6^D

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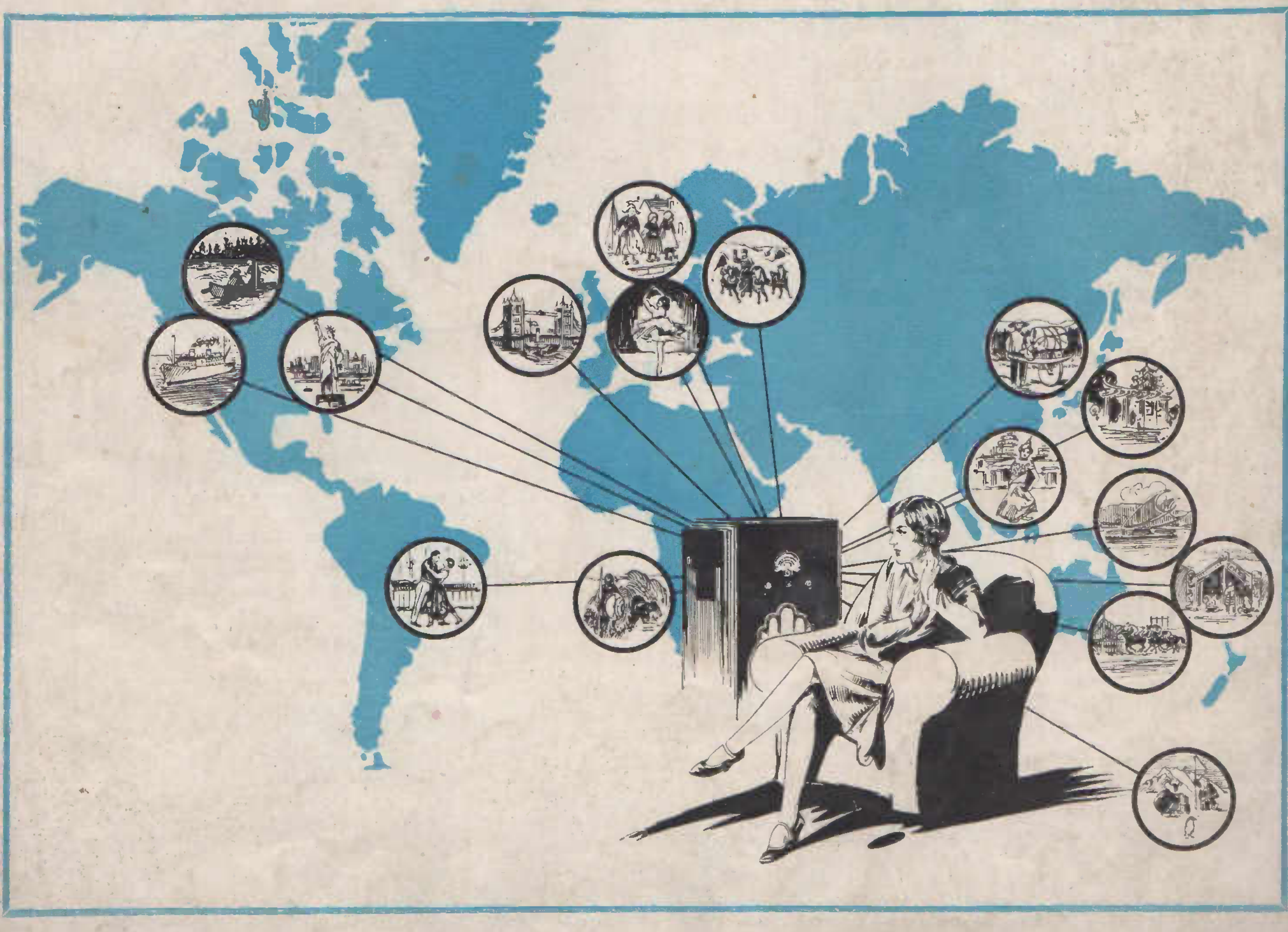
SHORT WAVE ENTHUSIASTS AND AMATEURS.

RADIO REALM

Vol. 1, No. 3. SYDNEY AUGUST 1st, 1934.



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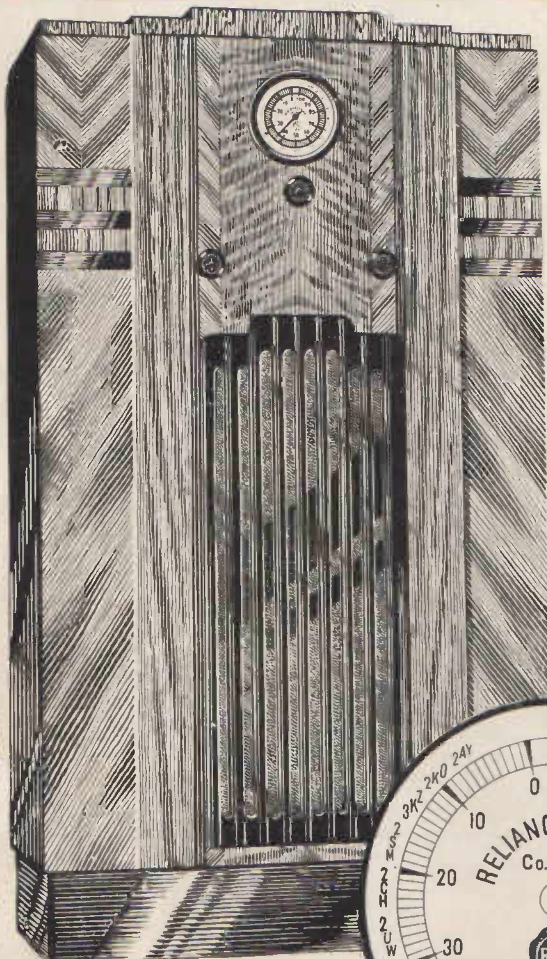

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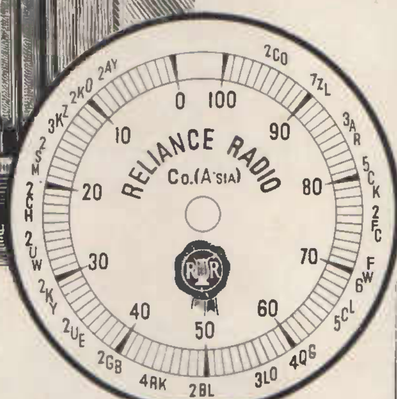

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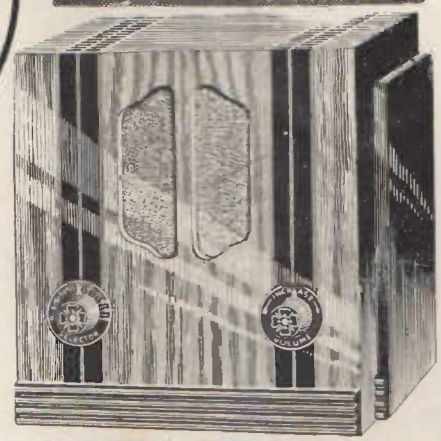

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RADIO REALM

Editor: Douglas N. Linnett.

Associate Editor: P. H. Boulton.

Editorial Address:
14 Spring Street. 'Phone: BW 7389.

Contributions will be welcomed and paid for after publication. If stamps are enclosed, rejected manuscripts will be returned, but the Editor accepts no responsibility in the matter.
Address all MSS. to the Editor, "Radio Realm," Box 3430R, G.P.O., Sydney.

Advertising Manager:
A. L. M. Griffiths.

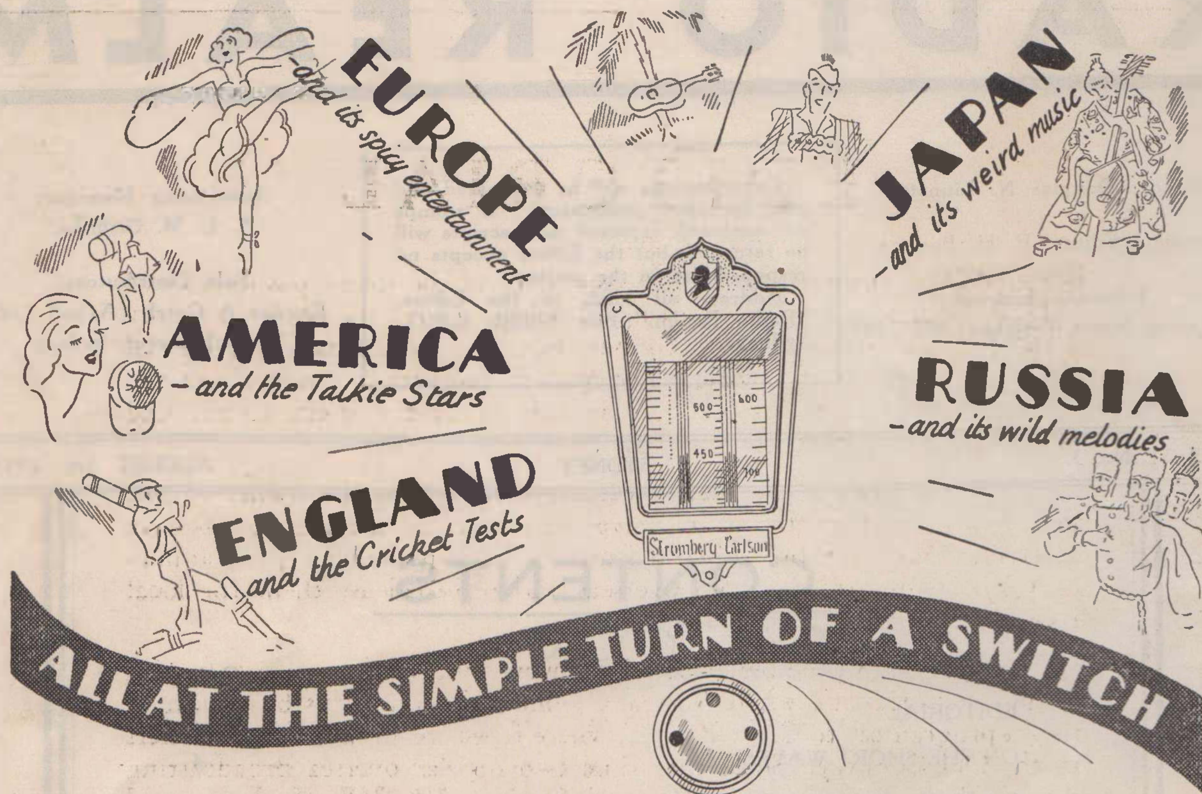
Sole Distributors:
Gordon & Gotch (A/sia) Ltd.,
Barrack Street, Sydney.

VOL. 1, No. 3. SYDNEY AUGUST 1st, 1934.

CONTENTS

Subscription Rates . . .

Posted monthly to any address in Australia or New Zealand for 12 months 7/-, and 6 months 3/6. Cheques and money orders to be made out to "Radio Realm" and addressed to the Circulation Manager, "Radio Realm," Box 3430R, G.P.O., Sydney.



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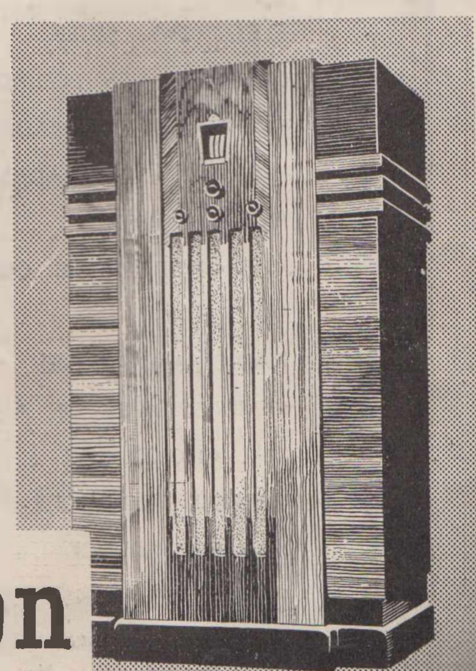

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EDITORIAL

OUR front cover of this issue depicts the many possibilities of short-wave broadcasting in bringing into the home, not only our national programmes, but also performances from all parts of the world. The modern receiver in one evening can transport us either to the East or to the West, to the Old World or to the New.

Yet not always are these pleasures confined to the owner of the short-wave receiver, the short-wave converter, or the recent all-wave receiver. Our own broadcasting stations have picked up programmes of varying importance from overseas and re-broadcast them for local reception.

As early as September, 1927, there were successful experiments with Empire broadcasting when Australia pioneered such relays by transmitting a programme to Great Britain, where it was re-broadcast to listeners in the Old Country. Since that time two regular oversea Broadcasting services have been inaugurated, and Stations VK2ME (Sydney) and VK3ME (Melbourne) transmit the voice of Australia which is heard throughout the Empire.

Nevertheless, there are greater possibilities of further improvements in the exchange of oversea programmes. Of the difficulties in reception we are fully aware, yet the benefits of bringing closer the foreign countries are so great that they warrant very determined attempts.

In addition to the undoubted entertainment and educational value of listening to the different oversea stations, which have such a great variety in artists and modes of expression, here in these days of conflict and turmoil is an instrument for peace. Australia's isolation from other important centres of the world makes it difficult for us to understand the rapid changes in the political arena, but through the medium of short-wave broadcasting there are immense potentialities for giving us better understanding of the different national characteristics, and the many political changes of which we hear so little. Empire broadcasting, moreover, will bring closer together the British Commonwealth of Nations.

And undoubtedly, developments with micro-waves will open greater prospects for consistent services. In this rather revolutionary form of radio transmission lies the next great stride in the science of radio transmission. Research and experiment are investigating the many possibilities, and eventually will demonstrate the scope and effectiveness of this system of transmission. Advances with micro-ray apparatus, moreover, may bring television much nearer an accomplished fact.

ON THE Short Waves

Possibilities of short wave reception—reasons for the variable conditions and inconsistent service—stations that have been heard—the programmes broadcast.

Opinions pertaining to the results obtainable from the "Short Wave Converter" or the "All Wave Receiver" are very divided, and the layman is often at a loss to understand the many differing claims advanced. Nevertheless, short-wave broadcasting has brought the world to the hearth. It has opened wonderful opportunities for reaching into the unknown. Moreover, there is a certain thrill of adventure when, by turning some dials, foreign sounds, music, and voices issue from the loud-speaker.

Yet it is not so very long ago that these bands were used only by code and experimental stations. To-day, however, music and speech have been heard from practically every country in the world.

A recent innovation has immeasurably increased the popularity of these broadcasts, for most of the foreign stations, in addition to making announcements in their native tongue, have included sessions specially catering for the English-speaking nations.

Immense variety of programme, moreover, is available to the short-wave listener. Concerts by world-famous artists, music by the finest of orchestras, talks by eminent authorities, and news of all kinds have been heard. French and German stations devote considerable time to news services in English, while the Russian programmes are interspersed with political propaganda.

LIMITATIONS TO RECEPTION.

But with all these marvellous possibilities, at present there are certain very definite limitations to short-wave reception. Before the signal from the broadcast station reaches the receiver, there are many variable conditions with which it has to contend. And this makes it impossible—even with the finest of receivers—to guarantee other than inconsistent service. Yet there are many stations to be heard, and a tour of the world by radio will always bring in some distance music.

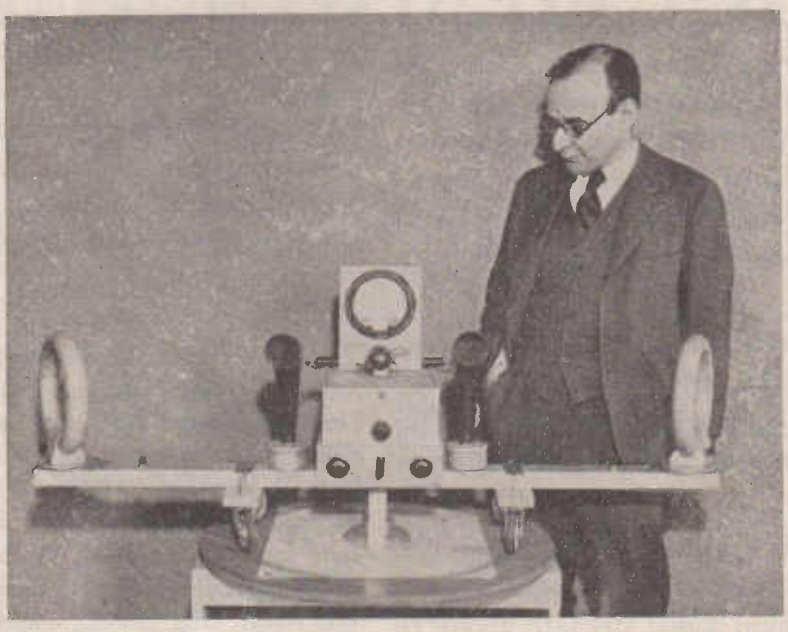
To appreciate the difficulties and reasons for these variable conditions, we must understand something of what happens after the wave leaves the transmitting station.

When the wave leaves the short-wave broadcast station, broadly speaking, there are two paths which the energy follows—along the earth's surface and upwards towards the heavens. The wave travelling along the earth's surface dies out quickly, so we are concerned with the energy transmitted upwards or the sky wave.

In the upper regions of the atmosphere there is a highly ionised strata which reflects and bends this wave from the broadcasting station back to earth. Thus the wave sent out first goes upwards, is then sent back to the earth, reflected from the earth to the sky again, and so covers the distance by bounding between these two layers. If the receiver is located at a point where the transmitted wave touches the earth, the signals are heard.

If this upper region remained at the same height throughout the year, there would be no difficulties; but it varies with the time of the day and season of the year, being lower in the middle of the day and higher at night, averaging lower in the summer and higher during the winter months. It may be 60 miles high at noon on a summer's day, or 300 miles on a winter's night; and it is continually changing, sometimes rapidly and sometimes slowly, gradually blending from one condition to another.

Thus it will be seen that the parts where the wave touches the ground are constantly changing, which phenomena causes the undesirable feature of short-wave, long-distance reception in prohibiting consistent service throughout the year.



New Radio Direction and Distance Finder invented by L. J. Simon.

OTHER VARIABLE CONDITIONS.

Another variation is the path which the signal takes in travelling from the broadcast station to the receiver. The wave can travel either by the shortest path, or in the opposite direction, round the world. This sometimes results in two signals being received, one fraction of a second after the other.

And with the short-wave receiver, although static interference is less troublesome, it has been found that the set is more susceptible to certain classes of noises than the broadcast receiver with which we are so familiar. Inductive interference or man-made static is far more pronounced. Design and installation considerations, however, can somewhat reduce this difficulty.

Because of the many variable conditions to short-wave reception being adversely affected by astronomical and meteorological conditions which are not so apparent in their effects on the broadcast waves, we have been making observations of reception phenomena in our laboratory to find which stations can be heard and the types of programmes broadcast.

EMPIRE BROADCASTS.

Of the Empire broadcasting stations in England, GSB, on 31.54 metres, can be heard at full speaker strength during the afternoons, but begins to fade out towards 4.30 p.m. In the early mornings this station has been heard, although at this time it is very erratic. GSD, on 25.53 metres, is nearly as good as GSB in the afternoons, yet less effective in the early mornings.

GSF, on 19.81 metres, has been heard at about 11 p.m., but not at good signal strength; and GSG is very irregular, particularly during the winter months, but both of these stations will improve with the coming of summer.

Of the Continental stations, FYA, Paris, 25.63 metres, probably gives the best signals, and is received at good strength during the morning and afternoon between 10 a.m. and 3 p.m. The morning session from 10 a.m. to 12 noon consists of news in several different languages, broken at intervals by musical items. During the afternoon there are concerts and topical talks. At present the night session from 10 p.m. is very poor, although this will improve as summer approaches.

The German station DJA, 31.38 metres, situated at Koenigswusterhausen, can be heard in the mornings up to 9 a.m. broadcasting music, and also at 2 a.m., when it gives an English session daily broadcast at 11 a.m., when the signals are extremely weak. Signal strength, however, rapidly increases towards noon, and usually closes down about 1.30 p.m. Here, again, music and news in English are broadcast. DJB, on 19.74 metres, has been heard at midnight, but is very uncertain; this will improve towards summer.

CLASSICAL MUSIC FROM ROME.

I2RO, 25.40 metres, located at Rome, Italy, has been heard in the mornings, but is very spasmodic. Sometimes about 10 p.m. this station can be heard, although at very poor signal strength. I2RO, however, is noted for its classical music.

Of the Russian stations, RNE, 25 metres, Moscow, is audible at 9 p.m., when it gives an English session, consisting for the most part of propaganda. During Sunday afternoon, between 1 p.m. and 2 p.m., this station also has been heard. RW15, 70.21 metres, at Khabarovsk, Siberia, has been heard at 8 p.m. broadcasting musical items and some political speeches. Static, however, often interferes with this reception.

The Japanese station, J1AA, 37.03 metres, Tokio, is heard in the early evening about 7.55 p.m., when it gives an English news session. This station is poor at present, but is rapidly improving.

Station N1ROM, 49.1 metres, situated in Java, Dutch East Indies, can be heard from 8 p.m., and reaches maximum signal strength about 10 p.m. The programme consists of music interspersed with English items. PMY, 49.6 metres, also at Java, commences at 10 p.m., and rapidly improves in strength until 12 p.m., broadcasting musical numbers.

American Station W2XAF, 31.48 metres, Schenectady, N.Y., has been heard in the early mornings, although it is very changeable, being quite good on some mornings and very poor on others. This programme consists of stock exchange and market reports, followed by musical items, but it fades about 9 a.m.

Occasionally American stations on the 25 metre band, transmit during the early afternoon, when they are received at good strength; and sometimes an American station breaks through about 10 p.m., although at present they are very irregular, but will improve during the next months as summer approaches.

From the foregoing survey it will be seen that the best times to listen in are between 7 a.m. and 5 p.m. Near midnight on the 19 and 25 metre band conditions are at present rather erratic, but during the summer the reverse will be the case, when the best results will be obtained near midnight, with the late afternoons erratic, and probably the early mornings *non est*.

Space does not permit to mention the many stations that have been heard—some undoubtedly due to freak conditions, while others are working although not tuned-in on our receivers. Nevertheless, the foregoing will illustrate the possibilities and limitations of short-wave reception and help to clear the chaos in the average layman's mind in regard to short-wave broadcasting.

THE opening of the new Spanish air-line from Seville to the Canary Islands has again demonstrated the value (for long-distance air routes) of the Marconi combined medium and short-wave aircraft equipment, as used in the Imperial Airways "Atalanta" class aeroplanes on the African and Indian routes. On the Spanish airline the aircraft following the West African coast for about 1,100 kilometres' flying distance, from Tangier to Cabo Juby (via Rabat, Casa Blanca, Mogador, Agadir and Casaba), and across to Las Palmas by short-wave wireless (50 metres), and with the local coastal and aerodrome stations on the route by medium-wave wireless (900 metres). In addition to normal air and ground communication, the wireless operators have also been able to report direct to Madrid on the short waves.

Broadcasting a play—illustrating the many sound effects.

Looking On *at the* A.B.C.

By Gwen Hughes

An air of ease, luxury, and efficiency permeates the whole atmosphere when we enter Stations 2FC and 2BL. But with all this there are many undertakings in hand; everyone has his part to play in the varied and complex organisations which we know only by the programmes heard through the medium of the loud-speaker.

The main studio tastefully camouflages the many gadgets which are required in producing the concert or play. Walls and doors are of immense thickness to make the room soundproof. There is a deathly silence; no echo of street noises, no ringing of bells, once the door has closed behind us.

On one side of the room is a large soundproof window, through which is obtained a glimpse of the control room. Here is the announcer's table, fitted with reading lamp, shelves to hold his notes, etc., and in the centre is a square marble affair with a little globe on the top. This is the magic microphone, where the merest whisper is heard by millions of people. It has been autographed by various celebrities who have visited the studio from time to time.

Close at hand is a long table on which the gramophone records are played; here is another microphone. A queer sensation is experienced when the records are played—a movement of a switch, the needle carefully adjusted, and instead of hearing the music anticipated, not a sound, except the soft "whirr" of the needle. The mystery is explained by the fact that wires from the table run invisibly along the wall to the control room, where the actual transmission takes places. Lectures and talks of varied interests are broadcast from the speaker's desk. Suspended from the ceiling is another microphone. Here small orchestral items are rendered, and the players of broadcast fame are grouped to delight us with their dramas, etc.

At the extreme far end of the room is a grand piano, where some of the world's leading pianists have performed. Close by is a microphone on a stand, in front of which the vocalists and instrumentalists take their place.

On a table against the wall is a mystifying object called a "door," made of heavy wood. It is really a case having a hinged door, on which is fitted all kinds of locks, chains, bells, etc. Here lies the secret of sound effects which give that realistic touch to the oral text of the broadcast play.

The studio "prop.'s" man attends to this. He bangs the "door" at the psychological moment when the villain "stamps out of the room," rings a bell which indicates the telephone in the play, clanks the "chains" which keep a poor hero "within the prison cell."

"Clattering of the horses' hoofs" is obtained by tapping two pieces of wood alternately on the floor. The "prop.'s man" is the "rustle of the wind through the trees," when he puffs or blows or emits a low whistle. We only hope, for his sake, he is not called upon to represent "the shrieking gale which rises above the roaring torrent." These effects are very amusing to observe in the studio, but are absolutely necessary to give a realistic interpretation of the play.

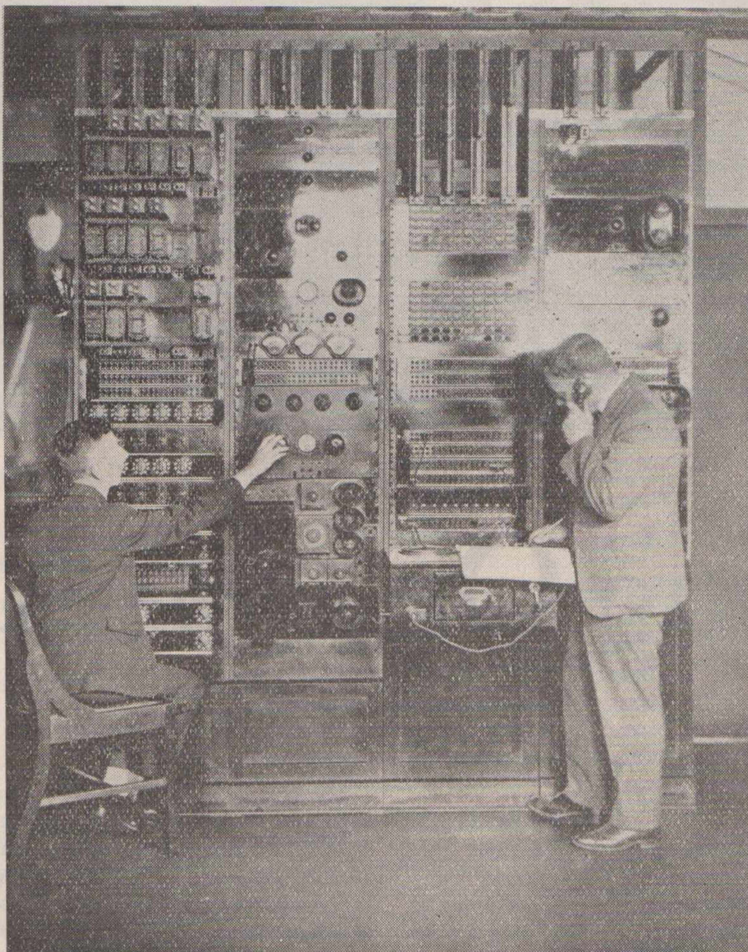
A vocalist is ushered into the studio, and the official accompanist takes her seat. We leave, for, out of deference to the artiste, no one is allowed in excepting the announcer.

The smaller studio leads off the main studio through a door at the end of the room. Here is a compact room with another speaker's table fitted with a microphone. On the opposite side is a music stand and piano. This room is rarely used, excepting in the case of separate transmission or private auditions.

Large symphony concerts or choral items are held at Studio No. 4, Broadcast House Pitt Street. This studio is much larger than those in Market Street. On the left are rows of comfortable chairs, where the string orchestra plays; just beyond is a stage raised in tiers, where the choristers sit. Visitors are allowed in this studio during a special programme transmission.

Having made a tour of the studios, we shall go back to the main studio. Here an audition is to be given. On the way to the control room we pass a number of "aspiring" announcers, vocalists and instrumentalists, and immediately become conscious of a tension in the atmosphere. This is confirmed by the facial expressions of the broadcasting neophytes.

With a feeling of awe we enter the control room. Here the studio engineer is at work—his duty is to faithfully follow the programme cues, so we shall watch carefully and see what happens.



The Control Room at the Studio of 2BL, Sydney.

In one of the panels of the immense switchboard there are five small globes, with switches underneath, which are in direct contact with the five microphones in the studio. A speaker wishes to make an announcement, so the engineer turns a switch and the little globe above and the one on the microphone in the studio simultaneously become alight. This means that the announcer is now "on the air." Another switch is turned on immediately his voice is heard through the medium of an amplifier on the opposite side of the control room.

The modulations of the speaker's voice is indicated on a small dial called the "level indicator," the little hand of which moves rapidly backwards and forwards with the rise and fall of tones. If, through excitement, he speaks too loudly, a harshness is heard, so to counteract this the engineer adjusts the dial and immediately the voice is softened.

To the right of the switchboard there is a long panel, to which plugs are attached—similar to a telephonist's switchboard. By means of adjusting these plugs this connects both the transmitter and receiver.

Broadcast programmes originating in the studio are here connected with the transmitting room at wireless headquarters, Pennant Hills. Thus this room can be called the nerve centre of operations. Through constant supervision, programmes are picked up from any studio, concert platform, theatre, etc., and connected with the headquarters.

The studio engineer is adjusting a plug—we are now to hear the chimes. This is made possible by means of a microphone within the G.P.O. clock, which is in direct contact with the control room. That curious buzzing noise we hear prior to the chimes is the roar of the great city below.

The audition is to commence, so all plugs are removed in order that the voices of the various artists are heard only

(*Turn to page* 22.)

ELECTRONIC MUSIC...

This new advance in Science makes us wonder whether Music, as we know it to-day, is about to be revolutionised. Artists and composers now have a new field for expression

Electrical musical instruments and electrical music are not the self-playing pianos and all other music automatons which used to strike terror into the breasts of real music lovers. They are modern instruments, in which the entire range of tone consists of electrical oscillations—nothing other than alternating currents—made audible by the loud-speaker.

This new advance in science makes us wonder whether music-playing as we have known it in the past is about to be revolutionised by these remarkable instruments—the Hellertion, the Sphaerophone, the Trautonium, the Ether Wave Piano, the Electric Violin, 'Cello and Piano. With them it is not only possible to play full and half tones, as on the piano, but also much smaller tone intervals. These electrical contrivances offer many new possibilities in novel tonalities, and practically every known instrument can be imitated.

At the Berlin Radio Exhibition an electrical orchestra was assembled to demonstrate the possibilities, while at the National Electrical Exposition in New York an electronic piano aroused considerable interest.

HOW THE SOUNDS ARE PRODUCED.

The electrical oscillations can be produced in a variety of ways. The instruments so far developed mainly differ in the mode of production of the alternating currents, and in the devices serving for varying pitch and loudness of notes. It is the advance in electro-acoustic technique which owes everything to the invention of the thermionic valve. This has brought about these instruments, which now have opened absolutely new ways for the production of electrical music.

In conjunction with inductances and condensers in a reaction circuit, the thermionic valve produces an alternating current. With the values of inductance and capacity in the circuit made variable, the frequency of the alternating current can be changed at will. After suitable amplification, if this current is applied to the loud-speaker, it will reproduce a sound vibration at the same frequency as the alternating current.

The human ear can discern variations of pitch corresponding to a range of frequencies extending from about 16 to about 16,000 cycles per second. If we wish to produce the note electrically, we must produce in the oscillating circuit an alternating current at audible frequency, which is obtained by suitably adjusting the controlling elements.

The same object, however, is obtained by producing simultaneously two oscillating circuits at very high frequency—above the audible range. By these two frequencies mixing together in a rectifying valve, only the difference between the frequencies is received. In order to vary the pitch of the tone produced when playing a tune, it is only necessary to vary the frequency of one of the oscillating circuits.

FIRST EXPERIMENTERS.

One of the first experimenters in producing electrical notes was a German, Jorg Mager. He intended to evolve an instrument on which not only semi and whole tones, but also much smaller intervals, could be played.

In early models the trouble experienced was that all tones lying between a change from one tone to another became audible. But with later design, Mager divided the entire tone sphere after the style of keyboard instruments into a larger number of fixed intervals. His instrument, the Sphaerophone, however, is single voiced—unlike the piano, only one note can be played at a time. Polyphony is only obtained by building together many instruments having separate keyboards, but with the amplifier and loud-speaker common to all.

Professor Theremin constructed his "Ether Wave Piano" to free the artist of all distractions of mechanical manipulation. His keyboard is really suspended in air, and for the adjustment of pitch he uses the phenomena known as "hand capacity." The right hand of the artist becomes by capacity part of the apparatus, and by its movement alters the frequency of one of the two high frequency oscillators. A disadvantage, perhaps, is that the artist has no guide at the hitting on the pitch and, therefore, must play entirely by ear. The unavoidable impurities of tone can be covered by a light vibrato.

The Hellerton, invented by B. Helberger and P. Lertes, has another method of regulating pitch and loudness. It is executed in such a way that the fingers will determine the pitch and the pressure of the fingers the loudness. By running the fingers over the manual, the tone can be altered within a range of five octaves. But the Hellerton is single voiced, although up to four instruments can be combined for polyphony.

The A.B.C. (Melbourne) Symphony Orchestra.

THE TRAUTONIUM.

According to the theories of Dr Trautwein, the tones of every musical instrument are composed of fundamental tone which determines the tone colour. He has gone a step further than previous investigators with the "Trautonium," which permits variations not only of pitch and loudness but also in tonality.

The tones of the piccolo-flute, produced by this instrument are similar to those from very large organ pipes, while the beating of drums can be quite realistically simulated. It is possible to render quite easily and surely notes of instruments not at the disposal of every orchestra. Tones now soft, now harsh, another time dreamy, then again grotesque, effective vibratos and crescendos, or, generally speaking, tonalities never heard before give the player expressiveness only limited by his ability.

NEW INSTRUMENTS.

A new epoch in the traditional making of instruments is marked by a group of instruments not "fully electrical," but may be described as "semi-electrical." These have mechanical vibrations (string vibrations) first set up and then transformed into electrical oscillations, which are made audible in the loud-speaker. The sounds are imitations of the piano, violin, cello, and others; those parts of the instruments recognised as good being deliberately retained.

The player performs as formally on the normal instrument, the essential difference being that the sound-board is missing. Centuries of experience and development have been necessary to obtain full sound perfection by traditional

(*Turn to page* 26.)

Personalities Behind the Microphone

Mr. Bryson Taylor, whose pleasing and efficient personality both as vocalist and announcer, needs no introduction to radio listeners. He has been connected with broadcasting since its inception in 1924, when he first became prominent as tenor vocalist and in radio production work. He was appointed to 2CH when that station was first opened, but shortly afterwards was invited to join the staff of the A.B.C. as announcer, with whom he has been for the last two years. He has announced, sung, written and arranged presentations, conducted special sessions under the title of "Mental and Musical Reflections," and also conducted that ever-popular community singing which is held every Friday under the auspices of the A.B.C. During the last few weeks, in conjunction with his many other activities, he has, during the absence of Mr. Halbert, been an exceedingly busy man with programme arrangements for the N.S.W. division.

* * *

Miss Hilda Morse, who, since her inception to 2FC two and a half months ago, is better known to the children as "Hilda," made a zig-zag journey to the microphone. She is a New Zealand girl, and started a course as a student of medicine, after which some time was spent in the Native Law Courts. Abandoning these professions, she made her appearance before the public on the legitimate stage, and from here made her initial appearance before the microphone. For three and a half years Miss Morse very ably arranged and conducted the children's session at 1ZM, New Zealand. She has also broadcast from 1YA, Auckland, monologues, plays and sketches. Apart from her work at these stations, Miss Morse had a studio of her own where she taught dramatic art and elocution. At 2FC Miss Morse is a member of the broadcast players, and has taken part in all the productions since her arrival here in Sydney. She is very keen on her work in the children's session, and writes the children's stories she broadcasts. The letters she receives from the little listeners, both from here and New Zealand, show how greatly they are appreciated. The studio is fortunate in securing the services of such a charming and versatile personality.

Mr. Bryson Taylor.

* * *

A popular personality of broadcast fame is Mr. Frank Hatherley. For a period of six and a half years he delighted Victorian listeners, both young and old, as a member of the Children's Session, and in an able manner conducted the community singing.

At the request of the A.B.C., he consented to visit Sydney for a period of one month to institute community singing concerts for 2FC. His efforts met with such success that he was persuaded to stay in Sydney, where he has been for the last two and a half years. Here he also conducts the Children's Session, under the title of Bobbie Bluegum, and to his credit is the formation of the Sunshine Soldiers' Club. This last-mentioned activity is well worthy of note, its object being the installing of unselfishness and doctrine of "help one another," in the minds of its very willing members. Parents owe a debt of gratitude to Mr. Hatherley for the very fine influence which he has over the children interested in the activities.

* * *

All who listen to the Children's Session at 2FC are delighted with the stories broadcast by Miss Elizabeth Elliott, better known as "Elizabeth" to the children. A comparatively new member of the staff, Miss Elliott made

(*Turn to page* 33.)

HAPPENINGS . . . . . . ABROAD

ALTHOUGH many countries have annually celebrated the anniversary of their adoption of broadcasting, it was left to Belgium, on March 28 last, to give listeners a faithful copy of what was, we believe, the first radio programme heard in Europe twenty years ago. As a result of the keen interest shown by the late King Albert of Belgium in radio matters, some Brussels engineers constructed a transmitter in the grounds of the Laeken Palace, near the Belgian capital, and broadcast their first programme on March 28, 1914. The entire installation was dismantled and destroyed on the approach of the German Army some few months later. In their faithful copy of this early programme Brussels reproduced the sound of the toy trumpet used as an opening and interval signal preceding the station call and, as was also customary, repeated all announcements twice, very slowly.

* * *

KNOWN as the Marconi-Adcock System, new direction finding apparatus for aircraft has been installed at Lympne Airport following a three years' test at Fullham (Norfolk). In the event of an air pilot requiring assistance in regard to his position, bearings on his wireless signals are taken simultaneously at Croydon, Lympne, and Pulham, and the readings are transmitted to the London Airport, where they are plotted on a map. Within a few seconds the Control Tower is able to give the necessary information. Under the new system a much higher degree of accuracy has been obtained, especially at night.

* * *

SEVERAL Copenhagen newspapers are giving prominence to letters received from Danish physicians in respect to the effects produced by radio on the human system. The Medical Faculty in that country appears to be divided into two camps, one asserting that in the case of crystal set owners the pressure of headphones on the ears tends to cause arterio-sclerosis and congestion, the other party maintaining that listening in such conditions re-educates the aural nerves. In the meantime, a fillip is being given to the sales of mains-driven receivers!

* * *

POLICE patrols of Los Angeles (Cal.) have been equipped with small portable wireless receivers to permit them to keep in touch with headquarters. The instrument is carried on a belt around the waist, the aerial being fitted in a triangular strap, in rucksack fashion, which supports the equipment.

* * *

SINCE radio first began, roughly ten years ogo, the reception of programmes, both here and abroad, has been marred by extraneous interferences. Radio has passed through many vicissitudes since Marconi first gave the world true home entertainments, and as time has gone on various experts in the radio world have tracked these interferences to their individual sources, and slowly but surely found cures and put them into effect. The question of "jamming," i.e., the overlapping of two programmes, has been thoroughly dealt with, and to all intents and purposes eliminated by the Lucerne Plan, which has recently come into operation, and various other distractions which the listener commonly meets have been successfully overcome.

Two great bugbears, however, still exist, the first and by far the most serious being the interference experienced from electrical apparatus of all kinds, which can be referred to as "man-made static." The second is nature's own interference, known as "atmospherics," and is the last stronghold to be taken in the war on interference.

The trouble caused by electrical machinery has been thoroughly investigated by Marconiphone engineers, and after years of intensive research a system has been evolved whereby those in charge of radio receivers (the selling and maintaining) can bring all the sources of science to bear towards eliminating such undesirable additions to radio programmes.

Scientists, experts, and engineers working at the Marconiphone Factory at Hayes, in Middlesex, have split up the various sources of interference into "cause and effect," and a series of records has been made on which are noises characteristic of every type of interference commonly met. Some thirty different types of source of interference have been identified, and the noises they make in the normal sensitive receiver recorded. With these series of four records a thirty-six page manual is issued, describing how each type of interference arises, and how best it can be cured. If noise coming from an unknown source, it is necessary only to compare it with the noise recorded on one of the bands in the series of records. This will refer to a page in the manual, and on that page will be set out the results of Marconiphone experts' experience with that particular type of interference. This should provide a useful guide to the best method of dealing with the trouble.

It is, of course, impossible for one organisation to undertake to search for and deal with each type of interference as it is met. Therefore, Marconiphone are issuing this manual and records to all its service dealers throughout the British Isles.

* * *

DR. NEVIL M. HOPKINS, a lecturer in engineering at the New York University, has developed a new electrical device which will revolutionise radio broadcasting. Dr. Hopkins calls his instrument the "Televotes," and by its use a listener to the broadcast programmes can, by pressing a button, immediately transmit to the station his reaction to the programme. It is necessary, however, for the broadcasting station to be equipped with high speed recording instruments, which will show the popularity of the various items. Dr. Hopkins believes that this instrument will materially affect broadcasting, because it will tend to give the producer of the radio programme an accurate means of estimating the types of programmes most suitable to his listeners. Three buttons are included on the instrument. One is marked "Present," which assures the broadcasting company that the programme is being heard. The other two buttons are marked "Yes" and "No" to indicate the opinion of the unseen audience.

* * *

ALTHOUGH the new Budapest single aerial mast is higher than the Eiffel Tower, it does not hold the record as the loftiest construction, which is still retained by the Empire State building at New York. From insulator to summit, the Romanian tower measures 314 metres (1,036 feet). At roughly 800 feet it is equipped with an automatic meteorological station with recording instruments for temperature, atmospheric pressure, direction and strength of wind, and rainfall gauge, on a similar principle to the Leningrad installation. This gigantic structure is capped by an illuminated crown, consisting of electric lamps of several hundred thousand candle-power, as a warning to aircraft.

Illustrating the device which is used to talk back to the Studio.

ALTHOUGH in the ordinary course of events owners of wireless receivers in Germany are forbidden to place loud-speakers at windows or on balconies, or to re-broadcast to passers-by in the streets, the Government permits their use in this manner for all official transmissions as on such occasions as national demonstrations, the feting of anniversaries, and so on. This propaganda for the development of broadcasting is to be encouraged.

* * *

AS a rule, a broadcasting transmitter takes its name from the site on which it has been erected. Some villages in this manner have become famous, such as Huizen, Langenberg, Junglinster (Luxembourg). In Switzerland, Munster was selected as the most favourable spot for a high power regional station and, owing to publicity given to the name, has now been authorised to adopt the same appellation as the transmitter, i.e., Beromunster. Formerly, the village was known as Muenster, but it was apt to be confused with a town of that name in Germany.

* * *

ROUGHLY speaking, Iceland numbers only one hundred thousand inhabitants, of which a mere 8,300 are registered listeners to the Reykjavik programmes. With the exception of dwellers in the capital, most of them are situated in distant and almost inaccessible districts of the island. Broadcasting to them is not only a source of entertainment, but actually during the winter months their sole link with the outside world.

* * *

A NEW decree issued in the Soviet Union calls for the construction of thirteen high-power transmitters, to be brought into operation before the end of 1935. As some of these are to be installed on the western and south-western frontiers, it is anticipated that their official opening will coincide with a wave of broadcast propaganda destined to neighbouring States.

BROADCASTING IN AMERICA

Very little real progress in the technical improvement of radio broadcasting has been made in the past four years. This is the opinion of Stuart Ballantine, President of the Boonton Research Corporation, who recently discussed the problem at a meeting of the Franklin Institute in Philadelphia.

The loud-speaker is the weakest link in the receiving end of the chain of sound and electrical impulses from studio to listener. According to Mr. Ballantine, it produces more distortion than any other parts of the system, with the exception of the microphones.

The conventional loud-speaker not only fails to reproduce a high enough range of frequencies, but its sound output fluctuates too much over the range it does cover. New high-fidelity receivers and loud-speakers have been developed which are capable of accurately reproducing sounds from 60 to 8,000 cycles and whose performance is noticeably superior to present types.

In the transmitters, which are important in controlling radio quality, because they serve so many receivers, Mr. Ballantine believes that high quality transmission is realisable without wholesale scrapping of present equipment and at only reasonable additional cost.

The ear responds to sound frequencies from 16 to 16,000 cycles per second. The separation between radio broadcasting stations is only 10,000 cycles, and Mr. Ballantine finds that the transmission of a 7,000 or 8,000 cycle band is about all that is technically feasible. Although 7,000 or 8,000 cycles does not give the ear all that it is capable of hearing, reproduction of this frequency range is quite acceptable, and the ear does not materially notice the range of sound frequencies that have been omitted.

Actually, however, many transmitters are now only feeding a band of 5,000 to 6,000 cycles width into their broadcasting, and this does not satisfy the ears and give convincing recreation of the sounds in the studio.

The utilisation of wire lines, now made available by the telephone companies, which are capable of 8,000 cycle transmission, was urged by Mr. Ballantine. Ordinary wire lines impose a limit of about 6,000 cycles, which is now usual.

Serious frequency distortion is caused by many of the microphones now in use in studios, and Mr. Ballantine recommended the replacement of all carbon and condenser microphones with the newer crystal and ribbon types. Broadcasting studios should also install for monitoring and audition purposes high-fidelity loud-speakers. These would allow them to place the microphones within the studios to better effect and otherwise control the sound conditions in the rooms where the radio programmes originate.

RADIO ROOF *is* HIGHER *in* POLAR REGIONS

The "radio roof" of the atmosphere, that electrified layer, which reflects radio waves and makes possible long-distance transmission, is higher in polar regions than in temperate latitudes, Prof. M. A. Bontch-Bruewitch, Soviet Scientist, revealed in a report to the British scientific journal, "Nature."

Experimenting at Nurmansk, in the extreme north-western portion of the U.S.S.R., near the Arctic Ocean, Prof. Bontch-Bruewitch discovered many unusual phenomena in connection with the fading of radio signals.

The height of the radio reflecting layer is ordinarily measured by sending radio signals and recording their reception on an oscillogram. If the receiver is within a short distance of the transmitter, two signals will come in, one direct from the ground wave, and the other reflected by the radio roof as light is from a mirror. The time interval betweeen the original signal and the echo, gives an index to the height of the reflecting layer.

Two reflecting layers were found by the Soviet scientist in the polar regions, corresponding to the two layers found in England by Prof. E. V. Appleton, but the lower layer, known as the "E" layer, is not generally active so far north.

This means that at the ends of the earth, long-wave radio signals ordinarily reflected by this lower layer will penetrate to the higher or "F" layer, and hence travel greater distances than in temperate latitudes.

Very complex reflections from the upper regions indicate that this part of the ionosphere has a stratified or undulatory structure, Prof. Bontch-Bruewitch reported.

Evidence was also found of radio-absorbing "Clouds," or separate moving masses, which pass along the radio-reflecting layer and prevent its reflection, as a cloud passing over the face of the moon prevents its light from reaching us.

When these radio "clouds" were present, the echoes were entirely absent for a short time. Such clouds make up an absorbing layer, independent of the reflecting layers and comparatively low in height, probably less than 37 miles, as compared with heights of the reflecting layers ranging on the average from 68 miles to 136 miles, or higher.

There is undoubtedly direct connection between the echo cessation and magnetic activity, Prof. Bontch-Bruewitch believes.

"The difficulty caused by magnetic storms of maintaining continuous wireless communication over high latitudes may be attributed to the existence of the absorbing layer," he concluded.

His research was conducted in connection with the International Polar Year, and was organised by the Leningrad Section of the Institute for Scientific Research of the People's Commissariat for Communication, in association with the Central Geophysical Observatory.

THE BIRTH OF RADIO

Many scientists have contributed to the growth in the Science of Radio. But Marconi had the genius to conceive and develop the possibilities of previous discoveries

Wireless telegraphy, or to use the modern and more accurate term, "Radio Telegraphy," is a specialised branch of the electrical science. The question of its discovery is often debated—yet there is no real inventor in the accepted meaning of the term. Many discoveries led up to this phenomena that date back as far as 1838.

Heinrich Rudolph Hertz.

First to discuss the origin of the telegraph. Samuel Finley Morse, born in 1791, attended his first lectures on electricity during the year 1809. At that time, electricity offered no openings for a career. Morse, who had distinct artistic ability, became a portrait painter.

It was not until 1827 that he again turned to electricity, by attending a series of lectures on the subject in New York. He conceived the idea of an electrical telegraph, and immediately laboured to perfect his system. In 1837 the first successful experiment over 1,700 feet of wire was performed. Although he had proved its practicability, it was not the end of his difficulties. The public at that time could not appreciate its possibilities.

After much striving, however, in 1842, the Congress voted him 30,000 dollars to construct a line from Washington to Baltimore. This was the first telegraph completed at the beginning of May, 1844.

Professor Henry, of the Princetown University, in 1842, found that the effect of the discharge of a Leyden jar could be detected at a distance, and in 1853 Lord Kelvin made further investigations on this phenomena, and gave the laws which govern the action of an oscillatory discharge.

Yet, J. Clerk Maxwell, the English Physicist, laid the real foundation of radio telegraph in 1863—entirely theoretical though they be. He advanced the hypothesis, at that time a very daring one, that the phenomena of light belonged to the same class as electro-magnetism, thus bringing light into the domain of electricity. Both travel at the same speed—186,000 miles an hour.

In 1886, Heinrich Rudolph Hertz startled the scientific world by his experiments with aether waves produced by the discharge of high tension currents. These waves have since been named "Hertzian Waves." He proved experimentally most of Maxwell's theory, and demonstrated the wonderful characteristics of these waves.

Many contend that he is the inventor of Radio, but he worked to prove the hypothetical theory. Unfortunately, he did not finish his work, and died in January, 1894, at the early age of 35 years.

About that time many eminent scientists, including Sir Oliver Lodge, began to study the disturbances set up by the discharge of the Leyden jar. They made many discoveries of great importance.

Professor Branley, in 1890, while working on these effects, invented an instrument which he called a coherer to detect these waves and make them audible in a telephone receiver.

Popoff, in Russia, used the Branley coherer in 1895 for his experiments in studying atoms. In order to collect waves from a lightning discharge, he used a vertical insulated conductor, which is said to be the first antenna. He used the coherer to make the received energy audible.

MARCONI ENTERS THE FIELD.

Marconi did not enter the field until about the year 1895. He first mentioned the possibilities of a wireless telegraph to his professor, and was very surprised to hear the older man shared the view of Sir Oliver Lodge, that wireless was neither necessary nor practicable. He watched developments, however, all the time expecting someone to realise his dream. Nothing having been done, he began to develop previous discoveries in a practical manner. Although much work had been done, there were enormous technical difficulties to be overcome.

Unable to arouse sufficient interest in his own country, Marconi migrated to England in 1896. Here he worked with feverish speed to perfect his apparatus. Having a working model, he took it to Sir William Preece, then Chief Engineer of the General Post Office.

It so happened that Sir William was having difficulty with line telegraphy, and had himself conducted experiments in Wireless Telegraphy. He eagerly listened to Marconi's exposition of his apparatus. A demonstration was given from the G.P.O., when messages were sent for a distance of 100 yards.

Financial aid having been obtained, there followed a year of hard thinking and patient work. In March, 1897, a demonstration took place at Salisbury Plains, when waves covered a distance of four miles.

This news immediately stirred the imagination of the British public. Developments progressed until 1901, when Marconi succeeded in transmitting over a distance of 200 miles. The summit of this stage of development, however, was reached a year later in 1902. He succeeded in bridging the Atlantic. This experiment was conducted between Glace Bav, Nova Scotia, and Cornwall, England—a distance of 2,200 miles. The power used for this accomplishment was 15 K.W., which, when considering the crude instruments for reception, was remarkable that the signals were ever received.

Marconi had now realised his dream.

About this time many scientists were experimenting with this new science, and added much useful data for its development. Space does not permit to mention all, but a few are: Blondel, Braun, Sir Oliver Lodge, General Ferrie, at that time Captain, Dr. Lee de Forest, Professor R. A. Fessenden, and Dr. John Stone.

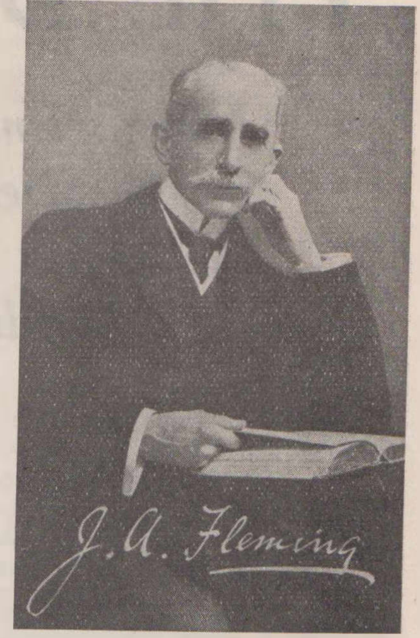
From the foregoing remarks it will be seen that there was no real inventor—in the accepted meaning of the word—of radio telegraphy. The whole edifice was built up from pieces. Frequently Marconi's part has been wrongly judged. Too much has been ascribed to him by some, and too little by others. Marconi had the genius to conceive the possibilities in the discoveries of his predecessors. Aided by his great energy and wonderful capabilities as an experimenter, he achieved practical results.

Marchese Marconi.

This great achievement really came from years of study and experiment, and the general growth in scientific knowledge.

INVENTION OF THE VALVE.

Once Radio had been placed on a workable basis, its advancement went along by leaps and bounds. The next important development was the two electrode valve, invented by Dr. Fleming. The invention of this device has caused a considerable amount of discussion.



Dr. J. A. Fleming.

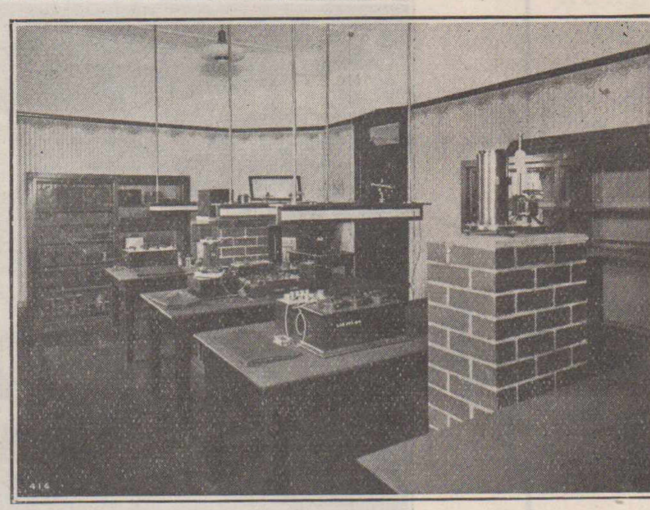
In 1884, when Thomas Edison was experimenting with the filaments of electric light globes, he found what has been called the "Edison Effect." At the time there was no thought of the connection between this and the detection of radio waves.

It was not until Dr. Fleming made his discovery that its possibilities were ever considered. He found that a plate inserted inside an electric light globe allowed current to pass in one direction only. This is the fundamental of the thermionic valve to-day. All arguments as to who invented the valve were dispensed with by the United States Circuit Court of Appeal on the 9th May, 1917, when the judgment was given in favour of Dr. Fleming.

It is still considered in some quarters that Dr. Lee de Forest was the real inventor of the thermionic valve. He improved the Fleming valve by inserting the third element known as the grid between the plate and the filament. This was to control the current inside the valve. Dr. Lee de Forest deserves all praise, for it was through his invention that radio has progressed so rapidly. This new element made the valve more sensitive, made amplification possible, and the wireless telephone an accomplished fact.

To-day it is well-known the service that radio is to civilisation. Ships at sea are able to communicate with each other and the land. Broadcasting has become a necessity, and most homes have their radio for entertainment and education. Its use in aviation has been demonstrated. Television is in the air. Is power by radio the next development? No doubt the next generation will see more advancement, and look upon the present art as very early stages of development.

Modern Radio



Modern Radio Laboratory at A.W.A. Factory.

The receiver to-day is the result of extensive research and experiment, and what can be obtained under highly skilled conditions cannot be had from the factory product. The nearer production is to research the better the completed receiver.

Ever since the possibilities of broadcasting were realised, enormous sums have been expended annually on engineering research. Every invention has been through the melting pot. And to-day we buy a receiver which is the result of years of intensive research and experiment.

Theoretically it should be possible to receive the faintest signal transmitted from any part of the world. In fact, this actually has been accomplished, for many amateurs have corresponded across the globe, using less power than is required to light the tail lamp of a car.

But without detracting from the undoubted merits of these attainments, it must be realised that these results are obtained under freak conditions and cannot be repeated at will. Only under special atmospheric and other conditions has the feat been possible at all. The manufacturer of the modern radio receiver, however, it not concerned with these erratic happenings. He has to produce an article which will be reliable at all times and will give specific results under continuous service. He cannot make a radio on which some station has been received—he has to produce a receiver that will repeat the same performance and render broadcast programmes whenever desired.

Other aspects are that results must be free from any interference, reproduce the music faithfully, and have a pleasing appearance. Thus it will be seen that the problem of producing the commercial receiver is far different from that of the experimenter.

A peep into the factory will illustrate the difficulties. Apart from the actual machinery, there is a separate building which cannot be entered unless the visitor is specially favoured. This is the research laboratory. It is here that the latest developments in radio are being investigated with a view to incorporating improvements in future models.

Here, moreover, after months of research and experiment, a receiver is built and submitted to the factory for report. But the production manager views this new creation from an entirely different viewpoint. He looks at it from a production aspect, for he has to make jigs, dyes and what-nots. Then there is the assembly and finally the cost.

It may so happen that costs can be materially reduced if a component is moved from one position on the chassis to another, or by altering the size of the component. So involved and intricate is the modern receiver, that any small alterations may change the properties of the original model, so back it goes to the research department for review. There probably are a good many of these consultations before the final receiver is ready for production.

It will be seen from the foregoing that the individual set might be the most marvellous creation, yet it does not follow that this can be duplicated in the factory.

An experimenter may build himself a most wonderful receiver, but trouble arises when he tries to duplicate it for others, or he has to place it in a cabinet. Further, it must be remembered that the factory has evolved a receiver as near the ideal as is practical, after taking into consideration technical features and the aspect of the price at which the receiver is to be sold.

In regard to circuits, it is of interest to mention that they are fundamentally the same, having some minor adjustment or improvement particular to the manufacturer. As far as the main features are concerned, there is a definite method by which the received signals are passed from one

Factory Production of Radio Receivers.

valve to another and finally converted into sound at the loud-speaker.

The intrinsic difference in commercial receivers will be found in the quality and arrangement of component parts. Two people may build receivers from the same schematic circuit, yet in the final results it will be found that they function quite differently. Proximity of wires to each other and to the various component parts have a distinct bearing upon the completed product.

Research engineers realise all these difficulties in manufacture and so allow sufficient latitude that slight variations from the laboratory receiver will not materially affect the rendition.

And there are service considerations for which allowance should be made. Layout of components must be such that the service man is able to get at any defective component without undue difficulties, so that when trouble occurs each part can be tested and the defect quickly removed. If the receiver were such that parts were difficult to reach, much time would be wasted and unnecessary work required. This is a most important aspect of the commercial receiver.

After arrangements for new models are completed, manufacturers often release particulars of receivers which have functioned excellently, but cannot go into production for various reasons. These circuits, in the hands of a capable experimenter, will produce better results than the manufactured product, but they are complicated and difficult to handle, so not available to the general public.

Thus will be seen the importance of the research department in producing a reliable, practical instrument as near the ideal as possible. Production resembles the research model after allowing for engineering practices and cost with the closer the relationship the better the commercial receiver.

Meteors Affect Reception of Short Waves

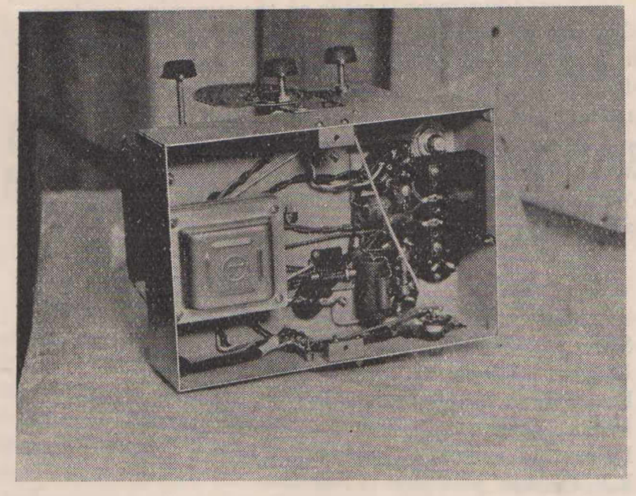
In addition to sunspots and magnetic storms, the radio listener may now add meteors to the list of natural phenomena affecting reception of long distance signals.

While Drs. R. Minohara and Y. Ito, of the Naval Experiment and Research Establishment at Tokio, Japan, were working on a series of experiments for determining the height of the Kennelly-Heaviside Layer, it was an easy matter for them to determine, as a sort of side issue of their research, the effect of meteors on the transmission of radio signals.

Meteors speed through the upper air at the rate of 26 miles a second or more, the investigators stated in a report to the Radio Research Committee of the National Research Council of Japan. The friction caused by these objects hurtling through the atmosphere produces ionisation in their pathways before the meteors are heated to incandescence and become visible. Small meteors serve to ionise the upper atmosphere, while the larger ones penetrate to and ionise relatively lower altitudes.

Even in the daytime it was found that meteors affect radio waves, causing irregularities in reception. Those of relatively long wave-lengths are affected comparatively little, because long wave-lengths are reflected at the lower surface of the sun-ionised region of the atmosphere. Shorter waves, however, penetrate farther and may be reflected by "ion clouds" formed by the meteors, or by an upper ionised layer formed by the smaller meteors.

At night, when the ionising effect of the sun is not so great, the effect of the meteors is relatively greater.



View of the wiring of the Short-wave Converter.

Short Wave Converter

The Converter described below has been carefully tested with a good receiver and has brought in many long distance stations operating on the short waves

BY

F. BASIL COOKE

To alter the broadcast receiver so that it will bring in the short-wave broadcasting stations as well as the regular programmes, there are two general methods by which this may be done—by using the Adapter or the Converter.

The adaptor is an attachment operating from the power supply of the broadcast receiver, to which it is coupled, while the converter has its own power supply arrangements and acts as an independent unit. The adaptor, however, is difficult to operate with many types of receivers, and has distinct disadvantages. But the independent converter has the advantage of working satisfactorily with almost any kind of receiver.

The converter shown in the accompanying photos has been carefully tested, and with a good receiver will give excellent results. It is on the superheterodyne principle, using plug-in coils or more preferably some well-designed tuning unit.

In view of the many obvious objections to a series of plug-in coils, the tuning unit is self-contained, covering a band of wave-lengths from 10 to 200 metres. There is a carefully-constructed switching system in which dead-end losses have been reduced to a minimum.

ASSEMBLY.

A study of the circuit diagram and accompanying illustrations will illustrate the best method of assembly. With the valves, electrolytic condensers and S.W. unit placed in position, the balance will follow automatically.

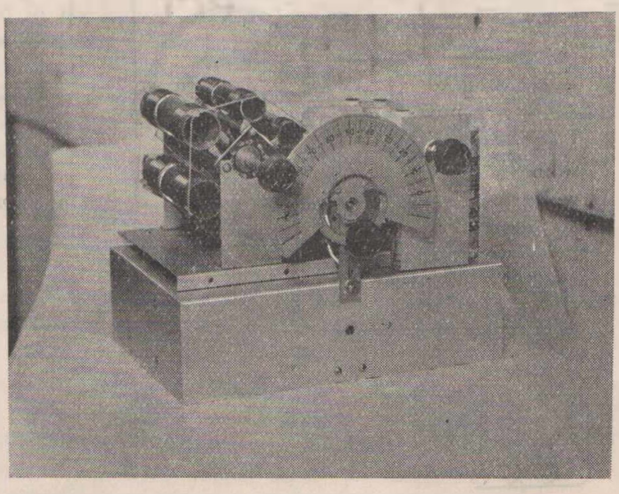
Having mounted the valve sockets and electrolytic condensers on to the chassis, the tuning unit is fixed, with the wires being brought through the chassis. The power transformer and filter choke are not fitted until after the wiring has been completed. But the short-wave coupler and R.F. Choke should be firmly bolted to the chassis.

The set is now ready for wiring.

WIRING.

As certain parts of the assembly are inaccessible once the filter choke and power transformer have been fitted, it is advisable first to connect one side of the filament supply of the 80-valve socket to the nearest electrolytic condenser.

Before placing the power transformer in position, put the power flex through a rubber-bushed hole in the back of the chassis.



Top view of the set as constructed.

Having thus made provision for all contingencies, commence by wiring the filaments and dial lights with twisted flex. Make sure of good soldered joints and run this feed neatly round the chassis..

All earth connections should be to a common bus-bar, running through the centre of the chassis. The screens and cathodes of the valves now receive attention, and are connected to their respective points. Next the short-wave unit is wired, care being taken to follow instructions implicitly. With the main circuit wiring complete, the filter choke can be attached and wired. And, lastly, the power transformer is assembled and wired.

A good plan is to use a terminal strip for the leads from the power transformer. This makes the job look much neater and also will increase the safety factor.

On the top of the chassis there is practically no wiring, but care should be taken to see that the wiring of the trimming condenser does not foul the valve shield.

OPERATION.

There are three terminals: two for aerial and earth, with the third connecting the converter to the aerial terminal of the broadcast receiver.

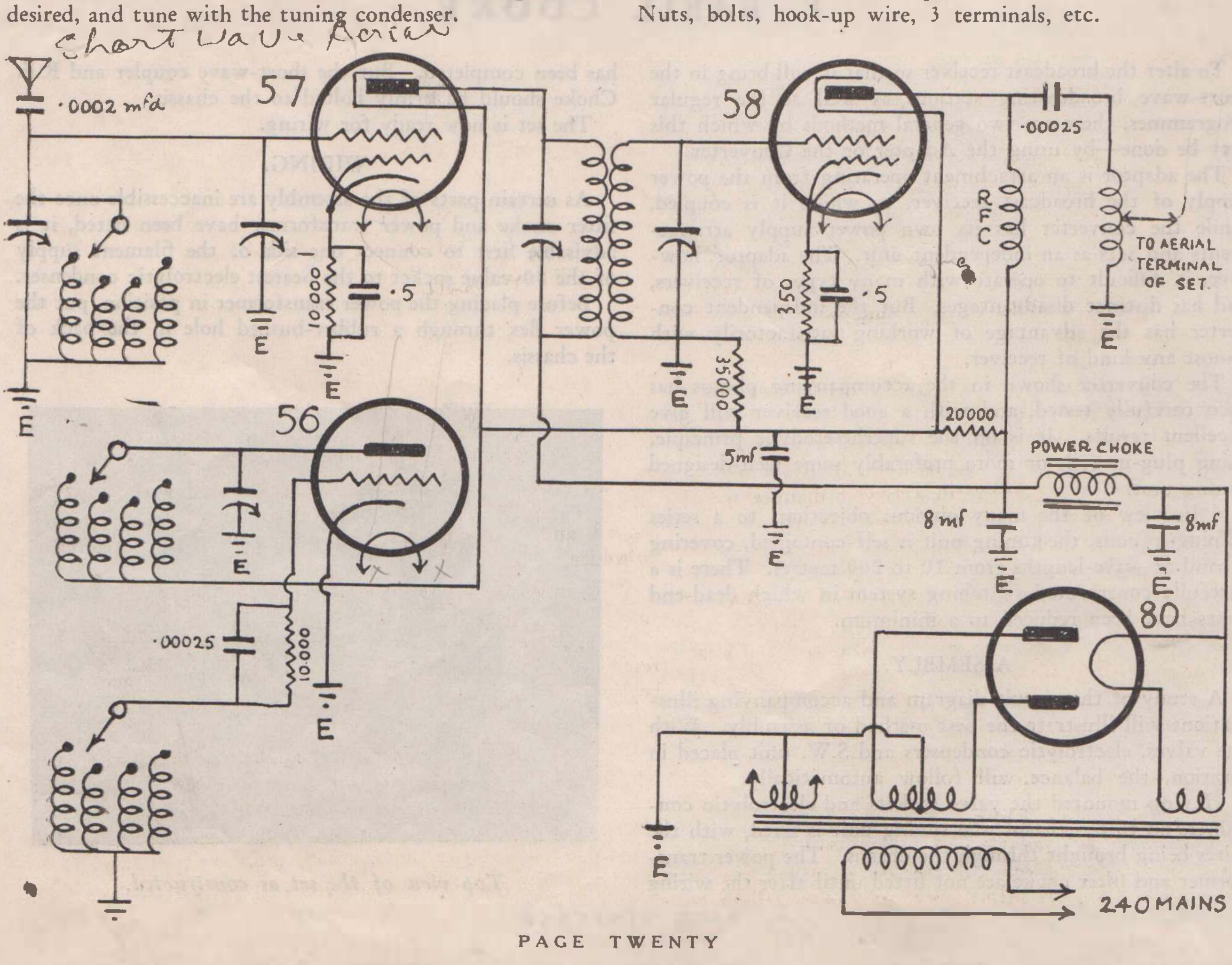
The broadcast set first is tuned to 585 K.C., or 512 metres, by picking up some station and slowly adjusting the broadcast set for best results. Do not alter this for short-wave reception.

Everything ready, see that both the broadcast receiver and the converter have been switched on at the mains. Next move the selector switch for the wave-length band desired, and tune with the tuning condenser.

The final adjustment is made on the trimming condenser. Tuning on short waves is extremely delicate, and the smallest movement of the tuning condenser may be sufficient to lose the station completely. Therefore, in searching the band for some station that is broadcasting, the dial must be moved very slowly, otherwise the station may be missed. Every care and attention must be given to tuning on the short waves, for this has a considerable bearing upon ultimate success.

LIST OF COMPONENTS FOR SHORT-WAVE CONVERTER.

1 S.W. Kit, S.W. 10/200 Lekmek.
1 Base, $11\frac{1}{2}$ x $9\frac{1}{2}$ x $3\frac{1}{4}$.
1 Power Transformer, 275 volts each side of centre tap.
1 Vernier Dial.
1 Filter Choke, 30 Henries 75 mils.
1 R.F. Choke.
3 By-pass Condensers, .5 m.f.
2 Fixed Condensers, .00025 m.f.
1 Condenser, .0001 m.f.
2 Electrolytic Condensers, 8 m.f.
2 Resistors, 10,000 ohms.
1 Resistor, 20,000 ohms.
1 Resistor, 35,000 ohms.
1 Resistor, 350 ohms, w.w.
Valves, 1/58, 1/57, 1/56, 1/80.
3 Valve Shields.
4 Sockets, 1/4, 1/5, 2/6, pin.
Nuts, bolts, hook-up wire, 3 terminals, etc.



SOLDERING

Ultimate results always depend upon good electrical contact obtained by the proper use of the soldering iron. Importance of soldering can never be overstressed.

Results after building a receiver are either made or marred by the ability of the home constructor to make good electrical contact with solder. It was the writer's experience to eliminate trouble from a set constructed exactly to specification, and as far as everything could be seen the work was in order. But the high resistance of connections due to the over-use of soldering flux stopped the receiver from functioning.

Best quality solder is made from pure lead and pure tin in about equal proportions. This melts at about 370 degrees Fahrenheit. If there are any impurities, such as zinc or antimony, they tend to make the solder run sluggishly, and also do not allow the perfect adhesion of the surfaces, which is so desirable in all radio work.

Solder usually is obtained in strips about half an inch in width, and three-eighths of an inch in thickness. The variety most suitable for the home constructor, however, is in the form of a long rod about one-eighth of an inch in diameter, with a hollow centre. This cavity is filled with a specially prepared flux or resin, and so avoid the necessity of using an independent flux.

IMPORTANCE OF FLUX.

Without the aid of flux, solder would be practically useless for joining purposes. Its purpose is twofold. First, it must exclude air from the surfaces to be united so as to prevent oxidation. Secondly, it paves the way for the solder and enables it to flow over the surfaces to be joined.

If solder is applied to the surface of ordinary clean metal by means of a soldering iron, and without the aid of a flux, it will be found that the solder forms into globular shapes, and will not adhere to the surface. If it adheres to the surface at all, it can be brushed off with the slightest perceptible effort.

Repeat the experiment with a suitable flux spread over the surface, however, and it will be found that the melted solder will flow over the metal in a similar manner to oil over water. It is the property of the flux that causes the solder to spread and flow, and this makes the flux of paramount importance in all soldering operations.

Yet there are many varieties of flux that can be used for soldering, although not all of these are suitable for the radio receiver. A brown paste known as Fluxite or other similar preparations are good. Resin is another good flux, and can be obtained in the form of resin-cored solder. Hydrochloric acid mixed with an equal quantity of water and used with galvanised iron is quite unsuitable, because the acid will creep and corode the metal.

VARYING TYPES OF IRONS.

Soldering irons are available in various weights suitable for their different purposes. In the elementary form it consists of a rectangular-shaped piece of copper which is pointed at one end and tapered to the other. This is attached to the shank of a handle by means of a rivet or bolt.

Size of the copper has an important bearing upon soldering. The weight of a few ounces is sufficient for very small work, while for general purposes one of about a pound is satisfactory. But the small iron cools more rapidly than a large one, although the larger iron takes longer to heat.

There are a few types of self-heated irons. For radio purposes, the electrically-heated iron is the most suitable. It is a very handy tool to have on the bench.

Really, there is nothing very difficult in soldering, but it requires a certain amount of knack, and the careful observation of a few rules. In the first place, the iron should be at the right temperautre. To judge this, hold the iron near the cheek, when the heat given out will be readily judged. Until some experience is obtained, the best judgment of the correct temperature is obtained by attempting to melt a piece of solder with the iron. The temperature will be about right when the solder melts immediately it is touched.

On no account should the iron be heated to redness. This tends to burn away the copper and destroys the tinned surface at the point. For successful soldering this point must be well-tinned.

RE-TINNING THE IRON.

The operation of re-tinning an iron is as follows: First heat the iron and then lightly file or scrape the end to clean it and remove all traces of oxide. Place a piece of clean tin plate on the bench with a little flux and a few drops of solder on the surface. The hot iron is quickly placed in the centre of the flux and pressed against the pieces of solder which immediately flow over the surface of the tin. Roll the point of the iron about in the solder and flux until the end of the iron is covered with solder, which is evident by the silvery film. The iron is now tinned, and it is only in this condition that it is possible to solder.

It is important that the work to be joined must be thoroughly cleansed. Scrape the metal, rub with a smooth file or a piece of emery cloth until a bright, clean surface results. Next apply the flux to both of the surfaces to be joined. A minimum of flux should be used and placed where the solder is to flow.

The next step is to tin the surfaces or wires to be joined. This is done by picking up a small piece of solder with the iron and applying to the work. Having tinned both surfaces, join and again apply the iron, but at the same time add more solder by applying the stick of solder to the end of the iron and melting sufficient to make the join.

(Continued on page 22.)

Radio Waves Measure Size of Ammonia Molecules

Two University of Michigan scientists are experimenting with radio waves less than half an inch long, which are produced by electrical oscillations inside a tiny vacuum tube. The anodes or positive plates of the valve are made from graphite cylinders only three-tenths of an inch in diameter. The wave-length produced by this valve depends upon the time it takes the electrons to travel from the filament located in the centre to the inner walls of the cylinder.

The whole vacuum tube is placed in a strong magnetic field, which also influences the wave-length of the waves produced. The stronger the magnetic field, the shorter the waves.

The Michigan physicists, Dr. C. E. Cleeton and Dr. N. H. Williams, measured the wave-lengths of these ultra-short waves by reflecting them from two brass mirrors three feet in diameter, to concentrate the energy and spreading them out in a spectrum, by means of a grating or set of finely-ruled lines on a polished surface. The waves, after being focussed by the second mirror, fell on a crystal detector that amplified their electrical energy.

Perhaps the most striking thing about this experiment is the partial closing of the gap between the far infra-red rays and the shortest radio waves. This gap has so far been the most difficult for the experimenter to close, and this advance has decreased the radio waves by at least two octaves on a frequency scale.

The production of these ultra-short waves, a feat in itself, was but a part of the accomplishment of the two physicists. The waves were passed through a rubberised cloth bag, full of ammonia gas, which absorbed a certain wave-length of the band of waves to an abnormal degree. From their measurements on this absorbed wave-length, the scientists were able to show that the ammonia molecule has an apparent diameter of about three and a half hundred-millionths of an inch (0.000000035 inches). That is, 100,000,000 ammonia molecules in a chain would be only three and a half inches long.

SOLDERING.

(*Continued from page* 21.)

It must be remembered that solder will flow towards the heat. Consequently, as soon as the solder commences to flow, the iron must be traversed steadily and regularly around the joint face. It will be observed that the melted solder will flow over the joint and will run into and over it.

The completed join should be uniformly covered with a film of solder. The joint then is held firmly together as the solder makes good mechanical contact with the surface of the metal. Having completed the joint satisfactorily, the surplus flux must be removed. A small brush dipped in petrol is very effective. Resin will chip off easily when dry by scraping with a screw-driver.

Special Headphones for the Deaf

A recent experiment carried out by the His Master's Voice Company shows that deaf persons, providing their hearing organs have not been totally destroyed, can hear programmes from this company's radio-gramophones with the aid of special headphones. A well known Knight, who for some years has only been able to hear music, approached the company with a view to ascertaining whether it would be possible for him to enjoy the programmes provided by the H.M.V. seven-valve radio-gramophone he had bought for his family. H.M.V. engineers, therefore, had a special pair of headphones wound to match the impedance of the radio-gramophone. These 'phones employ cones in the earpieces instead of the ordinary flat diaphragms, and are used throughout the world by Naval and Air Force radio installations. Although this gentleman cannot hear speech or music without his hearing apparatus, he is now able to enjoy a radio transmission or entertainment from records to the same degree as a person of normal hearing. The sounds of music and speech from the headphones, if worn by a person of normal hearing, would practically deafen him.

LOOKING ON AT THE A.B.C.

(*Continued from page* 8.)

by the studio manager, Mr. Conrad Charlton, Mr. Bryson Taylor (programmes), and the engineer.

It is well to mention here that every person who makes an application is afforded the opportunity of an audition under the identical conditions which existing artists broadcast, each receiving close consideration and unbiassed criticism. It is the policy of the A.B.C. to use whatever talent is satisfactory to their needs.

An audition is given every Monday at 10.30 a.m., from which is weeded out the "probables," who are given another audition on Thursday. From this test the chosen ones are added to the list of broadcast artists. Mr. Bryson Taylor, who is in charge of the programmes, makes it a point that they come within our hearing as soon as possible, so that there is no long waiting list.

Aspirants to broadcasting fame await in the foyer, outside the main studio, some seated, some standing, others pacing nervously backwards and forwards awaiting their turn. One is ushered into the studio, faces the microphone with a look of trepidation and grim determination, then commences his piece.

Mr. Charlton, within the control room, judges the speaker's capabilities, but if through nervousness his voice is a little shaky and stilted, he is given a nod of encouragement and sufficient time to recover his composure. As the instrumentalists and vocalists take their place, Mr. Bryson Taylor steps forward, and by means of gesticulations through the window, suggests a different stance, etc., after which he in turn delivers his judgment.

The tension which was so obvious diminishes as each applicant pours forth his art. He leaves the studio with an expression which is a combination of relief and expectancy, and so the audition draws to a close.

RADIO and CRIME

Radio has become an essential aid to the New York Police Department in their war against crime

Covering an area of 316 square miles, the radio Control System of the City of New York has in operation 400 automobiles, 3 boats, and 1 aeroplane, all radio equipped. At headquarters the dispatcher's control map keeps a tab on their movements, and on receipt of information the nearest patrol cars are immediately dispatched to the scene of the crime.

Although this weapon in the war against crime is relatively new, the New York Police Department obtained a license for its first transmitting station in 1916. This was the pioneer Police Radio Station in the United States of America. The service commonly referred to as Police Patrol, however, was initiated by the City of Detroit.

Early experiments were abandoned, only to be revived again about 1927. The service was placed on a substantial basis in 1929, when new transmitting equipment was installed and approximately fifty cars were equipped with radio receivers. The success of this system has resulted in about a hundred transmitting plants licensed for Municipal Police Service in the United States.

PATROL CARS.

Cars have a folding writing shelf with its own light attached to the instrument board in front of the observer's seat. Two windscreen wipers are provided, and the screens themselves open wider than on stock models to permit the use of revolvers. All sedans are equipped with tear gas bombs, and those used by detectives also have short rifles. The driver operates the radio equipment while the observer, who sits beside him, transcribes any alarms, keeps the log, and telephones the dispatcher as required.

Each car is represented by a numbered brass disc, which is placed over the sector of the dispatcher's map to which the car is assigned—discs are numbered on both sides. Black numerals indicate that the car is on routine patrol duty, and white ones show that it has been assigned to cover a special call. In addition, there are paint-filled depressions indicating by colour the type of car and the branch of the service to which it belongs, such as patrol cars, detective squad cars, detective division cars, and executive cars.

In operation, the telephone sends the incoming alarm to the dispatcher's desk when he notes the location of the trouble, selects the cars to be assigned, and gives instructions to the announcer-operator of the radio plant, who has, in the meantime, sent the attention signal which precedes all calls.

After the alarm has been issued the discs corresponding to the car assigned are turned over, showing the white numerals, and are left thus until the crew report the job completed. The report generally is made by the car which is first on the scene, giving the name of the officer reporting, the number of radio-equipped cars which answered the call, the locality of the assignment, what action was taken, and whether the car and crews are still required. Those no longer wanted resume patrol duty at once.

To make sure that the radio receivers on cars are functioning properly, every hour and a half time signals are broadcast. In the event of this signal not being received, the car reports at once and a radio service car is dispatched immediately.

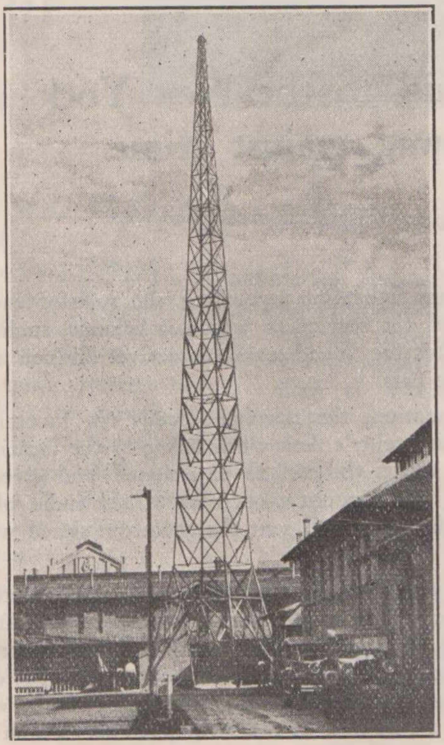
CRIME REACHED IN 45 SECONDS.

The radio system of New York is reserved for messages of prime importance, where immediate action is essential. On an average the Radio Patrol car reaches the scene of its assignment about 45 seconds after the transmission of instructions, and one arrest is made for every twelve calls. Sometimes the officer reaches the scene while the crime is still in progress, or as the criminal is making his escape.

To quote some typical examples of the cases handled by the radio patrol.

Two coloured men attacked the driver of a mail truck, and a person nearby heard the call for help and telephoned the Police Department. Two cars were assigned to the case. On their approach, the bandits ran into an apartment house, where one was found in a cellar and the other under a bed.

All patrol cars were ordered to another case to look for two men reported to be in a Hudson sedan, license number uncertain, except for the first two figures, last seen after leaving a fight during which they shot three other men, who had been removed to hospital in a serious condition. In seventeen minutes a car reported that they had captured the men, who still had the revolvers used in the fight.



The Radio Antenna at Redfern Police Barracks.

In a third case, the crew of a patrol car noticed a dishevelled man running along the street in the early evening. When he refused to stop, he was pursued and caught. Failing to give satisfactory explanations, they detained him, intending to investigate his connection with some street brawl. They then received a call for their car and two others to investigate a reported hold-up. On arrival the officers took the suspect into the restaurant with them, and he was identified as the man who had shot one of the employees during an attempted hold-up a few minutes before.

RADIO ONLY MEANS.

These cases clearly illustrate the good results obtained by the Radio Patrol in moving quickly to the scene of a crime. Radio communication has made this possible, as no other means is available once a car is out on patrol.

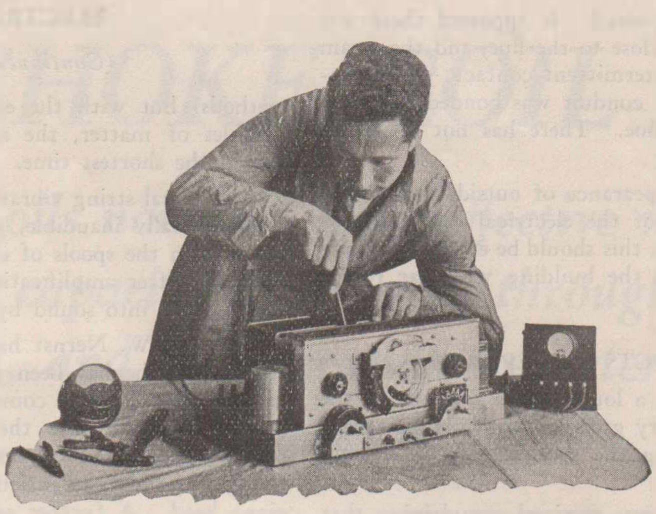
During twelve months this patrol has recovered stolen property worth more than 250,000 dollars, and the following summary for the same period makes some very interesting reading. In most of these cases, moreover, it is unlikely that the offenders would have been caught without the aid of radio communication:—

Arson	3
Assault, simple	24
Assault, felonious	84
Assault, robbery	165
Automobile drunken driver	19
Automobile leaving scene of accident	7
Automobile, reckless driving	4
Burglary	305
Counterfeiting	24
Disorderly conduct	122
Escaped prisoner	4
Homicide	12
Juvenile delinquency	134
Larceny, grand	152
Larceny, petty	100
Malicious mischief	17
Possession of burglar's tools	14
Possession of narcotics	5
Rape	7
Robbery	47
Possession of revolvers	145
Transportation of Alcohol	5
Unlawful entry	9

For this twelve months the Radio Patrol made 1,408 arrests, all of which are due to the assistance of the modern science of radio communication.

MARCONI DIRECTION FINDER FOR SUBMARINES

The Marconi Company has introduced a new wireless direction finding equipment for submarines, utilising a telescopic aerial system, which has proved its value under actual service conditions. This instrument, known as the Marconi Type D.F.G.9C direction finder, provides an important new navigational aid for submarines. When cruising beneath the surface a submarine is normally "blind" and "deaf," and must rely solely on compass readings, but this direction finder enables the navigating officer to take bearings on any known land station or vessel even when under water. Direction finding facilities are also, of course, of particular value if a submarine, having dived during clear weather, is enveloped in fog on rising, when the only method of ascertaining her position, apart from wireless, is by dead reckoning. The new apparatus comprises an ingenious telescopic aerial, which is raised above the normal superstructure of the submarine. When in position for operating it consists of two non-rotating loops mounted at right angles to each other about a vertical axis, forming a normal Marconi-Bellini-Tosi system.



REMINISCENCES of a SERVICE MAN

Undoubtedly the radio service engineer has a most varied career, coming in contact with all types and classes of people, and during the course of his day comes across many amusing incidents. There are, however, vexing happenings which test the good humour of all of us. Nevertheless, he has many varied and perplexing problems to solve, and these are not fully appreciated by the layman.

Apart from a complete stoppage of the receiver, the most common trouble experienced is that of peculiar noises. When anything happens the owner comes along to the service man and says: "My set goes gurgle gurgle or tick tick; please go and fix it."

It is difficult not to smile when some dignified men and women distort their faces in an endeavour to imitate the noise. Their efforts really do not assist the engineer and are quite useless, for to the trained man each kind of trouble produces its own characteristic sound, which cannot be imitated.

Sometimes the source of the trouble is easily found, while at other times it may be weeks before the cause is located. But the first thing for the layman to do is to determine whether the noise is due to a fault in the set or is coming from some outside source.

This can be done by disconnecting the aerial from the set. If the noises materially diminish, the source is on the outside, while if they persist, the trouble is in the set itself, so is treated accordingly.

Hunting for noise trouble in a receiver is done according to a definite plan, and often is located fairly quickly.

EXTERNAL NOISES DIFFICULT.

Noises from an outside source are the difficult ones. They may be caused from trams, electric sub-stations, or pole transformers, but mostly are caused through loose unearthed electric light wiring in one's own house.

A very extraordinary case occurred recently. The first indication was the usual request to remove the noises from the receiver. But after the preliminaries it was apparent that the noise was from outside.

At the first two calls, although an hour or so had been spent in waiting for the trouble to occur, the set behaved beautifully. Then came the cross examination of the owner, from which it appeared that the noise occurred only near meal times. The following day, therefore, an inspection was made at noon. At 12.20 the noise commenced, completely drowning all music.

Every switch was examined, and the light wiring found to be in order. Wondering what to do next, a glance through the servery window into the kitchen showed a kettle of water was boiling, with steam rising and condensing on the flue. A request was made to turn off the kettle.

As soon as the steam ceased, so did the noises.

The cause was soon discovered. It appeared there was an unbonded conduit very close to the flue, and the steam was sufficient to cause an intermittent contact, which created the fearful noise. The conduit was bonded and bent a little further from the flue. There has not been any further trouble with noises.

Sometimes the sudden appearance of outside noises give a warning that some part of the electrical installation is breaking down. In all cases, this should be examined. Any faulty electrical contact in the building will mar reception.

SPEAKER AFFECTS RECEPTION.

With battery sets having a loud-speaker separate to the set proper, very extraordinary growls and howls sometimes can be produced by passing the speaker cord in certain positions behind the set.

On one occasion a letter was received complaining that although the set had given every satisfaction for several years, it had suddenly developed the most dreadful roar. As the writer lived hundreds of miles away, it was necessary to do what was possible by correspondence.

Consequently a letter was sent asking all the questions which might be helpful. Upon receipt of the reply it was found that the set had been moved into another room, with the speaker on the left instead of the right, as formerly. A reply was sent requesting the owner to move the speaker to the other side of the set and report results.

Probably for many years yet to come visitors will be told of the wizard who could cure a set merely by moving the speaker.

Naturally, the service man has his cross to carry. One very cold, wet, stormy night an urgent call came through. Having settled before the fire and just commencing an enjoyable game of bridge, the engineer did not relish travelling 15 miles each way. But the summons had to be obeyed.

On arrival it was found that *the switch had not been turned on*—thirty miles on a wintry night, after being dragged from a warm fire and pleasant company, to turn on a switch!

THE BEDSIDE MANNER.

Probably the most valuable asset possessed by the medical man is a good bedside manner. So with the service man, for tact is essential to success. He has to meet every kind of being, from the clever young man to the dear old lady who must fuss and make herself a bother.

And things do not always turn out according to plan; so often it becomes necessary to explain many things.

On one occasion a very irate lady came into the service manager's office ready to murder him. She had already dealt with the outside staff, and was ready for anything. On entering the office she started: "Mr. ——, I have come a long way and gone to a lot of expense to see you." Before anything further was said, he replied, holding out his hand: "Mrs. ——, I think that was very charming of you, as it gives us both a chance of knowing each other better and settling any little troubles which worry some silly folk unnecessarily."

Harmony was immediately established.

ELECTRONIC MUSIC.

(*Continued from page* 10.)

methods; but with the electrical method, free from the shackles of matter, the same results have been attained within the shortest time.

Mechanical string vibrations without the sounding-board are practically inaudible, yet they excite weak alternating currents in the spools of electro-magnets placed above the strings. After amplification, the electrical oscillations are transformed into sound by the loud-speaker.

Professor W. Nernst has developed a piano so far perfected that he has been ready for more than a year to manufacture the first commercial electrical musical instrument. To overcome the disturbing sound of hammer blows, a special micro-hammer is built in, and this hits the string with only a twentieth part of the force of the normal piano head. A further advantage is the loose stretching of strings now possible, as they are not required to vibrate a heavy sounding board. This results in the die-away time being increased three to five times.

A gramophone can be connected to this instrument, and by this means it is possible to accompany on the grand piano a violin or 'cello solo produced by the gramophone record.

It is interesting to note that J. Crompton, an Englishman, applied in 1929 for a British patent for an electrical piano constructed on similar lines.

Space does not permit to go into the details of all the electrical musical instruments developed, but this latest sphere of electro-acoustic technique is as yet in its infancy, and it cannot be forecast what surprises electrical sound production will bring in the future. Artists and composers, however, will have an entirely new field for expression.

RECORDS

EVERY AVAILABLE RECORD
IN STOCK

SEND FOR CATALOGUES
AND
FREE PACKET OF SPECIAL NEEDLES
FOR PICK-UPS

TALKERIES MUSIC STORES
QUEEN VICTORIA BUILDING
SYDNEY

THE CHOKE COIL

Choke Coils not only have effective inductance but also capacity distributed throughout their windings, and so operation is determined by frequency

The Choke Coil is used to apply direct current voltage and radio frequency voltage to the one point without any of the radio frequency current entering the D.C. supply. The condenser is used to prevent the direct current from getting into the radio frequency circuit.

In Figure 1 the A.C. variations are kept out of the D.C. generator circuit, but, at the same time, are forced through the load resistance. With the switch S open, S1 closed, and the alternator running, alternating voltage will force current through the condenser to the load circuit. Reversing the switches allows the direct current to reach the load resistance. With both switches closed, the condenser stops the D.C. current from entering the A.C. source.

We shall consider the action of the choke coil in preventing the A.C. from entering the D.C. source.

The ideal plan would be to connect a high value of perfect inductance between the point X and the generator. Since the effect of inductance is to prevent current variations through it, all that appears necessary is to make the value of inductance sufficiently high to obtain the desired degree of choking effect. This would keep the A.C. variations entirely out of the D.C. circuit without opposing the flow of direct current to the load.

If a perfect inductance, or a coil containing inductance only with a normal amount of resistance, could be obtained,

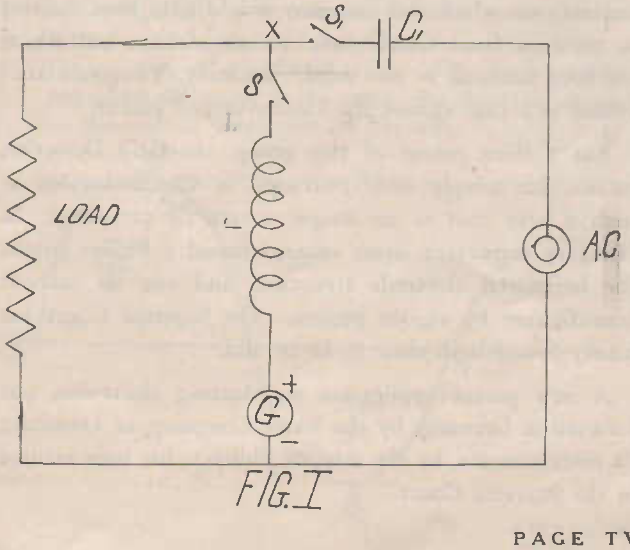


FIG. I

this would be true. Practically, this is not difficult to obtain at audio or low frequencies.

When this principle is applied to radio frequencies, however, and a large value of inductance is used to get the choking effect, it frequently occurs that the circuit acts as if no inductance were present.

On test it will be found, as far as the R.F. component is concerned, that the circuit acts as if a large capacity was between the point X and the generator. If the inductance is increased, it will be found that this condition is aggravated. Instead of a more opposing effect, the current variations through the D.C. circuit are increased.

It will be found that an increase of frequency will also increase the current variations through the D.C. circuit. This indicates that the coil is not acting as an inductance, but as a capacity.

The reason for this is that the coil not only has inductance, but also capacity distributed throughout the windings between the various turns. The shape of the coil determines this distributed capacity in the same way as its inductance.

ACTS AS PARALLEL CIRCUIT.

Effects of disturbed capacity are showin in Fig. 2. The capacities between the individual turns are in series, and the entire capacity is across the whole coil. This in effect forms a parallel circuit with inductance in one branch, and the distributed capacity of the coil forming the other. The choke coil, therefore, must be treated as a parallel circuit instead of the simple large inductance.

The parallel circuit may act as a resistance, a capacity, or an inductance, depending upon the frequency at which it is being worked. If the parallel circuit is worked at its resonant frequency, it acts as a high value of resistance, at frequencies higher than resonance as a capacity, and at frequencies lower than resonance as an inductance.

Thus every coil must have a resonant frequency. It may be placed in the circuit and, by adjusting the frequency, caused to act as a resistance, capacity, or inductance. To have a sharp impedance curve, one that rises to a high value of impedance at resonance and falls off sharply on either side, the tuned circuit requires a small value of inductance and a large value of capacity.

With the choke coil, however, the opposite results are required. In a transmitter it usually is designed to cover a comparatively wide band of frequencies, and even if designed for the one frequency it covers a considerable range of frequencies during calibration. The choke, therefore, is required to act as an inductance and be fairly effective over the entire frequency range. This will necessitate a circuit that will have a very high impedance curve over a wide frequency range.

With the tuned parallel circuit, due to the low value of reactance in each branch, the current through each is high. At resonance, the two counteract and the total resulting current is almost zero. Off resonance, one increases rapidly while the other decreases, resulting in a high current in the external circuit.

If a parallel circuit is designed so that the reactance of each branch is many thousand ohms, the current through each will be small. Assume an inductive reactance of 20,000 ohms and a capacitive reactance of 20,000 ohms at resonance. The resistance would be negligible and the resulting impedance probably several hundred thousand ohms. An alternating voltage of 5,000 volts is applied. The current in each branch will be .25 ampere, and the resulting current in the external circuit almost zero.

EFFECT OF FREQUENCY.

If the frequency is decreased twenty-five per cent., the inductive reactance will be 15,000 ohms and the current .333 ampere. This same decrease in frequency will increase the capacitive reactance to 25,000 ohms, and the current is now .2 ampere. The resulting current in the external circuit will be the difference—.133 ampere. The total impedance equals the applied voltage divided by the current, or 37,594 ohms.

In contrast to the sharply tuned or low resistance parallel circuit. this circuit, while possessing a similar high resistance at resonance, also has an impedance of more than thirty thousand ohms as far as twenty-five per cent. off the resonant frequency.

If the frequency had been increased the same amount above resonance, the impedance would still be more than thirty thousand ohms, although the circuit would act as a capacity instead of an inductance. This is undesirable; but the choke could still be used, owing to its high impedance. Therefore, a considerable frequency change could take place before the choke became useless, owing to its high impedance over such a large frequency band. The choke to be efficient should be designed to have its resonant frequency slightly higher than the frequency at which it is to be worked.

With parallel circuits a sharp impedance curve is obtained by using a small value of inductance with a large value of capacity. For a broad and high impedance curve the reverse is required—the maximum amount of inductance must be used. The limiting factor at any given frequency is the distributing capacity of the coil. The value of inductance is increased by adding more turns, but this also increases the distributed capacity.

To be efficient, a choke must act as an inductance. It therefore must have a resonant frequency higher than the frequency at which it is to be worked. As the inductance increases, the distributed capacity increases, and at a certain point the LC value will be such as to produce a resonant frequency equal to the operating frequency. If turns

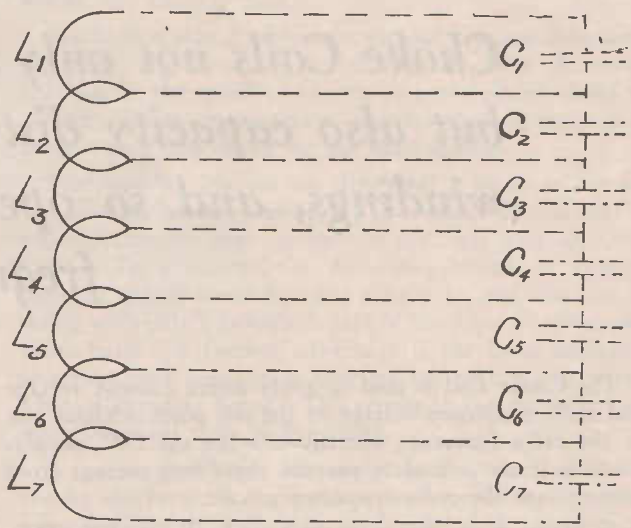


FIG. II

are to be added beyond this point, the coil assumes the characteristics of a capacity—an undesirable condition.

To increase the inductance without increasing the distributed capacity, one of the many methods of special winding must be adopted.

EUROPEAN VALVE PATENT BATTLE

A long patent battle has been going on in Europe, Messrs. Philips and Tungsram being involved over some very interesting technical points. Of certain claims put forward by Philips, one of the most important of those disallowed by the Courts concerned the "Cascade patent (re-tuned circuits) on which this company would have been entitled to royalties from Czechoslovakian set makers, but which has been declared as not valid. Similarly, Tungsram succeeded in a case against the Centre-tapped patent.

But a third patent of this group, the Grid Detection patent, has simply been restricted in Czechoslovakia in such a way that it no longer covers all variations. In Hungary important issues centred round a Philips patent for horizontal electrode structure, and one on cathode manufacture by vapour process. The Supreme Court has finally found both these to be invalid.

A new patent application on Slanting electrodes, put forward in Germany by the Valve Company, of Hamburg (a sister concern, by the way, of Philips), has been refused in the Supreme Court.

TABLOID TECHNIQUE

Explanations of wave motion through water which are similar to the transmitted wave travelling to the receiver

All have noticed what happens when a stone is dropped into a pond of water. From the centre of disturbance waves commence moving outwards towards the shore in ever-widening circles.

If we carefully examine these waves, several rather interesting and astonishing things will be noticed. In the first place the height or amplitude of the waves become less and less the further from the centre. And if a little chip of wood is floating on the water, it just bobs up and down without moving along with the wave. This means that although the wave moves toward the shore, the actual particles of the water do not—they merely move up and down.

Another interesting and rather startling fact is that the rate at which the wave moves is constant. It does not matter whether the wave is a large one or a small ripple; the speed or velocity is the same, providing that the water is deep.

If we measure the distance between the crests of two successive waves, it will be found to be the same as that of any two crests, whether near the source of disturbance or far from it. This distance is called the wave-length, and in wireless is denoted by the Greek letter λ, which is measured in metres.

Analysing the foregoing with the accompanying diagram, the following is found:—

1. Before there is a wave there must be a medium through which it is to travel—in this case water.
2. There is a centre of the disturbance, which was a stone dropped into the water.
3. The height or amplitude of the waves is greatest at the source and gradually diminishes as the wave travels outwards. This dying away of the amplitude is known in science as damping or decrement.
4. The speed or velocity of all waves in the same medium (water in this case) is the same, and does not depend on the size or amplitude of the wave.
5. The wave-length or distance of one wave crest to its neighbour is constant. With any two successive waves this distance is always the same, providing they come from the same source.
6. Finally the number of waves which pass a given point per second is known as the frequency.

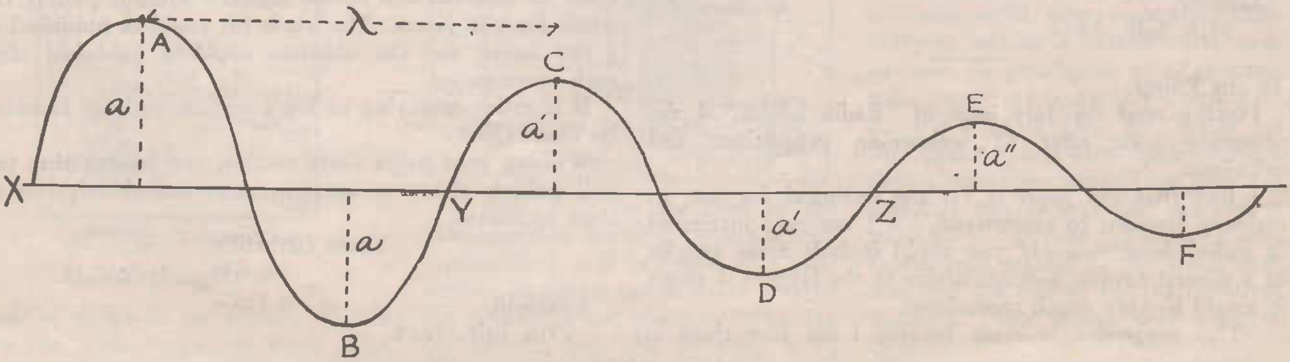
Fig. 1.—Waves Produced in a Pond by Throwing a Stone in the Water A

We can now consider a cross sectional picture of a wave train. Suppose the whole pond suddenly freezes solid and a thin strip is taken from the centre. The result will be a figure similar to the diagram.

The horizontal line represents the normal surface of the medium (water). A, C, E are successive crests, while B. D. F, are troughs. The distance AC is the wave-length, and denoted by the symbol λ, which distance is the same as CE or EG, or any other two successive waves.

The depth a is the amplitude, which becomes less and less, each wave such as a′, a′′, etc. This is known as damping, and one complete wave has a crest and a trough, which are represented by XY or YZ. This distance equals from A to C, the wave-length.

(*Turn to page 33.*)



Correspondence

Suggestions and Criticisms are welcomed and will be published on this page as space permits

To the Editor.

Might I be permitted to congratulate you on your enterprise in publishing a journal devoted solely to radio technical subjects, and I trust that "Radio Realm" will go on to be the success it deserves.

Naturally, I am extremely interested in the Amateur Section, which, if handled correctly, should receive the whole-hearted support of the experimental fraternity.

There is a large number of "hams" interested in low-power equipment, and so far this aspect of radio has been entirely neglected by publishers of technical journals, who usually cater only for "the man with the kilowatts."

Many experimenters would welcome sound constructive articles on QRP outfits, and the beginner always is glad of some helpful information. Here your journal has a golden opportunity of which, no doubt, you are already aware.

Anyway, I have said my piece, and I sincerely hope that one year from now I may be writing to congratulate you on your first anniversary.

(Signed) VK3DQ.

Oakleigh, Vic.,
28th July, 1934.

To the Editor.

Knowing that I am interested in radio in a modest way, a friend of mine handed me a copy of the July issue of "Radio Realm."

It was my intention merely to glance through it, but I became so interested that I practically read it from cover to cover, despite the fact that portions of it were "over my head."

I must congratulate you on your publication, as, in my opinion, there is great need at the present time for a journal such as yours, which is of interest both to expert and amateur.

If I may be permitted to offer a suggestion, it is that the present general portions be extended at the expense of the super-technical.

Wishing "Radio Realm" every success,

(Signed) P.R.K.

Lismore,
18th July, 1934.

To the Editor.

Having read the July issue of "Radio Realm," I am accepting your offer of welcoming suggestions and criticisms.

I find that the paper is far too technical for me, an ordinary layman, to understand, yet I am very interested in radio phenomena. If you could include more articles of a general nature, understandable to the layman, I think it would be very much appreciated.

This suggestion is made because I am sure there are many people like myself who listen to the broadcast programmes, yet want to know something that happens at the stations, and why we receive the music.

(Signed) B.F.L.

Melbourne,
24th July, 1934.

To the Editor.

While passing a bookstall the other day, my attention was drawn to your new publication, "Radio Realm." After studying it thoroughly, I am sure that Australia has been waiting for just such a publication, and I would like to express my appreciation of your efforts.

The following suggestion may prove helpful to you: The paper is, in my opinion, at present far too technical for the everyday reader. I, myself, understand the technical articles, but there are many that will find them too advanced.

One of my family, happening to notice "Radio Realm" on my table, picked it up, and was able to read and understand about two or three articles only. Therefore, my suggestion is: try to incorporate more articles of general interest, when I am sure that your efforts will be appreciated far more.

Wishing "Radio Realm" every success in the future,

(Signed) A.C.H.

Cootamundra,
20th July, 1934.

To the Editor.

I would like to back up R. M. Tate's letter in your second issue, re the publication of the A.O.P.C. questions and their answers. This would help the schoolboy enthusiast to whom the added cost of the papers (back numbers) means a lot. It would also help everyone, as the standard as well as the type of answer could be ascertained.

Another suggestion I would like to make is: If possible, devote the two centre leaves to a list of Australian and New Zealand Amateur Call Signs. These pages could easily be removed and bound together without pulling the whole book to pieces. The whole list could be published in a few issues, and the additions could be published after each examination.

It is rather annoying to log a station without knowing its exact QRA.

Wishing your paper every success, and hoping that you will publish plenty of amateur news and descriptions of their apparatus,

Yours faithfully,

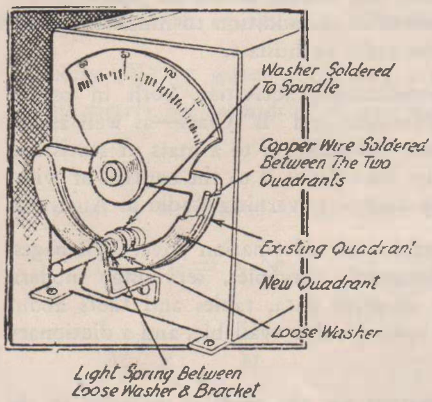
(Signed) R.C.D.

Lindfield,
29th July, 1934.

HINTS and KINKS

PREVENTING SLIP IN FRICTION DRIVES.

The accompanying sketch will interest readers who have suffered from slipping in the friction drive of their condensers. The drawing is self-

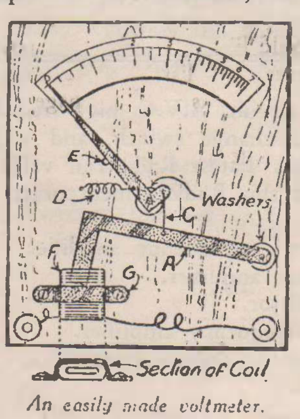


How to overcome slipping and backlash.

explanatory, but it is an improvement to rough the fixed washer on both sides and the loose washer on the side nearest the condenser. The advantage is, of course, that the two discs get a firmer grip on the spindle than one does, and if after they have been in use some time slipping should occur again, it is a simple operation to squeeze the edges of the discs together again with a pair of pliers.

AN EASILY MADE VOLTMETER.

A simple voltmeter, working on the principle of the solenoid, may be

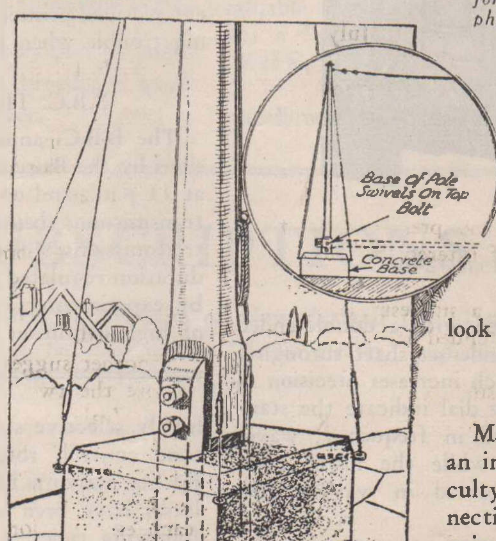


An easily made voltmeter.

made as shown in the sketch. Cut a base 3in. x 3in. from ½in. wood. Cut a lever A and the pointer from stout tin, and pivot them to the base, using small nails and washers. Connect them with a piece of thread C. Fix a weak spring at D to pull the pointer to the left, and put a nail E to act as a stop. To make the coil F, bend a piece of thin brass to form a flattened tube, as shown in the section, and wind on six layers of No. 36 D.C.C. wire. Secure the coil in position with a brass strip G, and connect the ends to two terminals. Glue a cardboard scale under the pointer, and the instrument is complete. If desired, it may be calibrated by testing it in conjunction with a standard voltmeter.

FIXING AN AERIAL MAST.

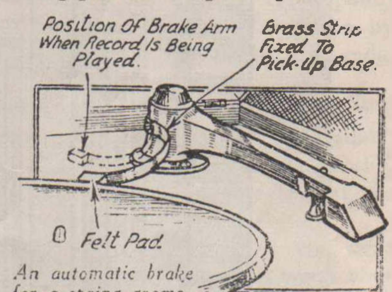
In spite of the thousands of aerials one sees, only a very small number are erected with a view to appearance as well as efficiency. A little trouble taken when the aerial is being installed will be amply repaid by increased service, and will result in the aerial being less of an eyesore than would otherwise be the case.



A mast built on the lines of the accompanying drawing (which is self-explanatory), will be found very convenient, in that it can be easily lowered for inspection and oiling by removing the bottom bolt and allowing it to swivel on the top one, the stays being loosened and used as guide ropes to assist in this operation. The concrete block, with the mast supports, is buried a few inches deep in the ground, its actual size depending upon the size and weight of the mast. For greater strength the mast supports could project through the underside of the block and into the ground for some distance.

AUTOMATIC BRAKE FOR SPRING GRAMO. MOTOR.

A very useful brake for a spring-driven gramophone can be made by fixing a small brass strip to the revolving part of the pick-up arm, with



An automatic brake for a spring gramophone motor.

a small pad at the end, as shown in the sketch. By bending the strip the brake can be made to press on the edge of the turntable when the pick-up is placed on one side, and so release the turntable as soon as it is moved towards the record for playing. The brass strip may be stained and varnished a dark brown to look like oxidised metal.

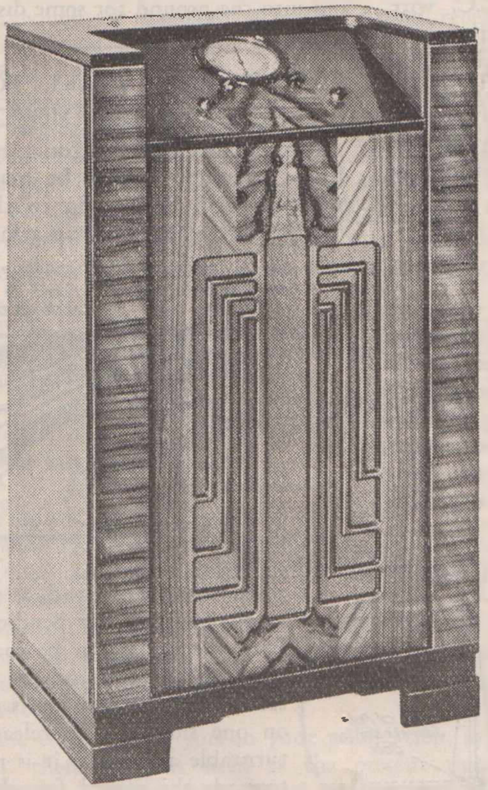
AN INDOOR "EARTH."

Many listeners who, of necessity, use an inside aerial, often experience difficulty in making a suitable earth connection; the possibilities of a "counterpoise earth" are frequently overlooked. As a matter of fact, an "earth" of this kind often is even more effective than a more conventional one, and it is certainly easy to arrange. All that is required is to take a second wire, similar and parallel to the aerial wire, and join the end of this to the earth terminal. The second wire must be insulated.

Trade Review . . .

Amalgamated Wireless (A/sia.) Ltd. have now entered the All-Wave field with the new Radiola All-Wave Model 240, which will receive the Australian broadcasting as well as bringing in oversea stations.

Cabinet design is outstanding, and gives a new ease in operation. The controls and dial have been placed on an inclined plane, which enables tuning to be accomplished without bending or stooping—the whole in full and direct vision, thus adding new comfort when searching for the short-wave stations.



Radiola All-Wave Model 240.

The Rotovisor Dial itself is filled with a double-ended pointer driven from the tuning condenser shaft through a drive of high ratio (15 to 1), which increases precision in tuning. The upper portions of the dial indicate the standard wave-band stations calibrated in frequency, wavelengths (metres) and call-signs, while the lower parts have the short-wave bands calibrated in wave-lengths (metres).

Three wave ranges are covered: 16.7 to 37.5 metres, 33.3 to 86 metres, and 200 to 550 metres.

In addition to the inclined control panel, the chassis also has been mounted on a slope. This feature gives an attractive view of the components, and greatly facilitates any servicing that may be required.

Technically, the receiver embodies modern principles of design and construction, and contains seven valves in a highly selective super-het. circuit, A.V.C. high-frequency tone control, rotary wave change switch, and a high fidelity moving coil speaker. Latest Radiotron valve releases have been used, and this Radiola incorporates the following types:—

1 6D6 short-wave radio frequency amplifier.
1 6D6 radio frequency amplifier.
1 6A7 detector oscillator.
1 6D6 intermediate frequency amplifier.
1 6B7 detector automatic volume control.
1 42 output pentode.
1 80 rectifier.

This receiver certainly gives the thrill of oversea short-wave reception when conditions are favourable.

Book Review . . .

RADIO TRADE ANNUAL OF AUSTRALIA, 1934—
AUSTRALIAN RADIO PUBLICATIONS LTD.,
SYDNEY. PRICE, 5/-.

We have received from the Australian Radio Pubications, Ltd., a copy of the second annual edition of the "Radio Trade Annual," which contains many new sections—and has been attractively printed—comparing favourably with similar works produced in other parts of the world.

As a reference book, this annual covers all phases of the Radio and Allied Industries, in addition to much information of interest to the radio enthusiast.

Sections cover broadcasting activities, both in regard to the Australian—National and "B" Class—as well as the New Zealand stations. In addition to a mass of statistical information, space has been devoted to the control of wireless with acts and regulations governing Radio in Australia.

Service data and technical information cover 120 pages, dealing with fundamental principles, servicing, modern receivers, including all-wave data, tables and facts about the many differing types of valve available, and a dictionary of definitions.

A mass of information for the trade is included in the "Who's Who in Radio" section, and the directory of manufacturers, distributors, dealers, buyers' guide, etc., is very comprehensive, and covers Radio and allied industries throughout Australia.

The publication, moreover, is handy for reference, having an excellent index at the back of the book, with the different sections printed on coloured paper, thus further reducing trouble when looking for some fact.

B.B.C. TELEVISION TRANSMISSIONS

The B.B.C. announces that 30-line television transmissions by the Baird system will now be radiated on Tuesdays at 11 p.m., and on Fridays at 11 a.m., the duration of the transmissions being approximately half an hour. These transmissions will be continued until further notice, their duration regulated partly by the use which is made of them by experimenters, and partly by the rate of development of high definition systems.

TABLOID TECHNIQUE.

(*Continued from page 29.*)

Suppose ten of these waves pass a given point in one second, and each wave is 4 metres long. What distance would this represent per second? Ten waves, each 4 metres long, pass a point in one second, which means 10 x 4 = 40 metres per second.

Thus velocity is distance per second, so, therefore, the wave is travelling at a velocity of 40 metres per second.

In terms of algebra we would make the above statement in the form of an equation, as follows:—

Velocity (V) = wave-length (λ) x frequency (N) or 40 metres per second = 4 metres x 10 waves, or

$$V = \lambda N.$$

This can be transposed in the three following ways:—

$$(1) \quad V = \lambda N$$

$$(2) \quad \lambda = \frac{V}{N}$$

$$(3) \quad N = \frac{V}{\lambda}$$

From these equations we can see, therefore, that if we know the velocity of waves in water and we know the wave-length we can calculate the frequency, or *vice versa.*

In the next issue we shall consider wave motion through the aether or the method by which the broadcast wave travels from the transmitter to the receiver.

PERSONALITIES BEHIND THE MICROPHONE.

(*Continued from page 11.*)

her introduction to radio last October, through the suggestion of Captain Stevens of 2UE. He being struck with the quality of her voice, arranged for an audition, the result being a series of talks broadcast from the A.B.C., entitled "Women Outback." Miss Elliott is well-informed on this subject, as her father is a prominent station owner in the Darling Downs District, Queensland, where she has spent the greater portion of her life, taking active part in all his interests. Her charming personality is an asset to the Children's Hour. Here she also conducts a Hobby Session one day a week, which results in a great deal of interesting and appreciative correspondence between the little folk and herself, besides her usual radio fan mail. Intensely interested in her work, Miss Elliott, quite apart from her usual studio activities, visits the various children's hospitals, thus creating a personal link between the little listener and herself.

"PIRATES" AGAIN.

To the Editor.

I have received by this morning's mail Vol. 1, No. 1, "Radio Realm," in which, under the heading "Correspondence," is a letter dated 9th February, 1934, written by myself, and in which attention is drawn to radio VK2FK.

Publicity of a similar nature was given VK2FK in a letter written by me and published in "Amateur Radio," after which I received a communication from VK2FK pointing out that this station was not in operation at the stated time.

As the letter published by you deals with the same distance, I would be pleased if I may encroach upon your valuable space with this brief explanation. Evidently it was a "pirate" who was heard using the call sign of VK2FK, in which case my criticism was misplaced.

(Signed) E. B. FERGUSON (VK2BP).

Hazelbrook, Aug. 1, 1934.

SUBSCRIPTIONS

Posted monthly to any address in Australia or New Zealand for 12 months 7/-, or 6 months 3/6. Cheques and Money Orders to be made out to "Radio Realm," and addressed to the Circulation Manager, "Radio Realm," Box 3430R, G.P.O., Sydney.

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AMATEUR SECTION..

Conducted by

W. E. C. BISCHOFF and R. STACEY

Ham Notes

By VK2HY

Conditions on the various bands have been only fair during the last month. On 80mx. a few fone stations have been "rag-chewing" nitely, but ZL's have been very few. 40mx. has given very little DX., other than a few yanx, but at times even these have been hard to raise.

There appears to be two periods when peak condx occur, as far as the yanx are concerns, from 4.30 p.m. to 6.30 p.m., and again from abt 8 p.m. to midnite. During the first period there is a preponderance of American West Coast stations, but owing to the evident QRM over there, it is very hard to work them. The second period shows an absence of West Coast stations, and only those stations on the Central and East Coast come thru.

It is very much easier to raise them at this time, owing to the skip effect operating over there, "Cutting out" most of the local Qrm. On one occasion 8 yanx were worked here during this period, and it was rather interesting to notice how signals followed the dawn from the East Coast right across to the Pacific Coast, starting with W2 in New York, who said: "Wx fb hr, sun just rising" and finishing a couple of hours later with a W6 in California, who said the same thing. It seems from this that the best period to work yanks at present is just at sunrise over there.

On 20mx. the Americans again monopolise the band, and every afternoon some of their fone stations are heard at gud strength. K6BAZ, W9LD, W6CNE, W6CIN, W5CCB, and many others come thru with great punch.

Occasionally one hears some unusual DX, such as VP5, K4, X1, or a stray European or African, but not for very long.

At night this band is just one mass of "quietness," as dead as the proverbial "doornail."

PERSONAL PARS.

Quite a number of new calls have been heard during the past month. 2VQ has a very solid RAC sig on 40mx., using PP 45's. 3NW has a gud sig frm a 210 in TNT. 2PK, 2ZC and 2QC are other new hams hrd.

On 40mx., John, of 2HG, is still seeking the midnite DX, and gets his share of the little that's gng. 2XJ is very consistent on 40 and 20mx., and the yanx must knw quite a lot abt his signal. Another who is consistent on both bands is 2XV, and he has a very fb sig. Gilbert 2XU is the best dxer on 20mx. this year, and he is often hrd putting his 10-watt fone over to W, VE, K4, VP5, etc. Vy fb om.

Amateur Station J1EZ.

2HZ is still in bed with "Synovitis" on the knee. We don't knw just what that means, maybe another name for YL, I wonder! Anyhow, Bill has been spending most of his time on 40mx. chasing the elusive DX and "filling in" with local yarns.

The 20mx. fone crank, 2LZ, spends most of his time playing around with his FB "Single Sniggle Snooper," and occasionally lives up to his reputation by putting his fone into Yankee Land. His 40mx. xmtr is the 250mx. BC job starting with osc on 500mx., but the output is very doubtful, hi!

(*Turn to page* 38.)

POWER SUPPLY

The regulation of the power supply depends on the Transformer, the Rectifier and the Filter System.

If the transformer is commercially made we are then in the hands of the manufacturer. A large laminated core with a small amount of wire, however, is far better than a small core and a large amount of wire. Yet the large core can be overdone, although generally it pays to buy a transformer with a large core, especially for transmitting power supplies.

If it is to be made by the amateur himself, however, he can build it to any specification required.

In regard to the secondary and filament windings we can find the circular mils. of each gauge of wire from a wire table. Allowing between 1,000 and 1,200 circular mils. per ampere, we can calculate the current that this gauge of wire will carry.

The current in each half of a centre-tapped secondary supplying a full-wave rectifier is .78 times the rectified (D.C.) current drawn from the power supply. For half-wave rectification, the current drawn from the secondary is 1.56 times the D.C. current drawn from the supply.

Owing to the resistance of the secondary windings, there is a voltage drop here. If the secondary windings are increased by about 8-10 per cent., however, this will overcome this voltage drop. The formula for finding the exact voltage drop is a little complicated, but is included for those who wish to accurately calculate it.

$$\text{Voltage drop} = \text{Current in Secondary} \times \text{resistance of sec.} + 1.25 \left\{ \frac{\text{sec. turns}}{\text{primary turns.}} \times \text{prim. current} \times \text{prim. resistance} \right\}$$

Here we have a transformer which will give very good regulation and will deliver the output required without any heating or other ill effects.

Transformers, generally, will stand an occasional over-load; but if over-loaded for any period will get very hot, resulting in the fracture of the enamel covering on the wire, and consequent shorting of turns. When that happens a new transformer is required unless the transformer is wound in pies when the affected pies only will have to be replaced.

The best wire is silk enamelled wire, but this is rather expensive, and most manufacturers use plain enamelled wire in an attempt to cut down the cost.

The above covers a few of the points to be considered when either buying or designing a suitable transformer for amateur use.

THE RECTIFER.

The second point to be considered is the rectifier. These may be divided into two classes:—(a) The usual rectifier, such as 280, 281 and 5Z3 type—the tubes have a voltage drop through them depending on the current drawn—(b) The mercury vapour and gas-filled rectifiers—these tubes include the 82, 83, 66 types. They have a constant voltage drop through them of about 15 volts, irrespective of load drawn.

The manufacturers of the former group generally supply curves showing the voltage delivered to the filter system. In the second class of rectifier we assume that choke input is used. In such a case we can expect the output voltage at full load to be only a little below the actual value of the RMS A.C. value, applied to the plates of the rectifier.

THE FILTER SYSTEM.

Lastly, there is the design of a filter system which, if neglected, even with a perfect transformer and rectifier, will give very bad regulation indeed.

The most obvious loss in a filter is the drop in voltage attributable to resistance of the chokes. This should be kept as low as possible. Chokes of ample current carrying capacity, moreover, should be used. It is very poor practice to overload them, for the voltage drop is high, and the inductance is considerably reduced.

We are taught that when using gas-filled rectifiers a choke should precede the filter to prevent a surge of current through the first filter condenser when the plate power is switched on. This surge can be great enough to to wreck the rectifier tubes.

Practice demonstrates, however, that if the size of the input condenser is limited to one or two mfd., and a reasonable amount of voltage used, we may use a condenser input filter without worrying about the tubes. Nevertheless, the choke input is the easiest part of the rectifier, and is essential for good regulation.

With a choke input filter, the first choke has everything to do with the regulation, the rest of the filter having no other function but filtering. If the choke is small, however, the first condenser begins to have something to say about regulation, and if no choke is used, the first condenser takes on the whole job of regulating. Thus we see that the first part of the filter controls the regulation of the filter system, and the latter part controls the actual filering action.

CONDENSER INPUT FILTER.

In a condenser input filter, the larger the first condenser the higher will be the output voltage, and the better the regulation. To get desired results, much capacity would be needed, which would endanger the rectifier tubes. What is required, therefore, is a means of compensating for the drop in voltage with increasing loads without overloading the rectifier.

There is one way in which this can be done: by inserting a choke having an inductance which decreases as the direct current through it increases. If we could place the choke in an A.C. circuit, so that its reactance would become an important element of our power supply system, and let the D.C. load flow through it, we would have an automatic voltage regulator. This is exactly what happens when the choke is used between the rectifier and first filter condenser, and seems to be reasonable explanation for the improvement in regulation obtainable when using choke input.

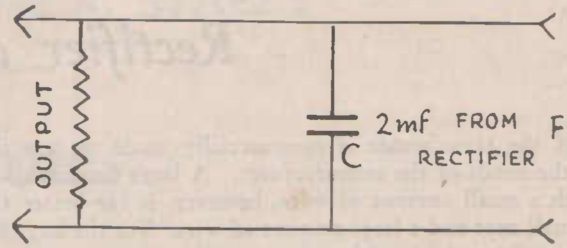
The air gap should be adjusted so that saturation takes place, the inductance thereby being greatly reduced with air gap, and have a very low D.C. resistance. It is im- a consequent reduction of voltage drop across the choke (at the ripple frequency) with an increase in load.

Thus, this regulation choke should have little or no portant to note that as the inductance drops in this procedure, so does the amount of filtering contributed by this choke, and the lower the inductance of this choke the greater will be the voltage peaks that arrive at the first condenser. This condenser, as a result, will have to be rated somewhat higher than one following a large inductor, yet not as high as a condenser in a condenser input system.

To consider the filtering action of the filter circuit. Fig. 1 is the simplest form of filter, although not good practice. This will give nearly pure D.C.—if the first condenser is large enough—but the capacity may have to be taken to as high as 4 or even 8 mf. This type of filter, however, gives very poor regulation, and generally results in key thumps. If a self-excited rig is used, very bad chirps are sure to result.

Fig. 2 has an extra choke, and is much superior in every way to the single condenser, except that of available output voltage. The load on the transformer and rectifier is very much less, but the actual power it is capable of drawing from the system is greater.

The choke input tends to reduce the rectified transformer voltage to the average value of the A.C. input wave, which for waves of the normal sine shape is about 90 per cent. of the RMS value. If the resistance of the choke and half of the secondary winding are known, the voltage drop may be calculated for normal load conditions, and the result subtracted from the 90 per cent. value. Voltage drop through the rectifier also must be deducted, but this is only about 15 volts in mercury vapour tubes, and can be found from the curves of the other type of rectifier.



FIG

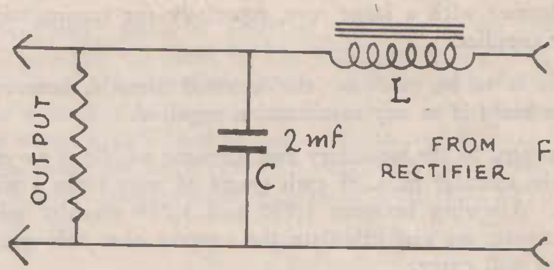


FIG2

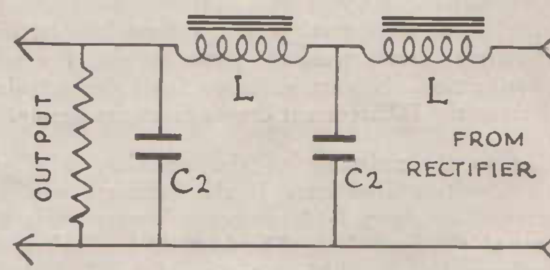


FIG3

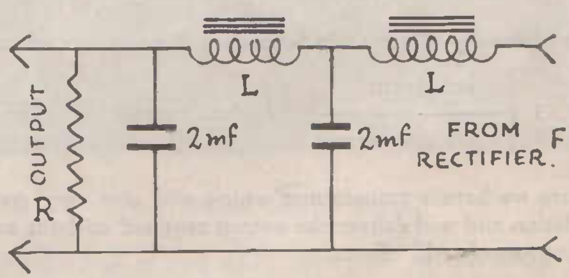


FIG4

The filter, as shown in Fig. 3, is the best arrangement, and will reduce ripple to a very small value. It is estimated that the ripple from such a filter is less than 1 per cent., hence it is ideal for 'phone transmitters.

Considering the value of the inductance L, only the first inductor is very critical, since it controls the regulation

(*Turn to page* **40**.)

PUSH-PULL MODULATION

Many hams use Push-pull Power Amplifiers and modulate them with either two tubes in parallel, or through a coupling transformer, which is, in effect, the same thing. In both cases, the Power Amplifier has its RF circuits in push-pull, the plates being connected together, and is modulated in the same manner as if the tubes were in parallel.

The same applies to push-pull oscillators, although modulation of self-excited oscillators is not recommended, and generally is looked upon with disfavour.

For this reason we shall consider modulation of push-pull power amplifiers only, as they are run as class "C" amplifiers, and enable the modulators to feed directly into a pure resistive load.

It is possible with this arrangement to match each modulator to its modulated P.A. And should the tubes not balance, it is possible to tell at a glance which one is defective, and to remedy it very quickly.

The circuit, as shown in Fig. 1, is different from the parallel arrangement, as two modulation chokes are required, two dropping resistors, with their by-pass condensers connected to the modulated P.A., and two jacks for M.A. meters to note the current drawn by each tube.

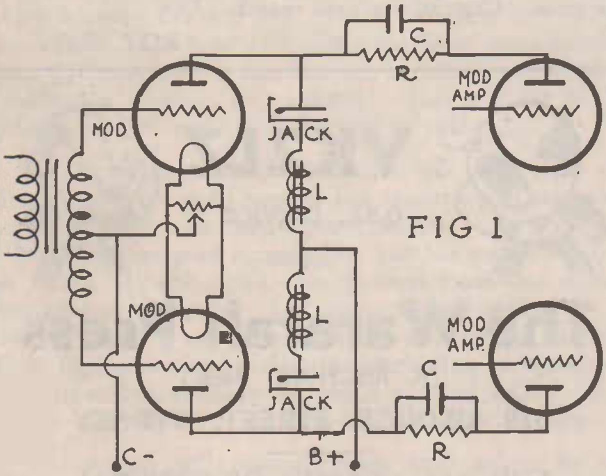


FIG 1

In this circuit L is the modulation choke, C is the audio by-pass condenser, and R the dropping resister. Automatic bias may be used if necessary on the modulators, although battery bias is shown in Fig. 1

No other constants are given, as the parts are practically the same as those using one modulator tube and one P.A. amplifier tube. One thing more, the ratio plate voltage of the modulator to that of the P.A. is 3-2, i.e., if we have 300 v. on the modulator, we must vary the resistor R to give us a voltage of 200 volts on the P.A.

Often much trouble is taken in getting a push-pull P.A. going, and a push-pull amplifier, only to, in effect, modulate them as if they are parallel.

"TRITET" OSCILLATOR

The "Tritet" oscillator is so-called because of its approximate equivalence to a combined low mu triode oscillator and a high mu tetrode amplifier.

The tube generally used is a 59 multi-grid power tube. Its application, however, is a practical compromise, since the ideal would be a true screen grid tube. Yet, by joining the grids 2 and 3 together, and employing them as a screen grid, the tube works very well when the output is tuned to a harmonic of the grid circuit frequency.

Two forms of oscillators may be used with the 59 in a tritet circuit. There is the plain electron coupled and the crystal-controlled version.

First we shall consider the crystal-controlled job.

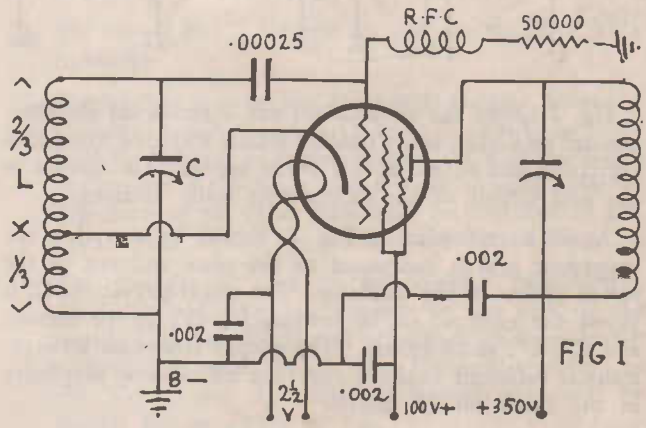


FIG I

Referring to Fig. 1, we see that it is very similar to a TPTG circuit, with the exception that the grid circuit oscillates on its own, and tuning the plate has practically no effect on the frequency. L and C are the usual value for a moderately high C tank, and should be very solidly constructed, for they will determine the frequency stability of the transmitter in addition to the frequency.

It is important to by-pass one side of the filaments to earth, and is preferable to operate the plate tank on a harmonic of the grid circuit, when excellent output is obtained even up to the 4th harmonics.

The use of this tube as a doubler has no special advantages over the type 46, although, by having a cathode it can very easily be biassed to prevent the plate current reaching unheard of limits. Moreover, this is essential for both tubes if voltage of 400 or more are in use. Resistors of between 300 and 1,000 ohms, however, are generally sufficient if suitably by-passed.

As a doubler, the 59 works better with the suppresser connected to the plate and not to the screen grid as often recommended.

Thus it will be seen that for a self-excited oscillator, the 59, or for that matter, the 89, a 6-volt tube is ideal, and when used in M.O.P.A. rigs are undoubtedly on their own.

Output at the grid circuit frequency may be had either by connecting the cathode to earth and inserting a plate tuned to the fundamental frequency, or in a M.O.P.A. circuit by putting in a non-resonant R.F. choke to replace the tuned plate circuit of the oscillator. Then tuning the output of the following RF stage to the fundamental. This latter scheme is very advantageous, as it eliminates the necessity of neutralising the amplifier stage, which does not self-oscillate with its grid circuit untuned. And at the same time it acts as an excellent buffer action between the two valves and their respective circuits.

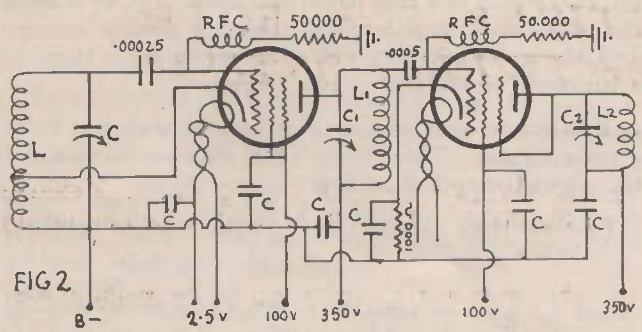


FIG 2

Fig. 2 shows the connections for a combined electron-coupled oscillator, and a doubler which will give wonderful excitation and output as low as ten metres. The output in the grid circuit of the oscillator is really amazing.

Again by referring to Fig. 2, it will be seen that the suppressor grid is connected to the plate and not to the screen grid as in the oscillator. The tuned circuit, L, C, is tuned for example to 80 metres, L′, C′, to 40 metres, and C″, L″, to 20 metres. The output from this arrangement is sufficient to drive any tube an amateur may have in the shack on 20 metres.

For ten metres the tuned circuit, L′, C′, may be tuned to 20 metres direct where it will be found that the output will light a torch-lamp in a loop to nearly full brilliance, and the last stage to ten metres, where even more output will result.

For the beginner, the circuit, as in Fig. 1, is, in effect, a M.O.P.A., and one of the easiest to get working—the tap on L may have to be varied somewhat, but should be about 1/3 of the coil from the earth end. With 300 volts on the plate of the 59, there should be enough RF to light a torch bulb to practically full brilliance if the bulb is in an enclosed loop.

With crystal control, the use of this valve in a tritet circuit only requires an adaption of the grid circuit. And this tube is being very successfully modulated by judicious use of its suppressor, resulting in a form of grid modulation. Further details will be published later.

HOW UNLICENSED GERMAN AMATEURS ARE STRAFED.

New licences have been granted to German short-wave experimenters. According to a recent decree, any person transmitting without permit, whether telegraphy or telephony, is liable to prosecution for high treason.

HAM NOTES.

(*Continued from page* 34.)

2XC was hrd recently with peculiar xtal ripply PDC sig, which evidently is hrd in U.S.A. O.K. 2NG and 2ML were hrd on fone one morning, 2NG quite gud, but 2ML plenty RAC in his carrier, and chopped his fone abt quite a lot. 2HF is going to build another S.S. Super this time with xtal filter, etc., and 11 tubes! He is re-building for the Cent. Test and promises to make a bid for the prize.

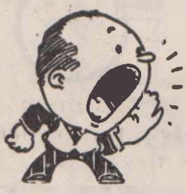
2DR on sometimes, on 80mx. fone. 2AE also from Gordon District is trying tritet osc driving 46's in PP parallel—he cannot understand why he gets 60 mills grid current! Rex 2VG finished re-building the breadboard, but has not been on much, he and 2OE Ron visited 2LZ the other day, and were surprised to hear yanks coming thru on 20mx. fone abt Rmx on the S.S. Super. 2AH, 2DU, 2HL, have all been quiet of late.

4EI most consistent VK4 hrd hr on 20 and 40mx., and he sure gets out with FB xtal sig. Another nice sig comes from 3MR, who works all kinds of FB DX. Other gud interstate sigs include 3GQ, 3ML, 3HG, 3KX, 4GK, 4JU, 4RV, 4RY, 5DT, 5HG, 5PK, 5RH, 6PK, 6MN.

2HV, of Inverell, and a BCL are in VIS on a short stay, during which time they intend looking up some of the gang. He reckons Inverell is "Dead Spot" so far as DX is concerned, and was amazed to hr sum of the DX coming thru down hr.

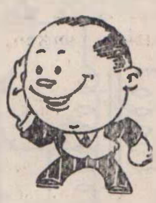
Well, chaps, gess QRU nw. Don't forget to let me hve some dope on ur outfits, and also fotos so that the other fellow can get an idea of what kind of rig is making all the noise. Cheerio, c u next month. 73's.

ROY, 2HY.



VK2LZ

Q.S.L. SERVICE



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MELBOURNE CENTENARY INTERNATIONAL DX CONTEST

RULES AND CONDITIONS FOR BOTH TRANSMITTING AND RECEIVING CONTESTS

The Melbourne Centenary International DX Contest is the first of this kind to be held in Australia. It will commence in October this year.

In the past we have taken part in similar tests conducted by the ARRL and RSGB, but now we can offer one in return, inviting the world to contact as many VK'S as they can.

To each station contacted, a serial number is handed, and one is received in exchange. Together with this, a signal strength report will complete the QSO.

Each competing station allots himself three figures, anything between 111 and 999. He retains these throughout the contest. He must exchange a six-figure serial number each QSO; so, for the first contact he adds three noughts, making his number, say, 111,000. This is given to the station worked, and one is received in exchange.

The second three figures from here are taken from the first three of the serial number last received, and are added to the stations own three-figured number. For example, VK5FM has assigned himself 281, and has passed 281,000 on to his first DX QSO. He received from that station 457,878 in exchange. His next number will now be 281,457, and so on throughout the test, adding the first three figures received to his own three after each contact. Stations at both ends do this, and is proof of a QSO. Both the in and out serial numbers are entered in the log.

VK stations will multiply their total points by the number of countries worked. What scores are possible with about 100 countries to work! It's a chance for everybody to attain WAC and WBE, even the QRP merchant, because the world would be listening for even the squeakiest VK signal.

Come on boys, let's make this contest the best ever held, advertise it to any DX you work, and let's show the world what an enthusiastic bunch of chaps we VK's are!

RULES AND CONDITIONS.

1. There shall be two contests:
   (a) Transmitting.
   (b) Receiving.
2. The Wireless Institute of Australia Centenary Contest Committee's ruling will be binding in case of any dispute.
3. The nature of the Contest requires the world to work Australia.
4. The Contest is to be held from 0001 G.M.T., Saturday, October 6, till Sunday, October 7, 1934, at 2359 G.M.T., and will be continued over the four week-ends in October at the times stated above on each occasion. The dates of the other week-ends are October 13 and 14, October 20 and 21, and October 27 and 28, 1934.
5. The Contest is open to all licensed transmitting amateurs, and receiving stations in any part of the world. Unlicensed ship and expedition stations are not permitted to enter the contest. Financial members of the W.I.A. and its affiliated societies only will be eligible for an award in VK.
6. Only one licensed operator is permitted to operate any one station under the owners' call-sign. Should two or more operators operate any particular station, each will be considered a competitor and must enter under his own call-sign and submit in his log the contacts established by him. This debars persons from entering who have not a ham license.
7. Each entry must be signed by each competitor as a declaration of the above statement.
8. Each participant will assign himself a serial number of three figures, as detailed in the contest description. When two or more operators work the one station, each of them will allot himself a separate number.
9. All amateur frequency bands may be used.
10. Only one contact with a specific station on each of the bands during each week-end will be permitted.
11. Contacts may be repeated on each of the succeeding week-ends with the same stations in accordance with Rule 10.
12. Each contact must be accompanied with an exchange of serial numbers and signal strength reports using T, QSA, and R systems.

13. Scoring: One point will be scored by each contacting station for every 1,000 miles between the capital cities of the States of the competing stations, measured by a Great Circle Line. The points claimed are to be entered on the entry form.
14. Australian stations will multiply their total score by the number of countries worked and the stations outside VK, by the number of Australian districts contacted, there being eight all told, viz., VK 2, 3, 4, 5, 6, 7, 8, and 9.
15. No prior entry need be made for this contest, but each contestant is to submit a log at the conclusion of the test, showing: Date, Time (G.M.T.), Band, Station worked, in and out signal strength reports, in and out serial numbers, distance between stations, and the points claimed for each QSO.
16. Entries from VK stations must reach the Wireless Institute of Australia (Victorian Division), Kelvin Hall, Collins Place, Melbourne, Victoria, no later than 1st December, 1934. Foreign entries will be received up till 31st January, 1935.
17. The awards for all winning competitors will consist of a special attractive Melbourne Centenary Contest Certificate. The station returning the highest total in any country will be entitled to an award, with the addition of similar special awards for the winners of each district of U.S.A. and Canada, and each of the British Isles. There will be no World Winner in this contest.
18. A special prize will be given to the grand winner in Australia, probably consisting of an 852 valve as the first prize. The contestant in each VK Division who returns the highest total in his district will also be awarded a Centenary Certificate. The official organ of the W.I.A. Amateur Radio will award a special trophy for the outstanding station description accompanying logs.
19. Foreign stations should call CQ, VK, "Cent.," and Australian stations CQ, DX, "Cent."

RECEIVING CONTEST.

1. The rules for the receiving contest are the same as for the transmitting contest, but is open to members of any recognised Short-Wave Listeners' Society in the world. No transmitting station is allowed to compete in the receiving contest.
2. Only one operator is permitted to operate any one receiver.
3. The dates, scoring of points, and logging of stations once on each band per week-end are subject to the same rules for the transmitting contest.
4. To count for points, the call sign of the station and tone of the calling station, together with the serial number and signal strength report sent by the calling station, must be entered in the log.
5. The above items must be filled in before points can be claimed—that is, it is not sufficient to log a station calling CQ or TEST. Verification of reception must be made in accordance with the conditions in Rule 4 above.
6. VK receiving stations cannot include VK transmitting calls in their logs, only foreign. Foreign stations will enter up VK stations heard only.
7. The awards in the transmitting and receiving contests will be similar. The winning V.K. receiving station will be awarded a cup, providing he is a member of the W.I.A. or its affiliated societies.
8. Receiving logs are to be similar to the transmitting logs.

POWER SUPPLY.

(*Continued from page 36.*)

of the power supply. Practice has shown that the best design for the first inductor is between 10 and 15 henries wound with as large a gauge wire as practicable, and with a closed air gap, or, better still, none at all. This results in the inductance becoming very nearly a short circuit as far as the ripple frequency is concerned; when a heavy current passes through it, and the first condenser acting as condenser input to the filter, will tend to increase the actual voltage available. This is to be desired.

Fig. 4 shows the actual tubes in the filter which is recommended for use with the mercury vapour rectifiers, or similar tubes.

It is generally safer to have a bleeder across the power supply either at the output of the filter or following the rectifier itself. This bleeder (R) is required, as it prevents the output voltage reaching the A.C. peak voltage in a C.W. transmitter, when the key is up. With choke input, however, it will certainly not reach this value, although it will reach a fair value. The addition of a bleeder in either case is a decided asset, as it saves the condensers in the filter supply from being subjected to extra voltage, and improves regulation. The value of the resister should be such as to draw about 30 to 50 m.a., depending on the actual voltage output from the power supply.

Recently a well-known man in the Radio Trade was interviewed by the P.M.G.'s Department for operating an unlicensed transmitter, when certain gear was confiscated. After some court proceedings, however, it has been ruled that the apparatus would be returned after the A.O.P.C. Examination had been passed.

HINTS *and* KINKS

Everyone has found some short cut in connection with radio work, and others would be pleased to know about it. The proprietors, therefore, are offering a Prize of Five Shillings for the Best Hint submitted each month. Other suggestions, if published, will be paid for. The Editor's decision shall be final.

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