of the action of the padding condenser, it is sufficient to notice that at the high frequency end of the scale when the tuning condenser has a very small value the effect of a large series capacity on the resultant capacity which is connected across the coil is very small and the circuit may be tracked by means of a small parallel trimmer. On the other hand at the low frequency end of the scale the adjustment of the padding condenser will have quite a large effect upon the resultant capacity connected across the oscillator coil. By using the padder to make the frequency track at the low frequency end of the band and the trimmer for that purpose at the high frequency end of the band the whole arrangement

will give an oscillator frequency which differs by an almost constant amount from that of the signal frequency. The correct value of oscillator coil is about 80% of the R.F. or first detector tuning coil. This value however, is not critical. In the case of short wave converters of the superheterodyne type an intermediate frequency near the bottom of the broadcast band is usually employed, e.g. 560 K.C. Two tuning controls are usually employed thus obviating the trouble which would be experienced if only a single control were used. When single control tuning is employed with a switching arrangement for the various wave bands a separate padder circuit must be associated with each oscillator coil as vernier control of inductance would be not usually practicable.

Class "B" Amplification.

The essential point in which Class "B" amplifiers differ from the more usual class "A" is that the grid is allowed to swing positive and hence draw current. In class A amplifiers sufficient negative bias is applied to the grid to ensure that the grid will never swing positive. This of course, means that a signal having an amplitude greater than the negative bias will cause the grid to swing positive and since a high resistance is usually present in the grid circuit, this means that considerable distortion will occur. At the same time the negative bias cannot be increased too far for then a portion of the negative peak of the signal voltage will be cut off.

A feature of this type of amplifier is that the average plate current as indicated by a milliammeter, does not vary. Assuming a perfect straight line characteristic curve, then the maximum plate circuit efficiency for a class A amplifier is 50% with a sine wave input signal. The actual plate circuit efficiencies however, are of the order of 20% for triodes and 40% for pentodes.

Undistorted Output.

A further excellent feature of this amplifier is that no appreciable power is required by the grid, and that essentially undistorted output is obtained with either a single valve or with 2 valves in push-pull. The push-pull class A amplifier is the nearest approach to distortionless amplification that is known. In a class B amplifier, the valve is operated so that the plate current is practically zero when no signal is applied to the grid. When a signal of suitable amplitude is applied to the grid, a considerably larger plate current will flow on the positive half of the cycle, while on the major portion of the negative half of the cycle there will be no plate current flowing at all. This of course, means that the average plate current will rise when the signal is applied to the grid. By reason of this, a considerable amount of distortion, consisting mainly of second and other even harmonics, is thus introduced. If, however, two valves are employed in place of one, using a push-pull circuit, then these even harmonics are eliminated from the power output. With such a circuit therefore, two valves may be employed as class B amplifiers, supplying what is virtually an undistorted output.

While the latest type of valves intended for class B operation are constructed to operate at zero grid bias, this is not an essential feature of this type of amplification. In fact, the original class B amplifiers using for example, type 230 or A415 valves, were arranged to operate with a negative grid bias of such a value that the plate current was practically zero.

No Automatic Bias.

The essential features of this circuit are, the push-pull arrangement of the valves, the fact that the grid swings positive thus drawing a certain amount of power from the preceding stage, and the arrangement of a grid circuit of sufficiently low resistance. It should be remembered that while the distortion arising from the fact that the major portion of the negative peak of the carrier is cut off, is eliminated in the push-pull arrangement, the distortion due to the automatic bias introduced by a grid current flowing through the resistance of the grid circuit is not compensated by this arrangement.

The type 46 valves now available for use as B class amplifiers, are arranged to take zero bias when operating in this circuit. This means that no automatic biasing resistor is needed, for this resistor would increase the resistance of the grid circuit and cause degenerative effects.

The variation in average plate current as shown by a milliammeter will be very large. For example, a pair of 46's operating as B class amplifiers with 300 volts on the plate and zero bias, will draw a normal plate current of 4 milliamps. When, however, the grids are fully loaded by a signal from the preceding stage, then the average plate current rises to something like 64 milliamps, while the grid current is just over 10. This means that the maximum instanteous value of the plate current is 128 milliamps, and the current drawn from the power pack will rise from 4 to 64 milliamps when the grids are fully loaded.

While we are undoubtedly able to get a large undistorted power output employing small valves with relatively low plate voltages, the main source of trouble with this type of amplifier as applied to A.C. operation, is the extremely good regulation which is required of the power pack. While it is an easy matter to instal a mercury vapour rectifying valve, it also means that exceptionally heavy low resistance transformers and chokes have to be used. Furthermore the operation of such mercury vapour rectifiers is very liable to cause interference with receivers, by reason of the parasitic damped oscillations which are set up in the normal operation of this valve.

When operating the class B amplifier the two grids of the 46 valve are connected together. When used as a class A amplifier, as for instance in the stage preceding the final class B output one, the outer grid is connected to the plate. By reason of the high amplification factor when the two grids are connected together, the plate current at zero grid bias is only a few milliamps.

Special Transformers.

This means that the power supply should be able to maintain an almost constant voltage output when the total current drain varies from 60 to 180 milliamps. as would be the case in the ordinary sized receiver employing class "B" output stage.

If we assume that the voltage drop across a mercury vapour type of rectifier is constant at about 15 volts due to the space charge, a total resistance of 500 ohms would cause a voltage variation of 50 volts. This of course would be rather an excessive figure. A variation of 20 or 30 volts in 400 would be quite permissible. In addition to a power supply with extremely good regulation, specially designed input and output transformers must be used. The step-down ratio of the input transformer is dependent upon several factors, (1) type of driver valve; (2) type of power valve; (3) load on power valve; (4) permissible distortion; (5) transformer efficiency. The primary impedance is essentially the same as in an ordinary amplifier where there is no load upon the secondary. Further the transformer should have reasonable power efficiency, since quite an appreciable amount of power is absorbed by the grids of the power valves.

The power output and the amount of distortion are very often critically dependent upon the constants associated with the circuit components. It thus follows that these constants should be made as nearly independent of frequency as is possible. It is essential that the driver valve should be operated well below its maximum class A output.

Minimum Distortion.

The load on the driver valve is chosen higher than the normal optimum value for maximum undistorted output. This is done in order to keep the overall distortion in the two stages down to a minimum. For a single triode driver, the minimum plate load is about 3 to 4 times the plate impedance of the driver valve. For push-pull driver stages the minimum plate load per valve is approximately equal to the plate impedance of an individual driver valve.

An input transformer with a very high step-down ratio causes no distortion in the class B input circuit, but limits the available signal voltage. Certain transformer designs make use of grid distortion to cancel a portion of the distortion produced in the plate circuit of the class B stage. The load values given for the class B amplifier stage are from plate to plate of the two valves. These values are not constant but change somewhat with the available input if maximum output and lowest distortion are designed for. It will be seen immediately that the load on one tube is one quarter of the value given in the table for plate to plate load, and that further, only one half of the primary in the output transformer furnishes power at any one instant.

When a 46 operating as a class A amplifier is self-biased, the resistance in the grid circuit should not exceed 0.5 megohm, while if there is no self-bias the resistance should not exceed 10,000 ohms.

Certain valves are now being brought out which incorporate both the assemblies for the pair of output valves in one envelope. In these, the filament and cathode will be connected together while the two grids and plates will be brought out separately. Their application is exactly the same as when two valves are employed, using of course, the advised load impedances.

Class "A" Prime Amplifiers.

Doubtless there will be many to whom this term is somewhat mystifying. Essentially a class A Prime amplifier might be described as a semi-class B. It consists of 2 valves operating in push-pull, which are over-biased when considered from the point of view of a class A amplifier, but underbiased when considered as a class B amplifier.

This means that portion of the negative peaks of each signal voltage applied to the grid will be cut off, as in class B amplifiers, although not to such a large extent. This is mainly instrumental in introducing a certain amount of even harmonic distortion which is cancelled out by the fact that the two valves are operating in push-pull. Further, due to the fact that the grid at the higher input voltages will swing slightly positive, distortion from this source will occur, unless a very low resistance grid circuit has been designed. This however, is somewhat unavoidable.

A certain amount of this distortion may be cancelled by increasing the plate load. For instance the normal load for a pair of 250 valves in push-pull, class A, is 8,000 ohms from plate to plate; with however, the class A prime, the correct load for a pair of 250's is approximately 15,000 ohms. The usual method of design for a class A prime stage, is to consider the maximum safe plate dissipation. Let us consider the design using a pair of 250's. The safe plate dissipation for a 250 is 25 watts, and the maximum rated plate voltage, 450. Let us increase the working plate voltage by about 25% or 30% to 600 volts. For a dissipation of 25 watts, this means a plate current of 42 m.A. This means that a bias of 130 volts is necessary. Neglecting the safe plate dissipation, and designing for ordinary working conditions of a class A amplifier, the bias would be 112 volts. Thus the bias for a class A prime amplifier is only 15% higher than for a class A push-pull amplifier. One diadvantage of course, is that a plate supply of 730 volts must be available unless separate bias is employed. However, a pair of 281 rectifiers would be necessary in any case to properly feed a pair of 250's even in class A push-pull.

Operating under these conditions, a power output of 30 watts may be obtained with a reasonable amount of distortion. That is to say, 5% total harmonics. At this point the grid current rises to about 0.4 milliamps and the plate circuit efficiency is about 45%. Contrasted with class A push-pull, where a maximum power output of 12 watts is obtainable, with a plate circuit efficiency of about 24%, this is decidedly good. A suitable driver stage would employ one 250 in class A service.

It is to be noted, however, that the optimum load is considerably higher than for a class A push-pull, so that a class A stage cannot be converted to class A prime, by simply increasing the bias. As an example, in the case considered above, the optimum plate load for class A prime is 15,000 ohms, compared with 8,000 for normal class A.

Considering what will be probably a more common example, namely that of 245 valves, the plate voltage is raised to 300 volts. To maintain the dissipation on the plate constant at this higher voltage, it is necessary to bias the grid 68 volts negative. As it will not be possible to swing this stage sufficiently from the output of a normal detector, using a 227 or a 56, or a 224 valve, especially as a step-down input transformer of ratio 1.28 : 1 will have to be used. Consequently, an audio stage using a 227, or a 56, will have to be inserted between the detector and the output stage. By these means the secondary resistance may be reduced sufficiently to vitiate the bad effects of the .25 m.A. average grid current which is drawn when the final stage is delivering a power output of 8 watts. Normally of course, a pair of 45's in push-pull will only deliver a power output of about 4 watts, allowing 5% distortion. In this case the power output is doubled. The big disadvantage, of course, lies in the necessity for an extra audio stage, although in many cases of ordinary push-pull amplifiers, using 245 valves, a first audio stage is used to make sure that the detector will not be overloaded.

Further, class A prime does not suffer from the big disadvantage of requiring a power supply with an extremely good regulation. One disadvantage, of course, lies in the fact that specially constructed input and output transformers will probably be necessary.

Short Wave Receivers.

Before dealing with any receivers it might not be amiss to include a few words on the subject of short-wave reception, dealing particularly with what results may and may not be expected. It is, no doubt, a fact that with very simple equipment it is possible to receive foreign broadcasting stations. At the same time it is also very true and frequently overlooked that the short waves are very adversely affected by certain astronomical and meteorological conditions which are not so apparent in their effects on broadcast frequency reception.

In addition we have to deal with the phenomenon of skip distance which is in itself an exceedingly complicated one, being closely allied with that of fading. The disturbance emitted from a short wave transmitting aerial can be divided arbitrarily into two components, the ground wave and the sky wave. It is the ground wave from which reception is obtained up to short distances. On the broadcast frequencies the ground wave can be received at far greater distances than on the short waves, for as the frequency of transmission is increased the ground wave is correspondingly more absorbed. In the case of a longer wave the sky wave is reflected back from what is known as the **Heaviside** layer (consisting essentially of a cloud of ionised gas particles which is continually varying in height and density) reaching the earth again before the ground wave has died out. As however the frequency is increased, a point comes where the ground wave dies out before the sky wave is reflected back to earth. It should be noted that only those waves that strike the layer at a very small angle are reflected ; those which meet the layer at a large angle or practically at right angles pass on and are absorbed. Thus it is that any receiver located near the edge of the skip region will experience a great deal of fading on the transmission due to the spontaneous variation of the reflecting medium.

Inconsistent Service.

Exceedingly complicated effects are introduced at very great distances where several reflections may have occurred. In point to point services it is possible to partially control the effects of skip and fading by using directional aerials which can also be made to determine the angle at which the wave strikes the **Heaviside** layer. Even so, conditions which are favourable for reception one day may be totally different the next. However, it is very often reasonable to state that such and such a station (Paris for example, near 19 metres) can be heard at such and such a time regularly (e.g. in this case 10 p.m. Sydney time).

The trend of commercial development in the short wave line seems to lean towards short wave converters of the superheterodyne type, very often self-powered and thus needing only one connection to their parent broadcast set. The American development of using wave changing switches to do away with plug-in coils seems to be rather slow in finding favour here, due to the great difficulties of construction and the consequent high cost on what is, as yet, a limited market. There are, however, indications that this will not always be the case.

Converter Problems.

The most desirable intermediate frequency seems to be about 560 K.C. Slight adjustments, of course, will be made in any one particular converter to get rid of any chance of broadcast interference. The use of a separate oscillator valve appears standard practice, probably due to the feedback difficulties which might be encountered using a combined mixer oscillator. In any case this is not a serious drawback as using two controls, namely first detector and oscillator tuning it will be found that the first detector tuning is not at all critical, particularly with the usual method of coupling the aerial straight to the grid of the mixer valve through a small condenser.

In the case of complete short wave receivers the trend seems to be towards using one tuned R.F. stage with a variable mu type valve followed by a regenerative detector and one or two stages of audio. It is desirable of course, that extra care be taken to eliminate hum. The detector is invariably regenerative and works just off the oscillation point for the reception of phone signals. This type of receiver has the advantage that it is well suited for code reception while the converter is definitely not, as only the modulation or clicks present on a carrier wave can be received. Plug-in coils should be coated with some dope or varnish so as to preserve the same tuning position on the dials even after long or rough handling of the coils. Clear duco makes quite an efficient job.

The troubles which beset short wave receivers are essentially the same as with the broadcast receiver. The only additional problem of any great interest here is the extraordinary capacity of a short wave receiver for picking up any inductive interference which may be present in any neighbourhood. In particular this is exemplified by the fact that it is quite possible to receive a noise from the ignition system of a car as far as 100 yards away. Loose guy wires, clothes lines or metal down-haul wires knocking against each other or other metal objects will create an annoying noise in a short wave receiver, particularly noticeable on windy days. The remedy is to bond such metal objects together or securely stay them so that intermittent contact is impossible. The same remarks apply to any intermittent connection present in the house wiring system.

List of Stations.

It should not be thought that all the stations listed in the following comprehensive catalogue will always be audible in Sydney. It is only during periods of good conditions that it will be possible to hear the majority of them, and during the periods of bad conditions which are bound to occur it is sometimes impossible to hear with good strength more than three or four stations transmitting speech. Of course, it must be remembered that morse and beam stations will always be audible. During the middle of the day when no short wave broadcasting is audible the beam stations provide a very effective method of testing the sensitivity of a short wave receiver or converter. In addition to the stations listed, numerous amateur phone stations in Australia and New Zealand can be heard between 75 and 85 metres (4000-3500 K.C.) at night, particularly in the winter months. In addition on some evenings and during the weekends amateur phones may be heard on the so-called 40 metre band (41-42.8 metres, 7,300-7,000 K.C.). The third popular amateur band runs from 20.83 to 21.43 metres (14,400-14,000 K.C.) but is mainly used for morse code work.

The Aerial System.

The importance of an efficient aerial and earth system is often overlooked when the receiver is first installed, in many cases when service has to be rendered to a receiver on account of weak signals it will be found that by making the aerial system more efficient, better results can be obtained. The main essentials of an efficient aerial are *height*, *good insulation* and *location clear* of any nearby conducting bodies, such as iron roofs, guttering, telephone or power wires and even trees. Good insulation can be obtained by the use of several small insulators and the use of high grade insulated wire for the lead-in. The location of the lead-in is particularly important as this should be run well clear of iron gutters, power wires and most particularly, any concealed wiring in the house itself.

The importance of height is often overlooked. Yet, it should be obvious that a 20 foot aerial 30 feet in height will give better results than a 30 foot aerial 20 feet high, even though the overall length of wire is exactly the same. The lead-in should be brought to the receiver by as direct a route as possible. While the insulation of the earth wire is not so important from an efficiency point of view, this should not be neglected. The earth wire should be as short as possible and grounded either to a water pipe entering the ground or to a large mass of buried metal. The effective length of a ground wire includes the length of water piping between the connection and the point where the pipe enters the ground.

In some places a certain amount of interference from electrical devices may be eliminated by using a twisted flex for the lead-in. In this arrangement one wire is used as a lead-in and the other is connected to the chassis of the receiver or ground. This ground wire is of course left unconnected at the top of the lead-in.

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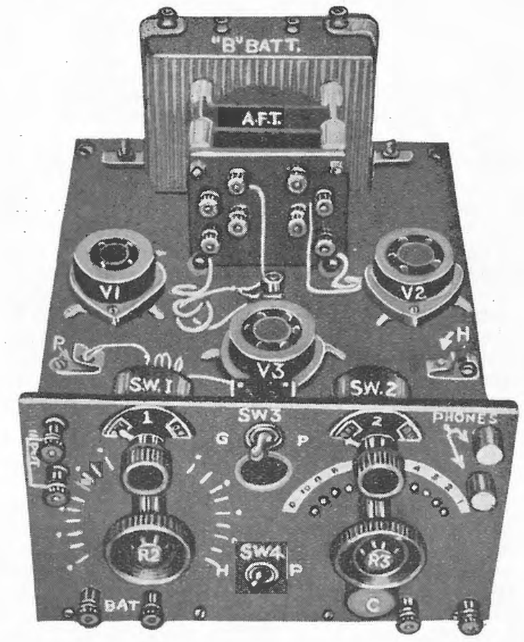
Principal Short Wave Stations of the World.

The following list of Stations operate at various times. 1st set of figures is the Wavelength in metres. 2nd set of figures is the frequency in Kilocycles, then the Call Sign, followed by the Location of the Station, Service and Transmitting Times.

5.80, 51,724, RW61, Moscow, U.S.S.R., Broadcast
13.92, 21,540, W8XK, Saxonburg, Pa., Phone, 2130, 0200.
14.01, 21,420, WKK, Lawrenceville, N.J., Phone to LSN; 2300-0700.
14.25, 21,060, WKA, Lawrenceville, N.J., Phone to England; 2300-0700.
14.27, 21,020, LSN, Buenos Aires, Phone to WLO; 2300-0700.
14.50, 20,690, LSN, Buenos Aires, Phone to Europe; after 1330.
14.59, 20,560, PMB, Malabar, Bandoeng, Phone to PCK; 1810, 1940.
15.08, 19,900, LSG, Buenos Aires, Phone to FTM; 0130, 0630.
15.12, 19,840, FTD, Paris, Phone
15.14, 19,820, WKN, Lawrenceville, Phone to England; 0300-0700.
15.21, 19,720, EAQ, Madrid, Phone to S.A.; 0200-0500.
15.24, 19,680, CEC, Santiago, Chile, Phone to Argentine; 0900.
15.45, 19,420, FRO-FRE, Paris, Phone.
15.50, 19,355, FTM, Paris, Phone to LSG; 0100-0500.
15.57, 19,260, PPU, Rio de Janeiro, Phone to FTM; 0130-0630.
15.60, 19,220, WNC, Lawrenceville, Phone to England; 2300-0700.
15.82, 18,960, LSR, Buenos Aires, Phone to Chile; 0200-0700.
15.90, 18,890, ZSS, Klipheuvel, Sth. Af., Phone to GAA; 1800-2300.
15.94, 18,820, PLE, Malabar, Bandoeng, Phone to PCK.
16.11, 18,620, GBU, Rugby, Eng., Phone to WMI; 2100-0500.
16.15, 18,580, GBJ, Bodmin, England, Phone to Montreal.
16.27, 18,440, HJY, Bogota, Columbia, Phone to Chile and Argentine; 0900.
16.32, 18,382, FRS, Saigon, Indo-China, Phone; 0400-0600.
16.35, 18,350, ZLW, Wellington, N.Z., Phone VK2ME, irregular.
16.36, 18,340, WLA, Lawrenceville, Transatlantic phone; 2300-0700.
16.38, 18,310, GBS, Rugby, Eng., Phone to WND; 2100-0500.
16.43, 18,250, FTO-FTE, Paris, Phone to FZR; 2000-2400.
16.53, 18,145, PMC, Tjimindi Bandoeng, Java, Phone to PCV; 1810-0020.
16.48, 18,200, GBW, Rugby, Phone to WNC.
16.57, 18,100, GBK, Bodmin, Eng., Phone to CGA; 2100-0500.
16.81, 17,850, PLF, Malabar, Bandoeng, Phone
16.82, 17,795, PCV, Kootwijk, Holland, Phone to Java; 2100-2400.
16.87, 17,780, W3XAL, Bound Brook, N.J., Broadcast; 2200-0600.
16.88, 17,775, PHI, Huizen, Holland, Broadcast;
16.88, 17,770, GSG, Empire Broadcasting Zone 2.
16.9, 17,750, HSP, Bangkok (Siam), Sun. and Tues.
17.02, 17,630, PMW, Malabar, Bandoeng, Broadcast.
17.24, 17,400, J1AA, Tokyo, Phone to Australia.
17.34, 17,300, VE9BY, London, Ont. Can., Broadcast irregular.
17.52, 17,120, WOO, Deal, N.J., Transatlantic phone.
17.56, 17,080, GBC, Rugby, England, Phone.
18.37, 16,330, VLK-VK2ME, Sydney, Broadcast; 1800-2100.
18.40, 16,305, PCL, Kootwijk, Holland, Phone to Bandoeng from; 2200.
18.40, 16,270, WLO, Lawrenceville, Phone to England.
18.44, 16,270, WLK, Lawrenceville, Phone to England.
18.48, 16,233, FZR, Saigon, Indo-China, Phone
18.59, 16,140, GBX, Rugby, Phone to VK2ME; 0700-1400.
18.68, 16,060, NSS, Annapolis, Md.; 0255-0300.
18.71, 16,030, KKP, Kauhuku, Hawaii, Phone to KWO; 0500-1000.
18.81, 15,950, PLG, Tjimindi, Bandoeng, Phone afternoons.
18.89, 15,880, FTK, Paris, Phone to FZS; 0000-0100.
19.04, 15,760, J1AA, Tokyo, Tests up to; 0100.
19.53, 15,355, KWU, Dixon, Calif, Phone to Hawaii; 0500-1000.
19.53, 15,355, KWO, Dixon, Calif., Phone to Hawaii; 0500-1000.
19.55, 15,340, W2XAD, Schenectady, N.Y., Broadcast; 0600-0900.
19.61, 15,300, OXO-OXZ, Copenhagen, Broadcast.
19.61, 15,300, ..., Tandjong Priok, Batavia, Broadcast.
19.61, 15,300, W6XAL, Westminster, Calif., Phone.
19.68, 15,245, FYA, Radio Colonial, Pontoise, France, Broadcast; 2200-0100.
19.72, 15,210, W8XK, Saxonburg, Pa., Broadcast; 2130-0700.
19.74, 15,200, DJB, Koenigswusterhausen, Ger., Broadcast; 2300-0300.
19.74, 15,200, J1AA, Tokyo, Japan, Broadcast, irregular.
19.84, 15,120, HVJ, Vatican City, Broadcast; 2000-2015.
20.00, 15,000, TI4NRH, Heredia, Costa Rica, Sat., Sun., Mon.; 0200-0300.
20.00, 15,000, CM6XJ, Central Tuinucu, Cuba, Broadcast, irregular.
20.50, 14,630, XDA, Mexico City, Broadcast; 0530-0600.
20.78, 14,440, GBW, Rugby, Phone to WNC; 2100-0900.
20.80, 14,425, VPD, Suva, Phone.
20.95, 14,310, G2NM, Sonning-on-Thames, England, Broadcast; 0430.
21.52, 13.940, YO1, Bucharest, Broadcast;
21.72, 13,811, SUZ, Abu Zabal, Cairo, Phone to GBC, daily up to; 0630.
22.58, 13,285, CGA, Drummondville, Can., Phone GBC; 2300-0500.
22.68, 13,230, ..., S.S. Conteraggo, Phone, sometimes broadcast; 2100-2300.
23.06, 13,010, FZG, Saigon, French Indo-China, Broadcast.
23.35, 12,850, W2XO, Schenectady, N.Y., Broadcast; 0000-0600.
23.35, 12,850, W9XL, Anoka, Minn., Broadcast.
23.40, 12,830, ..., Rabat, Morocco, Phone to Ste. Assise; 2230-2400.
23.47, 12,780, GBC, Rugby, Phone.
24.00, 12,500, CT3AQ, Funchal, Madeira, Broadcast;
24.02, 12,490, DAN, Norddeich, Germany, Phone to ships, noon; 0300-0600.
24.40, 12,295, ZLT, Wellington, N.Z., Phone to VK2ME; 1800-2300.
24.40, 12,295, PLM, Bandoeng, Java, Phone VK2ME; 2130.
24.41, 12,290, GBU, Rugby, Phone to WMI; 0500-1000.
24.47, 12,260, FTN, Paris, Phone Buenos Aires, Indo-China, Java, U.S.A.,; 0000-0400.
24.46, 12,265, PLM, Bandoeng, Java, Phone; 2245.
24.69, 12,150, GBS, Rugby, Transatlantic phone to Deal, N.J., WND; 0500-1000.
24.81, 12,090, ..., Tokyo, Phone; 2000-2300.
24.89, 12,045, NSS, Annapolis, Md., 1255 (time signal).
25.00, 12,000, FZG, Saigon, Indo-China, 0500-0505 (time signal)
25.01, 11,993, PK6KZ, Makassar, Celebes, Broadcast.
25.20, 11,905, FYA, Paris, Broadcast; 0400-0600, daily, 0130-0430.
25.25, 11,880, W8XK, Saxonburg, Pa., Broadcast; 0600-1200, daily.
25.27, 11,870, VUC, Calcutta, India, Broadcast;
25.28, 11,865, GSE, Empire Broadcasting, Zone 2.
25.34, 11,840, W2XE, Jamaica, Broadcast; 2230-1700, daily, 2300 Sun., 1500 Mon.
25.34 11,840, W9XAA, Chicago, Relays WCFL; 2200-2300, 0400-0500, 0700-0830, 0900-1030.
25.40, 11,810, 12RO, Rome, Broadcast; Sat. Sun., 0200-0300, 0700-0800, 1300-1400, Mon. Tu. 0200-0300, 0700-0800.
25.40, 11,810, VE9GW, Bowmanville, Ont. Can., Broadcast; 0400-1300 daily.
25.42, 11,801, UOR3, Vienna, Broadcast; 2100-2400, Wed. Thur.
25.51, 11,760, XDA, Mexico, D.F., Tests with XAM; 0400-0900.
25.53, 11,750, G5SW, Chelmsford, Eng., Broadcast; Mon.-Fri., 2145-2230, 0330-0910, Sat., 2200-2300, Sun. 0330-0910.
25.53, 11,750, GSD, Empire Broadcasting Zone 1.
25.60, 11,720, VE9JR, Winnipeg, Man. Can., Broadcast; 0900-1100 daily.
25.62, 11,712, HKN, Medellin, Colombia, Broadcast.
25.63, 11,705, FYA, Paris, Broadcast.
25.64, 11,700, YV4BV, Valencia, Venezuela, Broadcast.
25.68, 11,680, KIO, Kauhuku, Hawaii, Phone to KES; 0500-1100.
26.00, 11,530, XAM, Merida, Yucatan, Tests with XDA, 0300 and 0900.
26.02, 11,531, CGA, Drummondville, Can., Phone
26.10, 11,525, GBK, Bodmin, Eng., Phone

26.46, 11,340, DAN, Norddeich, Ger., Time Signal 2200 and 1000.
27.00, 11,111, XFD, Mexico City, Mexico, Broadcast.
27.17, 11,000, ZLW, Wellington, N.Z., Tests 1800-2300.
27.35, 10,975, OCI, Lima, Peru, Phone to HJY; evenings.
27.68, 10,840, KWV, Dixon, Cal., Phone to Hawaii, irregular.
27.80, 10,800, GBP, Rugby, Phone to VLK, JIAA; 1200 and 2100.
27.94, 10,755, CT1BO, Lisbon, Broadcast.
28.2, 10,365, PLR, Bandoeng, Java, Daily.
28.22, 10,630, PLR, Bandoeng, Java, Phone to Holland and France; week days from 2200.
28.44, 10,550, WOK, Lawrence, N.J., Phone to LSN; evenings.
28.50, 10,525, VLK-VK2ME, Sydney, Phone to GBX; 1600-2200.
28.52, 10,520, VK2FC, Sydney, Broadcast.
28.77, 10,425, UIG, Medan, Sumatra, Phone to Java and VLK; 1800-2300.
28.80, 10,415, PDK, Kootwijk, Holland, Phone.
28.82, 10,410, LSY, Buenos Aires, Phone.
28.87, 10,390, GBX, Rugby, Eng., Phone.
28.99, 10,350, LSX, Buenos Aires, Broadcast daily; 2300-2400.
29.04, 10,330, ORK, Brussels, Phone to OPM; 1700-1900, 0000-0200, 0600-0900.
29.59, 10,140, OPM, Leopoldville, Belgian Congo, Phone ORK.
29.84, 10,055, SUV, Abu Zabal, Cairo, Phone to GAA after 0630.
29.97, 10,013, CM2LA, Havana, Cuba, Broadcast.
30.00, 10,000, ..., Belgrade, Yugo-slavia, Broadcast.
30.10, 9,964, LSL, Buenos Aires, Phone to WLO; 0900-2100.
30.17, 9,950, GCU, Rugby, Phone to WMI; 0800-1400.
30.21, 9,930, HJY, Bogota, Colombia, Phone to DCI; irregular; evening.
30.33, 9,890, LSN, Buenos Aires, Phone to WLO; 0900-2100.
30.33, 9,890, LSA, Buenos Aires, Phone.
30.40, 9,870, WON, Lawrenceville, N.J., Phone.
30.43, 9,860, EAQ, Madrid, Broadcast; 0930-1100 and 0400-0600.
30.70, 9,772, EAM, Madrid, Broadcast.
30.74, 9,760, VLJ, Sydney, Phone to Java; 1900-2300.
30.77, 9,750, WOF, Lawrenceville, Phone to England; evenings.
30.77, 9,750, ..., Agen, France, Phone 0600-0715, Wed. Sat.
30.77, 9,750, WNC, Deal, N.J., Phone.
30.93, 9,700, LQA, Buenos Aires, Phone.
31.00, 9,672, T14NRH, Heredia, Costa R., Broadcast; daily except Mon.; 1200-1300.
31.10, 9,640, HS2PJ, Bangkok, Siam, Mon.
31.21, 9,616, VQ7LO, Nairobi, Kenya, Broadcast.
31.25, 9,600, CT1AA, Lisbon, Broadcast; 0700-1000, Fri. Sat.
31.25, 9,600, LGN, Bergen, Norway, Phone.
31.28, 9,590, W3XAU, Byberry, Pa., Relays WCAU; daily.
31.28, 9,590, VK2ME, Sydney, Broadcast; Sun. 1500-1700, 1930-2330, Mon. 0430-0630.
31.28, 9,590, PCJ, Hilversum, Holland, Broadcast.
31.29, 9,585, GSC, Empire Broadcasting, Zone 3.
31.32, 9,580, VE9DN, Montreal, Broadcast.
31.35, 9,570, WIXAZ, Springfield, Mass., Broadcast; 0630-1430.
31.35, 9,570, SRI, Poznan, Poland, Broadcast; Wed. 0445-0745, Fri. 0430-1100.
31.38, 9,560, DJA, Koenigswusterhausen, Ger., Broadcast.
31.40, 9,555, VE9DR, Drummondville, Can., Broadcast.
31.48, 9,530, W2XAF, Schenectady, N.Y., Broadcast; 0800-1400.
31.54, 9,510, GSB, Empire Broadcasting, Zones 4-5.
31.51, 9,510, OXY, Skamleback, Denmark, Broadcast; 0500-0930.
31.51, 9,520, ..., Tandjong Priok, Batavia, Broadcast.
31.55, 9,510, VK3ME, Melbourne, Broadcast; Wed. 2000-2130, Sat. 2000-2200.
31.58, 9,500, HSP2, Bangkok, Siam, Broadcast; 0000-0200.
31.58, 9,500, PRBA, Rio de Janeiro, Broadcast; between 0900 and 1130.
31.62, 9,488, OXO-OXZ, Copenhagen, Broadcast.
31.63, 9,485, PLW, Bandoeng, Phone to Australia; 1800-2300, irregular.
31.72, 9,460, ..., Buenos Aires, Broadcast.
31.86, 9,415, PLV, Bandoeng, Phone to Australia, Sumatra; 1900-2300.
31.88, 9,410, PLE, Bandoeng, Broadcast.
31.90, 9,405, PLV, Bandoeng, Phone.
31.98, 9,380, CMAP, Los Andes, Chile, Broadcast.
32.00, 9,388, CT3AQ, Funchal, Madeira, Broadcast; Wed. Fri. 0700-0930, Mon. 0130-0300.
32.02, 9,369, VK3LO, Melbourne, Broadcast.
32.05, 9,360, CM2MK, Havana, Cuba, Broadcast.
32.10, 9,332, CGA, Drummondville, Can., Phone to GBK; 0900-2100.
32.22, 9,310, GBC, Rugby, Phone 0530-0800.
32.30, 9,300, CNR, Rabat, Morocco, Broadcast; Mon. 0600-0800.
32.40, 9,250, GBK, Bodmin, England, Phone to CGA; 0900-2100.
32.50, 9,230, FL, Eiffel Tower, Time Signal; 1956 and 0756.
32.61, 9,200, GBS, Rugby, Transatlantic phone.
32.72, 9,170, WND, Lawrenceville, Phone to England; evenings.
32.76, 9,130, HB9OC, Berne, Switz., Broadcast; 0600-0830.
32.88, 9,125, HAT, Szekesbehervar, Hungary, Broadcast.
32.93, 9,110, SUS, Cairo, Phone to England.
33.00, 9,091, XDA, Mexico City, Broadcast.
33.00, 9,091, SFD, Mexico City, Broadcast.
33.26, 9,020, GCS, Rugby, Phone to WND; 0900-2100.
33.50, 8,928, TGX, Guatemala City, Guat., Broadcast; Sun. 1300-1500.
33.71, 8,900, ZLT. Wellington, N.Z., Phone to VLK; 1600-2400.
33.82, 8,870, NPO, Cavite (Manilla), P.I., Time Signal; 1255-1300.
34.68, 8,650, VE9BY, London, Canada, Broadcast; Tu. 0600-0700, irregular.
35.01, 8,570, RW15, Khabarovsk, Siberia, Broadcast.
35.50, 8,450, PRAG, Porto Alegre, Brazil, Phone; 2330-2400.
36.92, 8,125, PLW, Bandoeng, Java, Phone.
37.03, 8,100, J1AA, Tokyo, Japan, Tests; 2000-2300.
37.03, 8,100, EATH, Vienna, Austria, Phone; Tu., Fri. 0830-1000.
37.84, 7,930, DOA, Doeberitz, Ger., Phone; 0400-0600.
38.02, 7,890, VPD, Suva, Fiji, Phone.
38.02, 7,890, PK2AG, Samarang, Java, Broadcast.
38.31, 7,830, PGA, Kootwijk, Holl., Phone after; 1200.
38.52, 7,790, HBP, Geneva, Switz., Broadcast.
38.61, 7,770, FTF, Paris, Phone; 0600-1100.
39.16, 7,660, FTL, Paris, Phone.
39.41, 7,612, X26A, Nuevo Laredo, Tamps, Mex., Broadcast; Thurs. 0200-0300.
39.42, 7,610, HKF, Bogota, Colombia, Broadcast; 1000-1400.
39.82, 7,530, ..., Riobamba, Ecuador, Broadcast; Thur. 1200-1400.
39.89, 7,520, KDK-KKH, Kauhuku, Hawaii, Phone to KWO; 1200-1700.
40.20, 7,460, YR, Lyon, France, Broadcast; 1330-1630.
40.38, 7,430, YR, Paris, Broadcast.
40.48, 7,410, ..., Eberswalde, Ger., Broadcast; Thur. 0405.
40.50, 7,405, HKI, Bogota, Colombia, Broadcast; 1100-1400.
40.70, 7,370, X26A, Nuevo Laredo, Mexico, Broadcast; 0000-0100.
40.99, 7,320, ZTJ, Johannesburg, Broadcast; 0030-0530.
41.04, 7,310, CM5RY, Matanzas, Cuba, Broadcast; 1345-1430.
41.06, 7,305, HSP2, Bangkok, Siam, Tests Mon.; 0300-0200.
41.07, 7,300, CM6DW, Cienfuegos, Cuba, Broadcast.
41.47, 7,230, DOA, Doeberitz, Ger., Broadcast.
41.53, 7,220, HB9XD, Zurich, Switz., Broadcast; 2200-1700.
41.53, 7,220, ..., Budapest, Broadcast; 1730-1810.
41.60, 7,207, EAR58, Teneriffe, Canary Islands, Broadcast; 0730-0900.
41.67, 7,195, VS1AB, Singapore, Broadcast; Mon., Wed., Fri., 0030-0200.
41.80, 7,184, CM2MK, Havana, Cuba, Broadcast.
41.99, 7,140, HKX, Bogota, Colombia, Broadcast.
42.00, 7,139, HKT, Manizales, Colombia, Broadcast; 0200-0300.
42.20, 7,110, HKN, Medellin, Colombia, Broadcast; 1100-1300.
42.50, 7,059, ..., Johannesburg, Broadcast; 0800-1000.
42.50, 7,055, VS3AB, Johore Bahru, British Malaya, Broadcast.
42.74, 7,020, EAR125, Madrid, Broadcast; 0900-1000.
42.92, 6,989, GBS, Rugby, Phone to WND; 0900-2100.
42.92, 6,990, CT1AA, Lisbon, Broadcast; Fri. 0700-0900.
43.00, 6,980, EAR110, Madrid, Broadcast; Tue., Sat. 0730-1000.
43.54, 6,890, KEQ, Kauhuku, Hawaii, Phone to Calif., nights.
43.60, 6,875, F8MC, Casablanca, Morocco, Broadcast; Sun., Tues., Wed., Sat.

43.63, 6,877, ..., Rabat, Morocco, Broadcast.
43.73, 6,860, ..., Paris, Phone; 1900, 0200, 0600.
43.73, 6,860, KEL, Bolinas, Cal., Phone.
43.74, 6,840, VRY, Georgetown, British Guiana, Broadcast: 1015-1215.
44.00, 6,818, XDA, Mexico City, Broadcast.
44.41, 6,755, WND, Deal, N.J., Phone.
44.41, 6,755, WNB, Lawrenceville, Phone to Bermuda, nights.
45.25, 6,625, HKC, Bogota, Colombia, Broadcast; 1130-1400.
45.31, 6,620, PRADO, Riobamba, Ecuador, Broadcast; 1200-1400.
45.38, 6,611, REN, Moscow, U.S.S.R., Phone.
45.98, 6,525, RUI, Moscow, U.S.S.R., Relays Moscow; 0400-0900.
46.27, 6,480, TGW, Guatemala City, Guat, Broadcast; 1200-1400.
46.67, 6,430, VE9BY, London, Ont. Can., Broadcast; 1130-1230.
46.73, 6,420, RGX, Minsk, U.S.S.R., Broadcast, irregular.
46.96, 6,425, W3XL, Bound Brook, N.J., Relays WJZ, irregular.
47.00, 6,380, HKS, Cali, Colombia, Broadcast; 1100-1300.
47.02, 6,380, HC1DR, Quito, Ecuador, Broadcast; 1100-1400.
48.00, 6,250, CN8MC, Casablanca, Morocco, Relays Rabat; 0600-0700.
48.62, 6,170, HRB, Tegucigalpa, Honduras, Broadcast; 0809.
48.78, 6,150, VE9CL, Winnipeg, Broadcast; 0900-1100.
48.86, 6,140, W8XK, Saxonburg, Pa., Broadcast; 0700-1400.
48.90, 6,131, F3ICD, Saigon, French Indo-China, Broadcast; 2130-0130.
48.94, 6,130, VE9BA, Montreal, Broadcast.
49.02, 6,120, W2XE, New York City, Broadcast.
49.02, 6,120, FL, Eiffel Tower, Broadcast.
49.02, 6,120, ..., Toulouse, France, Broadcast; 0530-0700.
49.10, 6,110, VUC, Bombay, India, Broadcast.
49.10, 6,110, VE9CG, Calgary, Alberta, Can., Broadcast.
49.18, 6,100, W3XAL, Bound Brook, N.J., Broadcast; Sat., 0700-1500.
49.18, 6,100, W9XF, Chicago, Ill., Broadcast; daily 0630-1600.
49.22, 6,095, VE9GW, Bowmanville, Ont. Can., Broadcast; weekdays.
49.26, 6,090, OXY, Copenhagen, Broadcast.
49.26, 6.090, VE9BJ, St. John, N.B., Can., Broadcast.
49.34, 6,080, W9XAA, Chicago, Ill., Broadcast; 2122-1011, 1230-1315, 1415.
49.40, 6,073, ZTJ, Johannesburg, Broadcast; 0130-0630.
49.41, 6,072, UOR2, Vienna, Austria, Broadcast.
49.42, 6,070, VE9CS, Vancouver, B.C., Broadcast; Fri. before 1630-0630.
49.46, 6,065, SAJ, Motala, Sweden, Broadcast; 2130-2200.
49.50, 6,060, CMCI, Marianao, Cuba, Broadcast.
49.50, 6,060, VQ7LO, Nairobi, Kenya, Broadcast; 0200-0530.
49.50, 6,060, W3XAU, Byberry, Pa., Relays WCAU; Thur., Fri., 2115-1500.
49.50, 6,060, W8XAL, Cincinnati, O., Relays WLW; 2000-0030.
49.50, 6,060, ZL2ZX, Wellington, N.Z., Broadcast; 1715-2115 Mon.
49.58, 6,050, GSA, Empire Broadcasting Zones 3-5.
49.59, 6,050, VE9HX, Halifax, N.S., Broadcast; Mon., Tues.
49.60, 6,005, VE9DR, Drummondville, Can., Relays CTCF, 1000-1500.
49.67, 6,040, ..., Tandjong, Priok, Java, Broadcast.
49.67, 6,040, PK3AN, Soerabaya, Java, Broadcast; 2100-2400.
49.75, 6,030, VE9CA, Calgary, Alba, Can., Broadcast.
49.83, 6,020, W9XF, Chicago, Ill., Broadcast.
49.88, 6,015, VE9CX, Wolfville, N.S., Can., Broadcast.
49.96, 6,005, HRB, Tegucigalpa, Honduras, Broadcast.
49.96, 6,005, VE9DN, Montreal, Can., Broadcast.
49.97, 6,000, YV2BC, Caracas, Venezuela, Broadcast; 1045-1400 daily except Tues.
50.00, 6,000, RW49, Moscow, U.S.S.R., Broadcast; Mon. Tu., Fri., Sun., 0700-0800, Sun. 2000-2100.
50.00, 6,000, ZL3ZC, Christchurch, N.Z., Broadcast.
50.00, 6,000, ..., Tannarive, Madagascar, Broadcast; Wed., Thur., Fri., Sat., 0030-0230, Sun., Mon., 400-0600.
50.00, 6,000, ..., Eiffel Tower, Broadcast; 2130-2145, 0415-0430, 0815-0845.
50.00, 6,000, PK2AF, Djokjakarta, Java, Broadcast; 2140-0040.
50.03, 5,996, HKD, Barranquilla, Colombia, Broadcast; daily 1045-1330, Tu., Thur., 1100-1330, Mon. 1045-1130.
50.27, 5,968, HVJ, Vatican City, Broadcast; 0500-0515, daily, Sun., 2000-2030.
50.64, 5,925, HKO, Medellin, Colombia, Broadcast; Tu. Thur., Sat., 1100-1300, Wed., Fri., Sun., Mon., 0900-1100.
51.72, 5,800, VKQ, Melbourne, Phone.
52.00, 5,769, HKN, Medellin, Colombia, Broadcast.
52.50, 5,714, HCJB, Quito, Ecuador, Broadcast; 1030-1300 daily except Tues.
52.50, 5,710, VE9CL, Winnipeg, Broadcast.
52.70, 5,692.5, FIUI, Tannarive, Madagascar, Broadcast; Sun., Mon., 0400-0600, Tu., Wed., Thur., Fri., Sat., 1215-1415.
54.40, 5,515, SPV, Warsaw, Phone.
54.40, 5,515, VPX, Penaga, Penang, Broadcast.
57.88, 5,100, ..., Bogota, Colombia, Broadcast.
58.00, 5,172, OK1MPT, Prague, Czecho-Slovakia, Broadcast; 1130-1330.
58.03, 5,170, PMB, Soerabaya, Java, Broadcast.
58.30, 5,145, PMY, Bandoeng, Java, Phone to Australia; 0200.
60.30, 4,975, W2XV, Long Island City, N.Y., Broadcast; Thur. Sat., 1100-1300.
60.99, 4,920, F8GC, Paris, Broadcast.
62.57, 4,795, VE9BY, London, Ont., Broadcast; Mon. 0600-0700.
62.91, 4,770, ZL2XX, Wellington, N.Z., Phone.
63.02, 4,760, ..., Paris, Phone.
67.72, 4,430, DOA, Doeberitz, Ger., Broadcast; Tu., Thur., Sat., 0900-1000, 0500-0600.
70.10, 4,280, OHK2, Vienna, Austria, Broadcast & Sun. first 15 minutes of hour from 0400-1000.
70.15, 4,276, WIR, Rocky Point, N.Y., Phone.
70.21, 4,273, RW15, Khabarovsk, Siberia, Broadcast; 0600-1200.
72.87, 4,116, WPN, Garden City, N.Y., Phone.
72.87, 4,116, KTK, Mussel Rock, Cal., Phone.
74.72, 4,015, NAA, Arlington, Va., Time Signal 1255 and 0255.
75.16, 3,998, PK1AA, Batavia, Java, Broadcast.
80.00, 3,750, I2RO, Prato Smeraldo, Rome, Broadcast; 0600-0800.
80.00, 3,750, F8KR, Constantine, Tunis, Africa, Broadcast; Mon., Fri., nights.
82.88, 3,620, DOA, Doeberitz, Ger., Broadcast.
84.28, 3,560, OZ7RL, Copenhagen, Broadcast; Wed., Sat., after 0900.
95.00, 3,156, PK2AG, Samarang, Java, Phone.
99.02, 3,030, ..., Motala, Sweden, Phone; 0230-1500 0700-1300.



A Radio Dictionary of Definitions.

Admittance is a measure of the alternating current passed by a circuit. It is the reciprocal of impedance and the unit is the MHO.

Aerial resistance is the sum of (a) Radiation resistance ; (b) a resistance factor covering dielectric losses, and (c) ohmic resistance. The product of each of these components and the square of the aerial current, is (a) the useful signal power radiated into space ; (b) the dielectric losses, and (c) the power converted into heat in the aerial wire.

Amplification factor of a valve. The ratio of the change of plate voltage to grid voltage which is necessary to bring about a given increase in plate current. For instance, if a decrease of 1 volt in the grid bias creates the same change of plate current as an increase of 10 volts on the plate, then the amplification factor is 10.

Anode-bend rectification. The use as a detector of a valve with its grid bias adjusted to the knee or bend of the characteristic curve. Also known as plate rectification.

Attenuation. Gradual reduction in amplitude of an electromagnetic wave, or alternating current, due to resistance and dielectric losses.

Autodyne. Self-oscillating detector valve, by reason of having the plate and grid circuits coupled, usually inductively.

Automatic Volume Control. A self-acting device which maintains the output constant within relatively narrow limits while the input voltage varies over a wide range.

Baffle. A partition which may be used with an acoustic radiator to impede circulation between front and back.

Band-pass filter. A combination of inductances and condensers designed to pass a more or less narrow band of frequencies (as distinct from the single resonant frequency of a sharply tuned circuit), with a sharp cutoff at each end of the band. Used commonly in the input circuits of receivers, and the inter-valve couplings of I.F. amplifiers.

Beat Note. An apparently sinoidal wave due to the rise and fall in amplitude arising from the combination of two different frequencies.

Blue Glow. A blue light occurring inside a valve caused by ionisation of the gas present in the envelope.

Capacitive Reactance. The opposition offered by a condenser to the passage of alternating current through it.

Cathode Rays. The stream of electrons emitted by the cathode or negative electrode of a vacuum tube. This principle is made use of for television and laboratory purposes in the cathode ray oscillograph, where the direction of the electron stream is controlled by electrical and magnetic fields.

Characteristic Curves. A curve which shows the relation between two variable quantities. Most usually applied in the case of a valve to the curve of plate current against control grid bias.

Choke. A coil so wound as to have a high reactance at a desired frequency. Low frequency chokes are usually iron-cored, but the presence of iron in a radio frequency choke would introduce too great a loss.

Circular Mil. A circular mil is a unit of circular area, equal to the area of a circle having a diameter of 1 mil, or .001 inch. It is abbreviated C.M. or Cir. Mil. A circular mil is equal to .000,000,7854 sq. inches, or roughly three-fourths of one millionth of a square inch. To find the number of circular mils in the cross section of a wire, it is only necessary to square the diameter in mils.

Class A Amplifiers. Are generally employed in the operation of well-designed audio-frequency and radio-frequency amplifiers of radio receivers. For this use fidelity of signal reproduction is of prime importance. However, fidelity is obtained at the expense of power output and at relatively low efficiency. A radio valve used as a Class A Amplifier, is operated under such conditions that its dynamic characteristics are essentially linear.

Class B Amplifiers. Are employed in radio-frequency power amplifiers and in balanced or push-pull modulators of radio telephone transmitters. It is also finding applications for power output stages of some of the more recent designs of radio receivers. For these uses, large power output is obtained without appreciable distortion and with good efficiency. However, to obtain this large power, a larger exciting grid voltage is usually required than for the same valve in Class A Service. A radio valve used as a Class B amplifier is operated under such conditions that with no exciting grid voltage applied to the tube, the plate current is very small. Under these conditions when excitation voltage is applied, only the least negative half of this voltage produces poweroutput.

Class C Amplifiers. Cover those applications where valves are employed as oscillators or radio-frequency power amplifiers for transmitters. For these uses, very large power output with high efficiency is of primary consideration. However, this high output is obtained at the expense of considerable harmonic distortion. This distortion introduced in the output may be an advantage, as for example in the case of frequency doubler circuits. In the case of a transmitting power output stage, the harmonics are removed from the fundamental frequency by means of suitable filters. A radio valve used as a Class C Amplifier is operated under such conditions that the grid is biased well beyond the point at which plate current starts. Under these conditions when excitation voltage of sufficient magnitude is applied, large peaks of plate current are obtained in the output of the valve.

Conductance. The reciprocal of resistance. (C.F. Admittance.)

Contact Resistance. The resistance between two connecting surfaces not making perfect contact.

Cross Modulation. Interference from a nearby station only heard when the receiver is tuned to the carrier of another station and arriving mainly from the curved characteristics of the R.F. amplifier valves.

Damping. The term to express the rate at which an oscillation dies away. Sometimes applied to the resistance which causes the falling off in amplitude.

Dictionary—cont'd.

Dead Beat Instrument. A measuring instrument arranged so that the needle comes quickly to rest by reason of the high damping.

Decibel. The unit in which the gain of amplifiers is expressed. It is numerically equal to 10 times the logarithm of the ratio of the output power to the input power. Since the ear hears logarithmically, the increase in loudness will be proportional to the gain in decibels. A gain of 1 decibel is just perceptible.

Dielectric. Any insulator, more particularly that between the plates of a condenser.

Displacement current. An alteration in the position of the electrons in a dielectric, caused by an applied potential difference.

Distortion, frequency. Distortion due to unequal amplification or reproduction of audio currents of different frequencies.

Distortion, harmonic. Distortion due to a change in the wave form of the audio currents being amplified or reproduced.

Doublet. An aerial cut in the middle with a double and usually twisted lead-in. Often useful in the reduction of power line interference, particularly on the short waves.

Dynatron. A valve operated with a low plate voltage and a high grid or screen grid voltage, so that the plate impedance is virtually negative, an effect arising from secondary emission. Oscillations will thus occur if a tuned circuit is placed in the plate circuit, no feedback to the grid circuit being necessary.

Eddy Currents. Currents induced in a solid conductor due to a varying magnetic field, as in the core of a power transformer.

Electric-Acoustic Transducer. A transducer which is actuated by power from an electrical system and supplies power to an acoustic system or vice versa.

Electrolytic Condenser. A condenser employing a chemical solution for one plate, a metal electrode for the other, and a gaseous film between the two for the dielectric. Aluminium immersed in a solution of ammonium borate or phosphate is commonly employed.

Electron. The fundamental particle of electricity, negative in sign.

Filter, high-pass. A filter circuit arranged to permit only currents above a certain frequency to pass.

Filter, low pass. A filter circuit arranged to permit only currents below a certain frequency to pass.

Flux Density. The number of lines of force per square inch of sectional area of a magnetic path.

Forced Oscillations—are those maintained in a tuned circuit from an outside source of energy, always at the frequency of the supply.

Free Oscillations—are those which occur in a tuned circuit at the natural or resonant frequency of the circuit.

Grid Current. When the grid of a valve swings positive with respect to the cathode, grid current flows in the same way as in the plate circuit.

Grid Emission. Even at a high negative bias, a residual grid current always exists. It is a measure of the input impedance of the tube, and is due mainly to a photo-electric action by the light from the filament, and to the heat from the filament, causing electrons to be emitted which are attracted to the cathode, which is positive relative to the grid.

Grid Rectification. The use of a valve for de-modulating high frequency transmissions by utilising the one way conductivity of the grid filament circuit. During the impact of a chain of waves, the resultant flow of grid current through the resistance of the grid leak serves to depress the mean voltage level of the grid, and so reduces the value of the plate current at an audible frequency, corresponding to modulated components in the original wave.

Heaviside Layer. A stratum or layer of ionised gas particles in the upper regions of the atmosphere. It serves to reflect and refract back to earth the space waves and currents of transmissions which would otherwise escape into outer space. It is thus possible to make waves pass around the curvature of the earth's surface.

Hysteresis. The tendency of magnetisation to lag behind the magnetising force as, for instance, an iron core in a transformer. There is thus a loss of power which is the main cause of the iron loss in a transformer. This loss is directly proportional to the area of the hysteresis loop for the particular sample of iron. This can usually be obtained from the manufacturers.

Impedance. The opposition offered by a circuit to the passage of alternating current, due to the combined effects of inductance, resistance and capacity.

Inductance. The property of a conductor by virtue of which it opposes any alteration in the value of the current flowing .and hence offers opposition to A.C.

Induction Motor. An alternating current motor in which the armature is not connected to the external circuit, the input current passing only through the field coils, or stator. The armature is rotated by currents induced in the rotor windings. which are virtually short circuited internally. This type of motor is widely used in electric gramophones.

Ion. Any small charged particle of matter ; *e.g.*, an atom plus an electron is a negative ion. Most often used to refer to an atom of a gas which has lost an electron thus becoming positively charged.

Ionisation. The process of splitting up atoms or molecules into ions which thus act as carriers of electricity through a liquid or gas.

Jar. A unit of capacity equal to 1000 centimetres or .0011 mfd.

Kilocycle. A unit of frequency equal to 1,000 cycles. If the wavelength of a station is known it is only necessary to divide 300,000 by the wavelength in metres in order to obtain the frequency in kc. Conversely to obtain the wavelength it is necessary to divide 300,000 by the frequency in kc. Thus a wavelength of 300 metres corresponds to a frequency of 1,000 kc.

Line of Force. An imaginary line used to map out magnetic or electric fields. They are conceived as forming closed loops or circuits. The electric or magnetic force at any particular point acts directly along the one line of force which passes through that point.

Linear Detection. That form of detection in which the output voltage under consideration is substantially proportional to the carrier voltage throughout the useful range of the detecting device.

Dictionary—cont'd.

Litzendraht. (abb. Litz). A stranded conductor in which each strand is insulated from the next. This reduces R.F. resistance but the effect of even one broken strand is serious.

Load Impedance. The impedance of the circuit connected to the output of an electrical device. In the case of a loudspeaker, the load impedance is in part due to the mechanical damping imposed on the vibrating cone by the surrounding air. The load impedance of a triode for maximum undistorted output, should be about twice the plate impedance of the valve.

Megger. An instrument for measuring high resistance of the order of megohms.

Mho. The unit of admittance (A.C.) and also of conductance (D.C.).

Modulation. The variation at audio frequency of the amplitude of a radio frequency or carrier wave.

Mu. Amplification factor.

Neon Tubes. A bulb containing two electrodes in neon gas under reduced pressure. A discharge takes place between the two electrodes when the voltage between them is raised to a certain critical value.

Neutrodyne. A receiver in which the capacity between the plate and grid electrodes of the R.F. amplifiers is counterbalanced by an external capacity connected in one of several circuits. Rendered obsolete by the introduction of the screen grid valve.

Oscillograph. An instrument for recording photographically or showing visually, the waves from alternating or other periodically changing currents and voltages. In the electromagnetic type a large mirror is attached to a small coil vibrating in a magnetic field. In the cathode ray oscillograph a stream of electrons is controlled by alternating electric and magnetic fields

Percentage modulation. The ratio of half the difference between the maximum and minimum amplitudes of a modulated wave to the average amplitude, expressed in per cent.

Permeability. The ratio of the magnetic flux produced in any substance to the applied magnetising force, which is itself equal to the magnetic flux in air. The measure of magnetic conductivity.

Pot Magnet. The field magnet of a moving coil loud speaker, sometimes so called because of its shape.

Power Detection. The form of detection in which the power output of the detecting device is used to supply a substantial amount of power directly to a device such as a loud speaker or recorder.

Power Factor. The ratio of the true power (watts) in an alternating current circuit to the apparent power (volt-amperes). It is always less than one, and is necessary because the voltage and current are not in phase with each other.

Power Grid Detection. A modern development of the grid leak rectifier, in which considerably higher plate voltage is used in combination with a smaller grid condenser and leak. The result is less distortion with a large input voltage but it is not so sensitive as the older method.

Pre-Selection. The use of highly selective tuned circuits preceding the R.F. amplifiers in a receiver in order to avoid cross-modulation and similar troubles. Often referred to as band pass filter.

Quartz Oscillator. An oscillator in which the mechanical oscillations of a quartz plate are maintained by a valve by means of the piezo electric effect.

Regulation. The regulation of an electrical device is a measure of the change in voltage at its output terminals under varying conditions of load.

Screen Grid Valve. A 4 electrode valve in which an extra grid carrying a high positive potential is interposed between the plate and the control grid, in order to electrostatically screen these elements, thus preventing capacity feedback, while at the same time the flow of electrons is not greatly impeded.

Secondary Emission. Electrons liberated from the plate or grid of a valve by the violent impact of the normal electron stream.

S.I.C. Abbreviation for Specific Inductance Capacity or dielectric constant.

Side Band. The additional frequencies which appear when a carrier wave is modulated by a low frequency current. In broadcasting they extend roughly for 5,000 cycles on each side of the fundamental carrier frequency.

Skin Effect. The name given to a crowding of alternating or oscillatory current into the surface layers of a solid conductor at the higher frequencies, resulting in an apparently increased resistance.

Space Charge. The crowd of electrons normally trapped between the cathode and grid of a valve, tending to drive back those electrons which are about to leave the cathode. The effect is to increase the internal impedance of the valve.

Specific Inductive Capacity. The ratio between the capacities of two condensers, one with the material under consideration as the dielectric, the other with an air dielectric. Known as dielectric constant.

Stenode Radiostat. A selective circuit of the superheterodyne type, fitted with a piezo-electric crystal filter or gate to sharpen the tuning and a compensating circuit to restore the cut sidebands.

Superheterodyne. A receiving circuit in which the modulation on the incoming frequency is transferred to an intermediate frequency for amplification.

Super-Regenerator. A receiving circuit in which a reaction detector is maintained by means of a local quenching valve, at the threshold of oscillation where it operates with increased efficiency.

Tetrode. A type of thermionic tube containing a plate, a cathode, and two additional electrodes. (Ordinarily the two additional electrodes are of the nature of grids).

Transconductance. Another term for mutual conductance (q.v.).

Vector. A quantity which is represented by both the magnitude and direction of a straight line. Vector methods are largely applied in alternating current work.

Voice Coil. The coil attached to the cone of a dynamic speaker into which the voice frequency currents from a receiver are passed.

Wave Form. The shape of the curve, representing an alternating current.

Zero Beat. The central portion of a heterodyne whistle which is produced when the local oscillator has a frequency exactly equal to that of the incoming wave.

Dictionary—cont'd.

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Percentage modulation. The ratio of half the difference between the maximum and minimum amplitudes of a modulated wave to the average amplitude, expressed in per cent.

Permeability. The ratio of the magnetic flux produced in any substance to the applied magnetising force, which is itself equal to the magnetic flux in air. The measure of magnetic conductivity.

Pot Magnet. The field magnet of a moving coil loud speaker, sometimes so called because of its shape.

Power Detection. The form of detection in which the power output of the detecting device is used to supply a substantial amount of power directly to a device such as a loud speaker or recorder.

Power Factor. The ratio of the true power (watts) in an alternating current circuit to the apparent power (volt-amperes). It is always less than one, and is necessary because the voltage and current are not in phase with each other.

Power Grid Detection. A modern development of the grid leak rectifier, in which considerably higher plate voltage is used in combination with a smaller grid condenser and leak. The result is less distortion with a large input voltage but it is not so sensitive as the older method.

Pre-Selection. The use of highly selective tuned circuits preceding the R.F. amplifiers in a receiver in order to avoid cross-modulation and similar troubles. Often referred to as band pass filter.

Quartz Oscillator. An oscillator in which the mechanical oscillations of a quartz plate are maintained by a valve by means of the piezo electric effect.

Regulation. The regulation of an electrical device is a measure of the change in voltage at its output terminals under varying conditions of load.

Screen Grid Valve. A 4 electrode valve in which an extra grid carrying a high positive potential is interposed between the plate and the control grid, in order to electrostatically screen these elements, thus preventing capacity feedback, while at the same time the flow of electrons is not greatly impeded.

Secondary Emission. Electrons liberated from the plate or grid of a valve by the violent impact of the normal electron stream.

S.I.C. Abbreviation for Specific Inductance Capacity or dielectric constant.

Side Band. The additional frequencies which appear when a carrier wave is modulated by a low frequency current. In broadcasting they extend roughly for 5,000 cycles on each side of the fundamental carrier frequency.

Skin Effect. The name given to a crowding of alternating or oscillatory current into the surface layers of a solid conductor at the higher frequencies, resulting in an apparently increased resistance.

Space Charge. The crowd of electrons normally trapped between the cathode and grid of a valve, tending to drive back those electrons which are about to leave the cathode. The effect is to increase the internal impedance of the valve.

Specific Inductive Capacity. The ratio between the capacities of two condensers, one with the material under consideration as the dielectric, the other with an air dielectric. Known as dielectric constant.

Stenode Radiostat. A selective circuit of the superheterodyne type, fitted with a piezo-electric crystal filter or gate to sharpen the tuning and a compensating circuit to restore the cut sidebands.

Superheterodyne. A receiving circuit in which the modulation on the incoming frequency is transferred to an intermediate frequency for amplification.

Super-Regenerator. A receiving circuit in which a reaction detector is maintained by means of a local quenching valve, at the threshold of oscillation where it operates with increased efficiency.

Tetrode. A type of thermionic tube containing a plate, a cathode, and two additional electrodes. (Ordinarily the two additional electrodes are of the nature of grids).

Transconductance. Another term for mutual conductance (q.v.).

Vector. A quantity which is represented by both the magnitude and direction of a straight line. Vector methods are largely applied in alternating current work.

Voice Coil. The coil attached to the cone of a dynamic speaker into which the voice frequency currents from a receiver are passed.

Wave Form. The shape of the curve, representing an alternating current.

Zero Beat. The central portion of a heterodyne whistle which is produced when the local oscillator has a frequency exactly equal to that of the incoming wave.

Directory Section.

Most of the information contained in this Directory section has been obtained direct from the manufacturers and wholesalers concerned, and although every care has been taken to prevent inaccuracies or errors, no responsibility is assumed by the Publishers.

Omissions or inaccuries should be notified to the Editor so that the next edition can be revised.

Manufacturers' Directory.

Names, addresses, phone numbers, etc., of Australian radio manufacturers, together with their Interstate branches or representatives. Sole agents or distributors for overseas manufacturers are listed in this section.

MANUFACTURERS. (A).

ACORN PRESSED METAL CO., 6 Mathieson Street, Camperdown—L 2977, Chassis & Pressed Metal—Governing Director, E. Parmiter.

AIRZONE (1931) LTD., 16 Australia Street, Camperdown, Sydney. Phone L 2851 Telegrams and Cables "AIRZONE"—Manufacture "AIRZONE" Radio Receivers and component parts. Interstate Representatives. Frank Harvey, Arco House, Coles Place, Melbourne. R. Plowman, 886 Hay Street, Perth. W. E. Gill, Charles & Rundle Street, Adelaide.

AMALGAMATED WIRELESS (A/SIA.) LTD., 47 York Street, Sydney, Phone BW 2211, G.P.O. Box, 2516 Sydney. 167-169 Queen Street, Melbourne. Phone F 4161, G.P.O. Box 1272L. Melbourne. Interstate Distributors, J. B. Chandler & Company, Brisbane; Newton McLaren Ltd., Leigh Street, Adelaide; Phonographs Ltd., 671 Hay Street, Perth; Findlay's Pty. Ltd., 67 Brisbane Street, Launceston. Amalgamated Wireless prepare specifications and manufacture and instal all manner of wireless equipment all of which is designed and manufactured at Radio Electric Works, Ashfield, Sydney.

AMALGAMATED WIRELESS VALVE CO. LTD., 47 York Street, Sydney. Phone F 4161. General Manager Head Office, Sydney, A. P. Hosking, Melbourne Manager. Anticipated Australian made valves available about June. Agents for Radiotron valves which are available from all wholesalers in Australia.

ANDERSEN & FRANTZEN, cnr. Johnson & Queen Streets, Alexandria, N.S.W., Mascot 284, Cabinet Makers.

Arnold Nunn, 2A Levey Street, Chippendale, N.S.W., MA 1132—Metal Spinners.

Atlas Radio Co., Hibernian Bldgs., 342E Elizabeth Street, Sydney, MA 1871. General Sales Manager, P. A. Morse "ATLAS" radio sets and chassis.

Aucher Ltd., 14 Spring Street, Sydney, B 4167, Telegrams and Cables, "SUNUP."

Australasian Engineering Equipment Pty. Ltd., 415-419 Bourke Street, Melbourne. Telegrams and Cables "ENIQUIP"—Trade Name T.C.C., Products, Fixed & Electrolytic Condensers—Manager, D. G. Doughton, Sales Manager, W. M. Hipgrave. Interstate Representatives—N.S.W., W. J. McLellan,—Q., Trackson Bros.—W. A., Carlyle & Co.

MANUFACTURERS (B).

BEALE & COMPANY, LTD., 41-47 Trafalgar Street, Annandale—Phone L 2791, Telegrams and Cables "BEALE": P.O. Box No. 1621BB., Sydney. Product—Beale PANCHROMATIC Radio Sets—Sales Manager, J. M. Davis—Managing Director, Ronald M. Beale; Interstate Representatives—Maples, Melbourne, & Prahan, Vic., Maples, Wagga, Albury & Cootamundra, Maples, Launceston, Tas. Maples, Hobart, Tas. G. J. Grice Ltd., 90-92 Queen Street, Brisbane: Savery's Pianos Ltd., Adelaide, S.A.: Thomson's Ltd., Perth, W. A.

BLOCH & GERBER, LTD., 46-48 York Street, Sydney—Phone M 2675, Cable Address, "LESAB," G.P.O. Box 2282M: Products "WELDON" Radio Sets, "WELDON" Appliances and Components; Eugene Gerber, Managing Director, Otto Raz, Director; Sales Manager, Vincent J. Buckley, Interstate Representatives—D. Harris & Company, 138 Rundle Street, Adelaide—Craig & Company, 152 Williams Street, Perth; Whitecross Electrical Co., 12-20 Creek Street, Brisbane; W. & G. Genders Pty. Ltd., 53 Cameron Street, Launceston, and 69 Liverpool Street, Hobart.

BREVILLE RADIO, Braefield Bldgs, Cnr. Bourke & Liverpool Streets, Sydney. F 2234—Products; Complete Range of all electric and battery Superheterodyne and TRF Receivers. Proprietors, C. H. Norville and W. J. O'Brien—Sales Manager, W. L. J. O'Brien.

BRITISH GENERAL ELECTRIC CO. LTD., Magnet House, 104 Clarence Street, Sydney. BW 2941: Telegrams and Cables, "OSRAM"—G.P.O. Box 1594BB, Trade Name "OSRAM"—Products "OSRAM" Lamps and valves, "GENELEX" Radio, "GECOPHONE"— Managing Director E. E. Hirst—Sales Manager, W. R. Caithness—General Secretary, T. E. Morgan.

MANUFACTURERS (C).

CARR JAMES & VAUTIN, 661 George Street, Sydney—MA 1420—Cables, "JAYCAR," Trade Name, "CJV," "PERTINAX," Insulating Products—Proprietors John Carr, W. H. James, C. Vautin—Sales Manager—John Carr; Interstate, Vic., Blake Eilbeck, 403 Bourke Street, Melbourne.

Chandler, J. B. & Co., 43-45 Adelaide Street, Brisbane, B 2041, Telegrams & Cables "CHANDLERCO"—P.O. Box 8332. General Manager, J. B. Chandler.

COMMONWEALTH MOULDING & ELECTRIC CO., 24 Princes Highway, Arncliffe, LW 3876—Telegrams & Cables, "COMMOULD," Trade Name, "MARQUIS," Products, Marquis Mouldings. Manager, S. C. Mitchell—Sales Manager, J. P. Taylor, Interstate Representatives—G. P. Embelton & Company, 579 Bourke Street, Melbourne, P. H. Phillips, 195 Elizabeth Street, Brisbane, Qld., A. G. Healing, Ltd., Pirie & Pulteney Streets, Adelaide, S. A., Carlyle & Co., 915 Hay Street, Perth, W.A., W. & G. Genders, Ltd., 53 Cameron Street, Launceston.

Clyde Engineering Co. Ltd., Granville, N.S.W. (UW 8881). Battery Service Station 106-110 Goulburn Street, Sydney (M 6738)—Accumulators.

COLVILLE MOORE WIRELESS SUPPLIES, 4 Rowe Street, Sydney, B 2261, Short Wave Transmitters & receivers; Proprietor, Syd. Colville.

Crammond Radio Manufacturing Company, North Quay, Brisbane, Q'ld.

Creela Radio Products, 2-4 Levy Street, Chippendale, N.S.W. M 3172, Power Transformers and Line Filters.

CROYDON RADIO, Lang Street, Croydon, Telegrams, "SLADE"—Croydon, UJ 4576—Radio Sets, Superhets, Manager—Charles William Slade, Sales Manager, Allan H. Bate, Interstate Representative, Haig & Johnson, 73 Ann Street, Brisbane—Craiks Ltd., Perth, W.A.

Custom Built Radio, 254 Castlereagh Street, Sydney—Trade Name CBR. Proprietor & Sales Manager, E. A. Park.

MANUFACTURERS (D).

DAVIS, A. G. & CO., Wembley House, Railway Square, Sydney. AGD Products, Proprietor, A. G. Davis. MA 2866.

DICKIN, F. LTD., 18-34 Lords Road, Leichhardt. P.O. Box 18, Leichhardt. Products "DICKIN" Cabinets. Managing Director, A. J. Dickin, Sales Manager, T. H. Dickin. Pet. 839.

DON ELECTRICAL CO., 112-116 Salisbury Road, Camperdown—L 2839, "DON QUALITY PRODUCTS"—Proprietor, F. T. O'Donnell; Sales Manager—J. C. W. Vaughan.

DUCON CONDENSER PTY. LTD., 38 Carrington Street, Sydney, Telegrams, "DUCON," Cables, "ESOXUR," Products "DULYTIC," "CHANEX," Manager, A. R. Perrson, B 6541-2.

DUFFY RADIO CO. LTD., 18-20 Martin Place, Sydney: Phone B 3740—Managing Director, H. C. Walker, Chief Engineer, J. Duffy. Specialists in Short Wave Television equipment.

Darelle Products, 9 Brisbane Street, Sydney. Phone M 4916. Trade Name "DARELLE." Sets and Components. Distributors: W. G. Watson & Co. Ltd., (M 4331) Lawrence & Hanson, Electrical Co. Ltd., 33 York Street, Sydney. (B 6476).

MANUFACTURERS (E).

EASTERN TRADING CO. LTD., Keep House, 155 Clarence Street, Sydney. B 6305, Managing Director, A. C. Millingen, Radio Manager, B. Hobden. Branch at McEwan House, Little Collins Street, Melbourne, F 2528. Sole agents for "KENRAD" valves, "POLYMET" Electrolytic and cartridge Condensers, "HYDRA" fixed condensers, Allan Bradley resistor units, "BRADLEYOMETERS"

E.T.C. Mica condensers. Interstate distributors:—Edgar V. Hudson Pty. Ltd., 47 Charlotte Street, Brisbane, Q'ld. B 3733. Newton McLaren Ltd., Leigh Street, Adelaide, S.A. Cl. 8341. Carlyle & Co., 915 Hay Street, Perth, W.A. B 2017. Tasmania Territory handled by Melbourne Branch.

EASY MONDAY (AUST.) PTY. LTD., Head Office, 20 Queen Street Melbourne (Cl. 10044) 26 King Street, Sydney. (B 7625). "PLUMMA" Soldering flux and cord solder.

ECLIPSE RADIO PTY. LTD., 11 Queens Bridge Road, South Melbourne, (M 4681), 137 Clarence Street, Sydney. (B 6937). Telegrams and Cables, "ECLIPSE"—Products, "CROYDEN" sets, "UNIVOX" sets, "ALPHA" parts, "SAXON" parts. Directors, Albert Aarons, Saul C. Aarons, Charles O. Welsh. Sales Managers, Arch. McPhee. Interstate Branches, Adelaide, Manager, H. Collocott, 43 Austin Street, Adelaide (CL. 929). Sydney Manager, R. V. Smith.

EFCO MFG. CO. LTD., Princes Highway, Arncliffe, N.S.W., Telegrams and Cables "EFCO" Arncliffe, LW 1105. All types of dials. Trade name "EFCO"—Managing Director, Richard Facer, Sales Manager, A. J. Larkin. Dials available all wholesalers.

Electricity Meter Manufacturing Co. Ltd., Joynton Avenue, Waterloo, N.S.W. MA 6043. Telegrams and Cables, "ELECTROMET" Sydney. Trade name "EMMCO," Managing Director, J. K. Schartl—Sales Manager, E. M. Searson. Insterstate Representatives, William Begg & Sons, Melbourne, and Adelaide. J. G. Pritchard, Perth, W. & G. Genders Ltd., Tasmania.

Essanay Mfg. Co. Pty. Ltd., 54 Buckhurst Street, South Melbourne. M 3169. Set and Parts Manufacturer.

EVER READY CO. (GT. BRITAIN) LTD., Marshall Street, Surry Hills, N.S.W. FL 4639-4630. Telegrams and Cables "READYWORKS," Sydney. Dry Battery Manufacturers. Managing Director R. P. Walter. Sales Manager, G. K. Herring. Branches, 360 Collins Street, Melbourne, (A. Jewell). Perry House, Elizabeth Street, Brisbane. Distributed by all wholesalers.

EXPRESS UNIVERSAL INSTRUMENT CO., 5 Tinana Street, Haberfield, N.S.W., UW 2741. Interstate Representatives, S. H. Smith, Cr. Mary and Eagle Streets, Brisbane, J. E. Burgess, 403 Bourke Street, Melbourne, Saverys' Pianos, Adelaide and Findlay's Tas.

MANUFACTURERS (F).

Firth Bros. Pty. Ltd., Elizabeth & Latrobe Streets, Melbourne, Vic., F 4127. 301 Castlereagh Street, Sydney, M 2791. Makers of Radio Receivers—Trade Name "PRECEDENT."

MANUFACTURERS (G).

Gladiola & Co., 237-243 Waymouth Street, West Adelaide, S.A., (Cl. 6585). Receiver & Cabinet Manufacturers.

MANUFACTURERS (H).

HAZELL & MOORE LTD., 36 Campbell Street, Sydney, (M 4771) Telegrams and Cables "HAZELMORE" Sydney. "RED SEAL" Receivers. Manager, J. S. Moore, Sales Manager, Frank E. Wodell. Q'ld. Representatives, Westcott Hazell & Moore Ltd., 284 Adelaide Street, Brisbane. Newcastle Branch, 328 Hunter Street.

HEALING, A. G. LTD., 167-173 Franklin Street, Melbourne, C.1., F 5171. Telegrams and Cables, "HEALING." P.O. Box 870J. Products—Healing Golden Voiced. Radio Manager, Keith G. Healing, Sales Manager, G. Irvine, Interstate Branches, S.A., 155 Pirie Street, Adelaide, (CL 4635). N.S.W. 164 Goulburn Street (FL 2601) Sydney. Q'ld., R. J. Rose, Fairfield Rd., Yeerongbilly, Brisbane.

HEIRON & SMITH (SALONOLA) LTD., 389 George Street, Sydney, M 2355. Manufacturers of sets.

HECHT H. & CO., Australia House, 38 Carrington Street, Sydney. B 6451-2. Telegrams "HECHT," Cables "ESOXUR" Sydney and Melbourne. Trade names, "CHANCERY," "CHANEX," "DULYTIC," "JUBILEE," Manager, A. R. Perrson. Sales Manager, Geo. R. Davidson. Melbourne Office, Hecht & Co., 450 Little Collins Street, S.A., W,. T. Mathew, 95 Grenfell Street, Adelaide, W.A. Carlyle & Co., 856 Hay Street, Perth. Q'ld., J. C. Price, Perry House, Elizabeth Street, Brisbane, Tas. W. & G. Genders Pty. Ltd., 53 Cameron Street, Hobart.

HENDERSON P. A. & CO., 409 Lane Cove Road, Crows Nest, X 1214, N.S.W., Trade Name, "HENDERSON"—Products, Henderson Power Equipment. Manager, P. A. Henderson.

Heberholds Dry Batteries (Aust.) Pty., Ltd., 562-566 Spencer Street, Melbourne, Vic., F 5225. Manufacturers of Dry Batteries. Trade name "IMPEX" Telegrams and Cables—"PARWIN MELBOURNE". Manager, W. Parry, Director and Factory Manager, W. F. Winter. Interstate Representatives, A. G. Healing Ltd., Adelaide, W. J. Griffiths, Exton House, Queen Street, Brisbane, Ternes Green, 28 Bond Street, Sydney. W. & G. Genders Pty. Ltd., Cameron Street, Launceston (Tas.). G. M. Martin, King Street, Perth.

Hilco Products Ltd., 207 Latrobe Street, Melbourne, Vic.

Hoelle, J. J. & Co., 47 Alma Street, Darlington, N.S.W., MA 5762. Manufacturers of lugs and terminals. Sales Manager J. J. Hoelle. Interstate Representatives, Q'ld., Brownlow Jarman & Co., 318 Elizabeth Street, Brisbane. Vic., G. P. Hordern, 499 Little Collins Street, Melbourne. N.S.W. F. D. Beston, 379 Kent Street, Sydney. W. Australia, M. J. Bateman Ltd., 12 Milligan Street, Perth.

Howard Radio Co., Vere Street, Richmond, Vic.

Hydro Press Pty. Ltd., 146 Burnley Street, Richmond, E.1., Vic.

MANUFACTURERS (I)

Invincible Radio Co., 12 Castlereagh Street, Sydney., (B 1746). Trade Name, "INVINCIBLE": Products—Radio Chassis. Manager, E.C.R. Wolridge.

MANUFACTURERS (J)

Jackson & MacDonald, 360-362 Kent Street, Sydney, (M 2226). Telegrams and Cables "JAYONDEM" Sydney—Box 848G, Trade Name "REXONOLA": Products, Rexonola Radio Sets and cabinets. Sales Manager, F. W. Travers.

James Mfg. Co. Ltd., 573 Parramatta Rd., Leichhardt, N.S.W. (Pet. 4101-2071). Manufacturers of N.S.T. receivers and components.

MANUFACTURERS (K).

Knock Don B., 102 Nelson Bay Road, Bronte. Short Wave receivers.

Kriesler Radio Co. Ltd., 2 Levy Street, Chippendale, Sydney, (M 4430). Makers of sets and components.

MANUFACTURERS (L).

LEKMEK RADIO LABORATORIES (N. S. Gilmour) 75 William Street, Sydney. Phone, FL 2626. General Manager, N. S. Gilmour, Sales Manager, S. M. Conlon. Radio Sets, Chassis and Components. Telegrams and Cables "NOGIL" Sydney. P.O. 2971 N.N. G.P.O. Sydney. Interstate Distributors for complete sets and chassis. H. C. Little & Co., 858 Hay Street, Perth, W.A. B 7148. Telegrams "LITELECTRA" Perth. Queensland, Warburton Franki Ltd., 233 Elizabeth Street, Brisbane. B 3907. Telegrams "WARBURTONFRANKI" Brisbane. Tasmania, Stuart Johnston Radio, 104A Charles Street, Launceston. Phone B 1847. Lekmek Kits and parts distributed by Speakers (Aust.) Ltd., 70 Clarence Street, Sydney. BW 1114.

MANUFACTURERS (M).

Mead Mfg. Co., 1 Crown Lane, East Sydney. (F 3879). Products: Mead Chassis, Airmead Short Wave Superhetrodyne. Proprietor, Max Mead. Sales Manager, Douglas Craig.

MULLARD RADIO CO. (AUST.) LTD., 35 Clarence Street, Sydney. (BW 1278). Telegrams and Cables "MULVALVE" Sydney. P.O. Box 2118L. Trade Name "MULLARD." Managing Director, G. L. Murray. Sales Manager, Eric Dare. Branches: Victoria, 592 Bourke Street, Melbourne. South Australian Representative, R. C. Woollard, 18 Chesser Street, Adelaide. Queensland Representative, V. J. Griffiths, Exton House, Queen Street, Brisbane. Valves stocked by all wholesalers in all States.

METROPOLITAN ELECTRIC CO. LTD., Cnr. George and Cleveland Streets, Redfern, N.S.W. (M 6108). Telegrams and Cables "RADIOKES" Redfern. P.O. Box Redfern 10. Trade name "RADIOKES." Managing Director, R. K. Stokes. General Manager, J. A. Knight. Factory Representatives, A. M. Ralph, 31 Gilbert Place, Adelaide, S.A. P. H. Phillips, 195 Elizabeth Street, Brisbane, Q'ld. B. Eilbeck, 403 Bourke Street, Melbourne, Vic. Products available from all wholesalers.

Magnavox (Australia) Ltd., 61 Dowling Street, East Sydney, N.S.W. (FL 4174). Managing Director, D. T. Hinchen. Makers of dynamic speakers.

MACLURCAN C., 26 Jamieson Street, Sydney, B 5925, Australian representative for Cossor Valves, distributed through W. G. Watson & Co. Ltd., and available at all wholesalers.

MANUFACTURERS (N).

Newton McLaren Ltd., Leigh Street, Adelaide. (Cl. 8341). Telegrams, "NEWTON McLAREN" Cables "GENERATOR." P.O. Box 1339H. Trade Name "NIGHT HAWK." Managing Director, E. Eardley McLaren. Radio Sales Manager, John P. Hale.

NILSEN & CO. PTY. LTD., O. J. 45-47 Bourke Street, Melbourne. Telegrams and Cables "NILSENS." Trade name "FEDERAL." Manager, O. J. Nilsen. Sales Manager, C. T. Cromie. South Australian Branch Manager, Mr. Lawford, King William Street, Adelaide.

NOYES BROS. (SYDNEY) LTD., York & Erskine Streets, Sydney. B 7581. Telegrams and Cables "NOYES" Sydney. Box No. 1587B, G.P.O., Sydney. Makers of SEYON Radio Sets. Branches, 11 Watt Street, Newcastle, Burton House, Elizabeth Street, Brisbane, Q'ld.

MANUFACTURERS (P).

PARAMOUNT RADIO MFG. CO., 301 Castlereagh Street, Sydney, (MA 3875). Trade Name "PARAMOUNT". Products: Resistors, Coils, Dials. Manager, D. Maskall, Sales Manager, M. J. Anderson.

PEERLESS MANUFACTURING CO. LTD., 18-20 Martin Place, Sydney. (B 3740). Telegrams and Cables, "CINEMA." P.O. Box 1055H. Trade Name, "PEERLESS." Moulded products. Manager, H. C. Walker, Sales Manager, H. E. Gould.

PHILIPS LAMPS (AUST.) LTD., 69-73 Clarence Street, Sydney. (BW 2121). Telegrams and Cables, "ARGENTA," Box 2703C Trade Name "PHILIPS". Managing Director A deu Hertog. Sales Manager, V. H. Mackinney, Interstate Branches Philips Lamps (Aust.) Ltd., 345 P.O. Place, Melbourne. Perry House, Elizabeth Street, Brisbane. Unbehaun & Johnstone Ltd., J. R. W. Gardam, Perth, W.A. Valves and lamps available from all wholesalers in all States.

Precision Engineering Co., 25 Little Collins Street, Melbourne, Vic.

Prior & Rout, 40 Fletcher Street, Bondi, N.S.W. FW 2152. Chassis makers.

Pollock Electrical Mfg. Co. Ltd., 180 Elizabeth Street, Sydney, MA 4814. Coils.

MANUFACTURERS (R).

Radio Corporation Pty. Ltd., 21 Sturt Street, South Melbourne, Phone, M 4711. "ASTOR" Radio Sets.

Radiovision (Aust.) Pty. Ltd., Margaret Street, Richmond, E.1. Vic. Phone, J 2209.

RADIO ACCESSORIES MFG. CO., 155 Bourke Street, East Sydney, FL 1323, "RAMCO" sets and components. Proprietor, F. W. J. Dines. Sales Manager, R. E. Prior.

RAYCOPHONE LTD., Booth & Trafalgar Sts., Annandale, N.S.W. (MW 1834-1874). Telegrams, "RAYCOPHONE.' Radio sets, components and Talking Picture equipment. Distributors, Harringtons Ltd., (All States).

R.C.S. RADIO, 12 City Road, Sydney. MA 2226. Trade Name, "R.C.S." Products: Wire wound components. Proprietor, Ronald A. Bell. Factory representative, R. A. Kelsey, 29 Rowe Street, Sydney. (B 5373).

REYNOLDS R. W. LTD., 200 Chalmers Street, Sydney. (M 6879). Telegrams and Cables, "RENRADE," Products, Resistors, Condensers, (Mica) Voltage Dividers, etc. Manager, R. W. Reynolds. Interstate representative, Scott & Holladay Ltd., (W.A., Tas., N.Z., Q'ld., Vic.), Newton McLaren Ltd., Adelaide, (S.A.), A. G. Davis, Sydney (N.S.W.).

RELIANCE RADIO CO. (A/SIA), 45 York Street, Sydney. B 2223. Trade Name, "RELIANCE." Products, Radio sets, chassis, etc. Mgr. N. T. J. Craven; Sales Mgr. R. M. Wild.

Rola Co. (Aust.) Pty., Ltd., 359 Little Lonsdale St., Melbourne, F 3852. Telegrams "Rola" Melbourne. Products: Dynamic Speakers. Manager, A. L. C. Webb. Sales Manager, R. H. Yeend, Interstate rep., Reg. Rose & Co., Margaret Street Sydney.

RICKETTS & THORP LTD., Kimpton Street, Rockdale, N.S.W. (LW 2641). Cabinet Makers. Salesman F. E. Thorp, Interstate rep. W. O. Barker, Q.P.1. Buildings, Adelaide Street, Brisbane.

MANUFACTURERS (S).

SOUND SYSTEMS LTD., 160 Castlereagh Street, Sydney. M 4152. Public address systems and Talking Picture Equipment.

SPEAKERS (A/SIA) LTD., 70 Clarence Street, Sydney. BW 1114. Telegrams and Cables "SPEAKERS," Sydney. Trade Names, "AMPLION" speakers, "ACCURATE" clocks, "WESTINGHOUSE." Managing Director, P. J. Manley. Sales Manager, T. J. Mathews.

STANDARD TELEPHONES AND CABLES (A/SIA) LTD., 71 York Street, Sydney. BW 1226. Telegrams and Cables, "RELAY" Sydney. Box No. 525B. Trade Name S.T.C. Products: Sets and Components. Radio Manager, H. F. Pearce. Managing Director, H. C. Trenam. Sales Manager, James Clarke. Interstate representatives, C. R. Foster, 588 Bourke Street, Melbourne. Distributors (Vic.) Noyes Bros. (Melbourne) Ltd., 597 Lonsdale Street, Cl. 10105 Bruce Small, Pty. Ltd., 283 Elizabeth Street, F 5195 and Suttons Ltd., 290 Bourke Street, Melbourne, Cl. 4885. Q'ld., Edgar V. Hudson Ltd., 47 Charlotte Street, Brisbane, B 3733. South Australia, Noyes Bros. (Melbourne) Ltd., 119 Pirie Street, Adelaide, Tasmania, W. & G. Genders Pty. Ltd., 53 Cameron Street, Hobart. West Australia, M. J. Bateman, 12 Milligan Street, Perth.

STROMBERG CARLSON (A/SIA) LTD., 72-6 William Street, Sydney. (FL 4184). Telegrams and Cables "STROM" Sydney. Trade Name, "STROMBERG-CARLSON," "AUDIOLA," "ROAMER." Managing Director, L. P. R. Bean. Sales Manager, A. L. Freedman, Interstate representative J. E. Burgess, 403 Bourke Street Melbourne. (Cl.

11212). Q., Smith S. H., Ryan House, Eagle Street, Brisbane. Makers of Radio Receivers, Auto-Radio, variable gang condensers. Authorised distributors: N.S.W., Noyes Bros. (Sydney) Ltd. (B 7581), 11 Watt Street, Newcastle; Warburton Franki Ltd., 307 Kent Street, Sydney. Wagga Wireless Distributors, Box 93 Wagga. Victoria: M. Brash & Co. Pty. Ltd., Elizabeth St., Melbourne.; 146 Ryrie Street Geelong, A. J. Vealls Pty. Ltd., 243 Swanston Street Melbourne. Warburton Franki (Melbourne) Ltd., 380 Bourke Street, Melbourne. Queensland: Noyes Bros. (Sydney) Ltd., Burton House, Elizabeth Street, Brisbane; Lawrence & Hanson, Electrical Co. Ltd., 87 Elizabeth Street, Brisbane. Tasmania: Findlay Bros. Pty., Ltd., 80 Elizabeth Street, Hobart and Goorge Street, Launceston. Wills & Co. Pty. Ltd., of the Quadrant, Launceston and at Devonport. South Australia: Savery's Pianos Ltd., 29 Rundle Street, Adelaide, Radio Wholesalers James Place, Adelaide. Western Australia: Musgroves Ltd., Lyrie House, Murray Street, Perth.

Syme, W. A. & Co., 151 William Street, Sydney. FL 2463. Sets and chassis.

MANUFACTURERS (W).

Wendel Electric Co., 14 St. Francis Street, Melbourne, C.1. (F 6917).

Werring Radio Co., 213 Queensbury Street, Carlton, N.3. (F 5483). O. G. Werring, Manager. Component Manufacturers, "WERRING" Products.

WETLESS ELECTRIC MFG. CO., 281 King Street, St. Peters, N.S.W. (L 2263). Trade Name, "WETLESS." Products: Tubular Paper, Mica (Receiving Transmitting) & Midget var. Condensers. Manager, J. Wetless. Interstate representatives. Alan S. Duke Pty. Ltd., 486 Bourke Street, Melbourne. T. W. Egan, Perth, Trackson Bros., Brisbane, National Radio, Brisbane.

WIDDIS DIAMOND DRY CELLS PTY. LTD., Dalgety Road, Millers Point, B 3004. Head Office, 119 Hawke Street, West Melbourne. F 1175. Telegrams and Cables, "DIAMONDAL". Trade Name "Diamond". Products: Dry Batteries and Torch Units. Manager, W. McK. Scovell. interstate representatives, Hendon Electrical Co. (Melbourne), Reg. Rose & Co., Margaret Street, Sydney.

MANUFACTURERS (Y).

Yelland, L. J., 44-50 Glen Eira Road, Ripponlea S.4., Vic. (L 3130). Products: Radio Receivers, Condensers, Transformers. Trade name, "GRAND OPERA." Manager, L. J. Yelland. Interstate representative, Robert Bryce & Co., Adelaide, Paramount Stores, Hay Street, Perth.

MANUFACTURERS (Z).

ZENITH RADIO CO., 37 Oxford Street, Paddington, N.S.W. (FL 2248). Trade Name, "ZENITH." Radio sets and components. Manager, Jose Alberti. Interstate representative, Zenith Radio Pty. Ltd., Druid House, Swanston Street, Melbourne, Cullity Timbers Ltd., 60 Taylor Street, Leederville, Perth, W.A.

Directory of Trade Names.

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ACE—D. H. M. Callaghan & Co. (resistors).
ACORN—M. Acorn Pressed Metal Co. Ltd. (aluminium chassis, etc.).
ACCURATE—D. Speakers (A/sia) Ltd. (electric clocks).
A.G.D. PRODUCTS—M. A. G. Davis & Co. (chassis).
ALPHA—M. Eclipse Radio Pty. Ltd. (sets).
AIR CELLS—D. Speakers (A/sia) Ltd. (batteries).
AIRMEAD—M. Mead Mfg. Co. (chassis).
AIRWAY—D. Lawrence & Hanson Elec. Co. (receivers).
AIRZONE—M. Airzone (1931) Ltd. (radio receivers and component parts).
AMPLION—D. Speakers (A/sia) Ltd. (speakers and microphones).
ARCTURUS—D. New systems Telephones Pty. Ltd. (valves).
ASTOR—M. Radio Corporation Pty. Ltd. (sets).
ATLAS—M. Atlas Radio Co. (sets and chassis).
AUDIOLA—M. Stromberg-Carlson (A/asia) Ltd. (sets).
A.G.E.—M.D. Associated General Electric Co. Ltd. (sets).

B

BLUE SPOT—D. H. Hecht & Co. (speakers and pickups).
BRADLEYOHMETERS—D. Eastern Trading Co. Ltd. (variable resistors).
BRADLEYUNITS—D. Eastern Trading Co. Ltd. (resistors).
BREVILLE—M. Breville Radio (sets).
BRISTOL—D. Warburton, Franki (Melbourne) Ltd. (recording instruments).
B.T.H.—D. Atkins W. A. Ltd. (pickups).
BUTYLITY—D. G. Robert Davidson & Co. (moulded goods).

C

C.B.R.—M. Custom Built Radio (sets).
CHANCERY—D. H. Hecht & Co. (potentiometers).
CHANEX—M. Ducon Condenser Pty. Ltd. (electrolytic condensers).
C.J.V.—M. Carr, James & Vautin (synthetic resin, coil formers).
CLARITONE—W. Dobbie A. W. & Co. Ltd.
CLYDE—M. Clyde Batteries (accumulators).
COLMO—M. Colville Moore Wireless Supplies (sets).
COSSOR—F.R. Charles D. Maclurcan (valves).
CREELA—M. Creela Radio Products (power transformers and line filters).
CROYDEN—M. Eclipse Radio Pty. Ltd. (sets).

D

DIAMOND—M. Widdis Diamond Dry Cells Pty. Ltd. (batteries)
DICKIN—M. F. Dickin Ltd. (cabinets).
DON QUALITY PRODUCTS—M. Don Electrical Co. (sets).
DULYTIC—M. Ducon Condenser Pty. Ltd. (fixed condensers).
DURHAM—D. W. J. McLellan (resistors).
DARELLE—M. Darelle Products (sets and components).

E

EFCO—M. The Efco Mfg. Co. Ltd. (dials).
EMMCO—M. Electricity Meter Mfg. Co. Ltd. (sets).
E.T.C.—M. Eastern Trading Co. Ltd. (mica condensers).
EVER-READY—M. Ever-Ready Battery Co. Ltd. (dry batteries).
EXIDE—W. Exide Batteries of Australia Ltd. (accumulators).
EXPRESS UNIVERSAL—M. Express Universal Instrument Co. (service equipment).

F

FERRANTI—D. Noyes Bros. Pty. (meters).

G

GECOPHONE—M. & D. British General Electric Co. Ltd.
G.E.—D. Atkins (W.A.) Ltd. (sets).
GENALEX—M. British General Electric Co. Ltd. (radio).
GLADIOLA—M. Gladiola Co. (sets and cabinets).
GOLD MEDAL—M. F. Tritton (Pty.) Ltd. (radio sets) (cabinets)
GRAND OPERA—M. L. J. Yelland (sets and components).
G.R.D.—W. & D. General Radio Distributors (receivers).

11212). Q., Smith S. H., Ryan House, Eagle Street, Brisbane. Makers of Radio Receivers, Auto-Radio, variable gang condensers. Authorised distributors: N.S.W., Noyes Bros. (Sydney) Ltd. (B 7581), 11 Watt Street, Newcastle; Warburton Franki Ltd., 307 Kent Street, Sydney. Wagga

N.S.W. (L 2263). Trade Name, "WETLESS," Products: Tubular Paper, Mica (Receiving Transmitting) & Midget var. Condensers. Manager, J. Wetless. Interstate representatives. Alan S. Duke Pty. Ltd., 486 Bourke Street, Melbourne. T. W. Egan, Perth. Traeksen Bros., Brisbane.

MANUFACTURERS (T).

Targan Electric Co. Pty., Ltd., 131 Brunswick Road, Brunswick, Vic., Phone F 8857. Telegrams: "AIRMASTER." Trade Named Products: "AIRMASTER."

THOM & SMITH, 55 Dowling Street, East Sydney, N.S.W. Phones F 2117 and F 2118. Radio Manufacturers. Proprietors, J. E. Smith and F. W. P. Thom. Sales Manager, R. H. Jennings. Chief Engineer, Y. B. F. J. Grooneveld. Newcastle and District Representative, Eric Cupit, 39 Dumaresq Street, Hamilton. Victorian Representative, William Hill, 191 Queen Street, Melbourne, Phone Central 4155. Queensland Distributors, G. J. Grice, Limited, 91 Queen Street, Brisbane, Phone B 1674. Victorian Distributors, Noyes Bros. (Melbourne) Pty., Ltd., 597 Lonsdale Street, Melbourne, Phone Central 10105; The Leviathan, Ltd. Bourke Street Melbourne. Tasmanian Distributors, Noyes Bros. (Melb.) Pty., Ltd., 36 Argyle Street, Hobart; Noyes Bros. (Melb.) Pty., Ltd., 69 George Street, Launceston. South Australian Distributors, Noyes Bros. (Melb.) Pty., Ltd., 119 Pirie Street, Adelaide. Western Australian Distributors, Unbehaun & Johnstone (W.A.) Limited, 381 Murray Street, Perth.

Tilbury & Lewis Pty., Ltd., 45 Wangaratta Street, Richmond E.1, Victoria.

MANUFACTURERS (U).

UNIVERSITY RADIO CO., 22 City Road, Sydney, Phone MA 2419. Manager, B. Broadhurst. Makers of sets and chassis.

MANUFACTURERS (V).

Vesta Battery Co. (Aust.) Ltd., 14 George Street, Leichhardt, N.S.W., Phone Pet. 1844. Accumulators, Service Station, 71 Macquarie Street, Sydney, BW 5218.

Volta Dry Batteries Pty., Ltd., 123 Thistlewaite Street, South Melbourne, Vic., Phone M 3913. Manufacturers of all types of dry cells. N.S.W. Distributors, Speakers Ltd., 70 Clarence Street, Sydney, BW 1114.

O. G. Werring, Manager. Component Manufacturers, "WERRING" Products.

WETLESS ELECTRIC MFG. CO., 281 King Street, St. Peters,

tative, Zenith Radio Pty. Ltd., Druid House, Swanston Street, Melbourne, Cullity Timbers Ltd., 60 Taylor Street, Leederville, Perth, W.A.

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AIRMEAD—M. Mead Mfg. Co. (chassis).
AIRWAY—D. Lawrence & Hanson Elec. Co. (receivers).
AIRZONE—M. Airzone (1931) Ltd. (radio receivers and component parts).
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ARCTURUS—D. New systems Telephones Pty. Ltd. (valves).
ASTOR—M. Radio Corporation Pty. Ltd. (sets).
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BLUE SPOT—D. H. Hecht & Co. (speakers and pickups).
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CHANEX—M. Ducon Condenser Pty. Ltd. (electrolytic condensers).
C.J.V.—M. Carr, James & Vautin (synthetic resin, coil formers).
CLARITONE—W. Dobbie A. W. & Co. Ltd.
CLYDE—M. Clyde Batteries (accumulators).
COLMO—M. Colville Moore Wireless Supplies (sets).
COSSOR—F.R. Charles D. Maclurcan (valves).
CREELA—M. Creela Radio Products (power transformers and line filters).
CROYDEN—M. Eclipse Radio Pty. Ltd. (sets).

D

DIAMOND—M. Widdis Diamond Dry Cells Pty. Ltd. (batteries)
DICKIN—M. F. Dickin Ltd. (cabinets).
DON QUALITY PRODUCTS—M. Don Electrical Co. (sets).
DULYTIC—M. Ducon Condenser Pty. Ltd. (fixed condensers).
DURHAM—D. W. J. McLellan (resistors).
DARELLE—M. Darelle Products (sets and components).

E

EFCO—M. The Efco Mfg. Co. Ltd. (dials).
EMMCO—M. Electricity Meter Mfg. Co. Ltd. (sets).
E.T.C.—M. Eastern Trading Co. Ltd. (mica condensers).
EVER-READY—M. Ever-Ready Battery Co. Ltd. (dry batteries).
EXIDE—W. Exide Batteries of Australia Ltd. (accumulators).
EXPRESS UNIVERSAL—M. Express Universal Instrument Co. (service equipment).

F

FERRANTI—D. Noyes Bros. Pty. (meters).

G

GECOPHONE—M. & D. British General Electric Co. Ltd.
G.E.—D. Atkins (W.A.) Ltd. (sets).
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GRAND OPERA—M. L. J. Yelland (sets and components).
G.R.D.—W. & D. General Radio Distributors (receivers).

Trade Names—cont'd.

H

HEALING GOLDEN VOICED—M. A. J. Healing Ltd. (sets).
HENDERSON—M. P. A. Henderson & Co. (power equipment).
HOELLE—M. J. J. Hoelle & Co. (metal work terminals).
HOLLINGSWORTH—D. New Systems Telephones Pty. Ltd. (sets).
HYDRA—D. Eastern Trading Co. Ltd. (condensers).

I

IMPERIA—M. Harringtons Ltd. (sets).
IMPEX—M. Herberholds Dry Batteries (Aust.) Pty. Ltd. (batteries).
INVINCIBLE—M. Invincible Radio Co. (chassis).
I.R.C.—D. J. C. Price (Brisbane) (resistors).
I.R.C.—D. W. J. McLellan (resistors).

J

JENSEN—M. Jensen (Aus.) Ltd. (speakers).
JEWELL—D. Warburton, Franki Ltd. (measuring instruments).
JUBILEE—D. H. Hecht & Co. (speakers).

K

KELVIN—D. Henry G. Small & Co. (sets, components)
KENRAD—D. Eastern Trading Co. Ltd. (valves).
KRIESLER—M. Kriesler Radio Co. Ltd. (sets).

L

LEKMEK—M. Lekmek Radio Laboratory (kit sets).
LEWCOS—M. Liverpool Electric Cable Co. (wire).
LINCONOLA—W. M. Brash & Co. (receivers).

M

MAGNAVOX—M. Magnavox (Aust.) Ltd. (speakers).
MAGNET—M. British Generel Electric Co. Ltd. (appliances).
MAGNUM—D. Philips Lamps (Aust.) Ltd. (speakers).
MARQUIS—M. Commonwealth Moulding & Electric Co. (coil formers & pontiometers).
MEAD—M. Mead Mfg. Co. (chassis).
MULLARD—M.D. Mullard Radio Co. (valves).

N

NATIONAL UNION—D. International Radio Co. Ltd. (valves).
NIGHT HAWK—M. Newton McLaren Ltd. (receivers).

O

OSRAM—M.D. British General Electric Co. Ltd. (valves).
OCEANIC—M.D. Mick Simmons Ltd. (sets).

P

PAILLARD—D. W. J. McLellan. (Pick-ups & motors).
PANCHROMATIC—M.D. Beale & Co. Ltd. (sets).
PARAMOUNT—M.D. Paramount Mfg. Co. (resistors).
PEERLESS—M. Peerless Mfg. Co. Ltd. (coil formers, valve sockets, speaker plugs).
PERTINAX—M. Carr James & Vautin. (Insulating Material).
PHILIPS—M.D. Philips Lamps (A/sia) Ltd. (valves).
PLUMMA—M.D. Easy Monday (Aust.) Pty. Ltd. (Soldering flux).
POLLOCK—M.D. Pollock Elec. Mfg. Co. (potentiometers, coils).
POLYMET—M.D. Eastern Trading Co. (electrolytic condensers).
PRECEDENT—M.D. Firth Bros. Pty. Ltd. (sets).

Q

QUEEN OF THE AIR—D. Dobbie A. W. & Co. Ltd.

R

RADIOLA—M. Amalgamated Wireless (A/sia) Ltd. (sets).
RADIOLETTE—M. Amalgamated Wireless (A/sia) Ltd. (sets).
RADIOKES—M. Metropolitan Electric Co. Ltd. (coils & kits).
RADIOTRON—M. Amalgamated Wireless Valve Co. Ltd. (valves).
RADIOVISION—M. Radiovision (Aust.) Pty. Ltd. (sets).
RAMCO—M. Radio Accessories Mfg. Co. (sets).
RAYCOPHONE—M. Raycophone Ltd. (sets & components).
RAYTHEON—D. Standard Telephones & Cables (Aust.) Ltd.
R.C.S.—M. Receiver Components Sydney. (components).
RED SEAL—M. Hazell & Moore Ltd. (sets).
RELIANCE—M. Reliance Radio Co. (receivers & chassis).
RENRADE—M. R. W. Reynolds Ltd. (resistors, condensers).
REXONOLA—D. Jackson & Macdonald. (sets, cabinets).
RICHMOND—M. Richmond Products. (power equipment).
ROAMER—M. Stromberg-Carlson (A/sia) Ltd. (auto radio sets).
ROLA—M. Rola Co. (Aust.) Pty. Ltd. (speakers).

S

SANGAMO—D. Warburton, Franki Ltd. (fixed condensers & components).
SAXON—M.D. Eclipse Radio Pty. Ltd. (components).
SALONOLA—M. Heiron & Smith Ltd. (sets).
SEYON—M.D. Noyes Bros. Ltd. (sets).
SLADE—M.D. Croydon Radio. (sets, analysers).
S.T.C.—M.D. Standard Telephones & Cables Ltd. (sets).
STROMBERG-CARLSON—M. Stromberg-Carlson (A/sia) Ltd. (sets).
STUDEBERG—W. M. Brash & Co. (receivers).
SUNUP—M. Aucher Ltd. (chassis, dials, etc.).
SWIFT—D. R. A. Kelsy. (potentiometers).

T

TASMA—M. Thom & Smith. (sets), (all kinds of fixed condensers).
T.C.C.—M. Australasian Eng. Equipment Co. Pty. Ltd.
TROUBADOUR—M. Electricity Meter Mfg. Co. (receivers).

U

UNIVERSITY—M. University Radio Co. (sets).
UNIVOX—M. Eclipse Radio Pty. Ltd. (sets).
UTILUX—M. J. J. Hoelle & Co. (earthing clips & adaptors).

V

VESTA—M. Vesta Battery Co. (Aust.) Ltd. (accumulators).
VOLTA—M. Volta Batteries Ltd. (batteries).

W

WATES—D. Speakers Ltd. (meters).
WELDON—M. Bloch & Gerber Ltd. (sets & components).
WERRING—M. Werring Radio Co. (sets, components).
WESTINGHOUSE—D. Speakers (A/sia) Ltd. (rectifiers).
WESTON—D. Warburton, Franki Ltd. (measuring instruments).
WETLESS—M. Wetless Mfg. Co. (paper, tubular paper, mica receiving & transmitting, midget var. condensers).

Z

ZENITH—M. Zenith Radio Co. (chassis, receivers, tone & volume controls).
ZEVA—D. Warburton, Franki (Melbourne) Ltd. (soldering irons).

Company or Ownership Particulars.

AMALGAMATED WIRELESS (A/sia) LTD., Head Office, 47 York St., Sydney. Nominal Capital, £1,000,000. Paid up Capital, £744,282. Directors: E. T. Fisk, Esq. (Chairman), C. P. Bartholomew, Esq., The Rt. Hon. W. M. Hughes, P.C., K.C., LL.D., Senator J. D. Millen, T. J. Parker, Esq., Hon. J. F. Coates, M.L.C., F. Strahan, Esq., C.B.E., LL.B. Secretary: J. F. Wilson. General Manager: E. T. Fisk. Auditor: Alex Jobson, F.C.A.

BLOCH & GERBER LTD., Head Office, 46-48 York St., Sydney. Nominal Capital, £50,000. Paid up Capital, £26,200. Directors: Eugene Gerber, Otto Raz. Secretary: H. Lederman. General Manager: Eugene Gerber. Bankers: English, Scottish & Australian. Auditors: John Stewart & Co. Registered—1/4/1926.

3KZ BROADCASTING CO. PTY. LTD., Head Office, 64 Elizabeth St., Melbourne. Directors: M. G. Sloman, W. V. Morgan, S. Morgan. Secretary: M. B. Duffy. General Manager: S. Morgan. Bankers: Bank of Australasia. Auditors: Sloman & Mogg.

THE DUFFY RADIO CO. LTD., Head Office, 18-20 Martin Place, Sydney. Nominal Capital, £2,000. Issued Capital, £1,000. Directors: H. C. Walker. Managing Director: J. Duffy and G. S. Bongers. Secretary: H. C. Walker. General Manager: J. Duffy. Bankers: E.S. & A. Martin Place. Solicitor: Mr. Emil Ford. Registered, 9/2/1933.

HAZELL & MOORE LTD., Head Office, 36-38 Campbell St., Sydney. Nominal Capital, £30,000. Paid up Capital, £24,378. Directors: L. J. Hazell, A. W. Booth, R. A. Patrick, St. J. W. Dansey, E. R. Moore. General Manager: J. S. Moore. Bankers: E.S. & A. Ltd. Auditors: P. J. G. McGrath. Registered, 26/6/1924.

HERBERHOLDS DRY BATTERIES (AUST.) PTY. LTD., Head Office, 562 Spencer St., Melbourne, also Utrecht, Holland. Nominal Capital, £20,000. Directors: Casper Herberhold, W. F. Winter, W. Parry. Secretary: W. F. Winter. General Manager: W. Parry. Bankers: National Bank of Australasia Ltd. Solicitors: O'Donuhue & Brew. Registered, September, 1931.

NOYES BROS. (SYDNEY) LTD., Head Office, 115 Clarence St., Sydney. Nominal Capital, £100,000. Paid up Capital, £99,993. Directors: Messrs. E. F. Moates, E. C. Holroyde, A. Jobson and Mrs. C. C. Noyes. Secretary: Mr. H. L. Tuckerman. Bankers: The Commercial Bank of Australia Ltd. Solicitors: Stephen, Jaques & Stephen. Auditors: H. B. Allard, Way & Hardie. Registered, 3/9/1907.

SPEAKERS (AUSTRALASIA) LTD., Head Office, 70 Clarence St., Sydney. Nominal Capital, £10,000. Paid up Capital, £7,000. Directors: P. J. Manley, K. S. Kopsen. Secretary: J. J. Armstrong. Bankers: E. S. & A. Bank, King Street. Solicitors: Fred C. Emanuel & Pearce. Auditors: Perry & Johnson. Registered, 19/9/1930.

STANDARD TELEPHONES & CABLES (A/sia) LTD., Head Office, 71 York St., Sydney. Nominal Capital, £100,000. Paid up Capital, £100,000. Directors: H. C. Trenam, J. Clarke, R. S. Beckwith, E. H. McInnes, T. N. Bore. Secretary: H. A. Hack. General Manager: H. C. Trenam. Bankers: Bank of Australasia. Solicitors: Minter Simpson & Co. Auditors: Bowes & Craig. Registered, 12/4/1912.

WARBURTON, FRANKI LTD., Head Office, 307-15 Kent St., Sydney. Nominal Capital, £200,000. Paid up Capital, £100,000. Directors: F. J. Carrick (Chairman), G. S. Warburton (Managing Director), R. J. N. Franki. Secretary: H. J. Rodger. General Manager: H. J. Rodgers. Bankers: Commercial Banking Co. of Sydney Ltd., Head Office. Solicitors: Salway & Primrose. Auditors: Allard, Way & Hardie. Registered, 3/11/1910.

ANDERSON, H. C. & FRANTZEN, Johnson St., Alexandria. Proprietors: Hans Christian Anderson and Victor Frantzen. Registered, April, 1916.

BREVILLE RADIO, Braefield Bldgs, Bourke & Liverpool Sts., Sydney. Proprietors: W. J. O'Brien and C. H. Norville. Registered, November, 1932.

CROYDON RADIO SCHOOL, Lang St., Croydon. Proprietor: Chas. W. Slade. Registered, June, 1929.

EXPRESS UNIVERSAL INSTRUMENT CO., 5 Tinana St., Haberfield. Proprietor: A. J. Simpson and A. L. Thorrington. Registered, June 26th, 1932.

McLELLAN, WM. J., Bradbury House, 55 York St., Sydney. Proprietor: Wm. J. McLellan. Registered,

PARAMOUNT RADIO MFG. CO., 301 Castlereagh St., Sydney. Proprietor: Donald Maskall. Registered, May, 1932.

UNITED RADIO DISTRIBUTORS, Pomeroy House, York & Barrack Sts., Sydney. Proprietor: H. C. Long. Registered, 27/9/1932.

UNIVERSITY RADIO CO., 22 City Rd., Sydney. Proprietor: Benjamin Broadhurst. Registered, 11th January, 1933.

WETLESS ELECTRIC MFG. CO., 281 King St., St. Peters. Proprietor: A. P. J. Wetless. Registered, 24th April, 1929.

Wholesalers and Distributors.

ALPHABETICAL LIST.

A

AMALGAMATED WIRELESS (A/SIA) LTD., 45 York St., Sydney, BW 2211 ; 167 Queen St., Melbourne, F 4161.

Associated General Electric Supplies Ltd., 95 Clarence St., Sydney, BW 2261 ; 108 Queen St., Melbourne, CL 7900 ; 27 Grenfell St., Adelaide.

Atkins (W.A.) Ltd., 894 Hay St., Perth, W.A., B 3151, G.P.O. Box D147. Telegrams : " CALCOLIM " Perth. Sales Mgr. : J. J. Nathan. Interstate Rep. : Atkins MacLean Ltd., 301 Castlereagh St., Sydney, N.S.W.

Australian Engineering Equipment Co. Pty. Ltd., 415-419 Bourke St., Melbourne, CL 11315. Telegrams : " ENIQUIP," Melbourne.

B

M. J. Bateman Ltd., 12 Milligan St., Perth, W.A., B 6429. S.T.C. Distributor for W.A.

BEALE & CO. LTD., 41-47 Trafalgar St., Annandale, G.P.O. Box 1621BB. Telegrams : " BEALE," Sydney. L 2791.

Begg William & Co., 499 Little Collins St., Melbourne, C.1., M 1835. Telegrams : " BEGANSONS," Melbourne. Propr. : Reginald H. Begg. Interstate Rep. : William Begg & Son, Hayward Buildings, Charles St., Adelaide.

Bell Norman & Co., Adelaide St., Brisbane, Q'ld. Agent for British General Electric Co. Ltd.

BLOCH & GERBER LTD., 46-48 York St., Sydney. G.P.O. Box 2282M. Telegrams : " LESAB," Sydney. General Wholesalers all radio lines. Man. Dir. : Eugene Gerber ; Dir. : Otto Raz ; Sales Mgr. : Vincent J. Buckley. Interstate Rep. : D. Harris & Co., 130 Rundle St., Adelaide ; Craig & Co., 152 William St., Perth, W.A. ; Whitecross Electrical Co., 12-20 Creek St., Brisbane ; W. &. G. Genders Pty. Ltd., 53 Cameron St., Launceston, and 69 Liverpool St., Hobart, Tas ; Snelling's Sports Depot Rockampton, Q'ld. ; The Laurence Motor Co., Bolsover St., Rockhampton, Q'ld. ; F. Moody, Lake St., Cairns ; Field Cycle & Motor Works, Mackay, Q'ld.

Brash, M. & Co. Pty. Ltd., 108-110 Elizabeth St., Melbourne, C.1., CL 3729. Cables " BRASH PIANO," Melbourne. Managing Dir. : A. G. Brash ; Sales Mgrs. : J. E. Rowson and C. R. Graham. Distributors for Stromberg Carlson & Audiola, Radiola.

BRITISH GENERAL ELECTRIC CO. LTD., Magnet House, 104 Clarence St., Sydney, BW 2941. Telegrams : Cables : " OSRAM," Sydney, G.P.O. Box 1594BB. Managing Director : E. E. Hirst. Sales Mgr. : W. R. Caithness. General Secretary : T. E. Morgan. " Glenalex " and " Osram " " Gecophone." 388 Bourke St., Melbourne, CL 9940.

Brooklands Accessories Pty. Ltd., 150 Lonsdale St., Melbourne, CL 7142.

Brooks Robinson & Co. Ltd., 59 Elizabeth St., Melbourne, C.1., CL 8800. Radiola Distributors.

Bucklands, Wm., Pty. Ltd., 139 Franklin St., Melbourne, F 1188.

C

Callaghan & Co., H. M., 55 York St., Sydney, B 4649. Propr. : H. M. Callaghan. Ace Resistors, General Wholesalers.

Carlyle & Co., 915 Hay St., Perth, W.A., B 2017, G.P.O. Box J716. Telegrams : " LYLECAR," Perth. Mgr. : C. Cohen. General Wholesalers all radio components.

CARR JAMES & VAUTIN, 661 George St., Sydney, MA 1420. Cables : " JAYCAR," Sydney. Propr. : J. Carr, W. H. James, Claude S. Vautin. Sales Mgr. : John Carr. Interstate Rep. : Blake Eilbeck, 403 Bourke St., Melbourne. Insulating materials, moulded products.

Chandler, J. B. & Co., 43-45 Adelaide St., Brisbane. Telegrams : " CHANDLERCO," Brisbane, B 2041, G.P.O. Box 8332. Propr. : John Beals Chandler. General Wholesalers, Q'ld. Distributors for Radiotron, Radiola, Diamond Batteries.

Chandler, D. & W., Ltd., 276 Brunswick St., Fitzroy, N.6. Melbourne, J 4145.

CROYDON RADIO, Lang St., Croydon, N.S.W. Telegrams : " SLADE," Croydon, U J4576. Propr. : C. Slade. Sales Mgr. : Allan H. Bate. Interstate Rep. : Haig & Johnson, 73 Ann St., Brisbane, Q'ld. ; Craiks Ltd., Perth, W.A.

Custom Built Radio, 254 Castlereagh St., Sydney, MA 1308. Propr. & Mgr. : E. A. Park. General Wholesaler parts and sets.

D

Davidson, G., Robert & Co., 38 Carrington St., Sydney, B 1321. Telegrams : " DAVICO," Sydney. Mgr. : R. Davidson. " BUTILITY " Mouldings.

DAVIS, A. G. & CO., Wembley House, Railway Square, Sydney, MA 2866. Propr. : A. G. Davis. General Wholesaler.

Dobbie, E., Ltd., Rundle St. Adelaide, S.A., CL 6170, G.P.O. 70A. Telegrams, Cables : " DOBBICO," Adelaide. Propr. & Mgr. : A. H. Dobbie. General Wholesaler.

Duke, Alan Pty. Ltd., 486 Bourke St., Melbourne, CL 1255. Jensen Speakers, Mullard Valves, general radio wholesaler.

E

ECLIPSE RADIO PTY. LTD., 111 Queensbridge Rd., Sth. Melbourne, M 4681. Telegrams, Cables : " ECLIPSE," Melbourne. Dirs : Albert Aarons, Saul C. Aarons, Charles O. Welsh. Sales Mgr. : Arch. McPhee. Adelaide Branch, 43 Austin St., Adelaide, CL 929. Mgr. : H. Collocott. Sydney Mgr. : R. V. Smith, 137 Clarence St., Sydney, B 6937. Distribution of Parts, chassis sets and valves.

Eddys Ltd., Rundle St., Adelaide, S.A.

EFCO MFG. CO. LTD., Princes Highway, Arncliffe, N.S.W., LW 1105. Telegrams : " EFCO," Arncliffe. Mgr. : Richard Facer. Sales Mgr. : A. J. Larkin. " EFCO " dials all types.

Exide Batteries (Aust.) Ltd., Grace Bldgs., York St., Sydney, G.P.O. Box 3344PP., MA 4795. Telegrams & Cables : " CHLORIDIC," Sydney. Mgr. : E. H. Sharpe. Sales Mgr. : E. V. Hopkins. Interstate Rep. : N.S.W. : Exide Battery Service, Sydney. Victoria : A. P. Sutherland, Melbourne. Queensland : Exide Battery Service (Q.) Pty. Ltd. S. Australia : Unbehaun & Johnstone Ltd., Adelaide. W.A. : W. J. Bateman Ltd., Perth. Tasmania : Medhurst & Sons Pty. Ltd. Hobart and Launceston.

EXPRESS UNIVERSAL INSTRUMENT CO., 5 Tinana St., Haberfield. Analysers and Testing equipment. Interstate Rep. : S. H. Smith, cnr. Mary & Eagle Sts., Brisbane ; J. E. Burgess, 403 Bourke St., Melbourne ; Savery's Pianos, Adelaide and Findlays, Tasmania.

Embleeton, G. B. & Co., 579 Bourke St., Melbourne, CL 9133. Vic. distributors for " Radiokes," " Marquis."

EASTERN TRADING CO. LTD., Keep House, 155 Clarence St., Sydney, B 6305. Branch at McEwan House, Little Collins St., Melbourne, F 2528. Sole Agents for " KENRAD " Valves, " POLYMET " Electrolytic and cartridge Condensers, " HYDRA " fixed condensers, Allan Bradley resistor units, " BRADLEYOMETERS " E.T.C. Mica condensers. Interstate Distributors : Edgar V. Hudson Pty. Ltd., 47 Charlotte St., Brisbane, Q'ld., B 3733 ; Newton McLaren Ltd., Leigh St., Adelaide, S.A., CL 8341 ; Carlyle & Co., 915 Hay St., Perth, W.A., B 2017. Tasmania Territory handled by Melbourne Branch.

F

FOX & MacGILLYCUDDY LTD., Merino House, 57 York St., Sydney, G.P.O. Box 2144LL, B 2409. Telegrams : " FOX RADIO," Sydney. Man. Dir. : A. R. Fox. General Mgr. : G. T. Swanson. Wholesalers and Distributors of all radio lines.

Findlay Bros. Pty. Ltd., 80 Elizabeth St., Hobart and George St., Launceston CL 718. Tasmanian Distributors : Stromberg Carlson & Audiola.

G

Gardam, J. R. & Co., 130 Murray St., Perth, B 9241, G.P.O. Box L903. " GARDAM," Perth. Mgr. : J. R. W. Gardam. Sales Mgr. : M. Murray. Distributors : Philips, Volta Igranic, Ferranti, Jensen.

General Radio Distributors, 197 William St., Sydney, F 3295. Proprs. : F. S. Wilson, J. C. Morgan. Sales Mgr. : J. C. Morgan. Distributors : " GRD " Receivers.

Gerard & Goodman Ltd., 14-16 Synagogue Place, Adelaide, CL 5040, and 132 Rundle St., Adelaide, P.O. Box X2. Man. Dir. : A. E. Gerard. Mgr. & Dir. : A. Hubert Gerard. Telegrams : " GERARD-GOODMAN," Adelaide.

Genders, W. & G. Pty. Ltd., 52 Cameron St., Hobart, Tasmania. Distributors for S.T.C. sets.

Goulson, J., Esq., Radio Supplies, 174 Hunt St., Adelaide.

Grice, G. J., Ltd., 90 Queen St., Brisbane. Distributors for TASMA radio sets and Beale cabinets.

H

Hartleys Ltd., 270 Flinders St., Melbourne, CL 4970. Telegrams : " HARTLEYS," Melbourne. Cables : " HARTSPORT," Melbourne. S. Manager : A. Steward. Sec. : H. W. Joseph. Victorian Distributors, " Radiola " and general wholesalers.

HARRINGTONS LTD., 386 George St., Sydney, BW 2181, G.P.O. Box 4146X. Telegrams, Cables : " HARRINGTONS." Katoomba 507 and 88 Hunter St., Newcastle, 1994. Interstate Branches : 226 Colins St., Melbourne, J 2186 ; 212 Queen St., Brisbane, B 1438 ; 10 Rundle St., Adelaide, CL 3412 ; 28 King St., Perth, B 7725 ; 32 Elizabeth St., Hobart. Distributor of Raycophone sets, Pilot parts and all standard lines.

Harris, Scarfe Ltd., Rundle St., Adelaide.

Harris, Scarfe & Sandovers Ltd., Central Hay St., Perth, W.A., B 8131.

HAZELL & MOORE LTD., 36 Campbell St., Sydney. Telegrams : " HAZELMORE," Sydney. Cables : " HAZELMORE," Sydney. Mgr. : J. S. Moore. Sales Mgr. : Frank E. Wodell. Interstate Reps. : Westcott Hazell & Moore Ltd., 284 Adelaide St., Brisbane ; Hazell & Moore Ltd., 328 Hunter St., Newcaesle, N.S.W.

HEALING, A. G. LTD., 167-173 Franklin St., Melbourne, C.1. Telegrams : " HEALING," Melbourne, G.P.O. Box 870J. Mgr. : Keith G. Healing. S. Manager : C. J. Irvine. Interstate Branches : Adelaide—155 Pirie St., Adelaide, Radio Mgr. : K. Wadham. Sydney—Goulburn St. Brisbane—R. J. Rose, Fairfield Rd., Yeerong-billy, Brisbane.

HECHT, H. & CO., Australia House, 38 Carrington St., Sydney, N.S.W. Telegrams : " HECHT," Sydney. Cables : " ESOXUR," Sydney. Mgr. : A. R. Perrson. Sales Mgr. : G. R. Davidson. Interstate Rep. : Vic.—H. Hecht & Co. ; S.A.—Wm. T. Mathew ; W.A.—Carlysle & Co. ; Qld.—J. C. Price ; Tas.—W. G. Genders Ltd.

Horwood & Co., 123 Brisbane St., Launceston.

Horton, G. H. & Co. Ltd., 66 City Rd., Sydney, G.P.O. Box 35, Chippendale. Telegrams : " MAESTRO," Sydney. Mgr. : George Harry Horton.

Hudson, Edgar V. Pty. Ltd., 45 Charlotte St., Brisbane, B 3733, Box 522H, G.P.O. Brisbane. Telegrams and Cables : " QUPEE," Distributors for Mullard, Radiokes, Emmco, S.T.C., Paillard, T.C.C., Magnavox, Marquis, Impex, Ken-Rad, Polymet, Hydry, Amplion, Westinghouse, Ever-Ready, Diamond, Clyde, Philips, Cossor, Osram. General Wholesalers.

HEIRON & SMITH (SALONOLA) LTD., 389 George St., Sydney, M 2355.

I

Invincible Radio Co., 12 Castlereagh St., Sydney. Propr. : E. C. R. Wolrige.

International Radio Co. Ltd., 254 Castlereagh St., Sydney, MA 1387. Distriburors, National Union Valves, Jensen Speakers, Sprague electrolytic condensers.

J

Jackson & MacDonald, 360-362 Kent St., Sydney, M 2226. Telegrams : " JAYONDEM," Sydney.

K

Keep Bros. & Wood Pty. Ltd., 200 Latrobe St., Melbourne, C.1. Distributor " Astor " sets.

KELSEY, R. A., 29 Rowe St., Sydney. Factory Rep. : R. C. S. Radio products.

Kohn Bros., 116 York St., Launceston, Tasmania.

Kendall Knight & Co. Ltd., 59 York St., Sydney, B 7441. Meters & Testing equipment.

L

Lawrence & Hanson Electrical Co. Ltd., 33 York St., Sydney, B 6476; Leigh St., Adelaide; Elizabeth St., Brisbane. (Q. distributors for Stromberg Carlson); 172-6 William St., Melbourne, G.P.O. Box 80A. Telegrams: "LAWHANSON," Melbourne. Mgr.: S. J. Salmon.
Londringan & Co., 182 Rundle St., Adelaide.
Lovetts Radio, 81 Bathurst St., Hobart, Tas.
LIVERPOOL ELECTRIC CABLE CO. LTD., Lewcos House, 233 Clarence St., Sydney, G.P.O. Box 1296J, M 3821. Mgr.: A. Maughan. Interstate Reps.: Melbourne—Warburton, Franki Ltd., 380-382 Bourke St.; Perth—Carlyle & Co., 915 Hay St.; Brisbane—Intercolonial Boring Co., Ann St., J. C. Price, Perry House, Elizabeth St. Telegrams: Cables: "CONCENTRIC," Sydney. Wholesalers for all kinds of wires.
LEKMEK RADIO LABORATORIES, (N. S. Gilmour), 75 William St., Sydney, FL 2626. Sets and kits.

M

MACLURCAN, CHARLES D., Pratten Blg., 26 Jamieson St., Sydney. Cable Address: "ZINCITE," Sydney. Australian Representative: Cossor Valves. Distributors: W. G. Watson Co. Ltd., all states.
Martin, G. G. Esq., King St., Perth. Distributor Impex batteries.
Martin de Launay Ltd., Sydney & Newcastle. Cables: "MARTINDEL," Sydney. Managing Director: E. de Launay. Sales Manager: E. P. Logan. General wholesalers.
Medhurst, A. Pty. Ltd., Hobart, Tas.
MICK SIMMONS LTD., 28 Martin Place, Sydney, G.P.O. Box 18 B, Haymarket. M 6311. General Radio Wholesalers. Metropolitan Distributors for Radiola sets.
MULLARD RADIO CO. (AUST.), LTD., 35 Clarence St., Sydney G.P.O. Box 2118, L. BW 1278. Telegrams & Cables: "MULVALVE," Sydney. Dir.: G. L. Murray. Sales Mgr.: Eric Dare. valves only.
MUSGROVE LTD., Lyric House, Murray St., Perth, W.A. B 1971. G.P.O. Box 195. Telegrams: "PIANOFORTE," Perth. W.A. Distributors Stromberg Carlson & Audiola receivers.
McLELLAN, W. J., Bradbury House, 55 York St., B 1255. Mfrs. Rep. N.S.W. for T.C.C. condensers, Durham I.R.C. resistors, Stedipower resistors & dividers, Pallaird Motors & pickups, Harlie Microphones & pickups.

N

National Radio, Adelaide St., Brisbane, Queensland.
New System Telephones Pty. Ltd., 276-278 Castlereagh St., Sydney, M 6425. Telegrams: "NEWSYSTANST," Sydney. General Mgr.: J. J. Carroll, Radio Sales Mgr.: A. J. Carey. Branches—55 Rundle St., Adelaide: 181 King St., Melbourne, M 3191.
Newton, McLaren Ltd., Leigh St., Adelaide, S.A., G.P.O. Box 1330 H. Telegrams: "NEWTON McLaren," CL 8341. Man. Dir.: E. Eardley McLaren. Radio Sales Mgr.: John P. Hale. S.A. Distributors for Radiola sets, Radiotron, Diamond Batteries.
Nicholsons Ltd., Barrack St., Perth, Sub-Distributors Radiola sets.
NILSEN O. J. & CO. PTY. LTD., 45-47 Bourke St., Melbourne, CL 572 and 35 King William St., Adelaide, S.A. Telegrams: "NILSENO," Melbourne. Mgr.: Oliver J. Nilsen. Sales Mgr.: C. T. Cromie. Mgr. Adelaide Branch: Mr. Lawford.
NOYES BROS. (SYDNEY), LTD., 115 Clarence St., Sydney, B 7581. Telegrams & Cables: "NOYES" Sydney. Sales Mgr.: (Radio Dept.) Charles Dunn. 11 Watt St., Newcastle, Elizabeth St., Brisbane. Q'ld Distributors, Radiola, Stromberg-Carlson & Audiola sets.
Noyes Bros. (Melb.) Ltd., 597-603 Lonsdale St., Melbourne, C.1., CL 10105. G.P.O. Box 779 H, Telegrams & Cables: "NOYES," Melbourne. Mgr.: A. F. Gordon. Interstate Branches: 119 Pirie St., Adelaide, 36 Argyle St., Hobart, Tas., 59 George St., Launceston. Distributors for TASMA and S.T.C. radio sets.

O

O'Brien, O. H. (Sydney), 37-39 Pitt St., Sydney, BW 1034. Telegrams: Cables: "BELDAS," Sydney. Propr.: Oscar Hall O'Brien. Sales Manager: E. R. Tidswell. Interstate Rep.: W. E. Peterman, 160 Edward St., Brisbane, O. H. O'Brien, 654-664 Bourke St., Melbourne. CL 2179.
Oliver & Oliver Pty. Ltd., Hobart, Tasmania.

P

Paton, A. & Son. 136 Liverpool St., Hobart, Tas.
PHILIPS LAMPS (A/SIA) LTD., 69-73 Clarence St., Sydney. G.P.O. Box 2703 C, BW 2121. Telegrams & Cables: "ARGENTA," Sydney. Mgr.: A. den Hertog. Sales Mgr.: V. H. McKinney. Melbourne C.1. F3191. Adelaide, Unbehaun & Johnstone Ltd., Perth, J.R.W. Gardam, Perth, W.A.
Phonographs Ltd., 671 Hay St., Perth, B 4697. W.A. Distributors Radiola Radiotron, H. Howard Mgr.
Price, J. C., Perry House, Elizabeth St., Brisbane, Q'ld. Propr.: John Clarey Price. General wholesaler.
Pritchard, J. G., 18 William St., Perth. B 4711. Mfrs. Agent, Emmco, Alpha.

R

Radio Imports, Gilbert Place, Adelaide.
RELIANCE RADIO CO. (A/SIA), Reliance House, 45 York St., Sydney, B 2223. Mgr.: N. T. J. Craven, Sales Mgr.: R. M. Wild.
Radio Wholesalers, James Place, Adelaide, S.A. Distributors Stromberg-Carlson & Audiola.

S

Savery's Pianos Ltd., 29 Rundle St., Adelaide. Distributors Stromberg Carlson & Audiola.
Small, H. G., & Co., 374 Post Office Place, Melb. Telegrams & Cables; "HENGSMALL," Melbourne. CL 11455. Mgr.: Henry C. Small. Trade Name: "KELVIN." Wholesaler of sets & components.
Small, Bruce, Pty., Ltd., 283 Elizabeth St., Melbourne, F 515. Distributors, S.T.C.
Smith, S. H., Ryan House, Eagle & Mary St., Brisbane, Q'ld, B 7065. Telegrams: "STROM," Brisbane. Q'ld. Reps.: Stromberg Carlson & Audiola.
SMITH SONS & REES LTD., 30-32 Wentworth Ave., Sydney, M 2631. Telegrams: "SPEEDOMET," Sydney. Man. Dir.: M. W. Rees. Sales Mgr.: M. W. Rees. N.S.W. "Astor," Distributors.
SPEAKERS (AUST.) LTD., 70 Clarence St., Sydney, B 1114. Telegrams & Cables: "SPEAKERS," Sydney. Mgr. Dir.: P. J. Manley, Sales Mgr.: T. J. Mathews. "Amplion" speakers. Interstate Reps: Australasian Engineering Equipment Co. Pty. Ltd., Victoria, Edgar V. Hudson Pty. Ltd., & J. C. Price for Queensland. S. Australia, Newton McLaren Ltd.; W. Australia: Carlyle & Co.; Hobart: A. Paton & Son; Launceston: W. & G. Genders Pty. Ltd.: Trade Names, Amplion, Accurate, Westinghouse. Distributors: LEKMEK Kits, Volta Batteries. Wates Meters.
STANDARD TELEPHONES & CABLES (A/SIA) LTD., 71 York St., Sydney. G.P.O. Box 525 B. Telegrams & Cables; "RELAY," Sydney. S.T.C. Receivers, Raytheon Valves. Sales Mgr.: James Clarke.
Stokoe Motors Pty. Ltd., 559 Elizabeth St., Melbourne, C.1. F 4181.
Sutherland, A. P., 2 Maffra St., South Melbourne, Vic., M 2291. Exide Distributor.

T

TRACKSON BROS. PTY. LTD., 157-159 Elizabeth St., Brisbane, B 2804. Telegrams: "TRACKSON'S," Brisbane. Sales Mgr.: P. S. Trackson. Distributors for Astor, Radiokes, Impex, Renrade, Wetless, T.C.C., Amplion, Ever-ready, Dulytic, Weston & General wholesaler for all radio lines.
THOM & SMITH (TASMA), 55 Dowling St., East Sydney, F 2117. Sets and components.

U

Unbehaun & Johnston Ltd., Gawler Place, Adelaide.
UNITED RADIO DISTRIBUTORS, Pomeroy House, Cr. York & Barrack Sts., Sydney, B 3639. Propr., H. C. Long. General Radio wholesalers
Unbehaun & Johnston (W.A.) Ltd., 381 Murray St., Perth. W.A. Distributors TASMA receivers and Philips Valves.

V

Veal, Arthur J., Pty. Ltd., 243-7 Swanston St., Melbourne, Vic., CL 2057. Telegrams: "ARTVEAL," Melbourne. Mgr.: Herber V. Prior. Sales Mgr.: R. K. McDougall. Distributors, Radiola, Stromberg-Carlson, Audiola, general radio & electrical wholesalers.

W

WARBURTON, FRANKI (MELBOURNE) LTD., 380 Bourke St., Melbourne, C.1. Vic., P. O. Box 478 G. C.L. 8887. Cables: "IGNITION," Melbourne. General Mgr.: B. Montgomery. WARBURTON, FRANKI, LTD. 307-11 Kent St., Sydney, BW 1251. Warburton, Franki (Bris.) Ltd., 233-235 Elizabeth St., Brisbane, R. C. Forbes & Co., 37A Currie St., Adelaide. Carlyle & Co., 915 Hay St., Perth. Medhurst & Sons Pty. Ltd., 95 Collins St., Hobart, Tasmania. Vic. & N.S.W. Distributors: Stromberg-Carlson, Audiola. Weston Meters.
WATSON, W. G., & CO. LTD., 279 Clarence St., Sydney, M 4331. 31 Hunter St., Newcastle; 200 Queen St., Melbourne, CL 1525; 74 Pirie St., Adelaide; 45 King St., Perth; 73 Murray St., Hobart. Telegrams & Cables: "SWITCHON," Sydney. Man. Dir.: W. G. Watson. Distributors: Cossor Valves, Darelle sets.
Wagga Wireless Distributors, Box 93 Wagga, N.S.W. Country distributors for Stromberg-Carlson & Audiola.
Wills & Co. Pty. Ltd., 7 The Quadrant, Launceston, Tas., and at Devonport, Tas. Distributors for Stromberg Carlson & Audiola.

Z

ZENITH RADIO PTY. LTD., Druid House, Swanston St., Melbourne. Mgr.: C. Coles.

Radio Supplies Section.

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(s) Noyes Bros. (Melb.) Ltd.
(s) O'Brien, O. H. (Sydney).
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(s) Kodak (A/sia) Pty. Ltd.
(s) Lawrence & Hanson Electrical Co. Ltd.
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) **MICK SIMMONS LTD.**
(s) Newbigin, J. L.
(s) New Systems Telephones Pty. Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H. (Sydney).
(s) Oliver & Oliver, Ltd.
(s) Price, J. C.
(s) Reliance Radio Co.
(s) Small, H. A., Pty. Ltd.
(s) **SMITH SON & REES, LTD.**
(s) **SPEAKERS (AUST.), LTD.**
(s) **STANDARD TELEPHONES & CABLES, LTD.**
(s) **TRACKSON BROS., PTY, LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WATSON, W. G., & CO. LTD.**
(s) Wills & Co. Pty., Ltd.
(s) **ZENITH RADIO CO.**

BATTERY CLIPS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle, & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HAZELL & MOORE, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WATSON, W. G., & CO., LTD.**

BOLTS & NUTS.

(ms) **ACORN PRESSED METAL CO. LTD.**
(ms) Aucher, Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO. LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) **WATSON, W. G., & CO., LTD.**

BOOKS (RADIO).

(s) Australian Radio Publications.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) Veall, A. J., Pty., Ltd.

BRACKETS (PANEL & BASEBOARD).

(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

BRASSWORK.

(ms) **ACORN PRESSED METAL CO. LTD.**
(m) Gerard & Goodman, Ltd.
(s) **NOYES BROS., LTD.**
(s) **TRACKSON BROS. PTY., LTD.**

BROADCASTING STATIONS.

(ms) AMALGAMATED WIRELESS (A/SIA), LTD.
(ms) STANDARD TELEPHONES & CABLES (A/SIA), LTD.

BULBS (TORCH).

(s) BLOCH & GERBER, LTD.
(ms) BRITISH GENERAL ELECTRIC CO., LTD.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G., & CO.
(s) ECLIPSE RADIO PTY., LTD.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) Hartleys Pty.; Ltd.
(s) HEALING, A. G., LTD.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren, Ltd.
(s) NOYES BROS. (SYDNEY), LTD.
(s) Noyes Bros. (Melb.), Ltd.
(s) PHILIPS LAMPS (A/SIA), LTD.
(s) RELIANCE RADIO CO. (A/SIA), LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.
(s) WATSON, W. G., & CO., LTD.

CABINETS (WOOD).

(ms) ANDERSEN & FRANTZEN.
(m) BEALE & CO., LTD.
(s) BLOCH & GERBER, LTD.
(s) Begg William & Sons.
(s) Brasch & Co, Pty., Ltd.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G., & CO.
(s) DICKIN, F., LTD.
(s) ECLIPSE RADIO PTY., LTD.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(ms) Jackson and MacDonald.
(s) Martin de Launay, Ltd.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren, Ltd.
(s) RELIANCE RADIO CO., A/SIA.
(ms) RICKETTS & THORPE, LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.

CABINETS (Leather and Fabric).

(s) Callaghan, H. M., & Co.
(s) Custom Built Radio.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Martin de Launay, Ltd.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.

CARBONCELLS.

(s) BLOCH & GERBER, LTD.
(ms) BRITISH GENERAL ELECTRIC CO., LTD.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) ECLIPSE RADIO PTY., LTD.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HEALING, A. G., LTD.
(s) Martin de Launay, Ltd.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren Ltd.
(s) NOYES BROS. (SYD.), LTD.
(s) Noyes Bros. (Melb.), Ltd.
(s) RELIANCE RADIO CO. (A/SIA.)
(s) SPEAKERS (AUST.), LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.

CASTINGS.

(m) Electricity Meter Mfg. Co., Ltd.
(s) TRACKSON BROS. PTY., LTD.

CHATTERTONS COMPOUND.

(s) BRITISH GENERAL ELECTRIC CO., LTD.
(s) Gerard & Goodman, Ltd.
(s) HEALING, A. G., LTD.
(s) Newton McLaren, Ltd.
(s) NOYES BROS. (SYD.), LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) WATSON, W. G., & CO., LTD.

CHOKES.

(ms) AIRZONE LTD.
(s) A.S.A. Equipment Co., Ltd.
(s) BLOCH & GERBER, LTD.
(m) BREVILLE RADIO.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G.
(s) DUFFY RADIO CO., LTD.
(ms) ECLIPSE RADIO PTY., LTD.
(m) Electricity Meter Mfg. Co., Ltd.
(ms) Essanay.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(m) HENDERSON, P. A., & CO.
(ms) LEKMEK RADIO LABORATORIES.
(s) Martin de Launay, Ltd.
(m) METROPOLITAN ELECTRIC CO., LTD.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren, Ltd.
(s) NOYES BROS., LTD.
(s) O'Brien, O. H., (Syd.).
(ms) PARAMOUNT RADIO MFG., CO.
(s) Price, J. C.
(m) RAYCOPHONE LTD.
(ms) R.C.S. RADIO.
(s) RELIANCE RADIO CO., A/SIA.
(m) Richmond, J.
(s) SPEAKERS (AUST.), LTD.
(m) Targan Electric Co., Pty. Ltd.
(ms) THOM & SMITH.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.
(s) WATSON, W. G., & CO., LTD.
(m) Yelland, L. J.
(s) ZENITH RADIO CO.

CIRCUIT DRAWINGS.

(ms) AIRZONE LTD.
(s) Gerard & Goodman, Ltd.
(s) HEALING, A. G., LTD.
(s) Martin de Launay, Ltd.
(s) NOYES BROS. (SYD.), LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.

COILS (All kinds).

(ms) AIRZONE. LTD.
(s) A.S.A. Equipment Co., Ltd.
(s) BLOCH & GERBER, LTD.
(m) BREVILLE RADIO.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chand er, J. B., & Co.
(m) CROYDON RADIO.
(s) Custom Built Radio.
(s) DAVIS, A. G.
(s) DUFFY RADIO CO., LTD.
(ms) ECLIPSE RADIO PTY., LTD.
(m) Electricity Meter Mfg. Co., Ltd.
(s) Essanay Co.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HARRINGTONS, LTD.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(ms) LEKMEK RADIO LABORATORIES.
(s) Martin de Launay, Ltd.
(m) METROPOLITAN ELECTRIC CO., LTD.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren, Ltd.
(s) NOYES BROS., LTD.
(s) O'Brien, O. H., (Sydy.).
(s) PARAMOUNT RADIO MFG., CO.
(s) Price, J. C.
(m) RAMCO (Radio Accessories Mfg. Co.).
(sm) RAYCOPHONE, LTD.
(ms) R.S.C. RADIO.
(s) RELIANCE RADIO CO., A/SIA.
(m) STROMBERG-CARLSON (A/SIA), LTD.
(ms) THOM & SMITH.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.

CLOCKS (Electric).

(s) BLOCH & GERBER, LTD.
(m) BRITISH GENERAL ELECTRIC. CO., LTD.
(s) Chandler, J. B., & Co.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HARRINGTONS, LTD.
(s) HEALING, A. G., LTD.
(s) Martin de Launay, Ltd.
(s) MICK SIMMONS, LTD.
(s) Newton McLaren, Ltd.
(s) NOYES BROS. (SYD.), LTD.
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H., (Syd.).
(s) SOUND SYSTEMS, LTD.
(s) SPEAKERS (AUST.), LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.

COIL WINDING MACHINES.

(s) BLOCH & GERBER, LTD.
(s) CARR, JAMES & VAUTIN.
(m) Electricity Meter Mfg. Co., Ltd.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Martin de Launay, Ltd.
(m) THOM & SMITH.
(s) TRACKSON BROS. PTY., LTD.

CONDENSERS (Fixed Paper Type).

(s) A.S.A. Equipment Co., Ltd.
(s) BLOCH & GERBER, LTD.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) CARR, JAMES & VAUTIN.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G., & CO.
(s) DUFFY RADIO CO., LTD.
(ds) EASTERN TRADING CO., LTD.
(s) ECLIPSE RADIO PTY., LTD.
(s) Essanay Co.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HARRINGTONS, LTD.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(s) HECHT, H., & CO.
(s) Jackson & MacDonald.
(s) LEKMEK RADIO LABORATORIES.
(s) Martin de Launay, Ltd.
(s) McLELLAN, W. J.
(s) MICK SIMMONS, LTD.
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) NOYES BROS., LTD.
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) SOUND SYSTEMS, LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veall, A. J., Pty., Ltd.
(m) WETLESS MFG. CO.

CONDENSERS (Fixed Mica Type).

(s) BLOCH & GERBER, LTD.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) CARR, JAMES & VAUTIN.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G., & CO.
(s) DUFFY RADIO CO., LTD.
(ms) ECLIPSE RADIO PTY., LTD.
(m) Electricity Meter Mfg. Co., Ltd.
(ds) EASTERN TRADING CO., LTD.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HARRINGTONS, LTD.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(s) Jackson & MacDonald.
(s) LEKMEK RADIO LABORATORIES.
(s) Martin de Launay, Ltd.
(s) McLELLAN, W. J.
(s) MICK SIMMONS, LTD.
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) NOYES BROS., LTD.
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(m) REYNOLDS, R. W., LTD.
(s) SOUND SYSTEMS, LTD.
(s) TRACKSON BROS. PTY., LTD.
(s) UNITED RADIO DISTRIBUTORS.
(s) Veal , A. J., Pty., Ltd.
(m) WETLESS ELEC. MFG. CO.

CONDENSERS (Electrolytic).

(ms) Aucher, Ltd.
(s) BLOCH & GERBER, LTD.
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) CARR, JAMES & VAUTIN.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) DAVIS, A. G., & CO.
(s) DUFFY RADIO CO., LTD.
(s) ECLIPSE RADIO PTY., LTD.
(ds) EASTERN TRADING CO., LTD.
(s) FOX & MacGILLYCUDDY, LTD.
(s) Gerard & Goodman, Ltd.
(s) HARRINGTONS, LTD.
(s) Hartleys Pty., Ltd.
(s) HEALING, A. G., LTD.
(s) HECHT, H. & CO.
(s) Jackson & MacDonald.
(s) LEKMEK RADIO LABORATORIES.
(s) Martin de Launay, Ltd.
(s) McLELLAN, W. J.
(s) MICK SIMMONS, LTD.

(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) Small, H. G., & Co.
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS., PTY. LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

CONDENSERS (Midget Reaction).

(ms) **AIRZONE, LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) Essanay Co.
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty. Ltd.
(m) **WETLESS ELEC. CO., LTD.**

CONDENSERS (Variable).

(ms) **ACORN PRESSED METAL CO., LTD.**
(ms) **AIRZONE, LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(m) **RAYCOPHONE, LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(ms) **STROMBERG-CARLSON (A/SIA), LTD.**
(s) **SOUND SYSTEMS, LTD.**
(m) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(m) Yelland, L. J.

CONDENSER PADDING.

(m) **METROPOLITAN ELECTRIC CO., LTD.**

COPPER SHIELDING BRAID.

(s) **BLOCH & GERBER, LTD.**
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) Newton McLaren, Ltd.
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTBIURTORS.**
(s) Veall, A. J., Pty., Ltd.

CORDS (Battery, Headphones, etc.).

(s) **BLOCH & GERBRE, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**

CONDENSERS (Electrolytic).

(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LIVERPOOL ELECTRIC CABLE CO.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren. Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(s) Price, J. C.
(m) **REYNOLDS, R. W., LTD.**
(s) **SMITH SONS & REES LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty. Ltd.

CRYSTALS (Detectors).

(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle ; Co.
(s) Chandler J. B., & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS ,LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J. Pty., Ltd.

CRYSTALS (Quartz Oscillating).

(ms) **AMALGAMATED WIRELESS (A/SIA), LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **DUFFY RADIO CO., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

DIALS (All Types).

(ms) **ACORN PRESSED METAL CO.**
(ms) Aucher Ltd.
(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(m) **EFCO MFG. CO.**
(m) Electricity Meter Mfg. Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H., & CO.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Mead Mfg. Co.
(s) **METROPOLITAN ELECTRIC CO., LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Sydney).
(ms) **PARAMOUNT RADIO CO.**
(s) Price, J. C.
(m) **RAYCOPHONE, LTD.**
(s) **RELIANCE RADIO CO.**
(m) Targan Electric Co. Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(d) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

DIAPHRAGM (Headphones & Speakers).

(s) Chandler, J. B., & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES, BROS., LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(s) **UNITED RADIO DISTRIBUTORS.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) Veall, A. J., Pty., Ltd.

DIE MAKERS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(ms) **CARR, JAMES & VAUTIN.**
(m) Electricity Meter Mfg. Co.
(m) Gerard & Goodman, Ltd.
(m) **HOELLE, J. J., & CO.**
(m) **REYNOLDS, R. W., LTD.**
(ms) **THOM & SMITH.**

ELECTRO PLATING.

(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(m) **RAYCOPHONE, LTD.**
(m) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**

ELIMINATORS ABC.

(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(ms) Chandler, J. B., & Co.
(m) **CROYDON RADIO.**
(s) **DAVIS, A. G., & CO.**
(m) **DON ELECTRICAL CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co. Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(m) Mead Mfg. Co.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) **SMITH SONS & REES, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur G., Pty., Ltd.
(m) Yelland, L. J.

EMPIRE CLOTH.

(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) **CARR, JAMES & VAUTIN.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LIVERPOOL ELECTRIC CABLE CO.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H., (Syd.).
(s) Price, J. C.
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

ENGRAVING.

(s) **CARR, JAMES & VAUTIN.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**

ESCUTCHEONS.

(sm) **BEALE & CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(m) **EFCO MFG. CO., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(m) Mead Mfg. Co.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(s) Price, J. C.
(s) **RELIANCE RADIO CO., A/SIA.**
(m) Targan Electric Co. Pty., Ltd.
(s) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

FILTERS (Output).

(s) **BLOCH & GERBER, LTD.**
(s) Callaghan & Co., H. M.
(s) Carlyle & Co.
(s) Chandler & Co., J. B.
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.
(m) Yeland. L. J.

FORMERS.

(ms) A.S.A. Equipment Pty., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Carlyle & Company.
(s) Chandler, J. B., & Co.
(m) **COMMONWEALTH MOULDING & ELECTRIC CO.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H., (Sydney).
(ms) **PARAMOUNT MFG. CO.**
(s) Price, R. C.
(ms) **PEERLESS MGF. CO.**
(s) **R.C.S. RADIO.**
(ms) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty. Ltd.

FUSES.

(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) Hartley Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Jackson and MacDonald.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(m) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

GENERATORS & ROTARY CONVERTERS.

(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Chandler, J. B., & Co.
(m) **DON ELECTRICAL CO.**
(m) Electricity Meter Mfg. Co. Ltd.
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) Newton McLaren, Ltd.
(s) New Systems Telephones Pty., Ltd.
(s) **NOYES BROS., LTD.**
(s) **SMITH SONS & REES, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) Veall, Arthur J., Pty., Ltd.

GRID LEAKS.

(ms) Aucher Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(m) **HOELLE, J. J., & CO.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS, (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(m) **REYNOLDS, R. W., LTD.**
(s) Small, H. G., & Co.
(ms) **STROMBERG-CARLSON (A/SIA), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

HEADPHONES.

(s) Begg, William & Sons.
(s) **BLOCH & GERBER, LTD.**
(m) **BRITISH GENERAL ELECTRIC CO. LTD.**
(s) Callaghan, H. M., & Co.
(s) Chandler, J. B., & Co.
(s) Carlyle & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & Co.**
(s) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co.. Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(s) **STANDARD TELEPHONES & CABLES (AUST.), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

HOME TALKIE APPARATUS.

(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(m) **RAYCOPHONE, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(m) Yelland, L. J.

HORNS.

(s) Callaghan, H. J., & Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**

HYDROMETERS.

(ms) Aucher, Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Chandler, J. B., & Co.
(s) Carlisle & Co.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J. Pty., Ltd.

INSULATING COMPOUND TAPE & MATERIALS.

(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) **LIVERPOOL ELECTRIC CABLE CO.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) O'Brien, O. H., (Sydney).
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

INTERFERENCE ELIMINATORS.

(s) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(m) **DON ELECTRICAL CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **EASTERN TRADING CO., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(ms) **LEKMEK RADIO LABORATORIES.**
(ms) **MICK SIMMONS, LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

IRON (Soft.)

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Newton McLaren, Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) Veall, Arthur J., Pty., Ltd.

KIT SETS.

(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

KNOBS.

(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) **COMMONWEALTH MOULDING & ELECTRIC CO.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO & CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg., Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H., & CO.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(m) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

LABELS AND SCALES.

(s) **HARRINGTONS, LTD.**
(s) **TRACKSON BROS., PTY., LTD.**

LUGS (Tin and Tinned Copper).

(ms) **ACORN PRESSED METAL CO., LTD.**
(m) **REYNOLDS, R. W., LTD.**
(ms) **HOELLE, J. J.**

MARINE WIRELESS EQUIPMENT.

(ms) **AMALGAMATED WIRELESS (A/SIA), LTD.**
(s) **STANDARD TELEPHONES AND CABLES (AUST.), LTD.**

METALS (Rare).

(ms) **HARRINGTONS, LTD.**
(m) **RAYCOPHONE, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**

METERS & MEASURING INSTRUMENTS.

(s) **AMALGAMATED WIRELESS A/SIA, LTD.**
(s) **BLOCH & GERBER, LTD.**
(ms) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Carlyle & Company.
(s) Chandler, J. B., & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(ms) **EXPRESS UNIVERSAL INSTRUMENT CO.**
(ms) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.
(s) **WARBURTON, FRANKI, LTD.**
(s) **WATSON, W. G., LTD.**

MICROPHONES.

(ms) **AMALGAMATED WIRELESS (AUST.), LTD.**
(s) Chandler, J. B., & Co.
(s) Carlyle & Co.
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) **McLELLAN, W. M. J.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(m) **PHILIPS LAMPS A/SIA, LTD.**
(s) **SOUND SYSTEMS, LTD.**
(s) **SPEAKERS (AUST.), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

MICA.

(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H. (Sydney).
(s) **TRACKSON BROS. PTY., LTD.**

MOTORS (Electric Phonograph).

(ms) Aucher, Ltd.
(s) **BEALE & CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **BREVILLE RADIO.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G. LTD.**
(s) Jackson & MacDonald.
(s) Martin de Launay, Ltd.
(s) **McLELLAN, W. J.**
(s) **NOYES BROS., LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

MOULDINGS.

(s) Begg, Wm. & Sons.
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(m) **COMMONWEALTH MOULDING & ELECTRIC CO.**
(s) Davidson, G. R., & Co.
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO CO., PTY., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(ms) Gerard & Goodman, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H. (Sydney).
(ms) **PEERLESS RADIO MFG. CO.**
(m) Targan Electric Co. Pty., Ltd.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**

PHONOGRAPH ACCESSORIES.

(s) **BLOCH & GERBER LTD.**
(s) Chandler, J. B., & Co.
(s) **DUFFY, RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Jackson MacDonald.
(s) **McLELLAN, W. J.**
(s) **MICK SIMMONS, LTD.**
(s) **NOYES BROS., LTD.**
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**

PHONE TERMINALS.

(s) **DAVIS, A. G., & CO.**
(m) **HOELLE, J. J.**
(m) **EFCO MFG. CO.**
(m) **REYNOLDS, R. W., LTD.**

PHOTO ELECTRIC CELLS.

(s) **AMALGAMATED WIRELESS (A/SIA), LTD.**
(ms) **AMALGAMATED WIRELESS VALVE CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(ms) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) **McLELLAN, W. J.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) New Systems Telephones Pty. Ltd.
(s) **NOYES BROS., LTD.**
(m) **PHILIPS LAMPS (AUST.), LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(s) Small, H. A. & Co.
(s) **SOUND SYSTEMS, LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

PICKUPS.

(s) **BEALE & CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan & Co., H.M.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HECHT, H., & CO.**
(s) Jackson & MacDonald.
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, Wm. J.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) Price, J C.
(s) **PHILLIPS LAMPS (A/SIA), LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(s) **SOUND SYSTEMS LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

PLUGS AND JACKS.

(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(m) **COMMONWEALTH MOULDING & ELECTRIC CO.**
(s) Custom Built Radio.
(s) **DAVIS A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HOELLE, J. J., & CO.**
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(m) **STROMBERG-CARLSON, (AUST.), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

PLUGS AND SOCKETS (Radio).

(ms) Aucher, Ltd.
(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & BERGER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(m) **COMMONWEALTH ELECTRIC MOULDING, CO.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) Essanay Company.
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(m) **HOELLE, J. J., & CO.**
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(ms) **PEERLESS MFG. CO.**
(s) **RELIANCE RADIO CO.**
(s) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

POWER PACKS.

(s) A.S.A. Equipment Co., Ltd.
(ms) **AIRZONE (1931) LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(ms) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) Creela Radio Products.
(s) **DAVIS, A. G., & CO.**
(m) **DON ELECTRICAL CO.**
(s) **DUFFY RADIO & CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co.
(s) Essanay Company.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(m) **HENDERSON, P. A., & CO.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) O'Brien, O. H.
(s) Price, J. C.
(m) **RAYCOPHONE, LTD.**
(s) **RELIANCE RADIO CO., A/SIA.**
(m) Richmond, J.
(m) **STANDARD TELEPHONES & CABLES (AUST.) LTD.**
(s) **SMALL, H. G.**
(m) Targan Electric Co. Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur G., Pty., Ltd.
(m) Yelland, L. J.

POTENTIOMETERS.

(ms) **AIRZONE (1931) LTD.**
(ms) **ACORN PEESSED METAL CO., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) Carlyle & Co.
(s) Callaghan, H. M., & Co.
(s) Chandler, J. B., & Co.
(m) **COMMONWEALTH MOULDING & ELECTRIC CO**
(s) Custom Built Radio.

(s) **DAVIS, A. G., & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H., & CO.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de launay, Ltd.
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **McLELLAN, W. J.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS (SYDNEY), LTD.**
(s) Noyes Bros. (Melb.), Ltd.
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(ms) **PARAMOUNT MFG. CO.**
(s) **RELIANCE RADIO CO., A/SIA.**
(ms) **R.C.S. RADIO.**
(ms) **STROMBERG-CARLSON (A/SIA), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

PRESSINGS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) Callaghan, H. M., & Co.
(m) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(m) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(m) **HOELLE, J. J. & CO.**
(s) Price, J. C.
(s) **TRACKSON BROS. PTY., LTD.**

PUBLIC ADDRESS EQUIPMENT.

(ms) **AMALGAMATED WIRELESS (A/SIA), LTD.**
(s) Brasch, M., & Co. Pty., Ltd.
(s) **BREVILLE RADIO.**
(ms) Chandler, J. B., & Co.
(ms) **COLVILLE MOORE WIRELESS SUPPLIES.**
(m) **DON ELECTRICAL CO.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING A. G., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) **NOYES BROS. LTD.**
(m) **PHILIPS LAMPS (AUST.), LTD.**
(m) **RAYCOHPONE, LTD.**
(m) **RELIANCE RADIO CO., A/SIA.**
(s) **SOUND SYSTEMS, LTD.**
(s) **STANDARD TELEPHONES & CABLES (AUST.), LTD**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(m) Yelland, L. J.

RADIO TRADE ANNUAL DIRECTORY SECTION.

RADIO SCHOOLS AND COLLEGES.

Australian Radio College, 22 City Road, Sydney.
Australian School of Radio Engineering, 841 George St., Sydney.
International Correspondence Schools Limited, 140 Elizabeth Street, Sydney.
Marconi School of Wireless, Clarence Street, Sydney.

RECEIVERS (Crystal).

(s) **BLOCH & GERBER, LTD.**
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(m) Mead Mfg. Co.
(s) Newton McLaren, Ltd.
(s) Price, J. C.
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

RECEIVERS (Battery Valve Broadcasting Types).

(ms) **AIRZONE, LTD.**
(ms) **AMALGAMATED WIRELESS (A/SIA), LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) Begg, Wm., & Sons.
(ms) **BLOCH & GERBER, LTD.**
(s) Brasch, M., & Co.
(m) **BREVILLE RADIO.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(ms) Custom Built Radio.
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(sm) **HEIRON & SMITH (Salonola), LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones, Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYD.), LTD.**
(m) **RAYCOPHONE, LTD.**
(m) **RELIANCE RADIO CO.,**
(s) Small, H. G., & Son.
(m) **STROMBERG-CARLSON (A/SIA), LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON, FRANKI, LTD.**
(m) Yelland, L. J.

RECEIVERS (Wired Chassis).

(ms) **AIRZONE, LTD.**
(s) A.S.A. Equipment Co., Ltd.
(ms) Aucher, Ltd.
(s) Begg, Wm., & Sons.
(ms) **BLOCH & GERBER, LTD.**
(m) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(m) **CROYDON RADIO.**
(ms) Custom Built Radio.
(ms) Darelle Products.
(ms) **DAVIS, A. G., & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(m) Mead Mfg. Co.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(ms) **PARAMOUNT MFG. CO.**
(m) **RAMCO (Radio Accessories Mfg. Co.).**
(m) **RAYCOPHONE, LTD.**
(m) **RELIANCE RADIO CO. A/SIA.**
(s) Small, H. G., & Co.
(s) **SMITH SONS & REES, LTD.**
(ms) Syme, W.A., & Co.
(m) Targan Electric Co. Pty. Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(ms) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON. FRANKI LTD.**
(m) Yelland, L. J.

RECEIVERS (Valve Auto Battery).

(ms) **BLOCH & GERBER, LTD.**
(s) Brasch, M., & Co.
(m) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(ms) **HAZELL & MOORE, LTD.**
(s) **HEALING, A. G., LTD.**
(ms) **HEIRON & SMITH (Salonola), LTD.**
(s) Jackson MacDonald.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) **NOYES BROS., LTD.**
(m) **RELIANCE RADIO CO., A/SIA.**
(s) Small, H. G. & Co.
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON FRANKI, LTD.**

RECEIVERS D.C. SUPPLY.

(ms) **AIRZONE LTD.**
(ms) **AMALGAMATED WIRELESS A/SIA LTD.**
(ms) Aucher, Ltd.
(s) Begg, Wm. & Sons.
(ms) **BLOCH & GERBER, LTD.**
(m) Brasch, M. & Co.
(m) **BREVILLE RADIO.**
(s) Callaghan, H. M. & Co.
(s) Chandler, J. B. & Co.
(m) **CROYDON RADIO.**
(ms) Custom Built Radio.
(ms) Darelle Products.
(ms) **DAVIS, A. G. & Co.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys Pty., Ltd.
(ms) **HAZELL & MOORE, LTD.**
(s) **HEALING, A. G., LTD.**
(ms) **HEIRON & SMITH (Salonola), LTD.**
(s) Jackson & MacDonald.
(s) Lawrence & Hanson Elec., Co.
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) Noyes Bros. (Melb.) Ltd.
(s) Price, J. C.
(m) **RAYCOPHONE, LTD.**
(m) **RELIANCE RADIO CO. A/SIA.**
(s) Small, H. G., & Co.
(s) **SMITH SONS & REES, LTD.**
(ms) **STROMBERG-CARLSON A/SIA., LTD.**
(ms) Syme, W. A., & Co.
(m) Targan Electric Co., Pty., Ltd.
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON FRANKI, LTD.**
(m) Yelland, L. J.

RECEIVERS (VALVE A.C. 240V SUPPLY).

(ms) **AIRZONE, LTD.**
(ms) **AMALGAMATED WIRELESS A/SIA., LTD.**
(s) A.S.A. Equipment Co., Ltd.
(ms) Aucher, Ltd.
(s) **BEALE & CO., LTD.**
(s) Begg, Wm., & Sons.
(ms) **BLOCH & GERBER, LTD.**
(m) **BREVILLE RADIO.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Chandler, J. B., & Co.
(ms) Custom Built Radio.
(ms) Darelle Products.
(ms) **DAVIS, A. G., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(sm) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(ms) **HAZELL & MOORE, LTD.**
(s) **HEALING, A. G., LTD.**
(ms) **HEIRON & SMITH (Salonola) LTD.**
(s) Jackson & Macdonald.
(s) Lawrence & Hanson Elec. Co.
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(m) Mead Mfg. Co.
(s) **MICK SIMMONS, LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melbourne) Ltd.
(m) **RAMCO (Radio Accessories Mfg. Co.).**
(m) **RAYCOPHONE, LTD.**
(m) **RELIANCE RADIO CO., A/SIA.**
(s) Small, H. G., Pty., Ltd.
(s) **SMITH SONS & REES, LTD.**
(s) **SOUND SYSTEMS, LTD.**
(m) **STROMBERG-CARLSON A/SIA., LTD.**
(s) Syme, W. A., & Co.

(ms) Targan Electric Co., Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **UNITED RADIO DISTRIBUTORS.**
(m) **UNIVERSITY RADIO CO.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON FRANKI, LTD.**
(m) Yelland, L. J.

RECEIVERS (SUPERHETRODYNE)

ms) **AIRZONE (1931) LTD.**
(ms) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) **BEALE & CO.**
(s) Begg Wm., & Sons.
(ms) **BLOCH & GERBER LTD.**
(m) **BREVILLE RADIO.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Brasch M. & Co., Pty., Ltd.
(s) Callaghan H. M. & Co.
(s) Chandler J. B. & Co.
(m) **CROYDON RADIO.**
(ms) Custom Built Radio.
(ms) Darelle Products.
(ms) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co., Ltd.
(ms) Essanay Pty., Ltd.
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(ms) **HAZELL & MOORE LTD.**
(s) **HEALING, A. G. LTD.**
(ms) **HEIRON & SMITH (Salonola) LTD.**
(s) Jackson & MacDonald.
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) Mead Mfg. Co.
(s) **MICK SIMMONS LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. LTD.**
(m) **RAMCO (Radio Accessories Mfg. Co.)**
(m) **RAYCOPHONE LTD.**
(m) **RELIANCE RADIO CO. (A/SIA).**
(s) Small, H. G. & Co.
(s) **SMITH SONS & REES LTD.**
(s) **SOUND SYSTEMS LTD.**
(m) **STANDARD TELEPHONES & CABLES (AUST.) LTD.**
(m) **STROMBERG-CARLSON (A/SIA) LTD.**
(ms) Syme, W. A. & Co.
(m) Targan Electric Co. Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(m) **UNIVERSITY RADIO CO.**
(s) Veall, A. J. Pty., Ltd.
(s) **WARBURTON, FRANKI LTD.**
(m) Yelland, L. J.

RECEIVERS (Combination Radio Phonograph).

(ms) **AIRZONE (1931) LTD.**
(ms) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) Begg, Wm. & Sons.
(ms) **BLOCH & GERBER LTD.**
(m) **BREVILLE RADIO.**
(s) Brasch, M. & Co., Pty., Ltd.
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M. & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(ms) Darelle Products.
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) Electricity Meter Mfg. Co., Ltd.
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G. LTD.**
(ms) **HEIRON & SMITH (SALONOLA) LTD.**
(s) Jackson & MacDonald.
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) **MICK SIMMONS LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) **NOYES BROS. LTD.**
(m) **RAMCO (Radio Accessories Mfg. Co.)**
(m) **RAYCOPHONE LTD.**
(m) **RELIANCE RADIO CO. (A/SIA).**
(s) Small, H. G. & Co.
(s) **SMITH SONS & REES LTD.**
(m) **STROMBERG-CARLSON (A/SIA) LTD.**
(m) Targan Electric Co., Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(m) **UNIVERSITY RADIO CO.**
(s) Veall, A. J. Pty., Ltd.
(s) **WARBURTON, FRANKI Ltd.**
(s) Yelland, L. J.

RECTIFIERS (METAL AND DRY CONTACT).

(s) **BLOCH & GERBER LTD.**
(s) Callaghan, H. M. & Co.
(s) Custom Built Radio.
(m) **DON ELECTRICAL CO.**
(s) **DAVIS, A. G. & CO.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HEALING, A. G. LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) **MICK SIMMONS LTD.**
(s) McLellan, W. J.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) **RELIANCE RADIO CO. (A'SIA).**
(s) **SPEAKERS (A/SIA) LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

RECTIFIERS (VALVE).

(s) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(s) **BLOCH & GERBER LTD.**
(s) **BREVILLE RADIO.**
(ms) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M. & Co.
(s) Custom Built Radio.
(s) Chandler, J. B. & Co.
(s) Carlyle & Co.
(s) **DAVIS, A. G. & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G. LTD.**
(s) International Radio Co., Ltd.
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO LABORATORIES.**
(s) **MICK SIMMONS LTD.**
(ms) **MULLARD RADIO (A/SIA) CO., LTD.**
(s) New Systems Telephones Ltd.
(s) Newton MacLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) Noyes Bros. (Melb.) Ltd.
(m) **PHILIPS LAMPS (AUST.) LTD.**
(s) Price, J. C.
(s) **RELIANCE RADIO CO. (A/SIA).**
(s) H. G. Small Pty., Ltd.
(s) **STANDARD TELEPHONES & CABLES (A/SIA) LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WATSON, W. G. & CO.**

REPAIRS (coils, Headphones, Transformers, etc.)

(s) **BLOCH & GERBER LTD.**
(m) Chandler, J. B. & Co.
(m) **DON ELECTRICAL CO.**
(m) **DAVIS, A. G. LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) **MICK SIMMONS LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Arthur J., Veall Pty., Ltd.
(s) **WARBURTON, FRANKI LTD.**
(m) Yelland, L. J.

REPETITION WORK.

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) Begg Williams & Sons.
(ms) **EFCO MFG. CO.**
(s) Essanay Co.
(ms) Gerard & Goodman Ltd
(m) Targan Electric Co., Pty., Ltd.
(s) **TRACKSON BROS PTY., LTD.**

RESISTANCES.

(ms) **AIRZONE (1931) LTD.**
(ms) Aucher Ltd.
(s) **BLOCH & GERBER LTD.**
(ms) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(m) **DON ELECTRICAL CO**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G. LTD.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **McLELLAN, W. J.**
(s) **MICK SIMMONS LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. LTD.**
(s) O'Brien, O. H. (Sydney).
(ms) **PARAMOUNT RADIO MFG. CO.**
(s) Price, J. C.
(s) **RELIANCE RADIO CO.**
(m) **REYNOLDS, R. W. LTD.**
(ms) **R.C.S. RADIO.**
(s) Small, H. G. & Co.
(s) **SOUND SYSTEMS LTD.**
(ms) **STROMBERG-CARLSON (A/SIA) LTD.**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Arthur J., Veall, Pty., Ltd.

RHEOSTATS.

(ms) **AIRZONE (1931) LTD.**
(s) **BLOCH & GERBER LTD.**
(s) Callagahn & Co.
(s) Custom Built Radio.
(ms) Chandler, J. B. & Co.
(s) Carlyle & Co.
(m) **DON ELECTRICAL CO.**
(s) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) **MICK SIMMONS LTD.**
(s) Mead Mfg. Co.
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **McLELLAN, W. J.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) Ltd.**
(s) Noyes Bros. (Melb.) Ltd.
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(ms) **PARAMOUNT MFG. CO.**
(s) **RELIANCE RADIO CO.**
(ms) R.C.S. (Receiver Components Sydney).
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J. Pty., Ltd.

RECEIVERS (ALL WAVE BATTERIES)

(ms) **DUFFY RADIO CO., LTD.**

SHIELDS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(m) **AIRZONE LTD.**
(s) A.S.A. Equipment Co.
(ms) Arnold & Nunn.
(s) **BLOCH & GERBER LTD.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) Essanay Co.
(ms) Electricity Meter Mfg. Co., Ltd.
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G. LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) **MICK SIMMONS LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) Price, J. C.
(m) **RAYCOPHONE LTD.**
(s) **RELIANCE RADIO CO. (A/SIA).**
(s) **TRACKSON BROS. PTY., LTD.**
(ms) **STROMBERG-CARLSON (A/SIA) LTD.**
(ms) Targan Electric Co., Pty., Ltd.
(s) Trackson Bros. Pty. Ltd.
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

SHORT WAVE CONVERTERS.

(ms) **COLVILLE-MOORE WIRELLESS SUPPLIES.**

SHORT WAVE ADAPTORS.

(ms) **COLVILLE-MOORE WIRELESS SUPPLIES**

SOCKETS.

(ms) **AIRZONE LTD.**
(s) A.S.A. Equipment Co. Ltd.
(s) Aucher Ltd.
(s) **BLOCH & GERBER LTD.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) **CARR JAMES & VAUTIN.**
(s) Chandler & Co., J. B.
(m) **COMMONWEALTH MOULDING AND ELECTRIC CO.**

(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(s) **DUFFY RADIO CO., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(sm) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G. LTD.**
(s) **HECHT H. & CO.**
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) McLellan, W. J.
(s) **MICK SIMMONS LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) Noyes Bros. (Melb.) Ltd.
(s) O'Brien, O. H. (Sydney).
(ms) **PEERLESS RADIO MFG. CO.**
(s) Price, J. C.
(m) **RAYCOPHONE LTD.**
(s) **RELIANCE RADIO CO. (A/SIA).**
(m) **REYNOLDS, R. W., LTD.**
(m) **STANDARD TELEPHONES & CABLES (AUST.) LTD.**
(ms) **STROMBERG-CARLSON (A/SIA) LTD.**
(m) Targan Electric Co., Pty., Ltd.
(s) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur G., Pty., Ltd.

SCREENS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) A.S.A. Equipment Co., Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler & Co., J. B.
(s) **DAVIS, A. G., & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) Essanay Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Price, J. C.
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

SCREWS.

(ms) Aucher, Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Customs Built Radio.
(s) **DAVIS, A. G., & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HEALING, A. G., LTD.**
(s) Hartleys, Pty., Ltd.
(s) Jackson MacDonald.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.

SHORT WAVE COMPONENTS.

(s) A.S.A. Equipment.
(ms) **AIRZONE, LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler & Co., J. B.
(ms) **COLVILLE-MOORE WIRELESS SUPPLIES.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & Co.**
(s) Essanay Co.
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(m) Mead Mfg Co.
(s) New Syttems Telephones.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Price, J. C.
(ms) **PARAMOUNT MFG. CO.**
(m) **RAYCOPHONE, LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty. ,Ltd.
(m) Yelland, L. J.

SOLDERING MATERIAL—IRONS, ETC.

(s) **BLOCH & GERBER, LTD.**
(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co.
(s) Custom Built Radio.
(s) Chandler, J. B., & Co.
(s) Carlyle & Co.
(s) **DAVIS, A. G., & CO.**
(ms) **EASY MONDAY (AUST.), LTD.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Martin de Luanay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) O'Brien, O. H. (Sydney).
(ms) Targan Electric Co., Pty., Ltd.
(s) **TRACKSON BROS., PTY. ,LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. G., Pty., Ltd.

SPEAKERS (CONE TYPE).

(ms) **AMALGAMATED WIRELESS A/SIA., LTD.**
(s) **BLOCH & GERBER, LTD.**
(s) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **ECLIPSE RADIO, PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H., & CO.**
(s) International Radio Co., Ltd.
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(s) New Systems Telephones, Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melbourne), Ltd.
(s) **PHILIPS LAMPS (A/SIA.), LTD.**
(s) **RELIANCE RADIO CO. A/SIA.**
(s) Small, H. G., Pty., Ltd.
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur G., Pty., Ltd.

SPEAKERS (DYNAMIC).

(ms) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(s) **BEALE & CO., LTD.**
(s) Begg Wm. & Sons.
(s) **BLOCH & GERBER LTD.**
(s) Brasch, M. & Co., Pty., Ltd.
(s) **BREVILLE RADIO.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(s) **DUKE, ALAN S., PTY., LTD.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(ms) **FOX & MacGILLYCUDDY LTD.**
(s) Garard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H. & CO.**
(d) International Radio Co., Ltd.
(s) Jackson & MacDonald.
(ms) **JENSEN PTY., LTD.**
(s) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(s) **MICK SIMMONS LTD.**
(m) **MAGNAVOX (AUST.) LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) Noyes Bros. (Melb.) Ltd.
(s) O'Brien, O. H. (Sydney).
(s) **PHILIPS LAMPS (A/SIA) LTD.**
(s) Price, J. C.
(s) **RELIANCE RADIO CO. (A/SIA).**
(m) Rola Coy. (Aust.) Pty., Ltd.
(s) Small, H. G. & Co.
(s) **SMITH SON & REES LTD.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) A. J. Veall, Pty., Ltd.

STAMPINGS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(ms) **EFCO MFG. CO.**
(ms) Gerard & Goodman Ltd.
(s) **HEALING, A. G. LTD.**
(s) **HECHT, H. & CO.**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS., PTY., LTD.**

SUPER-HET COMPONENTS.

(ms) **AIRZONE (1931) LTD.**
(ms) Aucher Ltd.
(s) **BLOCH & GERBER LTD.**
(m) **BREVILLE RADIO.**
(s) Callaghan & Co., H. M.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(ms) Darelle Products.
(ms) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) Hartleys Pty., Ltd.
(s) **HARRINGTONS LTD.**
(s) **HEALING, A. G. LTD.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Ltd.
(m) Metropolitan Electric Co., Ltd.
(s) Newton McLaren Ltd.
(s) **NOYES BROS. LTD.**
(s) Price, J. C.
(m) **RAYCOPHONE LTD.**
(ms) **R.C.S. RADIO.**
(s) **SMITH SON & REES LTD.**
(s) **STROMBERG-CARLSON (A/SIA) LTD.**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Arthur J., Pty., Ltd.
(m) Yelland, L. J.

SWITCHES.

(s) Begg Wm. & Sons.
(s) **BLOCH & GERBER LTD.**
(s) **BRITISH GENERAL ELECTRIC CO.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) Hartleys Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay Lrd.
(s) **MICK SIMMONS LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. LTD.**
(s) Price, J. C.
(s) **SMITH SON & REES LTD.**
(s) **STROMBERG-CARLSON (A/SIA) LTD.**
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS. PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

SCREEN GRID CLIPS.

(s) **ACORN PRESSED METAL CO., LTD.**
(ms) **HOELLE & CO., J. J.**
(m) **REYNOLDS, R. W., LTD.**

SERVICE (FOR TRADE).

(s) Electrical & Radio Maintenance Co.
(s) **EXPRESS UNIVERSAL INSTRUMENT CO.**

TELEVISION APPARATUS.

(ms) **DUFFY RADIO CO., LTD.**
(s) **HARRINGTONS, LTD.**

TERMINAL CONNECTORS AND TAGS.

(ms) **ACORN PRESSED METAL CO.**
(s) A.S.A. Equipment Co., Ltd.
(ms) Aucher, Ltd.
(s) **BLOCH & GERBER, LTD.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Chandler, J. B., & Co.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(ms) **HOELLE, J. J., & CO.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Price, J. C.
(m) Targan Electric Co., Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS., PTY., LTD.**

(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

TOOLS.

(ms) **ACORN PRESSED METAL CO., LTD.**
(s) Callaghan, H. M. & Co.
(s) Chandler, J. B. & Co.
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Targan Electric Co., Pty., Ltd.
(s) **TRACKSON BROS., PTY., LTD.**
(s) Veall, A. J., Pty., Ltd.

TRANSFORMERS—AUDIO.

(m) **ACORN PRESSED METAL CO., LTD.**
(s) A.S.A. Equipment Co., Ltd.
(ms) **AIRZONE (1931), LTD.**
(s) **BLOCH & GRRBER, LTD.**
(s) Begg, Wm., & Sons.
(m) **BREVILLE RADIO.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Creela Radio.
(s) Custom Built Radio.
(m) **DON ELECTRICAL CO.**
(ms) Darelle Products.
(s) **DAVIS, A. G., & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(ms) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(m) **HENDERSON, P. A., & CO.**
(ms) **LEKMEK RADIO LABORATORIES.**
(s) Martin de Launay, Ltd.
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(m) **RAYCOPHONE, LTD.**
(m) Richmond, J.
(s) **RELIANCE RADIO CO. (A/SIA.).**
(s) Small, H. G., & Co.
(s) **SOUND SYSTEMS, LTD.**
(s) **STANDARD TELEPHONES & CABLES (A/SIA.). LTD.**
(m) **STROMBERG-CARLSON (A/SIA.), LTD.**
(m) Targan Electric Co., Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, Pty., Ltd.
(m) Yelland, L. J.

TRANSMITTING APPARATUS.

(ms) **AMALGAMATED WIRELESS (A/SIA.), LTD.**
(m) Chandler, J. B., & Co.
(m) **COLVILLE MOORE WIRELESS SUPPLIES.**
(ms) **HARRINGTONS, LTD.**
(m) **PHILIPS LAMPS (A/SIA.), LTD.**

TUNING UNITS.

(s) **BLOCH & GERBER, LTF.**
(s) Callaghan, H. M., & Co.
(s) Carlyle & Co.
(ms) Chandler, J. B., & Co.
(ms) Darelle Products.
(s) **DAVIS, A. G., & CO.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(ms) **HARR NGTONS, LTD.**
(s) **HEALING, A. G., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Price, J. C.
(s) **TRACKSON BROS , PTY., LTD**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.

VALVES (ALL TYPES).

(s) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(m) **AMALGAMATED WIRELLESS VALVE CO., LTD.**
(s) Associated General Electric Supplies Ltd.
(s) **BEALE & CO., LTD.**
(s) Begg Wm. & Sons.
(s) **BLOCH & GERBER LTD.**
(s) Brasch M. & Co., Pty., Ltd.
(s) **BREVILLE RADIO.**
(ms) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(s) Chandler & Co., J. B.
(s) Customs Built Radio.
(s) **DAVIS, A. G. & CO.**
(s) **DUFFY RADIO CO., LTD.**
(s) Duke, Alan S., Pty., Ltd.
(s)) **ECLIPSE RADIO PTY., LTD.**
(ds **EASTERN TRADING CO., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) Hartleys Ptv., Ltd.
(s) **HEALING, A. G., LTD.**
(s) International Radio Co., Ltd.
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO LABORATORIES.**
(a) **MacLURCAN, C. D.**
(s) Martin de Launay Ltd.
(s) **McLELLAN, W. J.**
(s) **MICK SIMMONS LTD.**
(ds) **MULLARD RADIO CO (A/SIA) LTD.**
(s) New Systems Telephones Pty., Ltd.
(s) Newton MacLaren Ltd.
(s) **NOYES BROS. LTD.**
(s) O'Brien, O. H. (Sydney).
(ms) **PHILIPS LAMPS (A/SIA) LTD.**
(s) Price, J. C.
(s) **RELIANCE RADIO CO. (A/SIA).**
(s) Radio Corporation Pry., Ltd.
(s) Small, H. G. & Co.
(s) **SMITH SON & REES.**
(s) **SOUND SYSTEMS LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall Arthur J., Pty., Ltd.
(s) **WARBURTON FRANKI LTD.**
(s) **WATSON, W. G. & CO.**

VOLUME CONTROLS.

(s) **BLOCH & GERBER LTD.**
(s) Callaghan & Co., H. M.
(s) Carlyle & Co.
(s) Chandler, J. B. & Co.
(ms) **COMMONWEALTH MOULDING ELECTRIC CO.**
(s) Custom Built Radio.
(s) **DAVIS, A. G. & CO.**
(ms) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY LTD.**
(s) Gerard & Goodman Ltd.
(s) **HARRINGTONS LTD.**
(s) **HEALING, A. G. LTD.**
(s) Hartleys Pty., Ltd.
(s) **HECHT, H. & CO.**
(s) Jackson & MacDonald.
(s) **LEKMEK RADIO.**
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **MICK SIMMONS LTD.**
(s) Newton McLaren Ltd.
(s) **NOYES BROS. (SYDNEY) LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(ms) **PARAMOUNT RADIO MFG. CO.**
(m) **RAYCOPHONE LTD.**
(s) **RELIANCE RADIO CO. (A/SIA).**
(s) **SOUND SYSTEMS LTD.**
(ms) **STROMBERG-CARLSON (A/SIA) LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J. Pty., Ltd.

VALVES (TRANSMITTING).

(s) **AMALGAMATED WIRELESS (A/SIA) LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(ds) **MULLARD RADIO (AUST.) LTD.**
(ds) **PHILIPS LAMPS**

VISUAL TURNING METERS.

(m) **RAYCOPHONE LTD.**
(ms) **STROMBERG-CARLSON (A/SIA) LTD.**
(s) Warburton, Franki Ltd.

VOLTAGE DIVIDERS.

(s) **DAVIS, A. G. & CO.**
(m) **METROPOLITAN ELECTRIC CO., LTD.**
(s) **McLELLAN, W. J.**
(m) **PARAMOUNT MFG. CO.**
(ms) **R.C.S. RADIO.**

WAVE TRAPS.

(s) **BEALE & CO., (LTD.**
(s) **BLOCH & GERBER, LTD.**
(m) **BREVILLE RADIO PTY., LTD.**
(s) Callaghan, H. M. & Co.
(s) Carlyle & Co.
(ms) Chandler, J. B., & Co.
(m) **CROYDON RADIO.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) Gerard & Goodman, Ltd.*b*
(ms) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Jackson & MacDonald.*a*
(m) **METROPOLITAN ELECTRIC CO., LTD**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Price, J. C.
(m) Targan Electric Co., Pty., Ltd.
(ms) **THOM & SMITH.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(m) Yelland, L. J.

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(s) **BRITISH GENERAL ELECTRIC CO., LTD.**
(s) Callaghan, H. M., & Co., Ltd.
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) **CARR, JAMES & VAUTIN.**
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) Jackson & MacDonald.
(s) **LIVERPOOL ELECTRIC CABLE CO., LTD.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J.**
(s) New Systems Telephones Ltd.
(s) Newton McLaren, Ltd.
(s) **NOYES BROS. (SYDNEY), LTD.**
(s) Noyes Bros. (Melbourne), Ltd.
(s) Price, J. C.
(s) **SMITH SON & REES, LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS,**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON, FRANKI, LTD.**

WIRE (CONNECTING AND RESISTANCE).

(s) **BLOCH & GERBER, LTD.**
(ms) **BRITISH GENERAL ELECTRIC CO.**
(s) Callaghan. H. M., & Co.
(s) **CARR JAMES & VAUTIN.**
(s) Carlyle & Co.
(s) Chandler, J. B., & Co.
(s) Custom Built Radio.
(s) **DAVIS, A. G., & CO.**
(s) **ECLIPSE RADIO, PTY., LTD.**
(s) **FOX & MacGILLYCUDDY, LTD.**
(s) Gerard & Goodman, Ltd.
(s) **HARRINGTONS, LTD.**
(s) Hartleys, Pty., Ltd.
(s) **HEALING, A. G., LTD.**
(s) **HECHT, H., & CO.**
(s) Jackson & MacDonald.
(s) **LIVERPOOL ELECTRIC CABLE CO.**
(s) Martin de Launay, Ltd.
(s) **MICK SIMMONS, LTD.**
(s) **McLELLAN, W. J.**
(s) Newton McLaren, Ltd.
(s) **NOYES BROS., LTD.**
(s) O'Brien, O. H. (Sydney).
(s) Price, J. C.
(s) **SMITH SON & REES, LTD.**
(s) **TRACKSON BROS., PTY., LTD.**
(s) **UNITED RADIO DISTRIBUTORS.**
(s) Veall, A. J., Pty., Ltd.
(s) **WARBURTON, FRANKI, LTD.**

Wireless Radio Magazines Printed and Circulated in Australia.

Australian Radio News, 252 George Street, Sydney, Phone B 7971. Published every Saturday. Contains technical and programme information. Price, 2d. Advertising page size, 9 in. x 7¼ in. Column, 14 ems, 2¼ in., 3 cols, per page. Over all size, 11 in. x. 8½ in.

ERDA. Official organ of the Electrical & Radio Association of N.S.W. Monthly trade publication, Grace Bldg., King St., Sydney. M 2531. Price, 6d., per copy, 5/– p.a. Advertising page size, approx. 9 in. x 7 in. Column, 13 ems, 2⅛ in, 3 cols, per page. Overall size, 11 in. x 8½ in.

THE LISTENER IN. Published by United Press, Head office, 62-74 Flinders St., Melbourne C.1. Cl. 6853. Sydney office, 30 Carrington St. Phone B 4186. Published every Saturday. Weekly technical and programme paper, deals with the development of broadcasting, etc. Price, 3d. Advertising page size, 9¼ in. x 6¾ in. Column, 13 ems, 2¼ in., 3 cols., pp. Overall size, 11 in. x 8 in.

Queensland Radio News, printed and published by Read Press Ltd., Douglas Chambers, Adelaide St., Brisbane. Phone B 2781. Monthly programme and technical magazine. Price, 6/–, p.a. Advertising page size, approx. 8 in. x 6¼ in. Column, 18 ems, 3 in, 2 cols, p.p. Overall size, 9¾ in. x 7¼ in.

Radio Monthly, printed and published by Briton Publications Ltd. 107 Pitt St., Sydney. Phone B 4610. Monthly technical and general magazine, Price, 1/–. Advertising page size, 9½ in. x 7 in. Column, 13 ems, 2⅛ in. 3 cols. p.p. Overall size, 11 in. x 8½ in.

RADIO RETAILER OF AUSTRALIA. Published by Australian Radio Publications, 15 Castlereagh St., Sydney. Phone B 2549. Monthly trade paper, circulating throughout Australia to the radio trade only. Dealing chiefly with merchandising side of radio and service problems. The only National trade magazine devoted entirely to radio. Price, 1/– per copy or 6/– p.a. Post free. Advertising page size 9¼ in. x 7 in. Column 20 ems, 3¼ in. 2 cols, per page. Overall size, 11 in. x 8½ in. Managing Editor, Oswald F. Mingay.

Radio Trader, published monthly by Pickwick Publishers Pty., Ltd. 309 Little Lonsdale St., Melbourne, C.1. Phone Cl. 1981. General trade and service matters. Annual sub., 6/– p.a. Advertising page size, 9¼ in. x 7¼ in. Column 22 ems and 13 ems. Overall size, 11¼ in. x 9 in.

WEST AUSTRALIAN WIRELESS NEWS AND MUSICAL WORLD. Published by R. S. Sampson Brokensha Co., 971 Hay Street, Perth, on the 1st and 16th of each month. Full programmes of all stations and technical matters. Editor, Ernest H. Shaw. Sub. 6/6 p.a. 3d., per copy. Advertising page size, 9¼ in. x 7 in. Column 20 ems, 3¼ in. 2 cols per page. Overall size, 11 in. x. 8½ in.

WIRELESS WEEKLY, published by Wireless Newspapers 60-66 Elizabeth St., Sydney. Phone BO 333. A weekly radio magazine containing technical and programme matter, circulating throughout Australasia. Published Friday each week. Price, 3d. Advertising page size, 9¼ in. x 7 in. Column, 13 ems, 2¼ in. 3 cols, per page. Overall size, 11 in. x 8 in.

List of Advertisers.

Acorn Pressed Metal Co.	6 Mathieson St., Camperdown, N.S.W.	L 2977
Airzone (1931) Ltd.	16 Australia St., Camperdown, N.S.W.	L 2851
Amalgamated Wireless A/sia Ltd.	47 York St., Sydney	BW 2211
Amalgamated Wireless Valve Co., Ltd.	47 York St., Sydney	BW 2211
Anderson & Frantzen	Johnston St., Alexandria, N.S.W.	Mascot 284
Beale & Co. Ltd.	41 Trafalgar St., Annandale, N.S.W.	L 2791
Bloch & Gerber Ltd.	48 York St., Sydney	M 2675
Breville Radio Co.	Cnr. Bourke & Liverpool Streets, Sydney	F 2234
British General Electric Co.	104 Clarence St., Sydney	BW 2941
Broadcasting Station 2GB	Bligh St., Sydney	B 7876
Broadcasting Station 2KY	424 George St., Sydney	MA 3590
Broadcasting Station 2UW	16 Ash St., Sydney	BW 6223
Broadcasting Station 3DB	36 Flinders St., Melbourne	F 2118
Broadcasting Station 3KZ	40 Victoria St., Melbourne	CL 318
Broadcasting Station 3UZ	45-47 Bourke St., Melbourne	M 3529
Broadcasting Station 5KA	Currie St., Adelaide	CL 2721
Broadcasting Station 4BC	45 Adelaide St., Brisbane	B 2041
Broadcasting Station 5AD	Weymouth St., Adelaide	CL 5772
Broadcasting Station 6ML	Lyric House, Murray St., Perth	B 1971
Carr James & Vautin	661 George St., Sydney	MA 1420
Colville Moore Wireless Supplies	4 Rowe St., Sydney	B 2261
Commonwealth Moulding & Electric Co.	240 Princes Highway Arncliffe, N.S.W.	LW 3876
Cossor Valves	C. MacLurcan, Jamieson St., Sydney	B 5925
Davis, A. G. & Co.	Wembley House, Railway Square, Sydney	MA 2866
Dickin & Co.	18 Lords St., Leichhardt, N.S.W.	Pet. 839.
Don Electrical Co.	112 Salisbury Road, Camperdown, N.S.W.	L 2839
Duffy Radio Co. Ltd.	18-20 Martin Place, Sydney	B 3740
Eastern Trading Co. Ltd.	155 Clarence St., Sydney	B 6305
Easy Monday Aust. Pty. Ltd.	20 Queen St., Melbourne	CL 10044
Eclipse Radio Pty. Ltd.	111 Queens Bridge Rd., Sth. Melbourne	M 4681
Efco Mfg. Co.	Princes Highway, Arncliffe, N.S.W.	LW 1105
Ever-Ready Battery Co.	Marshall St., Surrey Hills, N.S.W.	FL 4639
Express Universal Instrument Co.	5 Tinana St., Haberfield, N.S.W.	U 2741
Fox & MacGillycuddy Ltd.	57 York St., Sydney	B 2409
Harringtons Ltd.	386 George St., Sydney	B 2181
Hazell & Moore Ltd.	36-38 Campbell St., Sydney	M 4771
Hecht H. & Co.	Australia House, Carrington St., Sydney	B 6541
Henderson, P. A. & Co.	409 Lane Cove Road, Crows Nest, N.S.W.	X 1214
Heiron & Smith Ltd.	389 George St., Sydney	M 2355
Hoelle, J. J. & Co.	47 Alma St., Darlington, N.S.W.	MA 5762
Lekmek Radio Laboratories	75 William St., Sydney	FL 2626
Listener-In, The	62 Flinders St., Melbourne	CL 6853
Liverpool Electric Cable Co.	233 Clarence St., Sydney	M 3821
Metropolitan Electric Co.	Cnr. Cleveland & George Sts. Redfern, N.S.W.	M 6108
McLellan, W. J.	Bradbury House, York St., Sydney	B 1255
Mick Simmons Ltd.	Haymarket, Sydney	M 6311
Mullard Radio Co. Ltd.	35 Clarence St., Sydney	BW 1278
Noyes Bros. (Sydney) Ltd.	York St., Sydney	B 7581
Paramount Radio Mfg. Co.	301 Castlereagh St., Sydney	MA 3875
Peerless Radio Co.	18-20 Martin Place, Sydney	B 3740
Philips Lamps A/sia Ltd.	67 Clarence St., Sydney	BW 2121
Radio Accessories Mfg. Co.	155 Bourke St., East Sydney	FL 1323
Receiver Components Sydney	12 City Road, Sydney	MA 2226
Reliance Radio Co.	139 Clarence St., Sydney	B 2223
Reynolds R. W. Ltd.	200 Chalmers St., Sydney	M 6819
Ricketts & Thorp Ltd.	Kimpton St., Rockdale	LW 2641
Slade Chas. W.	Lang St., Croydon	UJ 4576
Smith Sons & Rees Ltd.	Wentworth Avenue, Sydney	M 2631
Sound Systems Ltd.	160 Castlereagh St., Sydney	M 4152
Speakers (A/sia) Ltd.	70 Clarence St., Sydney	BW 1114
Standard Telephones & Cables Ltd.	71 York St., Sydney	BW 1226
Stromberg Carlson A/sia Ltd.	72 William St., Sydney	FL 4184
Thom & Smith	55 Dowling St., East Sydney	F 2117
Trackson Bros., Ltd.	157 Elizabeth St., Brisbane	B 2804
United Radio Distributors	Pomeroy House, York St., Sydney	B 3639
University Radio Co.	22 City Road, Sydney	MA 2419
Warburton & Franki Ltd.	307 Kent St., Sydney	BW 1251
Watson W. G. & Co. Ltd.	277 Clarence St., Sydney	M 4331
Western Australian Wireless News	97 Hay St., Perth	B 3345
Wetless Mfg. Co.	281 King St., St. Peters, N.S.W.	L 2263
Widdis Diamond Dry Cell Pty. Ltd.	119 Hawke St., West Melbourne	F 1175
Wireless Newspapers Ltd.	Elizabeth St., Sydney	B 7148
Zenith Radio Co.	37 Oxford St., Paddington, N.S.W.	FL 2248

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Prominent Radio Traders.

This list comprises the trading name, address and 'phone of many prominent radio traders throughout Australia who have submitted their particulars for insertion. It is not intended that this list be taken as including all radio traders, and the publishers accept no responsibility for inserting these names, or for any omissions. A fee of 2/6 is charged for each insertion.

A.B.C. MOTOR AGENCY	Mary Street, GYMPIE, Q'LD	'phone 321
ABBOTT & TANNER	79 George Street, LAUNCESTON, TAS.	,, 723
ACE-AUTOS LTD.	P.O. Box 258, PORT LINCOLN, S.A.	,, 258 Pt. Lin.
ADAMS, R.	Wight Street, MILTON, BRIS., Q'LD	
AIR-ACE RADIO LABORATORY	21 Meeks Road, MARRICKVILLE, SYDNEY	
A.K.M. Radio Service	25 Waverley Road, EAST MALVERN, VIC.	,, U 7061
ALEXANDER, J., RADIO SERVICE	484 Parramatta Road, PETERSHAM, N.S.W.	,, Pet. 4136
ANDERSON, ERIC.	139 Oxford Street, SYDNEY, N.S.W.	,, FL 2382
Appleton & Brennan	278 Bondi Road, BONDI, N.S.W.	,, FW 3145
AUSTRAL RADIO	723 Anzac Parade, MAROUBRA JCT., N.S.W.	

Prominent Radio Traders—continued.

BAIRD'S THE, CO., LTD.	Murray to Wellington Streets, PERTH, W.A.	'phone B 2161
BALLARDIE, C. W.	147 Glebe Road, GLEBE, N.S.W.	
BALTZER'S GARAGE & RADIO DEALERS	Harris Street, GRANTHAM, Q'LD	,, 13
BARLOW, F. B.	Wattle Avenue, BRIGHTON, S.A.	
BATEMAN, M. J., LTD.	12 Milligan Street, PERTH, W.A.	,, B 6429B8423
	119 High Street, FREMANTLE, W.A.	,, FM 2630
BEHAN, H. G.	Bilbah Downs, EMMETT, CENTRAL Q'LD	,, 2 Emmet
Belmore Radio Service	475 Burwood Road, BELMORE, N.S.W.	,, UL 2138
BENNETT & WOOD	Cnr. Pitt & Bathurst Streets, SYDNEY, N.S.W.	,, M 6381
BLAND RADIO	57 Allinga Avenue, KNOXVILLE, S.A.	,, F 5581
Bluncks Garage	Brisbane Street, BEAUDESERT, Q'LD	,, 99
BONDI RADIO SERVICE	4B Hall Street, BONDI, N.S.W.	,, FW 4568
Brett Len Radio Service	42 Grosvenor Street, WOOLLAHRA, N.S.W.	
BRIGGS & MAZLIN	Main Street, PROSERPINE, Q'LD	,, 8
Buddle, M. R.	South Road, DARLINGTON, S.A.	,, X 7482
BUHLER'S LTD.	178 Murray Street, PERTH, W.A.	,, B 1646
C. & D. Electrical Sales & Service	Lord Street, ROSEVILLE, N.S.W.	,, J 5660
CAREY, D. C.	Box 190 G.P.O., TOWNSVILLE, Q'LD	
CEARNS' RADIO HOUSE	Burrows Street, YOUNG, N.S.W.	,, 231
COLTON PALMER & PRESTON LTD.	Currie Street, ADELAIDE, S.A.	
Constable, H.	377 Mont Albert Road, MONT ALBERT, MELB.	
CORNEY, E.	487 Hunter Street, NEWCASTLE, N.S.W.	,, 1664 N'castle
Cremorne Sports & Radio Store	420 Military Road, MOSMAN, N.S.W.	,, Y 2749
CULLEN, E. R., LTD.	96 Bathurst Street, SYDNEY, N.S.W.	,, M 4918
CUREDALE, E. R.	25 Napoleon Street, COTTESLOE, W.A.	
CYMBAL RADIO SERVICE	353 Penshurst Street, WILLOUGHBY JCT., N.S.W.	,, J 3729
Daniel's Garage	Abbott Street, CAIRNS, Q'LD	,, 2305
DIGGLE, W. H.	Wyndham Street, SHEPPERTON, VIC.	,, 224
Dobbie, A. W. & Co. Ltd.	99 Rundle Street, ADELAIDE, S.A.	,, C 6170
DOE, A. G.	Room 232A, Grace Bdg., 77 York Street, SYDNEY, N.S.W.	,, M 3420
DOMESTIC FURNISHING CO.	Ruthven Street, TOOWOOMBA, Q'LD	,, Too. 1051
Dyson, W. H.	17 Howard Street, RANDWICK, N.S.W.	,, FX 2195
Dixon, R. H.	NELSON BAY, NEWCASTLE, N.S.W.	
EASTWELL, L. B.	96 Grafton Street, WARWICK, Q'LD	,, 510
EDMONDS & SON	124 Burwood Road, BURWOOD, N.S.W.	,, UJ 3972
EDGES RADIO SERVICE	12 Sydney Road, MANLY, N.S.W.	,, YU 1464
EDWARDS, H. S.	102 Lyons Road, DRUMMOYNE, N.S.W.	,, Drum. 862
ELECTRICAL SERVICES PTY. LTD.	Queen Street, BRISBANE, Q'LD	,, B 8400
ELVEY & CO. LTD.	397 George Street, SYDNEY, N.S.W.	,, M 2319
EUDEY, THOS.	81 Govern Street, YARRAVILLE, W. 13, VIC.	,, F'scray 1344
EVERETT & CO.	Stirling Terrace, ALBANY, W.A.	,, 92
EXCELSAIR RADIO	202 Marrickville Road, MARRICKVILLE, N.S.W.	,, Pet. 3381
EXELTRON ELECTRIC CO.	52 Oxford Street, SYDNEY, N.S.W.	,, F 2335
EVERETT, R.	67A Enmore Road, NEWTOWN, N.S.W.	,, L 1988
FALCON RADIO	Cnr. Falcon & Miller Streets, NTH. SYDNEY, N.S.W.	,, X 2896
FIELD CYCLE & MOTOR WORKS	142-144 Victoria Street, MACKAY, Q'LD	
FITTELL, S. L.	Mary Street, GYMPIE, Q'LD	,, 264
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Fricker, N. M.	19 Moseley Street, GLENELG, S.A.	,, X 1619
FURNER, S. F.	164 Railway Parade, KOGARAH, N.S.W.	,, LW 2839
GAMBIER MOTORS & RADIO LTD.	144 Commercial Street, MOUNT GAMBIER, S.A.	,, 516
GARDNER & DANIEL	BUNGENDORE, N.S.W.	
GIBSON, LES.	Box No. 39 P.O. ALSTONVILLE, N.S.W.	
GIBSON, R. S.	292 Sydney Road, BALGOWLAH, N.S.W.	,, YU 2203
GILLAN, JAS.	Craiglee House, Fitzroy Street, ROCKHAMPTON, Q'LD	,, 1484
GILLESPIE, H. J.	475 Rocky Point Road, ROCKDALE, SYDNEY	,, LW 1337
GLADOLIA CO.	154 Rundle Street, ADELAIDE, S.A., and 84 Commercial Road, PORT ADELAIDE, S.A.	,, Cen. 6585
GOLDFINCH, H. R.	Dawson Street, STRATHALBYN, S.A.	,, Strath. 203
GOODWIN, E. L.	MORISSET, N.S.W.	,, Mor. 12
GORDON DOUGLAS	109 Chatham Road, BROADMEADOW, N.S.W.	,, Ham. 559
GORDON BROS.	Victoria Street, TAREE, N.S.W.	,, 218
GORMLEY, N. C.	8 Hotel Manly Bdg. MANLY, N.S.W.	,, YU 2216
GOSSARDS, PTY., LTD.	136 Bridge Road, RICHMOND, E. 1., VIC.	
GRACE BROS. LTD.	George Street West, SYDNEY, N.S.W.	,, M 6506
GREENWOOD, J. J.	118 Koornang Road, CARNEGIE, VIC.	,, UM 1102
GRIFFITHS, A. E.	196A Bondi Road, BONDI, N.S.W.	

Prominent Radio Traders—continued.

GRIMWOOD, STAN.	10 Heygarth Street, ECHUCA, VIC.	'phone 226
GROVE, E. V.	KUMBIA via KINGAROY, Q'LD	,, Kum. 33
GUILLE & CO. LTD.	264-266 King Street, NEWTOWN, N.S.W.	,, L 1227
HAIN, J. H.	282 Peat's Ferry Road, HORNSBY, N.S.W.	,, Wah. 998
Halberts Agency	CUNDERDIN, W.A.	,, Cun. 8
HANCOCK, D. M.	51 Taylor Street, KADINA, S.A.	
HARDY'S RADIO STORE	25 Royal Arcade, SYDNEY, N.S.W.	,, MA 2775
HARRIS, H. W.	20 Chelmsford Avenue, LINDFIELD, N.S.W.	,, J 3151
HARRIS, D. & CO.	140 Rundle Street, ADELAIDE, S.A.	,, C 1733
HARROLD, A. E.	123-125 Charlotte Street, BRISBANE, Q'LD	,, B 2729.
HATTON RADIO	18 Irene Street, FIVEDOCK, N.S.W.	
HEALING, A. G., LTD.	151-9 Pirie Street, ADELAIDE, S.A.	,, Cent. 4635
HEANEY, JAMES	108 Albert Road, MOONAH, TAS.	
HENDERSON, P. A. & CO.	409 Pacific Highway, CROWS NEST, N.S.W.	,, X 1214
HIGLETT & CO.	32 Douglas Street, STANMORE, N.S.W.	,, LM 1062
HILCO PRODUCTS PTY. LTD.	207-209 Latrobe Street, MELBOURNE, VIC.	,, M 2563
HILLS RADIO LTD.	363 Military Road, LARGS BAY, S.A.	
Hodder, G.	5 Barwon Street, FORBES, N.S.W.	,, 397
HOPKINSON, H.	465 King Street, NEWTOWN, N.S.W.	
HORDERN, ANTHONY & SONS LTD.	Brickfield Hill, SYDNEY, N.S.W.	,, M 2401
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