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CONTENTS

	Page
Editorial Comment	421
How the B.B.C. Relays America ..	422
Current Topics	425
The Wireless World Laboratory ..	426
True or False Sound Reproduction?	428
Listeners' Guide for the Week ..	430
Letters to the Editor	432
Cavalcade of Wireless	433
Growth of Broadcasting in Europe	446
Broadcast Brevities	447
Free Grid Looks Back	448
On the Short Waves	450
High-Definition Television in Holland	451
Random Radiations	452
Principal Broadcasting Stations ..	454
Recent Inventions	456

Editorial Comment

Ourselves

The Past and the Future

IN this age of invention and discovery, when even centenaries are of comparatively common occurrence, wireless is still a sufficiently youthful science to make the celebration of twenty-five years of publication of a journal devoted exclusively to that subject a notable milestone in its history.

The story of *The Wireless World* is unique. Ours was the first wireless publication to appear and its origin owed nothing to the modern popularity of broadcasting, nor even to the wireless telephone which in those days had not yet emerged from the laboratory. Twenty-five years ago wireless telegraphy was only just beginning to attract the attention of the general public. A succession of serious disasters at sea, in which the loss of life was minimised in consequence of the use of this method of communication, demonstrated strikingly its possibilities. In quick succession followed the recognition of the value of overland wireless from a strategic point of view and plans were approved to form a British Empire chain of stations.

The progress of wireless received a similar speeding up during the war to that which was experienced with aviation and other modern inventions, and during the four years of hostilities wireless may truly be said to have come into its own, so that when peace came wireless was in need of no propaganda.

After the war the next step was the wireless telephone, but the idea of broadcasting followed almost immediately and eclipsed, at least in popularity, all other practical uses of wireless.

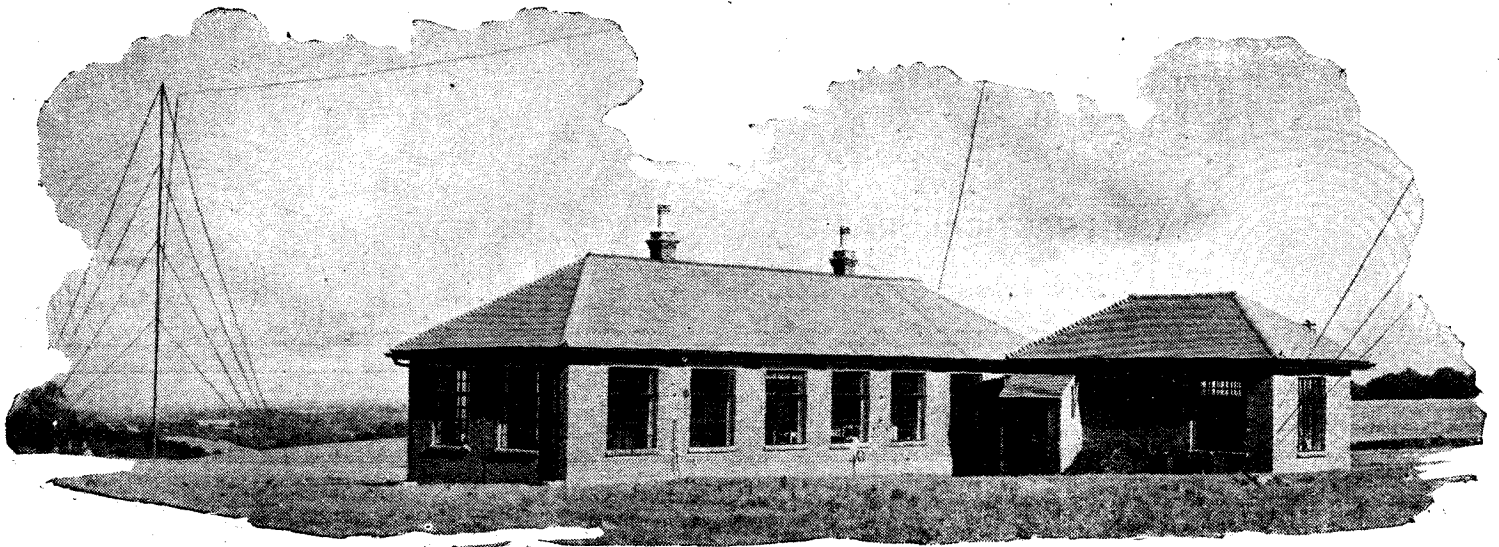
As a souvenir of our twenty-five years of publication we include in this

issue what may be described as a "Cavalcade of Wireless" and pages of past issues of the paper have been used to illustrate the progress of wireless invention and its applications over this period. In the lifetime of *The Wireless World* there have been many interesting phases of development involving remarkable changes in both the technical and commercial aspects. No less noteworthy in our own sphere of publishing are the changes that have occurred in wireless journalism and a fleeting retrospect brings to mind nearly a dozen wireless periodicals which came into existence with the advent of broadcasting, more than ten years after *The Wireless World*, but which one by one have retired from the field.

It has been our aim throughout the life of *The Wireless World* to maintain a consistent policy and to serve our readers by keeping them informed of every fresh development and placing in its true perspective before them each fresh contribution to wireless progress. In pursuit of this aim we have studiously avoided exaggeration and have never abused the credulity of our readers. We have valued our editorial independence no less in our readers' interests than in our own.

The future provides a horizon of limitless possibilities, for it is obvious that finality has in no sense been attained.

The present phase is one of consolidation rather than of development, although the material is available for extensive advances. Our endeavour for the future will be to maintain our policy of providing an educative factor in the study of wireless and promoting future development to the limit of our abilities.



How the B.B.C. Relays America

METHODS AND EQUIPMENT IN USE AT THE
TATSFIELD RECEIVING STATION

America

By

M. G. SCROGGIE, B.Sc., A.M.I.E.E.

NOW that short-wave receivers are no longer the preserve of "experts," reception of American broadcasting stations does not give one the prestige that it did. When the ordinary non-technical licence-holder can pick up America direct merely by turning the knob of a set he bought at a shop there is evidently nothing supremely clever or mysterious in the achievement.

Yet owners of "all-wave" models who

have taken advantage of the recent series of "Five Hours Back" programmes to compare the results they can obtain direct with those received *via* the local B.B.C. station will admit that there may still be some professional "secrets"!

Not always. There are occasional lucky periods. On March 21st last, for instance, I heard reception of the "Five Hours Back" direct from the States on a standard domestic receiver so perfectly

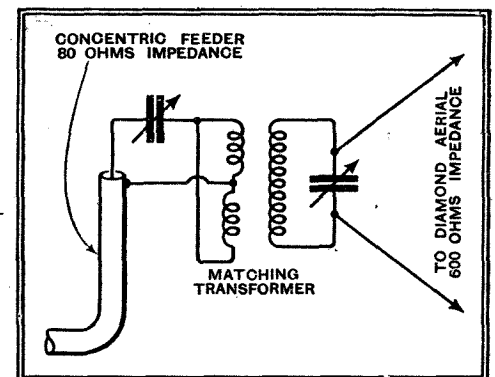


Fig. 2.—How the multiple aerials are linked to the receiving apparatus.

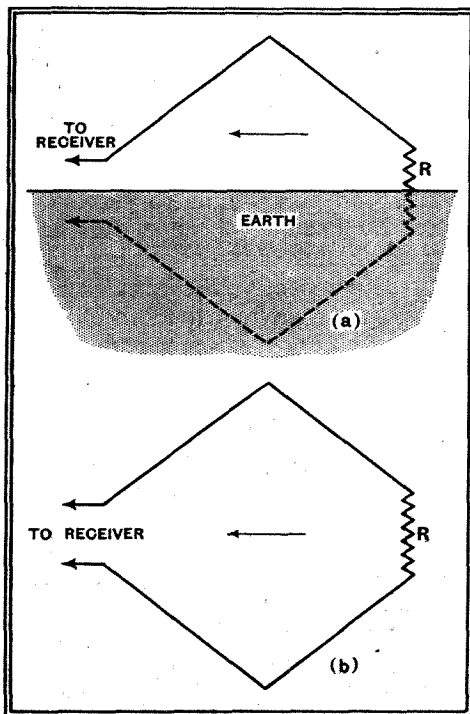


Fig. 1.—Special directional aerials: (a) shows the inverted V-type in elevation with the image portion dotted in to indicate its relationship with the diamond, seen in plan in sketch (b).

ALTHOUGH we recorded the use of multiple spaced aerials for transatlantic relays as long ago as 1927, the crude methods then in use had little in common with the highly developed and extremely dependable system in use to-day

that there was nothing for the B.B.C. to improve. But that is quite exceptional. There are other times when direct reception consists only of short gusts of distorted sound, whereas reference to the medium waveband proves that in some way the B.B.C. has been able to provide a relay which, if not quite of London studio standard, is at least a programme. What that way is will now be described, by the courtesy of the B.B.C., who arranged a special visit to their Tatsfield receiving station.

Readers will rightly have guessed that the situation of the receiving station has something to do with it. One does not have to go to Tatsfield to note that it occupies almost the highest point in south-east England—over 800ft. above sea level—and, for any district within easy reach of London, is singularly free from popula-

tion, with its inevitable accompaniment of electrical disturbances. The station stands on open ground, quite remote even from the tiny village of Tatsfield, and receiving conditions are excellent.

Next, as one would expect, the aerials are more ambitious than even the choicest example of the back garden or chimney variety. Among them are some very elaborate networks, but they do not happen to be the ones to be used. It is essential to be able to receive on practically any wavelength from 13 to 50 metres, which renders unsuitable many of the directional arrays used, for example, in the commercial beam services working on fixed wavelengths. An ordinary dipole is the simplest example of an aerial which gives a rapid falling-off in reception each side of the optimum wavelength. Most of the more elaborate systems, giving great magnification in particular direc-

How the B.B.C. Relays America—

tions, share this characteristic, and so are unsuitable for the purpose.

After considerable trial, two types of aerial have been found to combine good directional characteristics with wide wavelength response; there are the inverted V and the horizontal diamond. The object of using a directional aerial is, of course, not only to increase reception from the desired direction, but—much more important—to reduce reception from elsewhere.

Alternative Aerials

The horizontal diamond bears the same relationship to the inverted V as the horizontal dipole does to the vertical quarter-wave type; it responds to the horizontal component of the received wave rather than the vertical, and it does not depend upon the earth to form the other

The cause of fading is well known; when, as a result of various reflections, waves arrive by different routes, it is a matter of chance whether they assist one another or tend to cancel out. In short-wave reception they are liable to swing from one condition to the other in a period of the order of one second, but in an entirely irregular manner. Worse still, waves of slightly different frequency may fade quite independently of one another, so that the carrier wave may disappear while side-band frequencies are received strongly. The effect of this is equivalent to gross over-modulation, and is one cause of the distortion that is such a familiar accompaniment to bad fading. So far from helping matters, AVC, which relies for its operation on the strength of the carrier wave, causes the distorted modulation to be amplified to an abnormal volume. Clearly nothing that can be done along the lines already described is of any use when this selective fading is experienced.

It has been discovered, however, that whereas receivers with aerials only a few hundred yards apart may both be suffering from the same sort of bad fading, a c t u a l moment-by-moment records

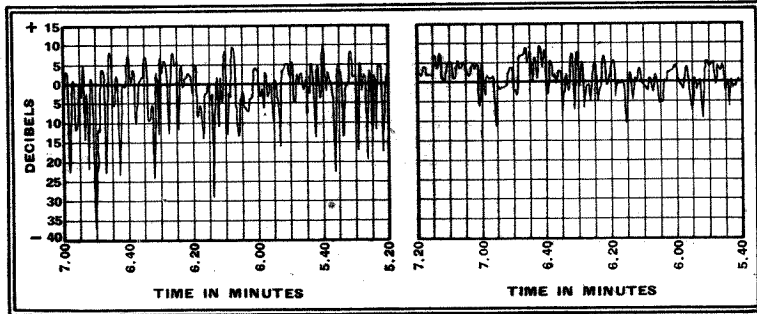


Fig. 3.—Graphs showing (on left) fluctuating signal strength of W8XK on a single aerial, and (on right) reduction in fading due to diversity reception over the same period of time.

half or image. Fig. 1 shows each diagrammatically, and it must be particularly noted that the viewpoint differs; the diamond is parallel to the ground, whereas the V rises up from it. Apart from this, and the fact that the dotted portion in the case of the V enjoys only a theoretical existence, the two are identical. Both receive most effectively from *approximately* the direction indicated by the arrow, while waves arriving from the opposite direction are absorbed by the resistance R. Actually the best angle is inclined to the plane of the aerial, and depends on its dimensions.

On their way from America the waves have been reflected several times between sea and sky, and the direction of strongest arrival may be inclined at 20 degrees or so above the horizon. At Tatsfield there are in common use two diamonds adjusted for different angles, and one V.

The chief problem in long-distance short-wave reception is fading. If one had to contend with no more than fading of the signal as a whole, the combination of a good site, an efficient aerial, a sensitive receiver and a well-designed AVC system would provide an effective defence against all except incredibly severe conditions. Even so, the periodical rise and fall of background noise would be disturbing. But there frequently exists a type of fading against which the best AVC is not only ineffective but positively detrimental.

of reception at these points would be entirely different. The more receivers the less is the probability that all of them are in the doldrums at any one instant. This looks as if, by combining resources, one could work on the insurance company principle of getting a steady average among fluctuating risks. Actually one can do better than this. An insurance company, naturally, is not allowed to collect only the

premiums and repudiate the claims, but a multiple receiving system can be arranged automatically to take only from the unit that at any instant chances to be giving the best yield.

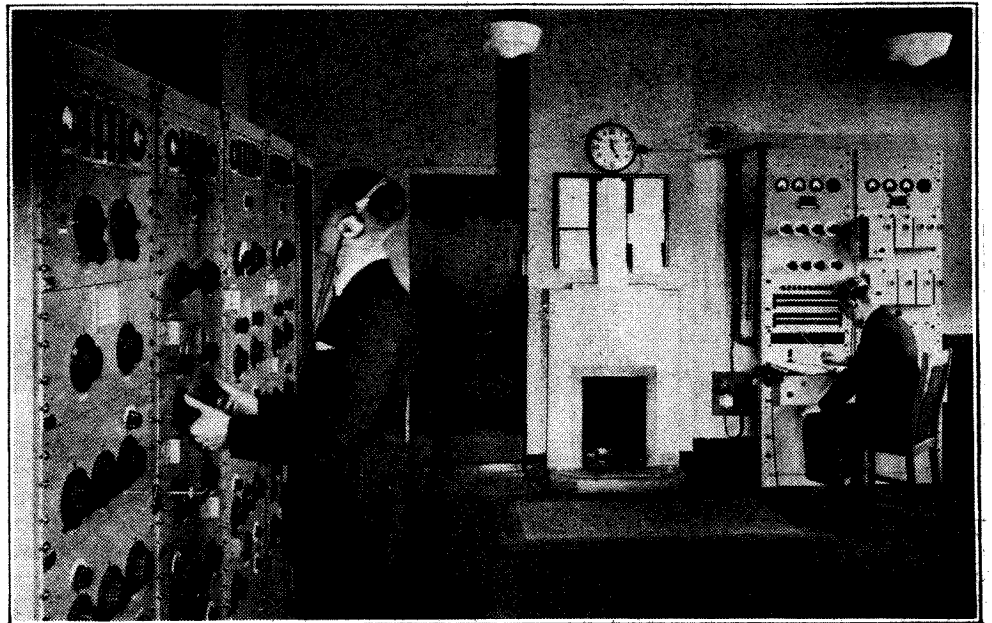
This is done in a very simple and ingenious way. Combining the HF outputs from the aerials, before amplifying in a common receiver, would be of no value, because the contributions would be as likely to cancel out as to add up. Or if the LF outputs were combined, the good reception *via* one receiver might be marred by violent distortion and noise from another, and the general result would simply be an average of badness.

What is done is to use a common AVC voltage for all receivers. Whichever receiver happens to be receiving the strongest carrier wave provides this AVC voltage, and the remaining receivers are more or less cut out of action by this relatively large AVC voltage applied to their HF and IF amplifying valves.

Feeding the Receivers

At Tatsfield there are four similar receivers, each of which can be linked to a different aerial. The aerials are something like five to ten wavelengths apart, and are connected by means of very tightly coupled matching transformers to concentric feeders spanning the distance from aerial to station (Fig. 2). The transformer covers a wide waveband, after the fashion of an over-coupled tuned transformer, and is balanced to earth by means of a centre-tap.

The receivers are mounted side by side on the usual racks. Each is a fairly normal superhet, with only one frequency changer (commercial signal services usually have two, but it is difficult to avoid stray beat notes with these when the receiver has to be tuned to any wavelength over a wide band). The principal departure from domestic practice is that the various condensers are tuned separately instead of being ganged. This,



General view of the receivers and relaying apparatus at Tatsfield.

How the B.B.C. Relays America—

together with rather exceptionally good tuning coils, allows considerable discrimination—about 40 db.—against second-channel interference to be obtained with only a single preselector stage and no “tricks.” The relatively high IF of about 700 kc/s helps, too. It is actually about 700, because a somewhat different frequency is adopted for each receiver in order to avoid the beat interference which would be very likely to occur if all the oscillators were running at approximately the same frequency.

Three Receivers in Use

Separate first-detector and oscillator valves are used after the HF stage, then three IF stages, two second detectors—a diode for audio output and a triode for AVC operation—and LF amplifier. The output is then passed to the line amplifier and control panel for despatch to the control room at Broadcasting House. There is a local high-quality loud speaker for judging the result; and each receiver can be separately tuned by phones and then brought into circuit. Generally three are used at once for diversity reception. There is no attempt to provide means

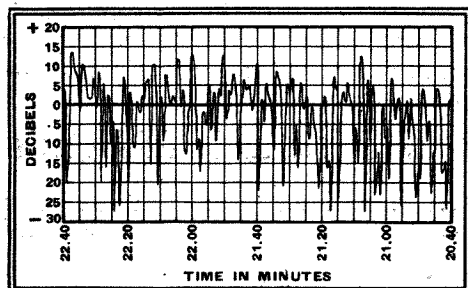
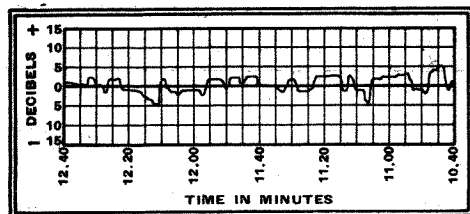


Fig. 4.—Illustrating the difference between rapid selective fading (above) and the slower and less acute general fading of signals from W3XAL; both received on a single aerial.



for a rapid switch-over between a number of fixed wavelengths; but it is possible to tune any disconnected receiver to another wave and then switch over to it if required.

The combining of the several IF outputs to give a common AVC bias is effected by switches, allowing the DC outputs of the separate AVC detectors to be paralleled as required. Similarly the audio frequency outputs of any or all of the receivers can be paralleled by switches. The receivers are provided with AVC voltmeters, and it is fascinating to watch these when the receivers are working independently and with the AVC lines disconnected. The random distribution of fading over the space occupied by the aerial systems is well shown, for there

seems to be no connection whatever between the movements of the three pointers, and it is very rarely that all three are at or near zero simultaneously. It is like other operations of chance, such as dice. There is one chance in six of scoring only one with a single throw, but only one chance in 216 of three dice all turning up a one at the same time.

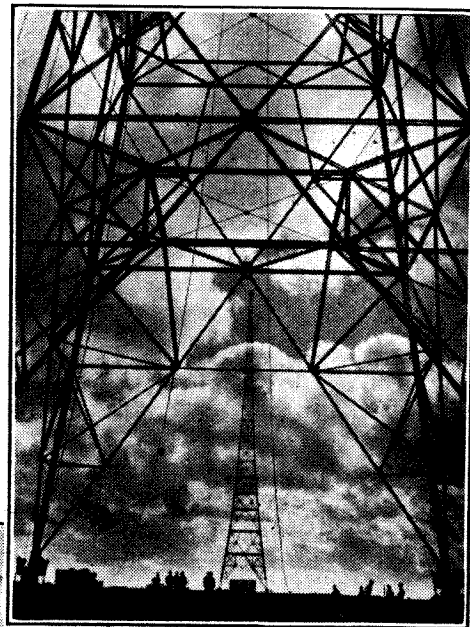
Recording Signal Variations

Even when the pointers are gesticulating wildly, they settle down to mostly quite small movements when the receivers are linked and the AVC is applied. A recording meter can be switched in for taking a continuous log of fading movements, and Fig. 3 shows samples from reception of W8XK; first with one aerial, giving fluctuations covering nearly 50 db., and then with diversity reception, which reduces the extremes to about 20 db. This, by the way, is a specimen of selective fading, which can be identified on the chart by its very narrow sharp crevasses and more rounded summits. General fading, in which the whole of the carrier and sidebands are affected simultaneously, is much less rapid and violent. The difference is easily seen in Fig. 4, which compares the two sorts of fading for single-aerial reception of W3XAL.

There are other receivers at Tatsfield, of

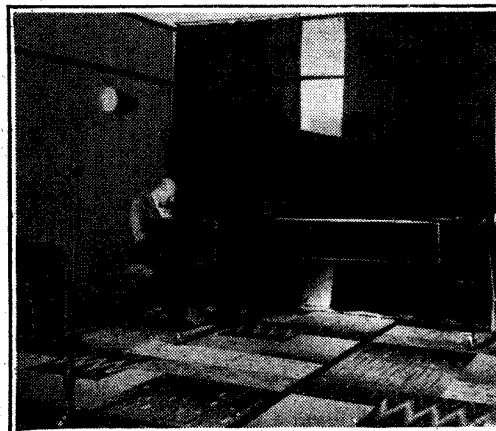
BROADCASTS TO THE ARCTIC

EVERY Saturday night the Canadian Radio Commission conducts a special broadcast, “The Northern Messenger,” for dwellers in the Eastern Arctic regions. This vast territory contains nearly one and a quarter million square miles, and it has a surprisingly large white population, consisting of the mounted police, the Hudson’s Bay Company’s agents, members of the Royal Canadian Signal Service, hunters, trappers, and so on. In addition, there are the Eskimos, who have taken very kindly to wireless. During the weekly broadcast news is sent out—one can imagine how



A distant prospect of the southern mast as seen from the base of its northern companion.

In the picture on the left the Music Director is seen giving a pianoforte recital.

**PALESTINE CALLING**

Three interesting views of the Jerusalem station, now operating on the wavelength of 449.1 metres, which it shares with North Regional, though no interference has been reported. The control room (on right) adjoins the talks studio in which an official can be seen reading a news bulletin.



course, for emergency relaying of home stations and for observation. The most important function of the station is frequency checking, and its equipment for detecting small departures of European broadcasters from the allotted channels is one of the most precise in the world. But that is another story, and one that has nothing to do with diversity reception.

eagerly it is awaited—and there is a regular service of messages from relatives and friends. One of the big difficulties of dwellers in the Far North is low-tension and high-tension current supply. One wonders how on earth they manage to keep their apparatus going with temperatures such as “forty-below.” But so much does the radio-link mean to them that they contrive to do it somehow.

CURRENT TOPICS

Events of the Week in Brief Review

Radiolympia

THIS year's Radiolympia will be held from August 26th to September 5th inclusive.

The Berlin Radio Show dates are August 28th to September 6th.

Encouraging Television Research

A TELEVISION section is to be a feature of the 34th Concours Lepine to be held in Paris in September next. The show is organised for the benefit of small manufacturers and inventors. Prizes are to be offered in a competition for the most effective television receiving apparatus.

Her Name is Beruyl

DURING the British Empire Radio Union (B.E.R.U.) transmitting contest a Rhodesian amateur was presented with a baby daughter. He has decided to call her "Beruyl."

A Lucky Strike

A TRAMWAY strike in Lille has revealed that the trams produce more interference with radio reception than any other "public nuisance." The local radio clubs are asking the authorities to fit adequate suppressors.

Southend Amateurs Thanked

THE Mayor of Southend publicly thanked members of the Southend and District Radio Society, at the recent annual dinner, for their valuable work in maintaining, free of charge, suitable receivers in the homes of fifty-six blind persons, in addition to the big installation which the Society presented to the local General Hospital at a cost of nearly £700.

The Mayor (Councillor H. A. White) also presented the Society's silver challenge trophy to two members who exhibited the most meritorious workmanship at the Society's Annual Exhibition of home-constructed apparatus. The prize-winners, Messrs. Pugh and Leggett, were also awarded miniature replicas of the cup.

Prizes for Reception Logs

THE majority of licensed amateur transmitters in the north-east of Essex are to take part in a special DX contest, and the Hon. Secretary of the Southend and District Radio Society is anxious to hear from

amateurs who would be willing to furnish reception logs for the month of May. Valuable prizes are being presented, including special awards for receiving stations only. The Hon. Secretary's address is: "Chippenham," Eastern Avenue, Southend-on-Sea, Essex.

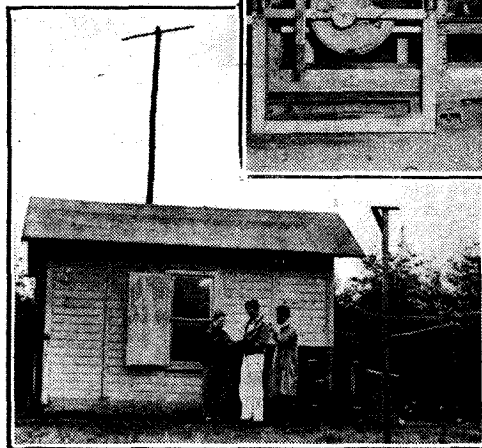
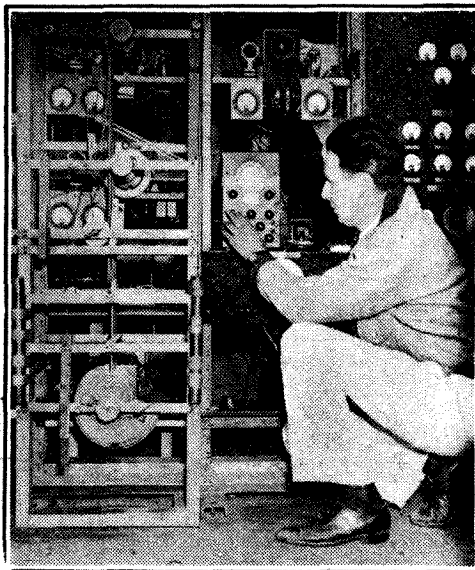
Ionosphere Tests During Eclipse

A GROUP of Harvard scientists now *en route* to Siberia to observe the Solar eclipse on June 19th includes four members of the Radio Corporation of America's laboratories, who will study the effect of the eclipse on radio signals and who will also assist the Siberian Expedition of Cruft Laboratory at Harvard University in making measurements of the reflection of radio waves from the ionosphere in Russian Turkistan.

longer applies to amateur transmitters, who are now permitted by the G.P.O. to use aerials up to 150 feet. This concession is particularly appreciated by operators on the 84-metre band, who, unable to erect a half-wave (132 feet) aerial for this band, have not been obtaining the maximum radiation possible from their transmitters.

Week-end 5-metre Tests

FIVE-METRE tests are to be carried out on Sunday from the top of Ashurst Beacon by Mr. W. Johnson (G2INP), who will be co-oper-



Car Radio Triumph

A BILL to make car radio illegal in the State of Missouri, promoted by two prominent St. Louis citizens, has been strangled at birth, following opposition by the Radio Manufacturers' Association, the Electrical Board of Trade, and the Automobile Club of America. It was stated that not one accident due to automobile radio had been reported from forty-four out of America's forty-eight States.

Longer Aerials

THAT old familiar licence clause: "The combined height and length of the aerial shall not exceed 100 feet" no

Signals that last only one ten-thousandth of a second are to be broadcast continuously for several years by the Carnegie Institution of Washington, from an experimental station at Kensington, Maryland, two views of which we show. The reception of these transmissions, which will be sent out on varying wavelengths, will be recorded and examined in an effort to get more conclusive evidence on the effect of the Heaviside layer on wireless signals.

ating with G5ZI. Transmission will be continuous from 09.30 till 16.00 using ICW and 'phone. Amateurs desirous of co-operating either in transmission or reception are asked to communicate with G2IN, 6, Denmark Road, Southport, as soon as possible.

I.E.E.

A MEETING of the I.E.E. Wireless Section will be held at Savoy Place, Victoria

Embankment, London, W.C.2, on Wednesday next, May 6th, at 6 p.m.

Mr. H. A. Thomas, M.Sc., will read papers on "The Stability of Induction Coils for Radio Frequencies" and "The Electrical Stability of Condensers."

A short communication will also be read by Messrs. R. W. Sloane, M.A., Ph.D., and E. G. James, B.Sc., Ph.D., on "Transit Time Effects in Diodes, Saturated or Unsaturated, in Pictorial Form."

Dr. E. Mallett is to give the Faraday lecture on "Television: An Outline," at the annual general meeting of the Institution of Electrical Engineers on Thursday next.

Editorial Appointment

MR. D. SISSON RELPH has been appointed Editor of *The Wireless and Gramophone Trader*. Mr. W. E. Miller continues as Technical Editor. Mr. Relph was formerly the Editor of *Wireless Magazine* and other journals.

A Pioneer Retires

AFTER nearly a quarter of a century's service with the Marconi Company, of whose works at Chelmsford he was Assistant Works Manager and, later, Works Manager for many years, Mr. Herbert B. Tilley, A.M.I.E.E., has just retired.

Lectures on Television

A SPECIAL course of four lectures on television is to be given by Mr. H. J. Barton Chapple, Wh.Sch., B.Sc., at the Polytechnic, Regent Street, London, W., on Mondays, commencing May 18th next, from 6.30 to 8 p.m.

The course, the fee for which is 6s., covers the various methods of scanning, ultra-short waves, types of modulation, the cathode-ray tube, electron multipliers, and big screen developments. The lectures will be illustrated by experiments, lantern slides, and demonstrations of modern television receiving equipment.

Mr. Barton Chapple is also giving a course of six lecture-demonstrations on television at the Norwood Technical Institute, Knight's Hill, West Norwood, S.E.27, on Thursdays at 8 p.m. The first lecture was arranged for yesterday. The fee for the course is 5s.

"The Wireless World"

A VISIT TO THE TESTING AND RESEARCH DEPARTMENT

A LABORATORY, in the eyes of many film producers, popular novelists, patent medicine vendors, black-and-white artists, and others, is a cross between the reception hall of the Ritz and the crypt of a cathedral. It combines the ideas of spacious nobility and eager intent with a flavouring of musty mystery, with the result that the general public look upon a "lab." as a place where angels fear to tread.

It is quite true that the visitor will discover no angels in *The Wireless World* laboratory, but he will find a colony of enquiring mortals only a little lower than the angels, for their situation on the eighth and top floor of one of the highest buildings on the south bank of the Thames gives them a moral, physical, and technical advantage over their fellow-men which must be of incalculable advantage to their readers. They are conscious that in optical range alone the *W.W.* aerial covers the whole of the metropolis, and that for the reception of foreign stations its position could hardly be bettered.

Let us enter the laboratory *via* the aerial lead-in. That may be easier than entrance by the doors, as inquisitive visitors are never welcome here. The lead-in is taken through a thick horizontal glass pane in the flat roof. Once in the "lab." we are just a little startled by the length of its two wings, which join at right angles to

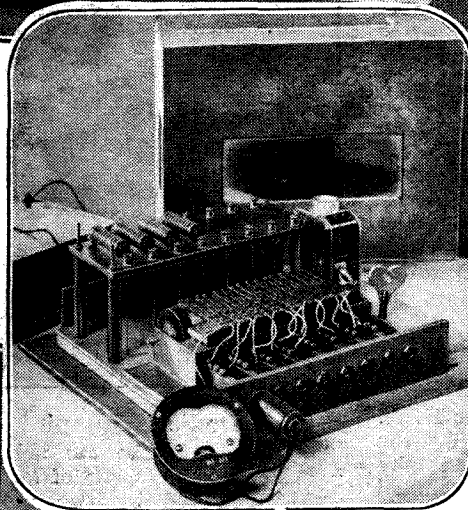
A STUDY IN CONTRASTS.—(Below) A corner of the old Fleet Street laboratory of "The Wireless World" in 1925. Compare this scene with the view of the modern "lab." above.

form a large "L." It would be picturesque to imagine the place either as a tumbled mass of glittering apparatus, brightened by high-voltage arcs and the 50-watt roar of a dozen speakers, or as a speckless apartment with the apparatus all "dressed by the right," and each spectacled research worker, in spotless white raiment, standing to attention beside

his bench. Neither description comes near the truth, however, for this is just a straightforward laboratory in which neither the finicky nor the slapdash



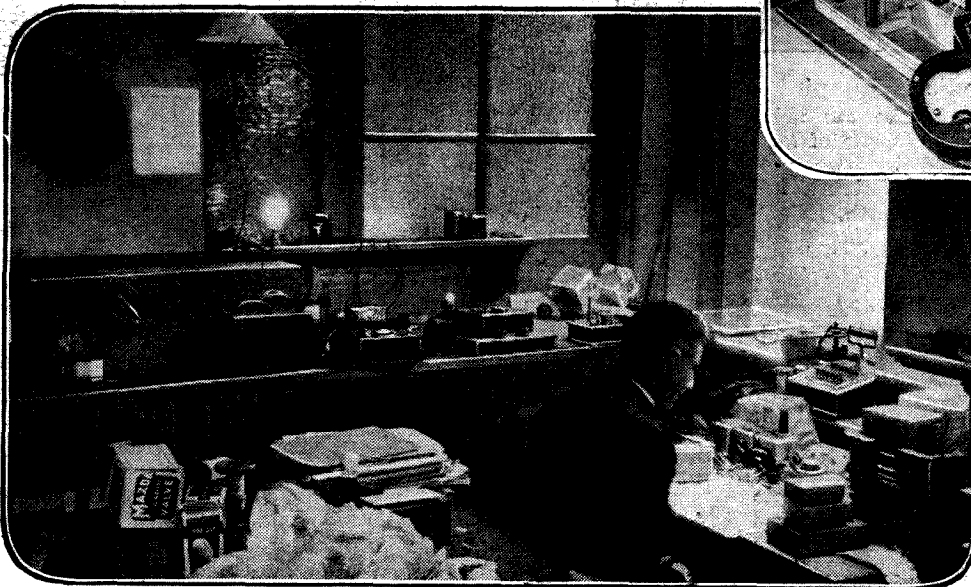
WEST WING of "The Wireless World" Laboratory to-day. The benches are arranged in bays on the unit system, each being self-contained as regards power supply, aerial contact and earth.



"HOME - MADE."—Necessity was the mother of this invention—a battery life-tester switched on and off automatically every four hours.

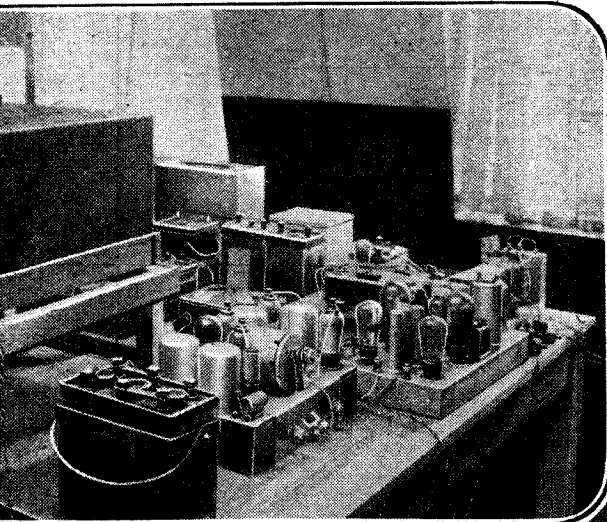
That this arrangement has been found necessary testifies to the ever-changing nature of wireless research. Otherwise elaborate valve-testing gear might be set up, only to be rendered obsolete within a week by the advent of entirely new valve circuits. For the more humdrum work of testing inductance and capacity the laboratory is, of course, equipped with bridges, but it is correct to

is tolerated. Its main characteristics are flexibility and versatility, and the general design is such that the most diverse tests can be carried out. For this reason there are very few "set pieces" in the matter of testing apparatus, the bulk of the testing gear being in the form of wired baseboards to which meters and components can be affixed to suit any particular experiment at a moment's notice.



Laboratory

THIS is the first description published of the laboratory in which "The Wireless World" technical staff carry out receiver and component tests in addition to original research work. Versatility and flexibility are the main features of the organisation.



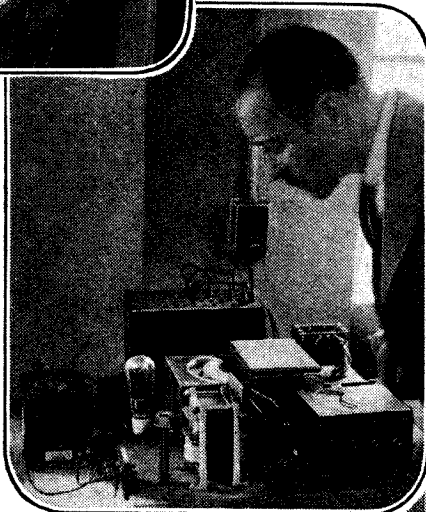
LOUD SPEAKER TEST EQUIPMENT. — The response curve camera is on the left, and to the right of it is the motor-driven heterodyne oscillator. Loud speakers are tested immediately above, on the roof.

say that not a small portion of the department's time must be devoted to evolving special test equipment for dealing adequately with the steady flow of new developments.

The benches are arranged on the unit system, as seen in the illustration, the great advantage being that one can tackle a job from both sides without having to walk all round the apartment. Each bench is pro-

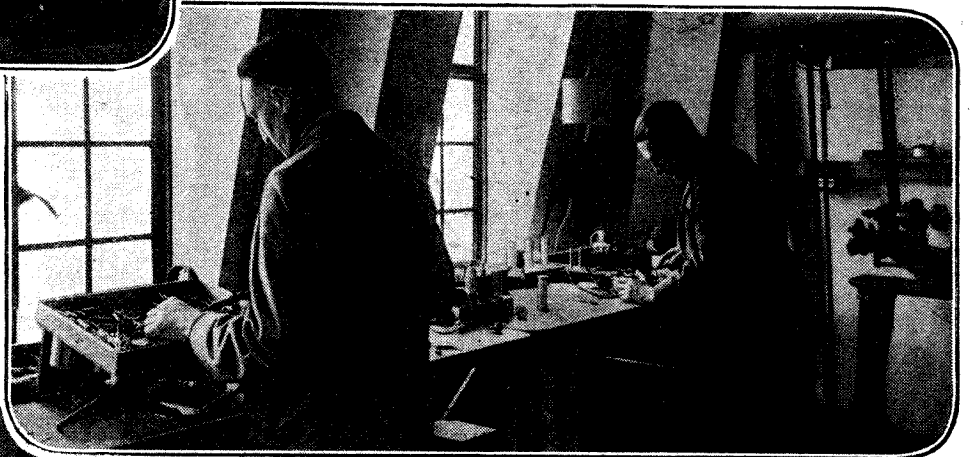
vided with AC and DC supply, is "earthed," and has its own lockers and shelves, and is thus literally a self-contained unit. Experimenters who have worked in laboratories equipped with one long communal bench will not need reminding that the *W.W.* method saves both time and temper!

Commercial receivers and components are constantly under test, but much of the laboratory work is concerned with the design of *Wireless World* receivers for home construction. It is not blind chance, therefore, that has placed the "workshop" within close reach of the "lab." By simply stepping across the corridor the set designer can watch his dreams taking shape on the work benches and see that they are good dreams, not bad.

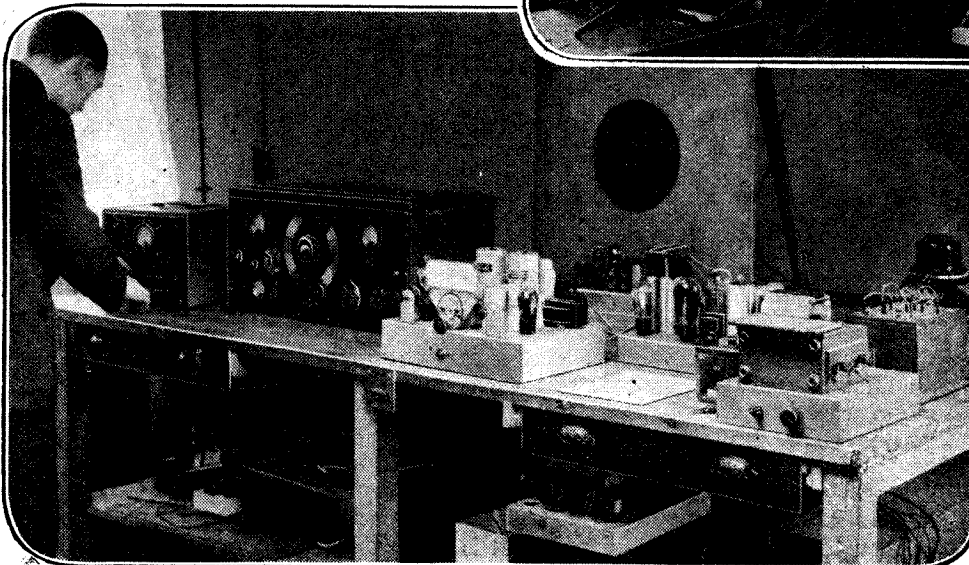


MEASURING the inductance of an LF choke with and without DC flowing in the windings.

(Below) **RECEIVER TEST BENCH** with apparatus arranged for measuring the overall frequency characteristics of sets.



WORKSHOP.—A corner of the set construction department, which is conveniently near to the laboratory.



The laboratory mascot is a delightful little non-patented gadget, never before described in *The Wireless World*, which was invented some years ago by a research worker driven desperate by lack of sleep. Used for life tests of dry batteries, it comprises a drum, operated by very homely clockwork, which completes a revolution in eight hours. Round half the drum are metal strips which make contacts with the batteries through a resistance and milliammeter. Automatically the batteries are switched on and off every four hours—and the inventor sleeps in peace.

E. C. T.

True or False Sound Reproduction ?

WHAT should be the aim of the technician in sound reproduction? Should he press towards the ideal of a perfect copy of the original? Or should he wilfully fake it?

This question sounds almost as improper as asking whether a shopkeeper should be honest, a witness truthful, or a clergyman of good moral character. In the judgment of public opinion, it is more tolerable for those who quietly use their discretion in these matters than for those who advertise it. Having no reputation to lose, however, I accept the lot of the Devil's advocate for the time being by not only daring to ask the question but also defending acoustical roguery.

The orthodox creed, which is seldom actually stated in so many words because it is supposed to be so obvious, is that the work of the engineer (as such) in the field of sound reproduction is to do his best to give the listener a perfect replica of the original performance. Note the "(as such)." If, outside his official capacity, the technician temporarily becomes an artist, with an artist's licence for interpretation, he can do pretty much as he pleases. If the constructor-listener likes to hear infra-negroid dance music or super-sibilant speech, he is entitled to apply his technical resources to that end, in the capacity of an "arranger" of somebody else's work—but not as a technician. Still less is it as a technician that a person acts if he takes advantage of the possibilities of electrical sound-reproduction to modify the accepted forms or style of music.

Some of the activities of the B.B.C. engineers come under suspicion, but very pardonably, sometimes. One can at least hear the soloist in a broadcast concerto, which is more than those in the concert hall can, if no worse, according to this principle; the more so in that they are presumably acting not for their own delectation but for the whole nation, which has to take or leave British broadcast programmes in the form in which they hand them out. But that is too dangerous an aspect of the question to adjudicate just now; we shall confine our atten-

tion to what can be done with the programmes after they have got the length of soaring through the ether.

It certainly does seem reasonable, as well as virtuous, for the strictly technical ideal to be *the reproduction, at the ear of the listener, of exactly the same strength and character of sound that he would hear if he were substituted for the microphone.* Conversely, it seems to be a breach of professional morality for the technicians to condone any lapse from true reproduction or to presume to "improve" upon the artists' work—even if, with a shudder, one admits such things as crooning to this status. Surely, it is not the province of the radio or PA manufacturer to provide "mellow" or "bright" or any other sort of tone; that is the job of the entertainer. The designer has to make his products pass it on, good or bad, as they find it. So some of our more rectilinear manufacturers boast that their sets are toneless.



"Infra-negroid dance music."

All this seems so very right. Well, what is the case against it? Chiefly that, while there is room for the few golden souls to explore for paths leading to perfection, the many must at least temporarily aim at something lower or go without. And why? Because the clear-cut objective of the technical purists is, for the present, no more than a mirage, an illusion. Leaving right out of account the difficulties of actually tackling the problem itself, it is impossible even to state what the problem is, in relation to facts.

No reproduction of sound can be perfectly true unless it is stereophonic—applied separately to each ear, giving the sense of direction with which Nature benevolently provided us. That cuts out loud speakers for a start. It also cuts out the whole of the present system of broadcasting, because for stereophonic reproduction it is necessary to have two separate transmissions for each programme. Yet it is an attainable feature with known technique, and has actually been tested experimentally. But the people who insist on perfection continue to develop a system—the loud speaker—that can never lead to it!

Then there is the listening room. It is

An Argument for Deception

By

"CATHODE RAY"

meaningless to talk of reproducing in it, by loud speaker, exactly the same sounds as are produced in the studio or concert hall. The sounds that reach the listener's ears are coloured—to an extent that would give the "flat curve" exponent a fit if it were charted—by the reflections from the surfaces of the room as well as those of the studio. And if, by some unimaginably complex device, it were possible to neutralise these effects for one listener, it would fail for a listener in another part of the room. This is not hair-splitting; the effect is much more marked than some of those that the perfectionists spend so much effort in eliminating.

Perfect "Volume Expander" Needed

Then there is dynamic range—the reproduction of the programmes in their true contrasts of volume. It is impracticable to transmit, by broadcasting, film, or gramophone record, the full range from the quietest to the loudest sounds. So the programme control men over-amplify the weakest sounds and throttle down the the fortissimos.

What are the true - reproduction exponents going to do about that? Contrast expansion? But what mechanical or electrical device can be endowed with omniscience and omnipotence to perform continuously the exact opposite of what the control man (I will not say engineer) at his artistic discretion is doing? For more on this turn up the issue for



"Breach of professional morality."

True or False Sound Reproduction?

October 4th last. Contrast expansion is a sheer fake. It may be possible some day to make it fit for the pure engineer to touch, but in the meantime listeners have to depend entirely on arbitrarily amended amplification.

Another important principle that must not be ignored is that there is no acoustic equivalent of the photographer's enlarger or reducer. Unless every bit of programme, from a heroine's sigh to a Berlioz 3-orchestras-5-choirs-and-2-brass-bands work of music, is reproduced at exactly the level of volume at which a direct listener would hear it, the beautiful flat frequency characteristics of the reproducer become completely invalid, in such a complex way that no tone-compensator can hope to adjust. This is very involved (see "Tone Compensation," August 30th, 1935). That is why, when a good receiver has been adjusted for a large-scale piece of music, the announcer's voice booms.

All these and other difficulties force the technician to use his judgment, instead of adhering steadfastly to a clear principle of true reproduction. He is obliged, willy-nilly, to descend to fakes, and is free only to choose which ones. Some of the circumstances that put him into this unhappy position may, conceivably, be removed. We may, in the course of time, have at least the option of stereophonic sound. We may have houses with acoustically dead listening rooms. We may be given pilot waves for operating true volume expanders at the receiving end. But presumably then—and certainly now—the vast majority of people will continue to lack the means to indulge in the most advanced technique, will lack the space for a special listening room, and won't be bothered anyway. Is the practical designer going to try to make the masses accept "straight-line (etc.)" apparatus misapplied to conditions in which they cannot do what they are intended to, or is he going to make the best of circumstances by employing judicious acoustical deception to give the most entertaining results?

Music from Statically Charged Objects

Interesting Experiments with Stretched Rubber Bands

AN interesting series of experiments in electronics based on the phenomenon discovered by K. G. Larson and J. J. Loop, of Indiana University, is described in the April issue of *Radio Craft*.

Observations had shown that if a stretched rubber band is placed near the input terminal of a high-gain LF amplifier a note can be heard in the loud speaker when the rubber band is plucked.

Further investigation revealed that the sound was produced by a static charge on the band, and that several different objects produced sounds of varying characteristics under similar conditions, provided they had a static charge. In the case of the rubber

band, the static charge is apparently produced by stretching, whereas other objects will need rubbing, or stroking, with some suitable material to set up the required charge.

Among the many experiments carried out

by *Radio Craft* was one in which a stretched rubber diaphragm placed near a metal plate joined to the grid terminal of the amplifier was used as a microphone. It is stated to function by static action, though the diaphragm has first to be charged by rubbing with wool, or by stroking lightly with a feather.

It gave about the same intensity as a crystal microphone, but apparently had a natural resonance near the low frequency end of the audible scale. Later a rubber-band harp was evolved and proved to have a rich musical tone, being especially good in the bass.

This seems to open up a new field for experiment in electronics and might quite well lead to some interesting developments.

America's Latest:

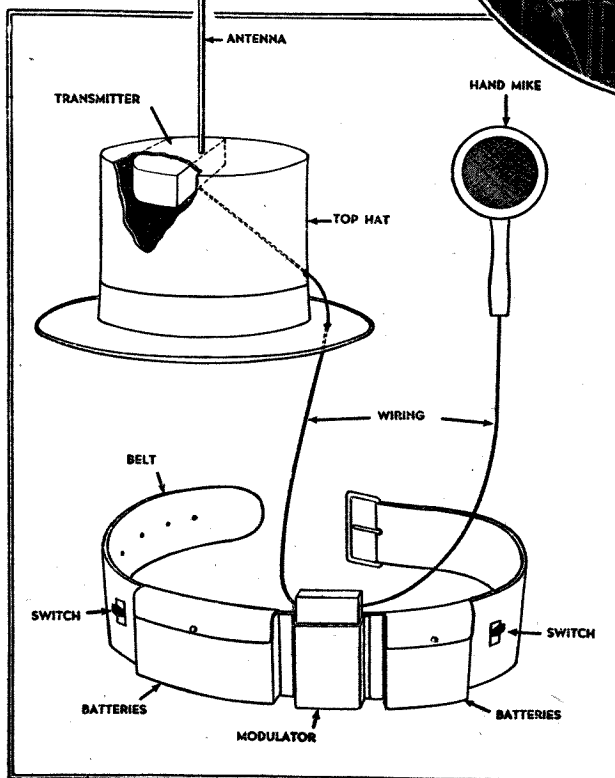
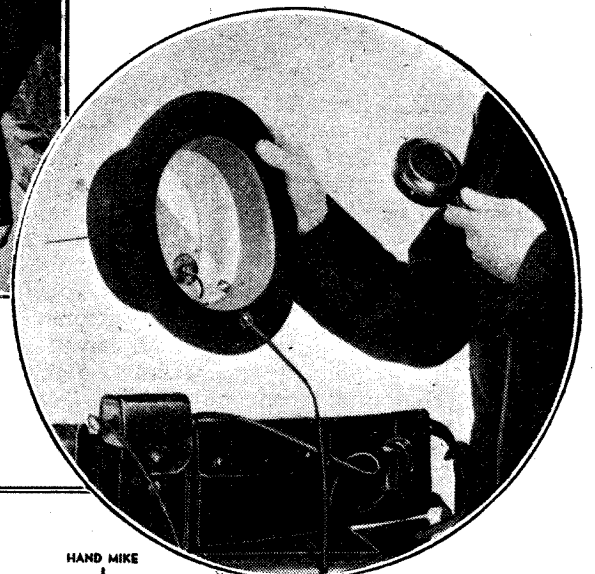
The Top-Hat Transmitter

N.B.C. "Commentator's Companion"

GEORGE HICKS, an announcer of the National Broadcasting Company of America, was "wired as a one-man broad-



THE TOP-HAT TRANSMITTER in action during a New York fashion parade. The 1-metre set, the layout of which can be seen from the diagram below, is described on this page.



casting station" by the Engineering Department for his commentary on New York's smart parade of new frocks on Easter Sunday.

The apparatus was probably the most unobtrusive ever used by an "O.B." man, the only visible sign of his profession being a miniature rod aerial 12in. high projecting from the band of his silk hat. A 1-metre transmitter was concealed in the hat, and was connected by concealed wiring to the power batteries and modulator unit contained in a wide leather belt. Three "acorn" valves were used.

The actual aerial power did not exceed 0.2 watt, but this sufficed for communication up to distances of a quarter of a mile from the N.B.C. mobile unit, which picked up the signals and passed them on to the broadcast control room at Radio City.

Listeners' Guide for the



"TREASURE ISLAND" will be heard as a radio play on Wednesday and Thursday next. The above rare photograph shows Robert Louis Stevenson, the author, at his Samoan home in the 'nineties with his relations and native staff. "R.L.S." is seated at the back.

of the 2nd Batt. The Manchester Regiment, and there will be an address by the Bishop of St. Albans.

York Minster is accounted one of the finest cathedrals in the world. It is over 524ft. long and 250ft. broad

across the transepts. Portions of the crypt date from 1070, though most of the present cathedral was completed 400 years later. The stained glass is estimated to be worth many millions of pounds.

AMATEUR BOXING: AMERICA v. BRITAIN

"BOB" BOWMAN, that incomparable sports commentator, is to describe the Golden Gloves Boxing Contests in a broadcast from the Empire Pool and Sports Arena, Wembley, on Tuesday (Reg., 10). Last year a team of English amateur boxers travelled to New York to meet a team of American amateurs, and, somewhat to the general surprise, the English team won. On this occasion the American boxers have come to England to wrest back

"RENARA" the well-known syncopation pianist, recording in the H.M.V. studios. She comes to the microphone in "The Little Show" at 10.20 on Tuesday (Nat.).



their lost honours. There are expected to be eleven bouts representing every known weight from "Fly" to "Heavy."

EARLY BEETHOVEN

BEETHOVEN enthusiasts should not miss next week's "Foundations of Music" at 6.30 each evening in the National programme. They are to consist of the Master's early chamber music, played by the Reginald Paul Piano-forte Quartet.

INTERNATIONAL VARIETY

ENGLAND, Scotland, Wales and Ireland are all represented in Ernest Longstaffe's variety programme at 8.30 on Tuesday (Reg.). Tom Kinniburgh and Jock McKay will stand staunchly for Scotland, Pat O'Brien will represent Erin, there will be Megan Thomas from Wales, and Tommy Handley and the Two Leslies will champion St. George and Merrie England.

TREASURE ISLAND

THE week's dramatic event is undoubtedly "Treasure Island," Robert Louis Stevenson's juvenile masterpiece, which has been adapted as a radio play by E. M. Delafield. The production, which comes from Bristol and will be heard Nationally at 8 on Wednesday, should be an excellent compression of this vigorous and stirring yarn. The action takes place at the Admiral Benbow Inn, at Squire Trelawney's house, at Bristol, on board the "Hispaniola," and, of course, on Treasure Island itself. There will be a repeat performance on Thursday (Regional) at 8.

FORTUNATE it is that no official ban prevents adults from listening to the Children's Hour, for it not infrequently happens that fare intended for the juniors is better than anything which is being offered on other wavelengths for the delectation of their august seniors.

To-morrow provides a case in point. No adult need be ashamed to tune in the Regional Children's Hour at 5.15, for it presents an excellent "O.B."—none other than a trip by Uncle Mac in a launch down to the Pool of London, past the Tower, the wharves and the shipping. The Pool of London has figured much in fiction and is connected with tales of the early fishing fleets and the romance of the London Docks. Uncle Mac, who will be transmitting on short waves from his launch, will return upstream to the training ship H.M.S. "President," which, incidentally, is anchored in the river near Savoy Hill, the original home of British broadcasting.

TWO POPULAR BANDS

BRIAN LAWRENCE, now regarded as one of London's smartest band leaders, was once a child prodigy, appearing on Australian concert platforms dressed in velvet knickers and a white blouse with a large black bow. He will be otherwise attired at

7.15 to-morrow (Saturday), when he brings his dance orchestra to the Regional studio.

Another popular dance combination is the Savoy Orpheans, which Carroll Gibbons brings to the National studio at 8 on Tuesday. Gibbons is an American by birth but has been for years at the Savoy, where he acted as pianist for the first "Orpheans." Brian Lawrance will appear this time in a singing capacity, and close harmony numbers will be given by the Three Ginx.

MOSCOW CELEBRATES — IN ENGLISH

"MAY DAY IN MOSCOW" is to be celebrated by a 4¼-hour running commentary in English from the Moscow 1724 and 25-metre transmitters this morning (Friday) from 7.45 a.m. to 12 noon (B.S.T.).

Three-and-a-half million people will be parading the streets of the city, thousands of them dancing and singing while waiting their turn to march through the Red Square, carrying flowers, banners and streamers.

FROM YORK MINSTER

SOMETHING of the pomp and pageantry of the annual military service and church parade at York Minster will be conveyed to National listeners at 10 a.m. on Sunday. Music will be provided by the bands of the 16th/5th Lancers and

POLICE AND PALACE BANDS

KÖNIGSBERG's first open-air concert of the season is announced. This is to take place at 12 noon on Sunday, the per-

Week

Outstanding Broadcasts at Home and Abroad

HIGHLIGHTS OF THE WEEK

FRIDAY, MAY 1st.

Nat., 8, Music from the Movies. 8.40, "May Day in England." 10.20, Alban Berg Memorial Concert.

Reg., 8.35, Amateur Shows from the Shows. 9.30, Charles Ernesco and his Quintet. 10.30, Maurice Winnick and his Band.

Abroad.

Warsaw, 8, Cassado (cello), and the Warsaw Philharmonic Orchestra.

SATURDAY, MAY 2nd.

Nat., Saturday Magazine. 8.30, "Music Hall" ¶ "More Macabre."

Reg., 8, Topics in the Air. ¶ MacGibbon String Quartet. ¶ Lew Stone and his Band.

Abroad.

Munich, 8.10, Operetta: "Gluck am Ziel" (Siegel.)

SUNDAY, May 3rd.

Nat., 10, Military Service from York Minster. ¶ "Vienna," by Berthe Grossbard. ¶ Elisabeth Schumann, soprano. ¶ Leslie Jeffries and Orchestra, Grand Hotel, Eastbourne.

Reg., 5.30, B.B.C. Military Band. ¶ Anton Webern conducts B.B.C. Symphony Orchestra.

Abroad.

Brasov, 8.15, Operetta: "Les Cloches de Corneville" (Planquette).

MONDAY, MAY 4th.

Nat., Tatiana Makushina, soprano. 8.30, Leslie Buerger Musical Potpourri. ¶ B.B.C. Northern Orchestra.

Reg., B.B.C. Dance Orchestra. 8.30, Act II, "Parsifal," from Covent Garden. ¶ Joe Loss and his Band.

Abroad.

Luxembourg, 9.5, Beethoven and Bruckner Symphony Concert.

TUESDAY, MAY 5th.

Nat., 8, Carroll Gibbons and the Savoy Orpheans. ¶ The Little Show.

Reg., B.B.C. Scottish Orchestra. 8.30, Variety. ¶ Jack Jackson and his Band.

Abroad.

Paris, P.T.T. 8.30, French National Orchestra in "Music inspired by Literature."

WEDNESDAY, MAY 6th.

Nat., 8, "Treasure Island," a radio play. ¶ B.B.C. Theatre Orchestra.

Reg., Geraldo and his Gaucho Tango Orchestra. 8.30, Sir Dan Godfrey conducts London Symphony Orchestra. ¶ Sydney Kyte and his Band.

Abroad.

Deutschlandsender, 8.45, "Music of Youth."

THURSDAY, May 7th.

Nat., 8, Sandy Powell Show. 10.5, "Rigoletto," from Covent Garden.

Reg., 8, "Treasure Island." ¶ "Words with Music," cavalcade of lyrics. ¶ Lou Preager and his Band.

Abroad.

Radio-Paris, 8.45, National Orchestra and Raugel Choir in Albert Doyen Memorial Concert.

formers being the Dantzig Police Band, which has an international reputation.

Bucharest, too, puts a famous band on the air—the Trumpeter Corps of the Royal Palace Guard—at 9.25 on Monday. The same station, relayed by Radio Romania (Brasov) offers a Liszt Festival Concert at 8.25 on Tuesday with Aurelia Gionca as solo pianoforte.

OPERA ABROAD

THE ever-sparkling Offenbach is represented in two programmes to-night. Strasbourg devotes its 9 o'clock transmission to his one-act opéra-bouffe, "L'Ile de Tulipatan." Radio-Paris also takes the air with Offenbach's very popular "La Belle Hélène," to be heard at 8.45.

Gluck, who became famous as the composer who completely altered his style half-way through his career, will be represented in the Berlin (Funkstunde) transmission at 7



"BOB" BOWMAN, the popular sports commentator, who will describe the Golden Gloves Boxing Contest at Wembley on Tuesday next. (Reg. 10) English and American boxing amateurs will be engaged.

to-morrow, when his Pastoral Opera, "The May Queen," will be heard. England played a large part in the career of Gluck, who was invited to London in 1745 to act as composer for the opera at the Haymarket. The fact that he was unsuccessful led him to change his style completely, with the result that he developed his gift along lines which have made him immortal.

Munich apparently aims at pleasing children both old and young with its 2 o'clock Sunday programme: a Fairy Play with music, "The Lazy Prince," which should delight everybody.

MAY DAY PROGRAMMES

TO-DAY, being May Day, brings a startling similarity of programme in the broadcasts of non-Royalist countries. In



JAZZ ORATORIO. The Danish Boys' Choir, which takes part in Christensen's Jazz Work: "Revolution in School" in the Copenhagen-Kalundborg programme at 9.50 on Monday.

fact, the festival is international rather than national, though an exception to this rule will be found in the German transmissions. The May Day arrangements for the Fatherland are that one station only is responsible for the programme at a given time, this transmission being relayed to the other ten. Stuttgart at 6 this evening relays throughout

the largest is Krems, dating back to A.D. 995, and always a centre of folk festivities.

Also on Sunday Bucharest gives a concert of Polish music for the Polish National Festival at 8.15.

JAZZ ORATORIO

A JAZZ oratorio composed by a modern Danish composer, Bernhard Christensen, is the big event in the Copenhagen-Kalundborg transmission from 9.50 to 10.20 on Monday. Entitled "Revolution in School," this ultra-modern work describes what happens when pupils become masters and vice versa. It will be sung by a Boys' Choir conducted by Mr. Henning Elbirk.

A HANDEL FAVOURITE

HANDEL'S "Judas Macca-bæus" is to be broadcast from St. Morten's, one of the oldest cathedrals in Denmark, on Wednesday, from 8 to 10.15, under the direction of Niels Andersen.

FIVE-HOUR RADIO BALL

ANOTHER Danish radio ball, lasting five hours ten minutes, will be broadcast by Copenhagen-Kalundborg to-morrow (Saturday). The fun begins at 8.50, when Louis Preil's radio dance band offers hot numbers till 11.15. Then Donde's band will broadcast from the famous "Lorry" restaurant till midnight. Jens Warny and his "Angleterre" band come on the air from midnight to 1, and the ball ends with an hour of Vald Eiberg's "Ritz" band from 1 to 2.

THE AUDITOR.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

Reception of Japan

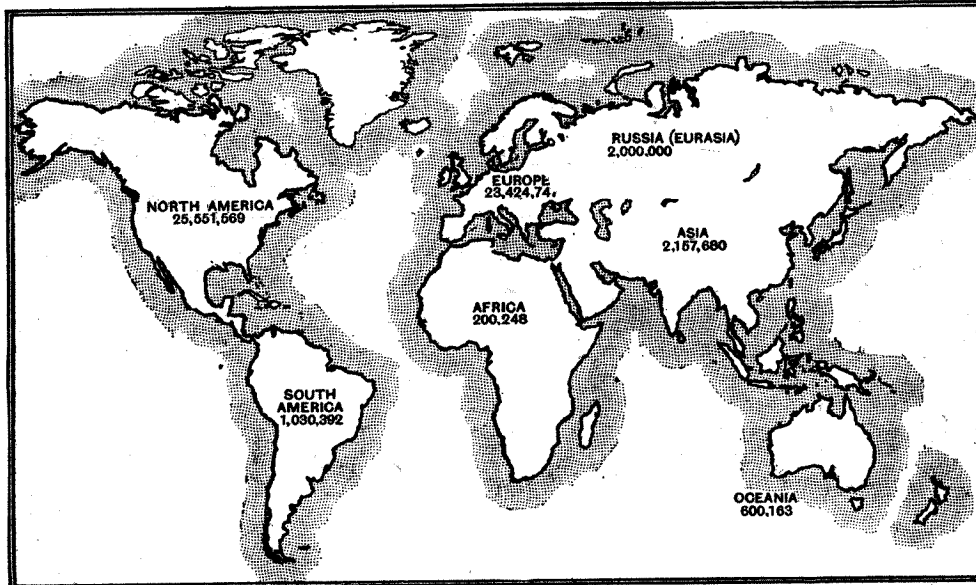
IN reply to a letter from Mr. Michel, which was published in the issue of *The Wireless World* dated April 17th, I should like to say that his reception of JVM does not constitute a record.

On March 3rd, 1936, at 19.15 hours I picked up JVM on 27.93 metres. Signal strength was R7, and I listened until the station closed down at 20.00.

Again, on March 6th, I heard the same station at R7.

vice on an organised scale, as it certainly is over there. Why do we lag behind? It seems to me that the service department is just considered a necessary evil and is not taken seriously enough by most dealers, and especially the small town type. As "Fairplay" points out, there are some poor examples of engineers doing radio work for many firms in Great Britain.

In Canada the day of the "dabbler" is long since past, but, unfortunately, here it is far from being the case. Modern receivers



A sketch map showing the approximate distribution of broadcast receivers throughout the world.

On March 13th I received JVM on 27.93 metres and JVP on 39.93 metres, both of which I put on a speaker at a steady R8.

My set is a battery-operated Eg-V-2.

While on the subject of SW reception, I should be pleased if any one could give me any information about a station on 49 metres which gives its call, COKJ, in two languages, Spanish and English.

On Sunday, April 12th, I received an R8 signal at 06.15 hours. A. L. STALHER.

Caterham, Surrey.

[Replies have also been received from many other readers who have heard JVM. —ED.]

Service Engineers

AS a reader of your excellent journal since 1914, I would like to add a few words in support of the letter written by "Fairplay," Middlesex, in your issue of April 17th.

Having recently returned to this country after ten years in Canada and the U.S.A., I was disappointed to find the status of the British service engineer was on a much lower standard than our Canadian and American cousins.

I was in charge of one of the largest service depots in the city of Montreal for a number of years and have more or less seen the service engineer "come into his own," as it were.

In this country we appear to be at least five years behind when it comes to radio ser-

vice are highly scientific apparatus, and therefore require expert knowledge to cope with their ills. Wireless operating at sea is looked upon as a profession, and as an old operator I assure you that in order to become an efficient service expert one must have at his finger-tips a far wider field of technical knowledge than is required to obtain a first-class P.M.G. The salary

offered is nothing short of disgraceful, and likewise the working hours. One never knows when work is finished or how long certain "calls" are going to take. The service man must always be "on the job" in case he is needed any evening in the week.

I am inclined to think British dealers started wrong. They give too much free service; the result is that many people expect something for nothing and generally get it. Dozens of calls are never paid for. Yet if a householder had to call in the service of a plumber or an electrician they would quite expect to pay him for his call. In Canada and the U.S.A. the minimum service charge is \$2 per call, and has been so for years.

Thirty days' free service after purchase is the maximum time given.

It has been proved that there is money to be made in giving efficient service. No one can give it away and keep a staff of trained engineers. The dealers are to blame. Service should be a cash proposition whenever possible, and if a job is done properly the system works. In conclusion, I can only say I hope to see better conditions brought about, but as I see the state of affairs over here it will take a long time to alter the situation or "live it down." Perhaps some reader may offer a suggestion to bring about a change for the better.

ERIC P. BURGESS.

Baildon, Yorks.

I WAS surprised to read "Fairplay's" letter in April 17th issue on service engineers with reference to required knowledge, comparative remunerations and car upkeep.

"Fairplay" states his connection with the business is of long standing. Well, in the eyes of service engineers, he has "stood" too long.

Service engineers demand and receive a much larger salary than he suggests and a better mileage allowance for use of a car.

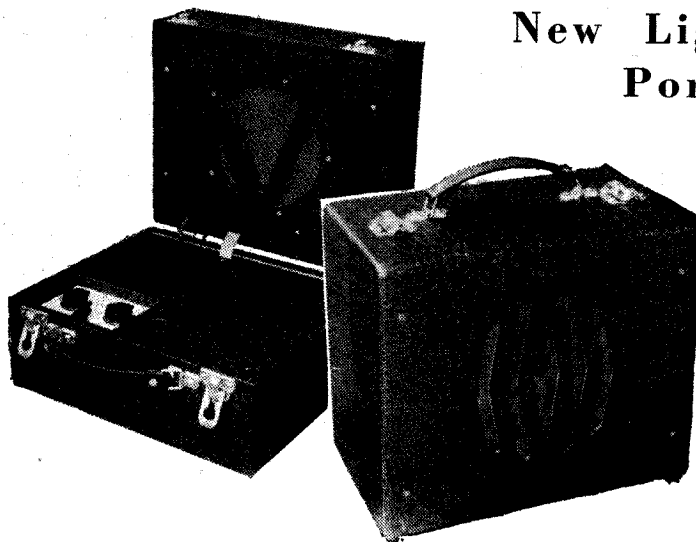
If "Fairplay" cares to look through the vacancy column of *The Electrical Review* he will find vacancies for service engineers on "talkie reproducers" at a commencing salary of £5 per week.

If "Fairplay" wishes to move along in the same old groove the onus must be on him.

P. C. ATTWOOD.

Birmingham.

New Lightweight Portable

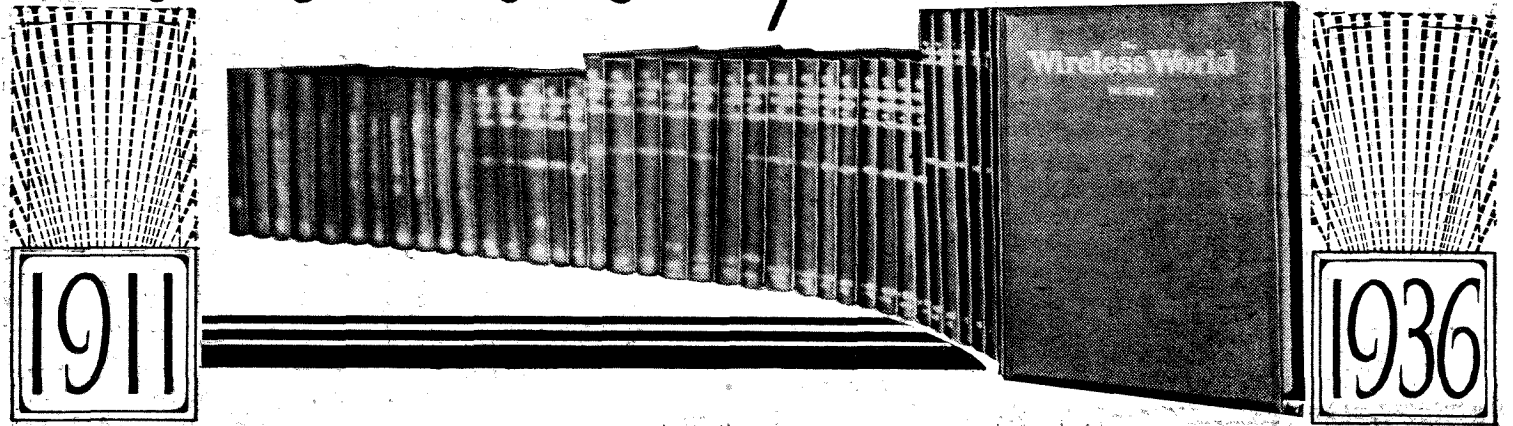


The Vidor Lightweight Portable.

IN spite of the fact that the weight is only 14 lb. and the dimensions $11\frac{1}{2} \times 6\frac{7}{8} \times 9\frac{1}{2}$ in., this new portable by Vidor, Ltd., incorporates a moving-coil loud speaker. The unit is built into the lid, which is fitted with openings on both sides so that the set operates equally well with the lid open or closed.

The case is covered with brown crocodile leatherette, and the price of the set complete with batteries is £5 18s. 6d.

Cavalcade of Wireless



THE PAGES OF

“The Wireless World”

UNFOLD A STORY

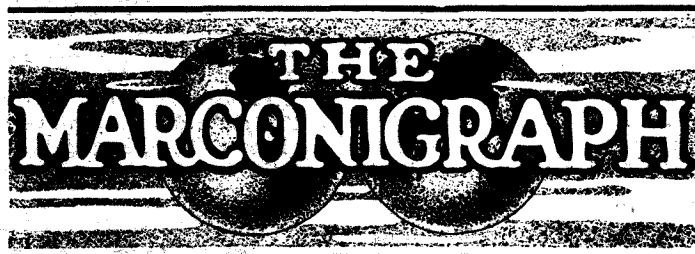
IN the following pages, without departing from *The Wireless World* as the source of information, we endeavour to give a sketch impression of the story of wireless over twenty-five years, indicating, as occasion arises, the part which this journal has played in encouraging enterprise and stimulating development.

The display of past volumes which we illustrate above serves to show how great a task we have set ourselves to endeavour to condense into a few pages the wealth of material they contain—we make no claim to a comprehensive survey but merely to give an impression of twenty-five years of the wireless history of a remarkable era.

1911.

THE history of *The Wireless World* dates from the first issue of the *Marconigraph* in April, 1911. Two years later the title was changed to “*The Wireless World*” incorporating the *Marconigraph*.” The title page of the first number carried a message from Sir Ambrose Fleming, the inventor of the valve, whilst the frontispiece was a portrait of Senatore Marconi.

The early numbers contained a large amount of information of interest to wireless engineers and operators, who formed the bulk of the readers at that time.



No. 1. April, 1911. Subscription, 3/- per annum, post free. Price 2d. Post Free 3d.

Title of the first page of the first wireless journal.

The first issue of the new monthly was very cordially received, and many good wishes for its future prosperity were included in the second issue.

“Since the appearance of the initial number of the *Marconigraph* it has been found necessary to increase the number of pages in the present issue to twenty-four, and it is anticipated that this enlargement will be permanently maintained.

“Arrangements have been made for the publication month by month of a series of articles, illustrated by photographs, relating to the erection of the wireless stations in various parts of the world.”

An account of the transmission of news by wireless telegraphy to vessels at sea for incorporation in *The Atlantic Daily News* was given in the June issue.

Under “Movements of Telegraphists” we find such notices

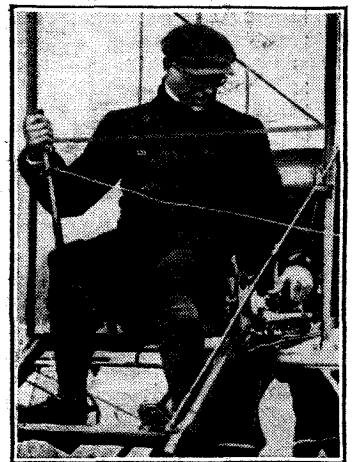
as “Dave Sarnoff, formerly of Seagate, and who has just returned from the icefields, has been placed in charge of the New York Wanamaker Station.” (Mr. Sarnoff is now President of the R.C.A.) And again: “Wireless telegraphy promises to solve, to a great extent, the difficulty of finding employment for Post Office telegraph messengers who have passed the age limit.”

“The applications of wireless telegraphy are now so widespread that much progress has been made in directions which, in the ordinary way, receive but little public recognition. One of these applications is in telegraphing from aeroplanes and airships. The advantage of being able to communicate with land or other stations was well exemplified in the case of the Wellman flight, and the gain to a military aeroplane scout in being able to send messages to his army is obvious.”

The photograph which we re-

produce from the August, 1911, issue shows Mr. Robert Lorraine (the actor-aviator), who carried out some wireless experiments on an aeroplane in conjunction with Mr. Thorne Baker.

“The wonderful achievements of maritime wireless telegraphy, heralded throughout all civilised countries, and made known in the distant corners of the world to which news percolates through slow and cumbersome channels, have made belief in the system well-nigh universal. But less well known, though none the less real, are the conquests made in overland communication.”



Aircraft wireless in 1911.

The above comment appears in an article describing a wireless telegraph station installed at the Wanamaker Stores in New York and Philadelphia.

Cavalcade of Wireless—1912.

January. "Messrs. A. W. Gamage, Ltd., of Holborn, London, are exhibiting and working amateur sets of wireless telegraphy made under licence from the Marconi Company. Needless to say, it is difficult to get anywhere near the operator while the sets are working."

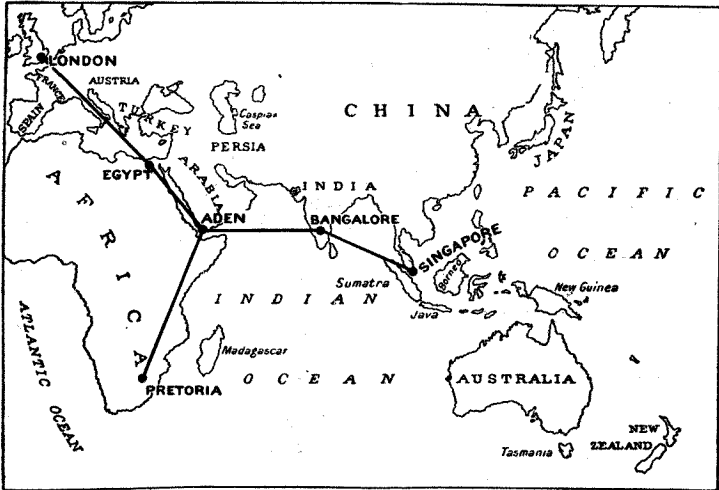
The Marconigraph described as "The Dawn of a New Era" the Government decision to

was a landmark and a centre of wireless interest for many years, and where the first London broadcasting station was later to be established.

Although still without valves, progress was being made in the design of receivers and we illustrate a multiple tuner for a 1/2 kW ship set.

The demand for wireless operators was growing very rapidly and a number of schools

STATIONS TO BE IMMEDIATELY CONSTRUCTED BY MARCONI'S WIRELESS TELEGRAPH CO. LTD. FOR THE IMPERIAL TELEGRAPH SERVICE

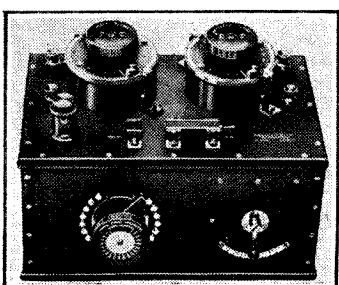


Map showing locations of stations under the Imperial Wireless Scheme projected in 1912.

place contracts for the establishment of wireless stations for the Imperial Telegraph Service. The sketch map reproduced from the April, 1912, issue shows where these stations were to be established and how they would inter-communicate. The War interfered with the completion of these stations, but it is interesting to note that until this date no British stations of any power existed over this area.

Probably no previous event had done so much to bring home to the world the immense value of wireless as a means of summoning aid to ships in distress as the disaster of the "Titanic" in April, 1912. Those who were saved from the "Titanic" owed their rescue entirely to the wireless appeals for assistance.

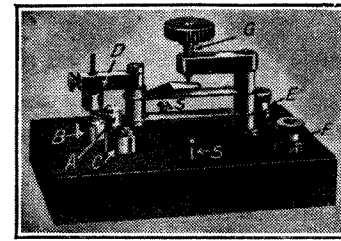
On May 16th, 1912, the Marconi Company moved to their new home in Marconi House, in the Strand, a building which



An early wireless tuner.

appointed wireless operator on the steamer 'Roanoke,' which sailed recently from San Francisco to Portland and Astoria. It appears that there has been some opposition to Miss Coombs going to sea as a wireless operator on the ground that gallantry on the part of the men of the vessel would not allow her to remain at her post during an accident."

1913. The Wireless Amateur. Details of U.S. regulations for wireless amateurs were published and it is on the basis of the regulations of that date that the



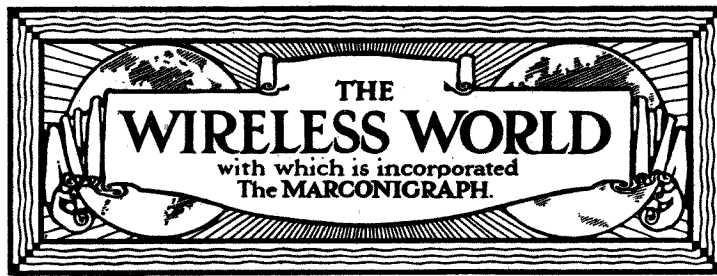
A crystal detector by Cossor, a firm more famous for valves and cathode ray tubes.

huge amateur organisation in America has been built up.

In March, 1913, the announcement appeared "This issue of The Marconigraph is the last to bear the familiar title on its cover. The April issue will appear in an entirely new guise, under the title of The Wireless World."

Discussing the paper and its object it was said: "... This, then, is our policy: to be of use and interest to our readers and, through them, to be a factor for progress."

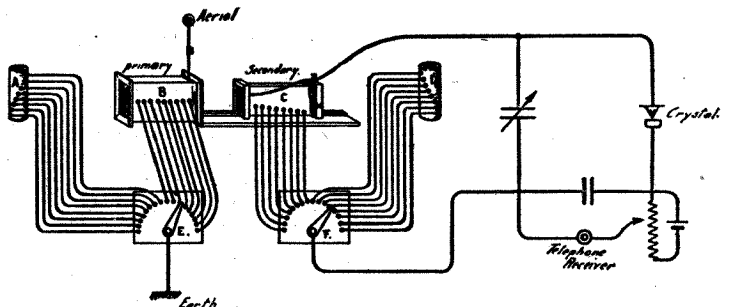
The findings of the Advisory Committee to the Postmaster General on long-distance wireless telegraphy, reported in the June issue, included a statement: "Receiving plant may take many forms, thus the first receiver may be a crystal contact or some discharge valve on the lines of the Fleming valve, and this may work in one of



Vol. 1.—No. 1. (NEW SERIES) April, 1913. Subscription 5/0 per annum post free. Price 3d. Post Free 5d.

Title of the first "Wireless World," the new name for the "Marconigraph."

various kinds of relay; and the record may be made by a Morse inker, by photography, by a phonograph, by simple telephone, or otherwise. There is



An early example of the circuit diagram of a receiver.

a wide field here for experiment and development."

"Although we have been obliged to increase the size of The Wireless World after only three months, we are still unable to deal adequately with the various matters that require attention."

The transmission of photographs and drawings by wireless telegraphy was the subject of an article by Prof. Korn in the September number, and the illustration reproduced is of "a telegraphic transmission of a photograph by means of an artificial conductor."

By the end of 1913 amateur and experimental interest in wireless was in full swing. The Wireless World contained prac-



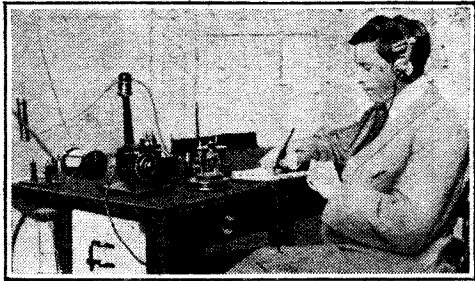
A photograph transmitted by telegraph in 1913.

tical articles on the construction of apparatus.

"The Wireless Society of London has just come into existence, with the determination to carry out a very ambitious programme, upon the success of which the amateur wireless world should reap considerable benefit." September, 1913.

Cavalcade of Wireless—1914.

The inaugural meeting of the Wireless Society of London took place on January 21st, the late Mr. A. A. Campbell Swinton giving the presidential address. *The Wireless World* described the meeting as "From every point of view an unqualified success. Never have we seen the large lecture theatre of the Institution so crowded by a gathering which followed the proceedings with the closest interest . . .



An American amateur station.

An aerial was erected on the roof and arrangements were made to receive a message from Eiffel Tower. This was received on a siphon recorder, and the movements of the pen marking

The August, 1914, issue went to press with no hint of the War, but instead such subjects as television were being touched upon, as the following extract indicates: "The efforts to solve

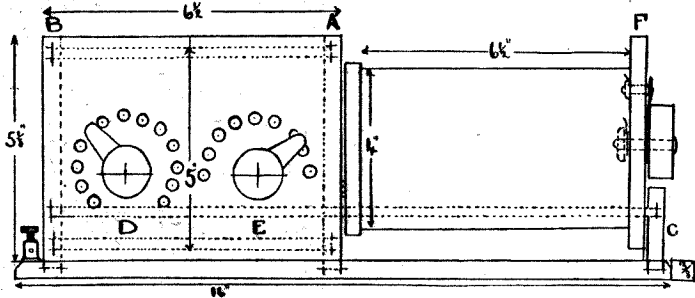


Fig. 1.

6 1/2 inches and 3/4 inch thick, are cut, forming the ends of the coil, connected by four 1/2-inch dowel sticks, upon which the wire is wound, and placed in a square, 1/2 inch from the edge of the wood, as shown in Fig. 2. One of the pieces of wood, marked A, Fig. 1, has its centre cut out for a 1/2-inch all round, to allow for the secondary to enter.

The secondary coil is made of a piece of wood, 5 inches by 5 inches and 3/4 inch thick, which is joined to a piece 4 1/2 inches by 4 1/2 inches, also 3/4 inch thick, by dowel as above. This is connected to primary coil by sliding it along two dowels placed in B, Fig. 1, and connected to the base by the

three turns, the taps being brought to switch E, the handle of which can be made of a

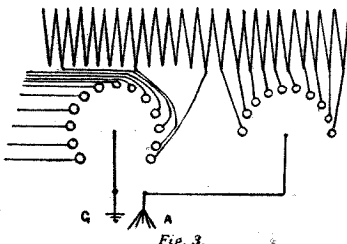


Fig. 3.

Reproduction from a constructional article of 1914.

the strip were clearly shown on the screen. For working the siphon recorder three of the relays designed by Mr. S. G. Brown were used."

In the course of his address Mr. Swinton said that "Wireless telephones," he supposed, were sure to come before very long.

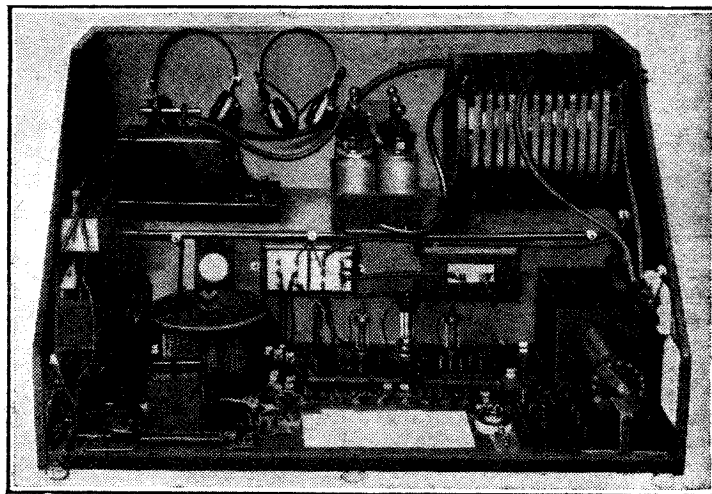
A description appeared of an amateur's experiences in San Francisco, a picture of whose station is reproduced.

The Wireless World began the compilation of a directory of amateur wireless stations, inviting amateurs to send in particulars for publication.

Numerous articles continued to appear, dealing with the home construction of apparatus. An illustration above shows the type of tuner which was popular with amateurs at that time.

In July appears the statement "One of the most interesting

for vision the problem, or problems of space which the telephone has solved for the ear, bears a close enough resemblance to some of the problems in the wireless field to permit us



An early amateur transmitting and receiving station.

Television

When shall we see as well as hear by Wireless?

SOME NOTES BY MR. MARCUS J. MARTIN.

Title of an article in 1915.

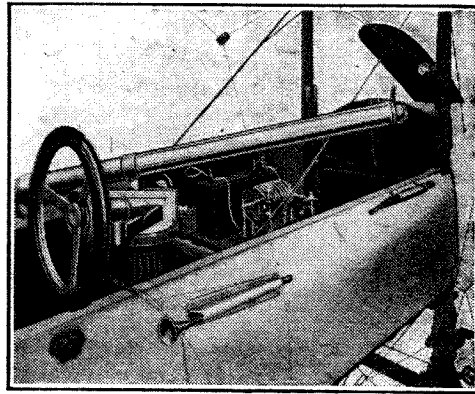
to follow with sympathetic interest the endeavours which scientists are making to reach a practical solution."

A Bill was introduced into Parliament making it compulsory for ships carrying fifty persons to be fitted with wireless telegraphy. At a meeting of the Marconi International Marine Communication Com-

"The Postmaster-General has issued instructions for the closing of all experimental wireless telegraph stations in this country."

1915.

An amateur contributes a design for a loud speaking telephone which consists of a microphone picking up from the telephone of the receiver and, in turn, operating another telephone fitted with a trumpet.



How a transmitter was installed in an aeroplane.

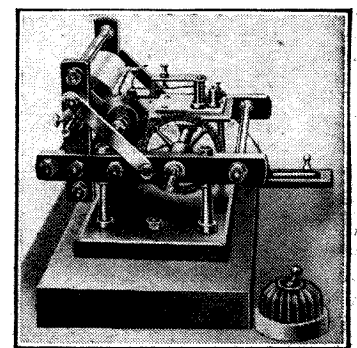
A series of articles is contributed about this time on the transmission of photographs by wireless, and the illustration reproduced is of the recording apparatus used by the author for the purpose. It will be noticed that the picture is produced on a cylinder

pany the question was asked, "What is going to happen when a ship sails from port with forty-nine passengers and crew on board and a fiftieth is born on the voyage?"

In the September number, the first of the War period, we find the statement, "Our readers will notice that the present issue is a slimmer volume. . . . This is due to the anticipated shortage of printing paper, which is one of the consequences of the war. It is not possible to foresee with certainty how far the shortage may affect us, especially if the war should be a lengthy one."

in a manner somewhat similar to the Fultograph which was so familiar a few years ago.

Descriptions of amateur stations were frequently included,



Apparatus for picture transmission.

and we reproduce an illustration of one of these.

A very large proportion of the amateur stations in those days included transmitting apparatus.

The equipment of aeroplanes with wireless assumed great importance for war needs.

"The Progress of Wireless Telegraphy.—Ship and shore stations of the world recorded at the Berne Bureau International: 1908, 508; 1909, 755; 1910, 1,217; 1911, 1,740; 1912, 2,280; 1913, 3,997; 1914, 5,277."

Cavalcade of Wireless—1916.

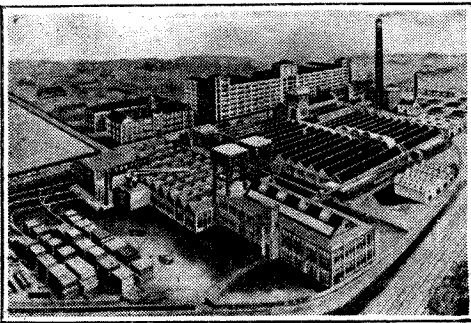
Announcements of the new volume promised. "Important Improvements in *The Wireless World*."

The Hayes factory of the Gramophone Company had not yet turned its attention to wireless equipment, but the factory was producing a series of Morse code records for instructional purposes.

Wireless telephony was an accepted achievement, although the quality of speech was extremely poor, the arc being the best means of generating oscillations.

An appreciation from a reader published in the August, 1916, number: "I love this wireless magazine; it makes

Where Morse practice records were made. The Hayes factory of the Gramophone Company.



me feel so frightfully keen. It tells me things I ought to know and places where it's nice to go. And as beside the babbling brook I read it with enraptured look, absorbing mental nourishment, and getting value every cent, I clean forget my heart is sore, and read of 'Wireless and the War,' or let my fancy wander free o'er 'Maritime Telegraphy.' When evening drives me in the cottage to read the charming works of Nottage, I gaze into the western sky and think of Dowsett's Aircraft high. Oh, yes, I am an ardent

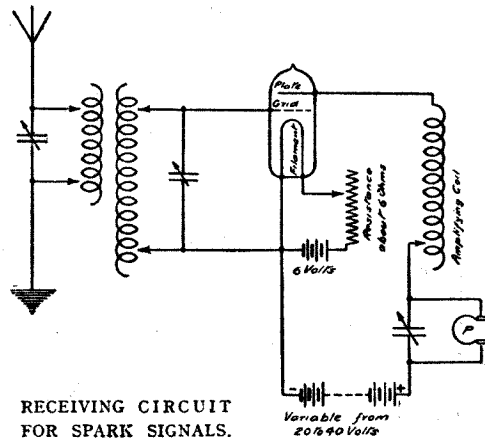
of *The Wireless World* at this time. Restrictions of the Censor excluded news of technical progress, and the only technical matter permitted was in the nature of theoretical instruction.

1917. The illustration shows a very early circuit of a three-electrode valve in *The Wireless World*.

The valve was, of course, in use to a considerable extent by this time, but secrecy restrictions had made it impossible to give any practical information on the subject of its use.

March issue: "In spite of the greatly increased difficulties

Wireless and Moving Pictures. —"For a long time it has been the aim of inventors to produce



RECEIVING CIRCUIT FOR SPARK SIGNALS.

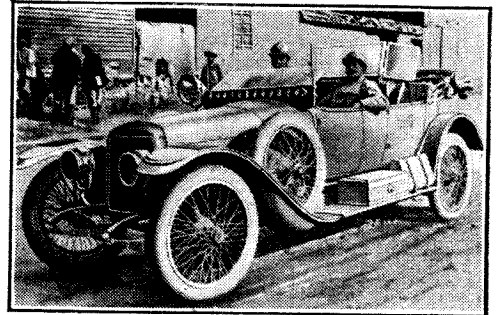
tain inventions relating thereto. The method of working is as follows: Each actor and actress has concealed in his or her clothing a microphone and a complete wireless telephone transmitter in miniature, the vacuum valve oscillation generator providing the necessary high-frequency current. Immediately above the stage an aerial system is provided to pick up the electric

An early example of a valve circuit.

cinematograph pictures which will speak. Many devices have already been produced, most of them combining the phonograph with the cinematograph. All previous inventions have, however, been unsatisfactory, the chief reason preventing their successful use being the difficulty of obtaining perfect synchronism between the picture and the record.

"Wireless tele-

A French director of communications somewhere at the Front.



phony is now being used in the production of talking moving pictures, and a company has recently been formed in the United States for exploiting cer-

in the clothing. The received oscillations are conducted to the usual type of wireless telephone receiver, and here they are made to record synchronously with the film upon the band of the telegraphone—a device which records sounds upon a moving band of steel wire. When the developed picture is projected, the turn of the crank of the projecting machine also reels out the wire of the telegraphone, reproducing the voice and the picture in perfect synchronism through a number of loud-speaking telephones distributed throughout the auditorium."

1918.

Even in 1918 anxiety was beginning to be felt at the increasing number of new names given to wireless valves, as the following extract quoted from an American source shows:—

"To-day the following words are in common use by radio engineers, as the names of devices in appearance similar to and in principle based upon the original audion:—

Oscillation valve, regenerative audion, kenotron, pliotron, electron, relay, thermionic relay, thermotron, audiotron, amplotron, detecto-amplifier, Moorhead tube, oscillion, ultra-audion, dynatron, oscilaudion, and pliodynatron."

of production (of the journal), the closing-down of all amateur stations, and the cessation of all private wireless research, we can claim a steadily rising circulation and the retention of a circle of readers with whom we are proud to be in touch."

Japan was a pioneer country in the early development of the wireless telephone. The illustration reproduced shows a Japanese wireless telephone equipment referred to in *The Wireless World* of April, 1917. This transmitter employed a special form of spark discharge for the generation of oscillations.

In June there appeared the first of a series of articles on the "Three Electrode Valve," described as a "piece of apparatus which has now been perfected to such an extent that it may

President Taft of the U.S.A. conversing by wireless telephone.



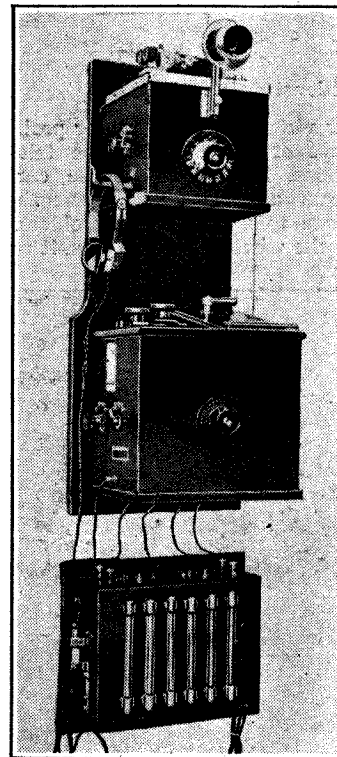
lover of every word within the cover, so now away to peaceful slumber and dreams about the coming number."

"The Fleming Valve and the De Forest Audion" was the title of a reference to a patent action in the United States.

Records of the war continued to form the principal contents

without any exaggeration be termed the wireless instrument of the future."

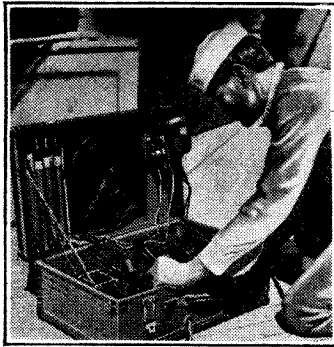
Portable sets were beginning to find favour for special purposes, and the illustration on the next page must represent one of the earliest forms. However, leads from the suitcase suggest the presence of separate battery supply.



Japanese spark system wireless telephone.

Cavalcade of Wireless—

In March, 1918, in announcing that the next issue would commence Volume VI of *The Wireless World*, some of the difficulties of producing the paper at that time were indicated; it was stated, "With the total suppression of amateur working, the prohibition of the publication of any matter relating to the construction of



A portable station of 1917.

wireless apparatus, and the heavy hand of censorship on practically all of the most interesting phases of wireless work in the country, it has been no mean task to select and produce matter of general interest to our readers."

In the same issue Senatore Marconi is quoted as saying: "The distances from which messages can be sent, and improvements effected in various ways, will astonish scientists not in close touch with war developments when they read about them some day."

Articles on theoretical subjects and accounts of wireless experiences during the war continued to fill most of the pages of the paper.

A photograph of unusual interest taken from the September issue shows a New York police car of that date fitted with wireless. It was stated that with the aid of this equipment a police army several thousand strong could be called into service in New York at short notice. The establishment of these cars in New York was not only interesting in itself but constituted a striking illustration of the way in which wireless telegraphy was permeating every phase of modern life.

This volume closes with a brighter outlook than it commenced, for the war had come to an end and from the point of view of the usefulness of *The Wireless World* alone, it meant that secrets of technical progress made during the war could now begin to be disclosed through its columns. There was still a long way to go, however, before the pre-war freedom to describe technical inventions could be regained.

1919.

Interesting pages at the beginning of 1919 are those reproducing letters expressing a tribute to wireless and wireless men for the work performed during the war, addressed to them through the medium of *The Wireless World*, from Beatty, Haig, and from Sir Joseph Maclay, who was the shipping controller at that time.

"On March 19th it was announced by Marconi's Wireless Telegraph Co., Ltd., that they had succeeded in establishing wireless telephone communication between Ballybunion, Ireland, and Louisburg, Cape Breton Is., Canada."

"With the widespread use of radiotelegraphy and telephony in the Army, Navy and Air Force, it has become necessary to form a Committee for the purpose of bringing together those who are directly responsible for radiotelegraphy and telephony in those forces. The Committee which bears the official name, the Wireless Telegraphy Board, has already been in existence for over a year, meetings being held at frequent intervals — on the average, once a week."

"In a letter dated March 24th, the Secretary of the Post Office notifies manufacturers of electrical apparatus that it has been decided to remove the restrictions imposed on the sale of buzzers, which may now be sold without enquiries as to the



Police wireless in New York—gangsters would see this coming to-day!

use to which the purchasers propose to apply them. *The restrictions on the sale of thermionic valves remain unaltered, which means that at present*

The Construction of Amateur Wireless Apparatus

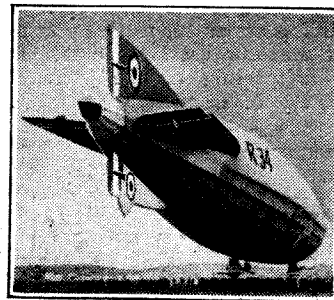
In this, the first of a new series of Articles designed to give practical instruction in the manufacture of amateur installations and apparatus, the author deals with the main considerations in the design of a station. Subsequent Articles will explain in detail how each piece of apparatus may be constructed. The Wireless Press, Ltd., has arranged with Marconi's Wireless Telegraph Co., Ltd., to supply complete apparatus to the designs here given as soon as Amateur restrictions are released.

Article One: GENERAL CONSIDERATIONS.

A promise of practical information again after the war censorship had been removed.

the amateur cannot legitimately own or buy valves."

Many accounts appeared in *The Wireless World* at this time dealing with the war experiences of those who had been engaged on wireless work, and were now at last permitted to write about them. Some descriptions also appeared of apparatus used during the war, which indicated how great an



The R34 made flying and wireless history.

advance had taken place during the period when the publication of technical descriptions was forbidden.

"When, on July 19th, a representative body of the Empire's forces marched through London in celebration of peace and victory, twelve wireless operators of the Mercantile Marine took a well-merited part in the procession."

"Owing to the continued delay by the Government in deciding the lines upon which the wireless amateur will be allowed to work, we (*The Wireless World*) have been unable to execute our original plans of supplying detailed information for the manufacture of amateur wireless apparatus. Pending an announcement of policy by the authorities our contributor will continue the present series along the lines already laid down."

So that we see that the delay in describing sets for home construction was inevitable as far as *The Wireless World* was concerned.

A photograph shows "The Magnavox, by means of which



The American "Magnavox" loud speaker with its associated amplifier.

huge crowds heard President Wilson's Victory Loan appeal spoken by an aviator flying at a height of 3,000 feet."

With the November issue there appeared a single sheet supplement giving the conditions under which the Postmaster-General was now prepared to grant licences for the use of experimental receiving apparatus. Licences to amateurs for transmitting were still not available.

A Report of the first meeting of the Wireless Society of London (later to become the Radio Society of Great Britain) after the war appeared in *The Wireless World* of December, 1919. The Minutes of the previous meeting, held on December 29th, 1915, were read.

In the same issue an article appeared on the design and construction of an amateur receiving station introduced with these words: "Now that the ban on amateur wireless has been partially lifted, we can go ahead with work of a practical nature."

Cavalcade of Wireless—1920.

The removal of the ban on amateur wireless resulted in great activity at this time. Valves were included in advertisements at 25s. each, and single valve panels with terminals and a filament resistance appeared at £4 5s. each.

important announcement appeared that the Post Office had agreed that a permit to use wireless apparatus could be regarded as sufficient authority to dealers to supply "such apparatus as comes within the terms of the permit and that, therefore, no special purchasing permits will be required by amateurs."

less World indicated how enthusiastically readers took advantage of the removal of restrictions by the Post Office.

In the autumn of 1920 *The Wireless World* undertook, in co-operation with American amateurs, the organisation of transatlantic reception tests, the purpose of which was to ascertain whether American transmitting amateurs could be heard in England on wavelengths of the order of 150 metres and on low power.

A four-electrode valve was described in December.

1921. A full report of an extremely interesting lecture by Prof. Whiddington was included in *The Wireless World* of January, 1921. This paper described the application of valve circuits to the measurement of physical quantities and was, perhaps, one of the first examples of the use of valves in fields other than wireless practice.

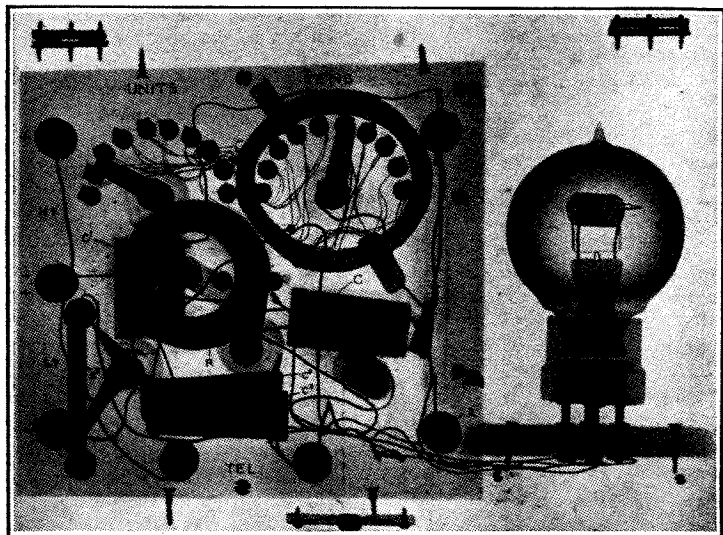
"Loudspeaking Telephones" the title of an article comprising a comprehensive review of loud speakers of that date. Of commercial types then available, there were the loud speaking telephone of S. G. Brown, the American, "Magnavox," and a type due to the Western Electric Company, but these speakers were rather expensive for the amateur, who generally had to content himself with fitting a horn to a single telephone ear-piece. Moving coil speakers were a much later product.

Efforts to devise a means of supplying wireless receivers with current from the mains was occupying the attention of experi-

menters early in 1921, and a note on lighting valve filaments with AC, appeared in the issue dated February 2nd.

There were no regular telephony transmissions to which the amateur could listen in this country, and the most popular source of entertainment for listeners was the reception of telephony concerts transmitted by a private company from a station at The Hague, in Holland. A subscription was opened by *The Wireless World* to assist in meeting the cost of maintaining them for a further period.

At a meeting of the Wireless Society of London a representative of *The Wireless World* was able to notify the meeting that the Marconi Company had made an application to the Post Office for a temporary licence to carry out some regular transmissions of telephony from Chelmsford for the benefit of amateurs. This small beginning resulted in the establishment of the station at Writtle, near Chelmsford,

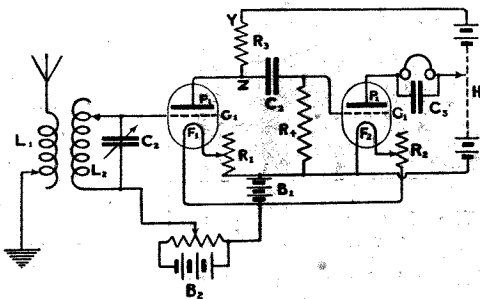


Mr. G. G. Blake's X-ray photograph of an amateur set of 1920.

A two-valve resistance amplifier was described in the March issue, the circuit of which is reprinted on this page.

Mr. R. C. Clinker, of the B.T.H. Company, demonstrated before the Wireless Society of London a portable receiver with some interesting features, in particular the provision of a pivot head in the lid to carry a rotatable

A number of examples of wireless apparatus made by firms for amateur use were exhibited at a meeting of the Wireless Society of London.



A resistance-coupled circuit of 1920.

frame aerial, as shown in the illustration reproduced.

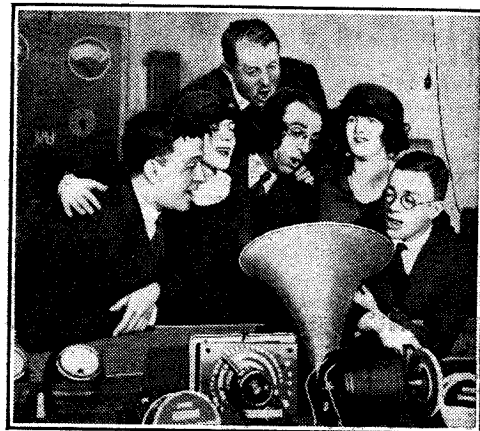
The first Amateur Conference of Wireless Societies was reported in *The Wireless World* of April 3rd.

The Wireless World was now published fortnightly instead of monthly.

Mr. A. A. Campbell Swinton, F.R.S., gave a presidential address to the Wireless Society of London in February. In the course of the address he gave a demonstration of reception of transmissions from Paris on a frame aerial and employed a 10-valve receiver and siphon recorder whilst a message was also received from the Slough station of the Radio Communication Company and a transmission from the Air Ministry. The record as made on the siphon recorder was projected on to a screen in the lecture hall.

In May of this year an im-

Lists of stations with times of transmission of weather reports and time signals were included, as these provided the principal transmissions of interest for amateurs to listen to. The popularity of the questions and answers columns of *The Wire-*

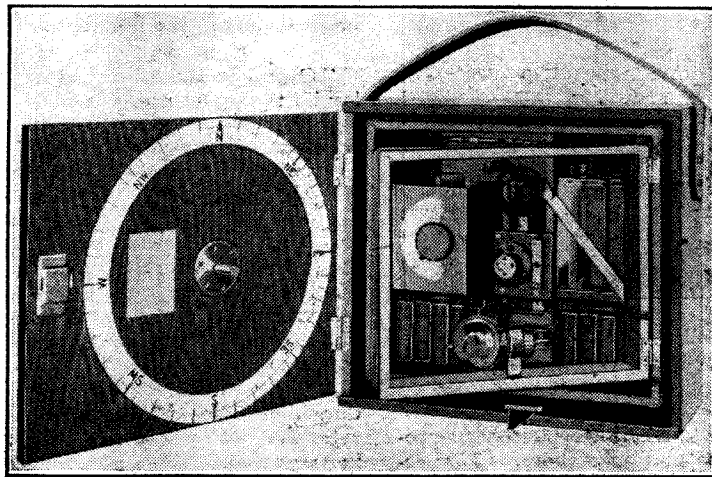


How broadcasting was done in 1921. The Co-Optimists at a charity demonstration.

and can be regarded as the beginning of broadcasting in this country.

An extract from a newspaper published from an advertisement in June 11th issue stated "Since the Postmaster-General lifted the ban on amateur wireless installations, the popularity of this fascinating hobby has grown to amazing proportions all over the country. There are now over 50 amateur wireless clubs with a membership of over 2,000, and the Post Office authorities are daily receiving new applications. . . . Amateurs can erect a receiving station for about £5 and get good results, including speech and Morse from stations as far away as America and Cairo."

How broadcasting was carried out in 1921 can be gathered from the accompanying illustration which shows the Co-optimists giving a performance by wireless telephony in aid of St. Dunstan's.



One of the very first portable valve receiving sets.

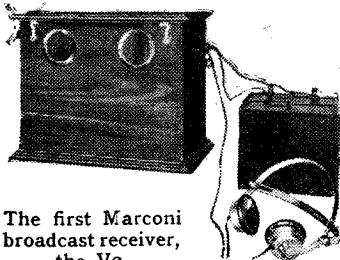
Cavalcade of Wireless—1922.

The April, 1922, issue of *The Wireless World* marked a very important milestone in its history, for with this issue the journal commenced weekly publication, and messages of congratulation were published from such illustrious pioneers as Senatore Marconi, Admiral Sir Henry Jackson, Dr. W. H. Eccles, Sir Ambrose Fleming, Sir Oliver Lodge, Mr. Campbell-Swinton, Prof. Howe, and General Ferrié.

New technical information was crowded into this volume. The accumulation of technical development during the War was beginning to be released.

The Writtle transmissions commenced early in the year, and in April we find this reference, "It is really only a matter of a few weeks since the introduction of the first officially recognised transmissions for amateurs in this country, and yet already the Tuesday evening telephony and transmission of calibration waves is looked forward to as an established feature in the amateur programme."

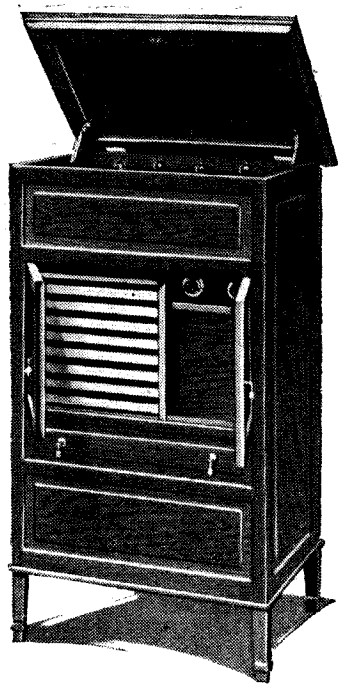
A very popular article published in May described the Johnsen Rahbek loud speaker, with details of how to construct it. This was by far the most efficient loud speaker that had yet been developed and attracted a great deal of attention at the time.



The first Marconi broadcast receiver, the V2.

Later in the same month under the title "The Radiotelephone Broadcasting," the first announcement appeared regarding the Post Office proposals for regular broadcasting. It was stated, "Permission to conduct a broadcasting service will be given to British firms who are *bona fide* manufacturers of wireless apparatus, and the Postmaster-General is calling together the representatives of the firms who have made application for this permission, in order that some system can be worked out which would be satisfactory to all concerned. . . . The limit of power for one station is fixed at 1½ kW. Times of broadcasting are fixed for 5 p.m. until 11 p.m. on week-days with no restriction as to time on Sundays.

The Postmaster-General, in making his announcement, stated in the House of Com-

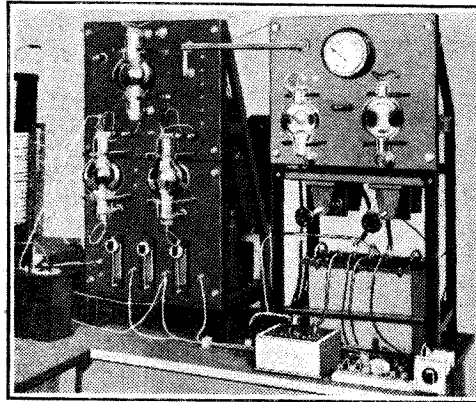


Broadcast receiver de luxe, of 1922.

mons, "The possibilities of this service are almost unlimited."

Later in the year was held the first All-British Wireless Exhibition, which had been organised through *The Wireless World*, and a review of the exhibits was included in the issue of October 7th. It was described as "the first real introduction of wireless telephony to the public."

The broadcasting equipment of the first transmitter at Writtle.



Successful transatlantic tests were carried out, when both British and American amateurs transmitted. The success of these and earlier tests established the importance of short waves for long distance communication.



For the first time: 1923 was rung in from 2LO.

The end of the year saw regular broadcasting in full swing, and the British Broadcasting Company, the parent of the B.B.C., formed by a group of wireless firms.



1923.

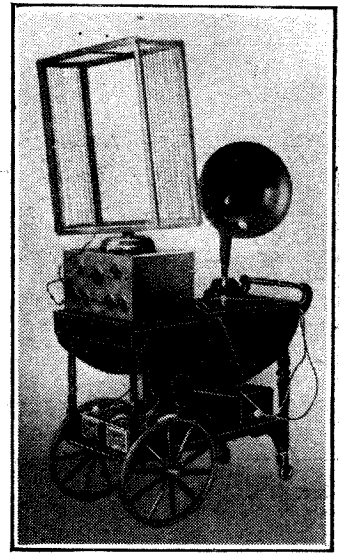
At the beginning of the year, six British, three French, and one Dutch station comprised our complete list of transmitters giving regular telephony programmes, but there was also a station in Germany conducting a service on strictly regimented lines. The 2,000 subscribers were supplied with fixed-tune receivers, mains-operated even at this early date; the transmissions dealt almost entirely with mercantile matters of interest to bankers and trading concerns.

The general run of broadcast receivers still had detector-LF circuits, with one or two "passenger" HF stages for the enthusiast. But better times were coming; the neutrodyne system, which offered real HF amplification, was introduced this year, but its practical application was fraught with many difficulties.

The wireless show indicated that the untidy unit set was

applications for experimental licences. No wonder that the less law-abiding section of the public preferred to do without any licence at all!

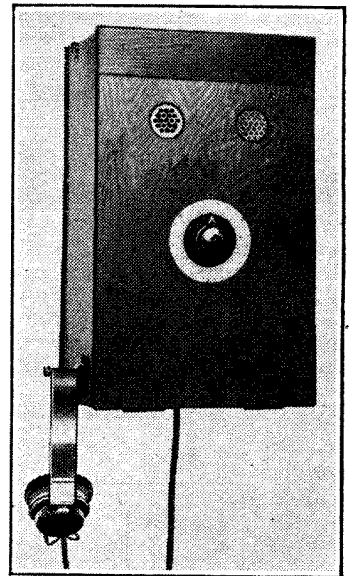
The properties and uses of the Rochelle salt crystal as a



"The compact wireless receiving set owned by H.R.H. the Duke of York. It is installed at White Lodge, Richmond Park."

gramophone pick-up, microphone, and telephony receiver were lucidly described, and we began to investigate the scientific aspects of loud-speaker design. But scientific methods generally sound crude—even those described in an article published "by permission of the Radio Research Board."

It was often our duty to protect the public from exploitation

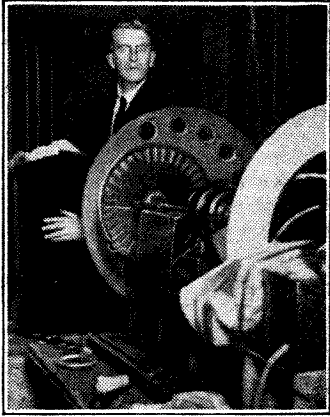


All broadcasting might have developed on these lines: the fixed-wavelength mains set used for the first German service.

by unscrupulous persons who attempted to profit by the new broadcast boom, and many "ramps" were exposed.

Cavalcade of Wireless—1924.

Strange as it may seem, it would hardly be an exaggeration to describe 1924 as a television year. We published Campbell Swinton's classic pronouncements on the cathode-ray system, Baird's first articles, and



Mr. J. L. Baird, then described as "the inventor of a very promising system of television."

also a description of the Mihaly system. The oscillating crystal detector, which, after incredibly laborious adjustment, might be made to produce oscillations, was explained in our pages by its Russian originator, and later we published a constructional article.

In commercial radio communication there was the wavelength revolution, and it is clear that we fully appreciated the fact that the short wave would be the future channel for transoceanic work. Ama-

The King, as Prince of Wales, visits the station of Mr. C. W. Goyder, of Mill Hill School, who successfully communicated with America and Canada and later with New Zealand.



teurs helped to prove its possibilities by communicating successfully with New Zealand—the ultimate limit in distance on this planet. Photographs were successfully transmitted across

the Atlantic by the Ranger system.

With regard to broadcasting technique, the moving coil microphone was introduced, and simultaneous radiation of the King's speech at the opening of the Wembley Exhibition through all British stations was the event of the year. In recording it, we made the happy prophecy that "it will almost undoubtedly be possible for the King to address his subjects in the greater part, if not the whole, of the British Empire."

In the field of broadcast receiver design, work on the neutrodyne was proceeding, but lack of complete knowledge regarding the design of HF couplings and the neutralisation of valve capacity prevented complete success. Still, a divine discontent with the "passenger" HF stage had been implanted in our minds, as even the crude neutrodyne was demonstrably much better than the unstabilised set of the period.

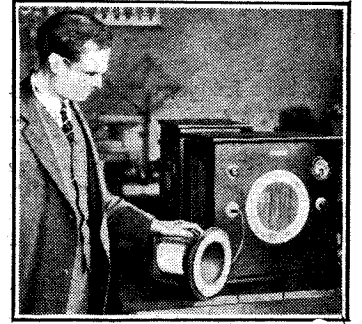
Dull-emitter valves were coming into widespread use, and the opening of the experimental high-power station made it necessary to convert many sets for long-wave reception. The Marconiophone "Ideal" transformer at last provided an alternative to resistance coupling for

was found, and the sum of £500 which we had offered to the R.S.G.B. for fighting a test case was not needed after all.

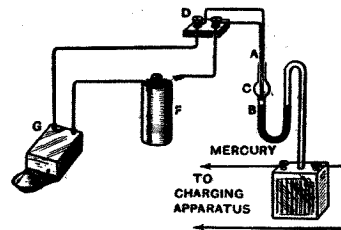
1925.

Readers of Robert Louis Stevenson will remember the obvious disappointment of that gifted man when, in about 1870, he was first confronted by a telephone—and found nothing worth while to say into it. The same idea now began to invade the minds of those responsible for broadcast programmes, and it was realised that a new kind of artistic technique was needed for exploiting the possibilities of the new medium. Studios in America were now being planned to create an atmosphere stimulating to the artist, and we in this country began to embark on "stunt" broadcasts, such as a concert from an aeroplane in flight. The opening of

making progress, and our later designs showed some real promise of the improvements that were to come. The year also saw the practical introduction of push-pull amplification; of our first all-mains receiver; and of an ambitious HT battery eliminator. We pride ourselves



The prototype of the modern loud speaker.



"Is the accumulator gassing?" A bright "Reader's Idea."

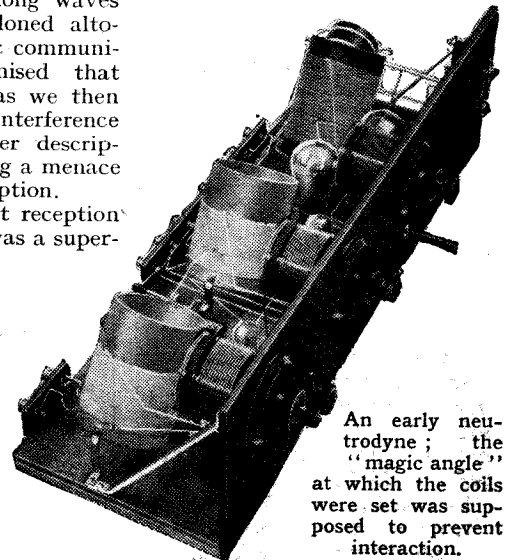
the Daventry long-wave station, replacing the experimental Marconi transmitter at Chelmsford, was an event of the year. About forty European stations were now broadcasting.

Beam transmission for point-to-point services became a practical possibility, with obvious advantages over the wasteful "all-round" radiation still employed. Short-wave directional transmitters were planned before the end of the year, and we questioned editorially whether long waves might not be abandoned altogether for telegraphic communication. We recognised that "machine noises," as we then described electrical interference (was it not a better description?), were becoming a menace to long-distance reception.

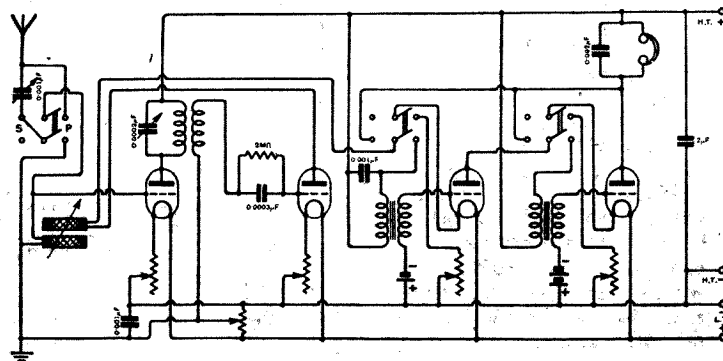
So far as broadcast reception was concerned, this was a super-heterodyne year, that type of receiver being described both constructionally and theoretically in many articles, and also well represented at the annual show. Sets generally were still clumsy enough, often with exposed valves and plug-in coils. We still tolerated "losser" methods of stabilising HF amplifiers, but the neutrodyne system was

on recognising the real importance of innovations, but we must admit that our welcome to the Rice-Kellogg moving coil speaker, which externally was identical with the present almost universal type, was distinctly lukewarm. Our excuse must be that the basic principles were already well known, and in any case we soon made amends by exhaustive treatment of the construction and principles of the instrument that was soon to displace the moving-iron horn speaker of the period; with the notable exception of the Celestion instrument, even the moving-iron cone had hardly made its appearance. Speech amplifiers, previously used rather as a novelty for public-address purposes, now came into general use, and portables became quite common.

Reception of broadcasting was often interrupted by flatly tuned spark transmitters working on 300, 450, and 600 metres. How-



An early neutrodyne; the "magic angle" at which the coils were set was supposed to prevent interaction.

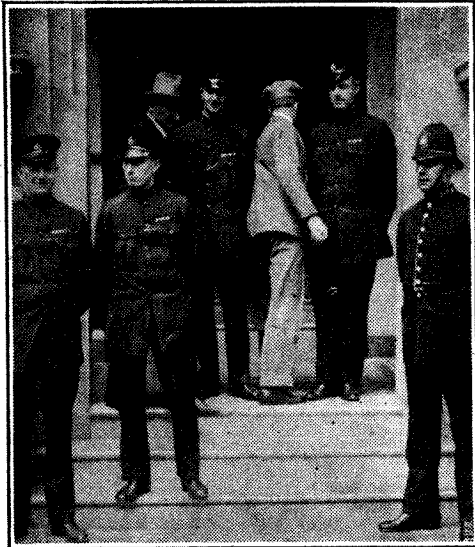


A typical circuit before the days of neutralisation.

ever, hope for future improvements was given by an article by an official of the Post Office.

Cavalcade of Wireless—1926.

Our coil competition, for which readers were invited to submit their efforts for measurement by apparatus specially devised for the purpose, was one of the events leading up to the production by *The Wireless World* of the famous Everyman Four receiver. Another was the classical work of Butterworth on



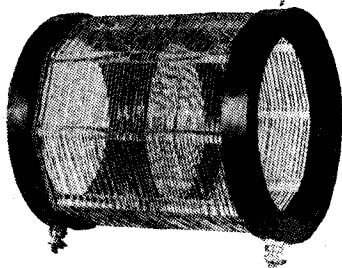
In the past, radio had often derived benefit from the misfortunes of humanity, and the general strike (during which our publication was interrupted for the only time in our history) proved that broadcasting was indeed one of the vital national services, worthy to be fostered as such by the Government. The old B.B.C. came to an end at the close of the year, being succeeded by the present corporation. Its past services were recognised by the conferring of a

B.B.C. headquarters became the nerve-centre of the nation during the General Strike, and were closely guarded.

coil design. In the matter of its bare specification, this set was not unconventional—a neutralised HF stage, anode bend detector, and two LF stages. Its merit lay in the fact that the coils were of outstanding "goodness" and that the efficiency of HF transformation and balancing was assured by correct methods of inter-circuit coupling.

The Everyman Four was demonstrably so vastly superior to the other sets of its time that it at once became the standard by which others were judged. Indeed, its merits were ultimately almost a source of embarrassment to us, for long after the set had been consigned to the decent obscurity of a glass case in the South Kensington Science Museum, there was still an insistent demand for space to be devoted to it and to its derivatives.

In spite of neutralising developments, many of the sets of this year's show still included unstabilised HF amplifiers, there were a few superheterodynes and—a great innovation—an



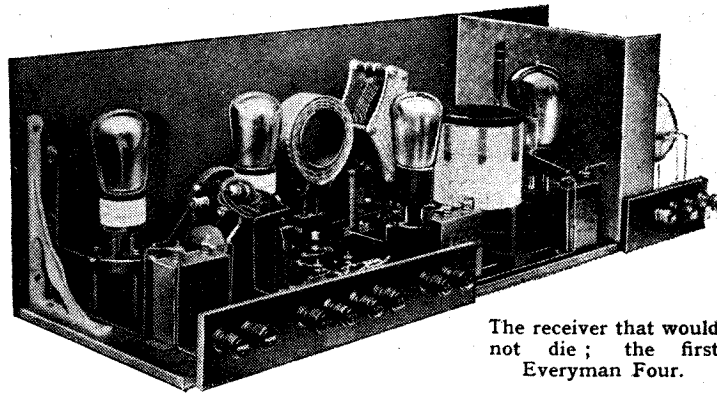
The winning coil: the most efficient of those entered for our competition.

AC mains set (the Gambrell) with 0.06 amp. valve filaments fed from a valve rectifier which also supplied HT. Better valves made practicable the HF-det.-LF 3-valve circuit, which was long to remain a standard arrangement.

In the past, radio had often derived benefit from the misfortunes of humanity, and the general strike (during which our publication was interrupted for the only time in our history) proved that broadcasting was indeed one of the vital national services, worthy to be fostered as such by the Government. The old B.B.C. came to an end at the close of the year, being succeeded by the present corporation. Its past services were recognised by the conferring of a

knighthood on its head, Sir John Reith.

Crystal control for transmitters was coming into use,



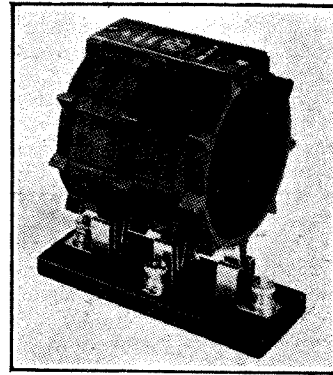
The receiver that would not die; the first Everyman Four.

and photo-electric cells were being produced commercially. Electrical recording was revolutionising the gramophone world, and the technique developed for wireless purposes was responsible for the introduction of talking films. Broadcasting was already bringing some relief to patients in hospitals; the "London" had an installation with 842 pairs of headphones.

At about this time, the Western Electric "Kone" balanced-armature speaker was setting the standard of broadcast reproduction.

1927.

Although the whole world takes the longitude of Greenwich as the prime meridian, it had long been a reproach to British wireless people that there was no service for dispensing the "original and only genuine"



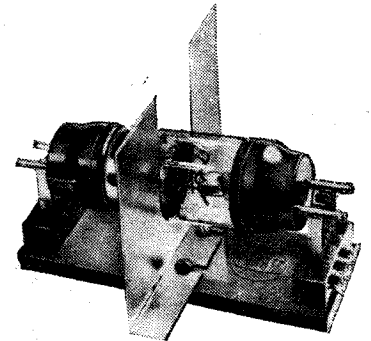
A high-efficiency McMichael coil, of a type becoming popular for neutralised circuits.

Greenwich time to navigators and others. This deficiency was now made good, and we were gratified to record that time signals were to be radiated from Rugby. Other important wireless events were the opening of the African and Australian beam services, the introduction of 100-kilowatt valves, and, in the broadcasting sphere, of the Marconi-Osram indirectly-heated receiving valves.

A still more significant development was the screened grid valve, of which the underlying principles were described at length, although commercial specimens did not become avail-

of broadcast listeners satisfied themselves with neutralised receivers of considerably lower efficiency. Our show report proved that the unstabilised set was almost dead, but there was "still room for improvement, and very few coupling transformers capable of giving a magnification of, at a guess, more than 20 were observed . . . interchangeable coils less popular . . . elaborate arrangements for making the necessary circuit changes for wave-band alterations . . . one or two sets with built-in speakers . . . hardly any superheterodynes."

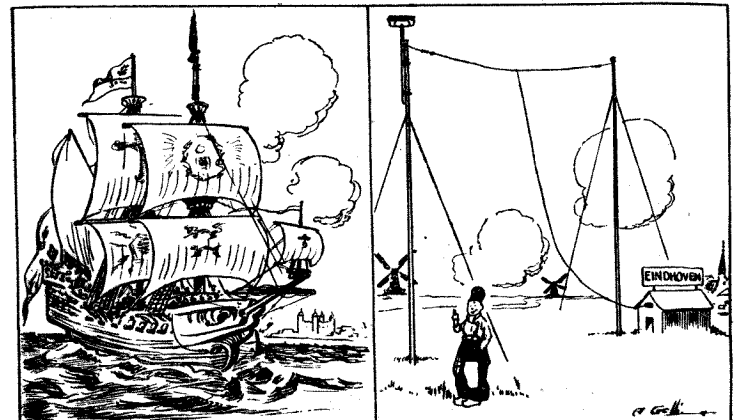
We claimed last year that British broadcasting was firmly established, but there were still a few dissentients. H. G. Wells, for example, said it was a farce, and its decline and eventual fading out was inevitable. However, the B.B.C. struggled on nobly, in particular extending the idea of outside broadcasting to cover the Boat Race and Grand National. Programme exchanges with America were



The first screen grid valve.

not even then new, but were carried out more successfully, thanks to the use of spaced aerials for reception.

The continued success of short-wave telephony led us to advocate a British Empire Broadcasting Service in April. Response from our readers, at home and, in particular, overseas, was immediate, but it was only after a long struggle that the idea was eventually adopted. An experimental service started from 5SW at the end of the year.



Holland leads the way on short waves and, in a spirit of friendly rivalry, emulates Van Tromp by hoisting a broom to the masthead.

Cavalcade of Wireless—1928.

In the preceding year we had drawn attention to the disquieting fact that the frequency characteristics of the theoretically almost perfect LF amplifier (which was now becoming a practical possibility) might be modified adversely by the presence of even a few ohms of resistance in the HT supply system common to the various valves. Fortunately, a prac-

wiring we could get several stages to work satisfactorily. The all-mains set was coming in, and high amplification, particularly at HF, was a craze. To this end, even the SG valve was neutralised.

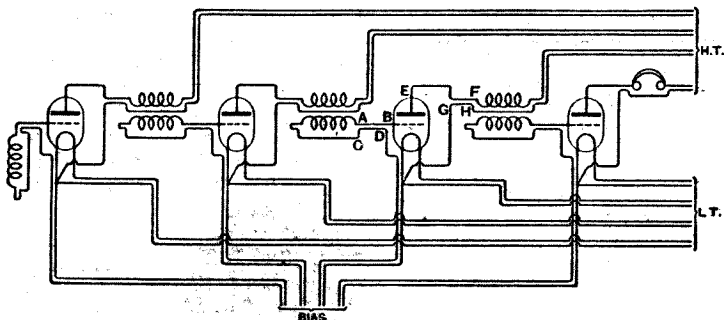
In general wireless technique the hit-or-miss methods of the past were rapidly giving way to scientific procedure. The Physical Society's Show now included many wireless exhibits, and the measured signal

channels as well as on the long waves.

Broadcast set designers had now mastered the practical application of the technical developments introduced during the last year or two, and the commercial set was becoming, not a mere assembly of components but a properly designed unit manufactured in the modern manner. There were still few ganged sets, but edgewise

delays, a start was being made with the regional system; television broadcasts also began.

The moving-coil loud speaker had now become practically the accepted standard for high-



The principles of "scientific wiring" were at last clearly laid down.

ticable cure for this trouble was not long in coming; in an important article published in 1928, we discussed the possibilities of decoupling, as developed in the Ferranti laboratories.

A kindred subject was that of stray coupling through the wiring, particularly in HF circuits. Hitherto the question had been discussed quite vaguely with suggestions about "keeping the grid wires short," and "avoiding straggling anode leads," but the whole matter was now put on a proper basis in an article under the apt title of "Scientific Wiring."

strength of transmitters was being plotted on contour maps—guesswork was giving way to measurement.

The Atlantic was spanned on 10 metres, and the broadcasting of pictures by the Fultograph system became a possibility.

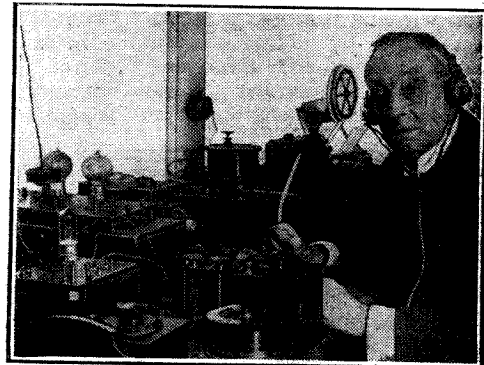
Those hitherto hereditary enemies, the wireless and cable companies, negotiated an amalgamation. The cost of the Transatlantic service was reduced from £15 to £9 per call.

1929.

About this time, a cynic remarked that if the B.B.C. performed no other useful function, it had justified its existence by providing the Englishman with a perpetual topic for grumbling. The campaign of Press criticism of the B.B.C. was now at its height, and every lay journalist short of a topic conducted an attack. Although we have never hesitated to draw attention to

occasional lapses from the path of rectitude by the Corporation, and to make many constructive suggestions that have since been adopted, we did not join in the battle; and, indeed, watched the rout of the critics with some satisfaction, as many of the attacks were quite frivolous.

The working of the new beam stations was now satisfactorily demonstrated, and duplex telephony took place between England and Australia. The busiest overseas telephone service was still the Transatlantic one, now operating on three short-wave

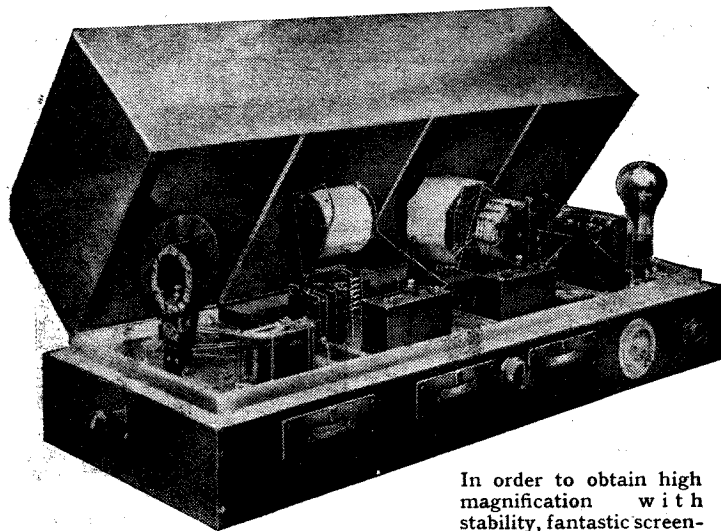


The wireless ruler of the King's Navy: Admiral of the Fleet Sir Henry Jackson, who died in 1929.

tuning drums placed side by side and operated by a single finger made a rather unsatisfactory compromise. Band-pass filters had been introduced, and the fact that a set was mains operated was no longer a matter for comment. DC sets still used battery valves with filaments in series.

quality reproduction, but was still expensive.

The rapid development of the radio art is due in part to the fact that so many of the pioneers were fervent enthusiasts who lived for wireless, turning to it as a hobby with renewed interest after the work-

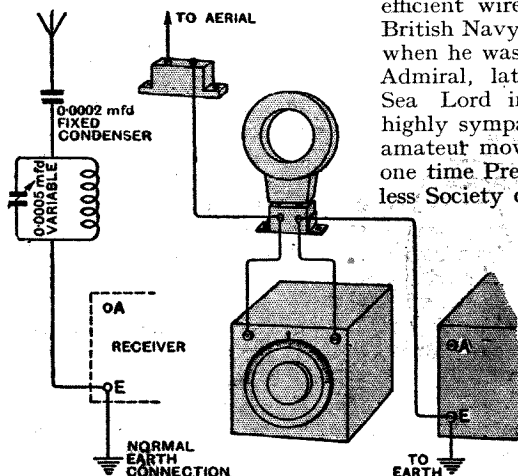


In order to obtain high magnification with stability, fantastic screening was now employed.

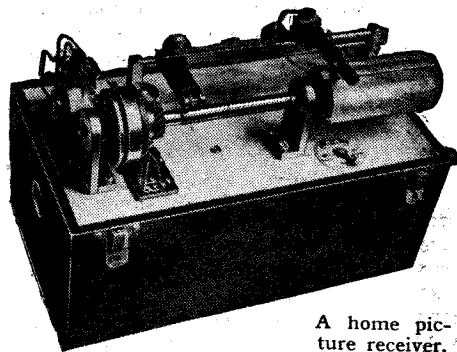
At the end of the year the imminent opening of the twin-wave transmitter at Brookmans Park resulted in frantic efforts to improve the selectivity of existing sets. Thus, after many

ing day was over. One of these enthusiasts was Admiral Sir Henry Jackson, whose death it was our sad task to record this year.

He was responsible for the development of the extremely efficient wireless service of the British Navy from 1896 to 1906, when he was promoted to Rear-Admiral, later becoming First Sea Lord in 1915. He was highly sympathetic towards the amateur movement, and was at one time President of the Wireless Society of London.



Twin-station transmissions begin, and interference becomes the popular bogey. An extemporised two-circuit tuner for improving selectivity.

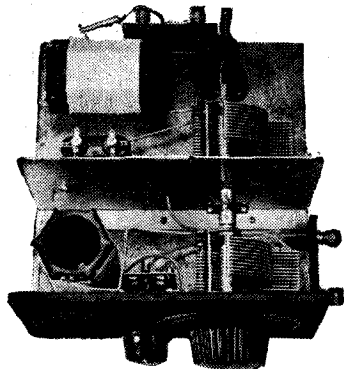


A home picture receiver.

Another landmark in broadcast receiver technique was the practical introduction of the screened-grid valve, which, so far as commercial receivers were concerned, now entirely displaced the neutralised triode. But it was rather disappointing to find that the residual anode-grid capacity of the new valve was quite appreciable, and that the high-efficiency neutralised triode, as developed by *The Wireless World*, was from many points of view more satisfactory; it still remained a favourite with the knowing enthusiast. Thanks to decoupling and scientific

Cavalcade of Wireless—1930.

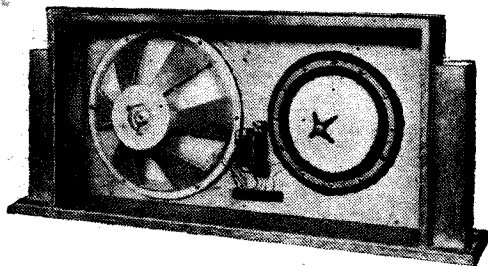
Band-pass tuning, to which so much space was devoted this year, was probably brought about by a serious shortcoming of the screened-grid valve to which attention was now being drawn. This was its susceptibility to cross-modulation, with the consequent need for high selectivity at the input end of the set. The filter was first discussed theoretically and later described as an "add-on" unit; but by the end of the year it had become practically uni-



An early band-pass filter unit.

versal in all sets we described. As a natural corollary, ganged tuning was also becoming universal, even in manufactured sets, although few of them yet included band-pass filters.

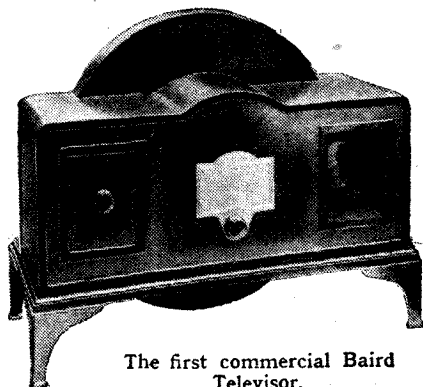
Due to the cross-modulation difficulty, input volume controls were of great importance, and some ingenious compen-



Twin moving-iron speakers.

sating devices were produced to prevent disturbance of tuning. A notable set reviewed during the year was the Murphy portable, which did much to establish the reputation of its makers.

What we now call "high fidelity" became a practical possibility. With collaboration of the B.B.C., the Science Museum authorities took frequency characteristics of their new demonstration set, which



The first commercial Baird Televisor.

showed a response flat within 1 db. from 59-10,000 c/s.

Portable sets were still popular, and a few of them still included that strange survival from the past, the two-stage aperiodic amplifier. Amplifier by courtesy only; we were impelled to "debunk" it at last, and did so most effectively.

Naturally, we still took a parental interest in the very experimental Empire service now being conducted, and were forced to express dissatisfaction with its inadequacy. The Colonial Office now undertook to subscribe towards the cost.

In this, our Jubilee year, it is interesting to remember that in 1930 we recorded two other jubilees—those of the German station Norddeich, and of the first signal measurements made in 1905 with the Duddell galvanometer; investigators measured wavelength in feet in those days.

It was said that the reception of Norddeich "distinguished certain amateurs of the Edwardian period from the lesser members of the tribe, who contented themselves with the comparatively powerful transmission from the Eiffel Tower."

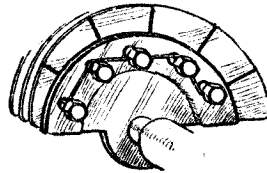
With the increasing numbers of transmitters, control of frequencies was becoming of great importance; much attention

was paid to quartz crystals and other controlling devices. The Stenode Radiostat, based on the principle of extremely sharp tuning (with or without crystal control), and, for telephony reception, subsequent compensating tone correction was responsible for much controversy.

1931.

In spite of the financial and economic crisis, short-wave international communication, both telegraphic and telephonic, made steady progress during this and the preceding year. The Transatlantic service was improved by the provision of secrecy devices, and among the new services opened was one from England to New Zealand, England to Brazil, and between Australia and the Argentine. Many more ships were now being fitted with short-wave apparatus.

In broadcasting there was a marked tendency to increase the power of stations, and we recorded the fact that KDKA was working on 400 kilowatts. The B.B.C. moved into the present Broadcasting House



Should this idea have been dropped? A variable condenser with provision for accurate adjustment of the end-vane segments.

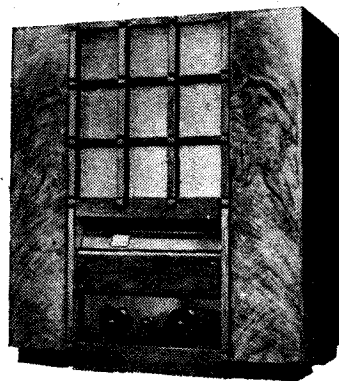
and the North Regional station was opened.

Much work was now being done on television, and we recorded "promising results of recent work in the H.M.V. research laboratory," as well as describing the Farnsworth cathode-ray television system.

Scientific methods of testing and assessing the performance of broadcast receivers now be-

Experimental H.M.V. television transmitter.

came widespread. The variable-mu valve, which had, almost at a stroke, overcome all our difficulties with cross-modulation, was probably the most important innovation of the year. Ganged tuning was now accepted as a matter of course, and, realising that the "potted" coil was now inevitable, we commissioned a special investigation of its design. With regard to circuit arrangements, "straight v. super" now became the

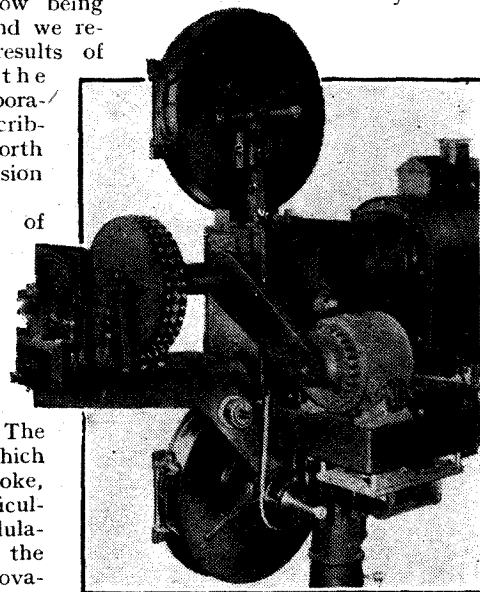


A Murphy set which exerted a great influence on cabinet design

issue; the straight set, now with band-pass tuning, maintained numerical ascendancy, but interest began to pass to the superhet. External refinements such as station calibration and wavelength calibration began to appear, and there was a re-

vival of interest in detection; operation of the grid detector from the point of view of quality was at last correctly analysed. There was also a revival of interest in the diode. Moving-iron loud speakers were no longer used except for cheapness.

In writing of loud-speaker progress, we said "This is undoubtedly a 'moving-coil' year. Of the numerous methods of converting electrical into sound energy which have been adopted in the construction of loud-speakers, the moving-coil principle has so far yielded the most satisfactory results. Its claim to superiority has been established now for some years, but hitherto its general adoption has been delayed on



account of cost. Further, the early designs were of comparatively large size, and required a power amplifying equipment beyond the means of the majority of wireless enthusiasts. The current crop of 'midget' moving coils are not only reasonable in price, but will also work well at a much lower level of volume. In actual fact, the 'threshold' level, below which the reproduction loses the lower register and sounds thin and harsh, has been lowered by careful design from 1 watt into the region of 300-500 milliwatts.

"The compact, self-contained, all-mains receiver is primarily responsible for the demand which has hastened the development of the midget moving-coil loud speaker. Consequently we find that a considerable proportion of these instruments are fitted with mains-energised field magnets."

With the increasing growth of broadcasting and the more sensitive receivers in use everywhere, the question of electrical interference became a pressing one, and systematic tracing of its source had begun in Germany, America and elsewhere.

Cavalcade of Wireless—1932.

Although experimental Empire broadcasting had been in operation for some time, it was not until the end of this, our "coming-of-age" year, that the official service for which we had striven so long, was at last opened.

In spite of the fact that broadcasting has done so much to

control of its tuning began to assume importance; these and kindred matters we investigated in our pages. Cathode-ray tubes were now becoming available through ordinary commercial sources and their use was extended.

The arrival of the first specimen iron-cored coils from Germany caused quite a flutter in our laboratory, as it did not take long to find out that a "vest-pocket" coil with the new core material was at least the equal of our unwieldy standard air-core windings.

By a natural process of evolu-

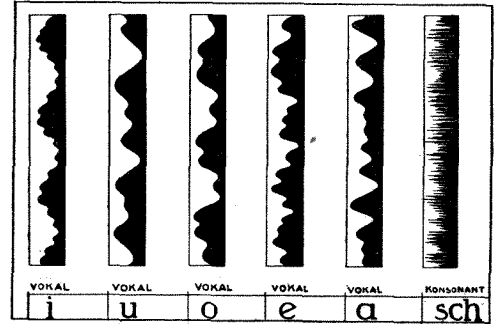
out, and constructive suggestions, many emanating from readers, were published. Perhaps we had ignored this matter a little too long; the typical wireless set had already taken definite shape in the public mind, and inherent conservatism prevented any strenuous efforts to devise anything more practical.

So far as technical receiver design was concerned, progress was chiefly in the direction of devising quiescent battery-

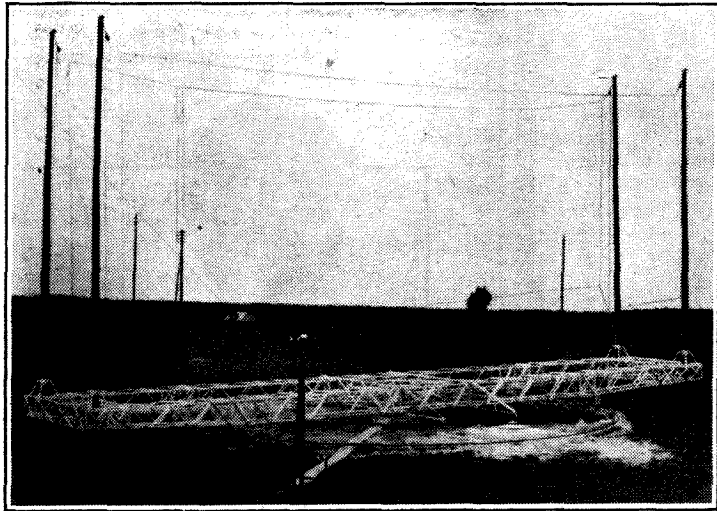
not found its way into many British commercial sets.

The Midget set, so popular in America, was introduced here, but, rather to our relief, had but a limited vogue.

Disquieting possibilities were opened up by the operation, apparently unchecked, of the



Synthetic sound records produced by Rudolf Pfenninger, whom we described as the "Walt Disney of acoustics."



For communicating with ships in all the oceans; rotating beam aerial at Portishead.

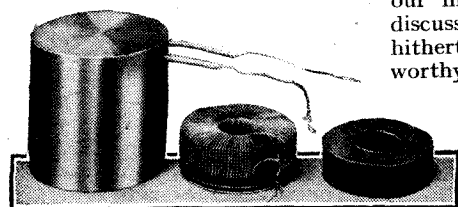
make the public "electrically minded," many electricity supply concerns still adopted a distinctly unfriendly attitude towards the home receiver, and we were often impelled to take up the cudgels on behalf of listeners against galling and often illegal impositions. Several such cases arose this year, and even a water supply company tried to prevent earthing of sets to its mains!

tion, the wired and wireless telephones were now being combined, and a good instance of this practice was the 5-metre wireless link across the Bristol Channel.

For broadcast reception, the superhet was still gaining ground. Ganging was universal, even in cheap sets, and all coils were "potted." We published the first description of a "universal" mains set using high-voltage valves, and also recorded the introduction of commercial dual compensated speakers.

1933.

Broadcast receiver design had now reached a state, not of finality, but certainly of some stability, and it is noticeable that for almost the first time in our history we found time to discuss non-essential matters hitherto considered almost unworthy of treatment. Illegibility of tuning scales was con-



The first Ferrocarril coils.

paign was now being actively conducted.

Due to the rise of the superheterodyne, problems arising from the particular forms of interference to which it is subject and also with regard to the gang-

demned, and it began to be questioned whether the general outward form of the broadcast receiver could not be improved upon. The awkwardness of many sets, and in particular of the radio-gramophone, was pointed

economy systems for reducing wastage of HT current. The popularising of AVC resulted in an extended use of diode detection, and the Westinghouse Westector, used for the same purpose, made an opportune appearance.

Speaking of the latest type of set, the so-called "small superhet," we said "the term superheterodyne has been associated for so many years with large and ambitious types of receiver that it comes as something of a shock to find the term applied to receivers that are much smaller than many of the straight sets of the past. The superheterodyne can no longer be called a luxury receiver." At this time the HF pentode was in use as a fre-

unlicensed Luxembourg station, and we expressed the fear that "broadcasting in Europe is no longer governed by a consideration of service to the listener as it once was; it has become a political tool." We drew attention to the danger of international friction caused by wireless propaganda.

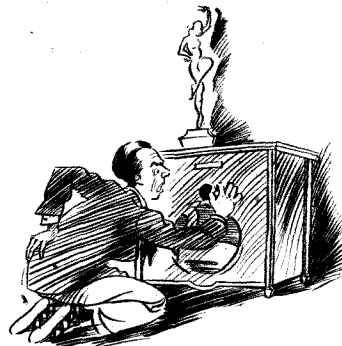
Calibrated oscillators and other aids to precise measurement began to become generally available to all wireless workers, and not only to research laboratories.

Further links in the chain of Empire communication were forged, and all the telephone services were now controlled through the Faraday Building exchange. The Air Ministry opened a micro-wave service across the Channel on 17 1/2 cm.

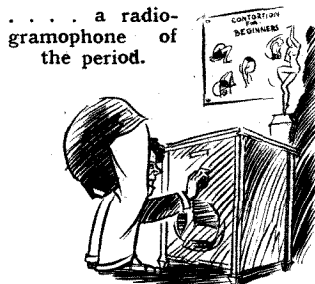
As the result of a suggestion made in The Wireless World, the G.P.O. authorities made arrangements whereby those suffering from electrical interference could obtain questionnaire forms from all Head Post Offices—a much simpler procedure than that hitherto in force. The technical aspects of interference suppression were receiving much attention in our pages at this time, and the Post Office Engineering Department was busily engaged on the subject at its newly-opened research station at Dollis Hill.

Car radio sets appeared as a novelty at the Motor Show. . . Five-metre amateur transmissions from Snowdon were heard at a distance of 200 miles. . . We congratulated the B.B.C. on linking West Regional and Brookmans Park on a common wavelength.

Though it was generally considered to be amusing rather than epoch making, the work of Rudolf Pfenninger, who laboriously prepared "synthetic sound" records by hand, may yet have an influence on the use of broadcasting as a means of artistic expression.



Perhaps our artist rather exaggerated the difficulty of operating . . .



frequency-changer, but many sets still had a separate oscillator. The modern type of electron-coupled frequency-changer had already appeared, though it had

Cavalcade of Wireless—1934.

To the ordinary man in the street, the virtual shrinkage of the world through the speeding-up of all means of communication was forcibly brought home by the England-Australia air race. Although wireless played no especially prominent part in the contest, it was used with really dramatic effect in transmitting back a news-reel film of the winner's arrival in Melbourne. Transmissions of the film, which comprised only a few frames, was reputed to have cost £6,240. Week-end telephone calls to South Africa, India, and Australia could now be had at the reduced cost of £1 per minute. Once more

"The Leader speaks." The modern method of appealing to crowd psychology.



wireless came to the help of the seafarer with a collision preventer (a form of visual-indicating direction finder) which was demonstrated by the Radio Research Board.

It would appear that difficulties in finding a definition of permissible interference intensity proved an almost unsurmountable barrier to the reaching of conclusions by the I.E.E. Committee on Electrical Interference. We expressed the opinion that, as an interim measure, something might be done on empirical lines. Nothing seems to have been heard of the Committee for some time; we can only assume that it (or at any rate, such members as still survive) are still sitting.

The small 3- or 4-valve superheterodyne was now established as the standard British

"Westector." Universal mains sets, with the new type of indirectly heated valve, had satisfactorily solved the problem of the listener on D.C. mains, especially if he anticipated a change to A.C. Variable selectivity, now almost essential if the conflicting requirements of long range and high-quality reception were to be reconciled, was discussed in our pages, and appeared in a few commercial sets. High-note and multiple speakers (including the piezo-electric type) were coming into common use.

With regard to LF amplification, we draw near to the present day, as *The Wireless World* Quality Amplifier, with its push-pull resistance-coupled circuit, was introduced; this arrangement is still accepted as a standard.

It was estimated that, in the short space of a dozen years, the European broadcast audience had risen to the almost astronomical figure of 70 millions.

1935. Commenting on broadcast receiver design, we described 1935 as a year of refinement rather than of innovation. Variable selectivity, last year reserved for the Rolls-Royce class of set, now became common, and all-wave sets were regular articles of commerce. We welcomed the introduction of many specialised receivers, such as real

the now-established Empire Christmas Party.

Although technical progress was not so rapid as in some previous years, there were no signs that finality had been reached in any branch of our art, although many of the developments are too recent to be considered in true perspective. Of these, the most promising are the Electron Multiplier, and Armstrong's system of frequency modulation, both of which promise a reduction of background noise.

Increasing power of domestic sets brought the "loud-speaker nuisance" into the limelight, and some constructive suggestions for abating it were given in an article on reducing sound transmission from house to house.

Publication of the Television Committee's report was generally welcomed. The standard of definition was almost unexpectedly high, but we found cause for regret that a firmer stand had not been taken on the question of patents. The country still waits, of course, for the findings of the Committee to be put into effect.

It has often been a matter of

means of communication was entirely beneficial to humanity, although some recent events had given rise to disturbing thoughts. As *The Times* said,



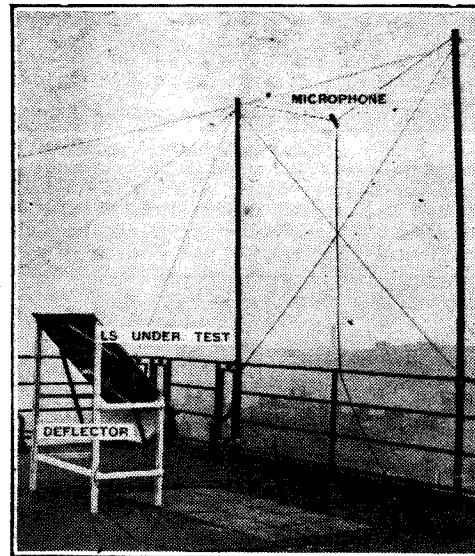
Broadcasting direct from the seat of war became an incentive to short-wave listening.

"There are few inventions which have so much to be said for them, so little against, as wireless telephony . . . who would suspend Hertz by one of the antennae to which his brilliant investigations have led?

A rose without a thorn, ointment without a fly. . . ."

But at this point the mind of *The Times* leader writer was clearly assailed by doubts, for he went on to express the opinion that these eulogistic metaphors were perhaps "not wholly appropriate, for broadcasting can be made an instrument of diabolical propa

"The Wireless World" was the first journal to prepare and publish loud-speaker response curves.



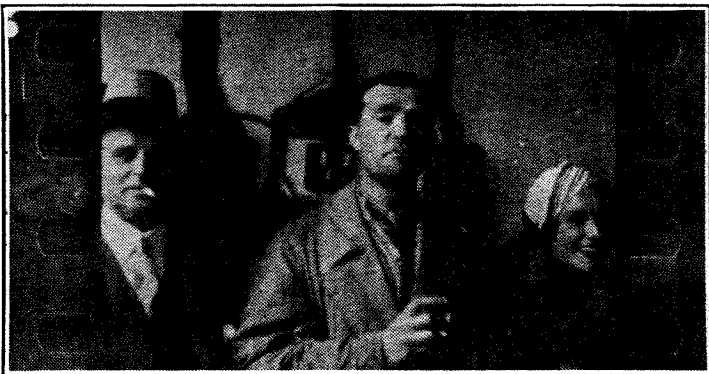
regret to us that Empire broadcasting, in relation to which we stand very much *in loco parentis*, should be so generally received in the British Dominions and possessions on foreign-built sets. From time to time, constructive suggestions for remedying this state of affairs have been put forward for the attention of British wireless manufacturers.

Developments in short-wave technique led us to enquire whether the Post Office might now grant licences more freely for telephonic transmission and reception on the 5-metre band.

Almost up to this time we wireless people had always been encouraged in our work by the comforting thought that the new

ganda." Without enquiring into the rights and wrongs of the aims propagated, it is certain that the historian of our generation will have much to say on the successful exploitation of mob psychology by wireless and the speech amplifier. But we can take courage for the future in the thought that the technical developments in which we have played our humble part can certainly be used as readily for propagating good as for evil.

Even if we ignore the blessings of broadcasting, which has brought a wider outlook and fuller life to millions, wireless has surely justified itself, first by increasing the safety of life at sea, and later by aiding air navigation to an even greater extent.



Scott reaches Melbourne: a frame from the news film transmitted to London by picture telegraphy.

receiver, and there was a distinct revival of interest in battery sets, due to the recently introduced "economy" devices—QPP, Class "B" and the

portables and sets for reception of schools broadcasting.

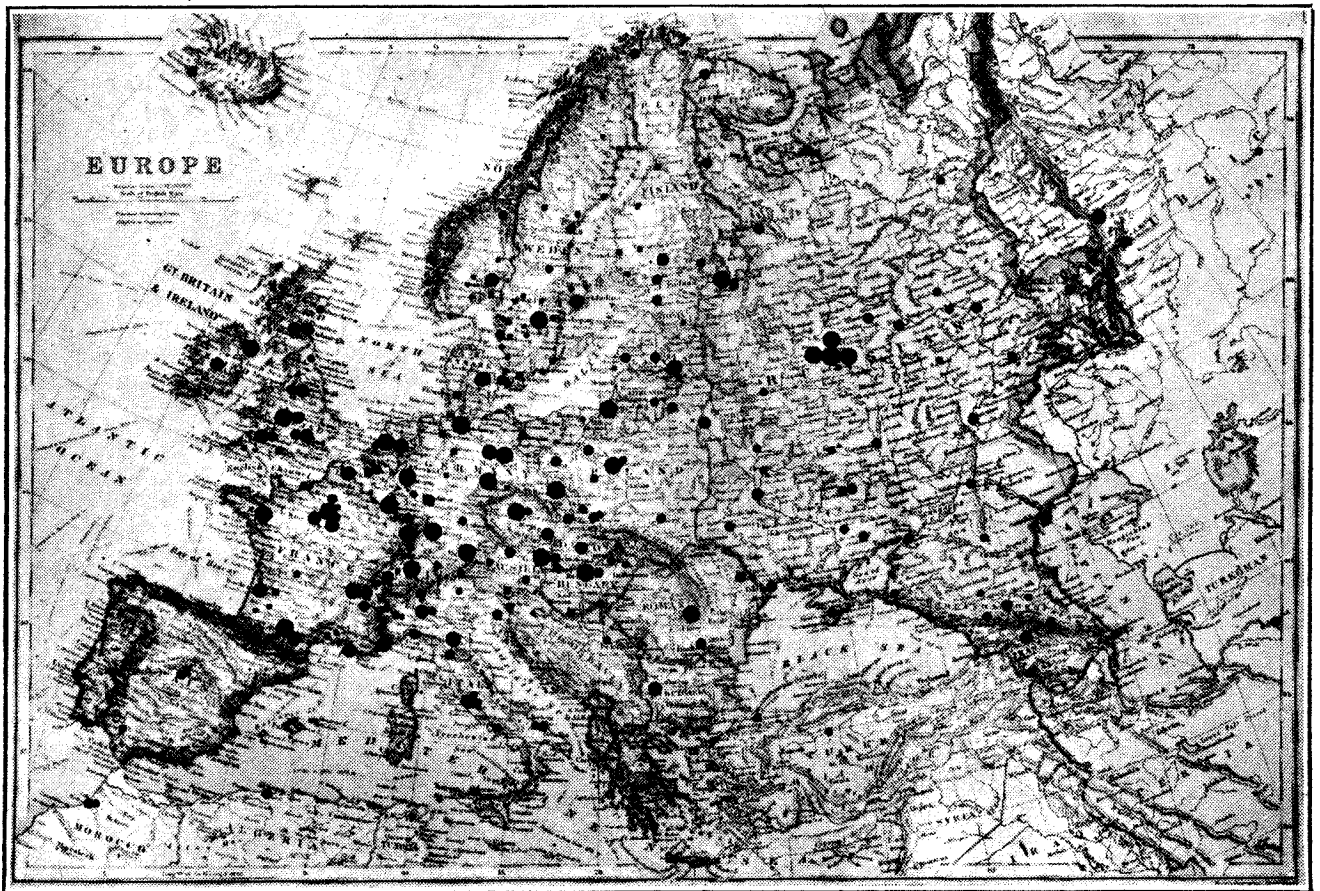
Outstanding broadcasts of the year included King George's Jubilee message, as well as

GROWTH OF BROADCASTING IN EUROPE 1923-1936

[Maps reproduced by courtesy of G. W. Bacon and Co., Ltd.]



In these two maps an attempt has been made to indicate how broadcasting stations have grown in number and in power since the early days of 1923. At that time there were six transmitters working regularly in England, though of only low power, and two on the Continent. The map reproduced below shows, by contrast, how stations have now appeared all over Europe with great increase in power indicated by the increase in the size of the black spots. The sizes of spots are approximately proportional to power. Only stations on the normal broadcast bands (medium and long) are indicated. The number to-day would be still greater if short-wave transmitters were included.



BROADCAST BREVITIES

By Our
Special
Correspondent

A Television Film

SCENES have already been "shot" for a B.B.C. film which is to tell the British Isles all about high definition television, and why.

Up at the Alexandra Palace the cameras have already captured the early stages of construction, so that the television film will be historic as well as topical in a few months' time.

A "Look-In" for Everyone

When everyone, from Cornwall to Caithness, has seen the film, it will not be possible for the provinces to say that they have "not had a look-in." The film will take us behind the scenes in a manner which will enable anyone who has seen it to say that he knows something about television.

I believe that a surprisingly small percentage of the ordinary public can make such a claim today; indeed, there is still a lingering minority who fancy that television will make it possible to look through 6ft. concrete walls, to the discomfort of those on the other side.

A Great Tour

IF vociferous applause is a safe guide, the B.B.C. Symphony Orchestra had a triumphal tour last week. In the relays from Paris, Zurich, Vienna and Budapest one could detect the note of genuine gratitude and admiration in the rounds of clapping in the various halls. Very graciously the foreign hosts seem to reserve their biggest ovations for the works of British composers.

"Carps." as Guide

Vice-Admiral Sir Charles Carpendale, Deputy-Director-General of the B.B.C., accompanied the orchestra on its tour in the rôle of semi-official ambassador or guide. Sir Charles is famous in Continental broadcasting circles for his long service as President of the International Broadcasting Union. He speaks French "like a native."

The New Opera Director

STANFORD ROBINSON is to fill the new B.B.C. post of Musical Director for Opera, and the appointment will be a popular one, for no one has done more than he in the development of chorus and general ensemble work at the microphone.

More Money for Opera?

While on the subject of opera, it is worth remembering that within the next few months the B.B.C. must consider what financial contribution it shall make to broadcast opera. Under the terms of the supplementary Charter the grant of £17,500 to be devoted to opera comes to an end this year, the last payment being made in October.

It is unlikely to be renewed. If and when the B.B.C. receives 75 per cent of the licence fees, as recommended by the Ullswater Committee, there should be ample funds available to provide opera with at least £20,000 annually.

Following the Plot

Operatic broadcasts are undoubtedly popular, but I think they would gain in interest if the B.B.C. were once again to issue printed libretti in advance of each performance. The intricate and sordid plots of opera are difficult enough to follow in the theatre; when the uninitiated listener must rely purely on the music and the doubtful German or Italian of the singers, he may be forgiven for questioning his own sanity and/or that of the B.B.C.

What of Keyhaven?

AFTER a long spell of wandering in the Isle of Wight and Hampshire generally, the B.B.C.'s mobile transmitter seems to have made a semi-permanent home for itself in a field

off New Lane, Keyhaven. Two 70ft. masts support the aerial.

The travelling equipment includes a mobile receiving van in addition to the transmitter van, and the former roams the country taking field strength measurements.

"Free and Easy"

It is a pity television is not already here to show you some of the scenes I witness during my visits to Broadcasting House. During "Eight Bells," Mr. Mungo Dewart's delightful programme of naval life the other night, the entire orchestra decked themselves out in natty white sailor hats, and the male chorus who sang rollicking sea songs sat on the studio floor similarly adorned.

The final nautical touch was given when the producer, Harry Pepper, "walked aboard" wearing a sea captain's hat with a white top and a gold anchor on the front, worn at a rakish angle. All of which was quite unknown to listeners, but it did help to create that "free and easy" atmosphere, and was great fun for those in the studio.

More High Spirits

Another exhibition of high spirits in the studio was during the recent "Pages from the Scrapbooks" programme, in which Miss Gwendoline Brogden sang that famous song, "I'll Make a Man of You," which Herman Finck wrote for her in the "Passing Show" revue of

1914. Miss Brogden is one of those charmed people who never grow a day older, and as she stood before the microphone singing that breezy song with all the energy and zest of her revue days, the orchestra caught her exuberant spirit.

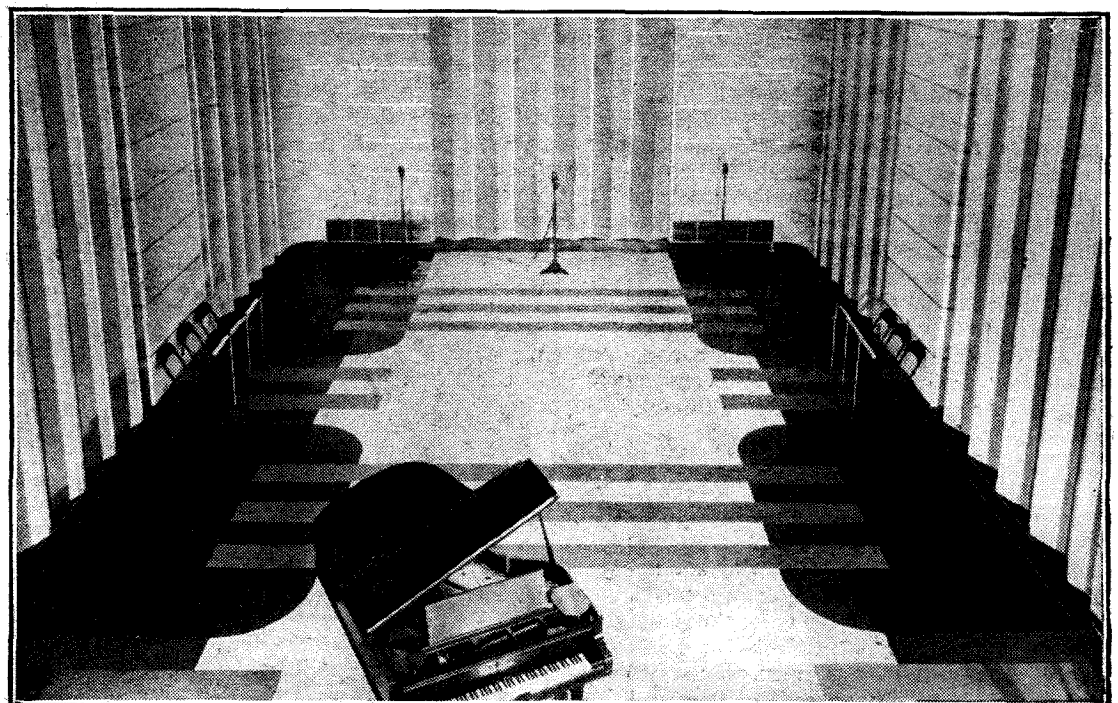
Glee in the Studio

First Mr. Montague Brearley, the leader of the Theatre Orchestra, stood up and played like a fiddler playing an Irish jig, bending up and down and bowing around to everyone in the studio; then, as he sat down, one after the other of the orchestra bobbed up and similarly fiddled with high glee. There were grins on every face. It's my opinion that when the people at the broadcasting end are enjoying themselves in that way, the people at the listening end also catch something of their high spirit.

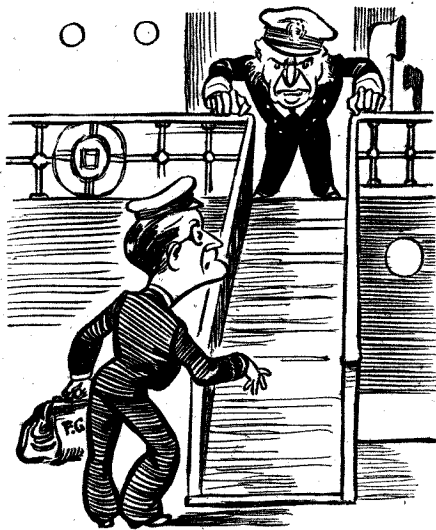
"Turn the Page"

MY eight-year-old son raises a question which, in these days of severe national Budgets, is worthy of consideration. "Why," he asks, "does the Editor of the B.B.C.'s 'Saturday Magazine' print it on one side of the paper only? I know it's on one side of the paper only because the announcer always 'turns the page' from one to two, from two to three, from three to four, and so on."

Can you laugh that one off, Mr. A. W. Hanson?



STEEL-WALLED STUDIO. In an effort to perfect the acoustic properties of their main studio, the Philadelphia short-wave station WCAU have had the walls made with perforated steel sheets backed up with a sound-absorbing material.



THOSE of you who have been reading this journal since 1911 and, like Mr. Micawber, still hope for what will turn up next week, will probably recollect that the month of March in that year was noteworthy for the exceptional inclemency of the weather. I was suffering from a severe cold and was, as a matter of fact, immersed in a mustard bath and active preparations for the forthcoming Coronation when I received the deputation sent to invite me to occupy the editorial chair of a new journal then about to be published. This journal was intended to deal with matters appertaining to wireless, then a comparative novelty and not taken very seriously. It was an everlasting loss to the radio industry that my other public commitments prevented me from accepting the offer, which thus passed into other hands.

At that time wireless was used mainly, although by no means exclusively, for marine communication, where, of course, it had no cable rivals. Press messages were looked forward to with the utmost eagerness by everybody on board, both passengers and crew. Strange as it may seem, this very fact was fated to be the chrysalis from which grew something which was destined completely to revolutionise our habits of life and our mental outlook generally. I refer to the mighty influence of what is known as the popular Press which so skilfully dishes up for us each day exactly the kind of news most pleasing to our palates and which puts points of view before us in such a commendably skilful manner that even the wisest of us are convinced that we thought of them ourselves.

The Empty Pad

As many of my older readers know, the main source of Press messages at sea before the century passed out of its teens, was the old Marconi long-wave station at Poldhu in Cornwall. This beloved old spark transmitter was accustomed to churn out its nightly records of love and crime, to say nothing of Stock Exchange prices, round about the midnight hour, and could be picked up by ships many

Free Grid Lo

hundreds of miles below the horizon, provided that atmospherics were reasonably moderate.

Unfortunately, however, the low, musical note of the transmitter, coupled with the rhythmic rolling of the ship, had a soothing and soporific influence on the lonely ship's operator sitting at his post of duty, with the result that he was often awoken by his relief to find his writing pad empty and nothing to relieve the deathly silence of the etheric void save a few derisive crackles of atmospherics.

Now, the fact that necessity is the mother of invention has been observed *ad nauseam*, but it is so true in this particular instance that I cannot refrain from repeating it. Any medical man among my readers who has had anything to do with testing the blood pressure of the average ship's captain will not need reminding that the risk of apoplexy is an ever-present danger that threatens him when anything disturbs the even tenor of his way, such as the loss of his breakfast-time Press news, to which all ships' captains showed a strange predilection in the early days of wireless.

Saving His Bacon

Now, it so happened that those ships' wireless operators who began their careers in cargo boats—and their name was legion—not infrequently had to fulfil also the unofficial role of ship's doctor, and one morning when there was no Press for breakfast, it was brought home very forcibly to one of these gentry what a grave risk this state of affairs caused to the captain's health, if not to his life itself, as well as to that of the people immediately surrounding him, a risk which in future would have to be avoided at all costs.

Consequently, on the following night, having once more fallen into the arms of

Morpheus, it was with the noble purpose of saving life that his pen commenced to move spontaneously over the arid wastes of blank paper before him, until it was filled with the customary vapourings of our great politicians, to say nothing of vivid and soul-stirring accounts of one of the perennial revolutions of Latin-America. Pepper and salt in the form of suitable sophisms from one of our learned judges were added to flavour the journalistic dish, while a little spice from the Breach of Promise Courts was not forgotten. The result was, of course, that not only was the cutting-short of the captain's life prevented and the passengers preserved from disappointment, but the operator was able to eat a hearty breakfast, his bacon having definitely been saved.

Now, it need hardly be said that the news of this noble example of sheer devotion to duty quickly spread from point to point, and, like all great things, it had many imitators. Eventually the whole



"The unrivalled news service which we enjoy to-day."

affair came to the ears of a great Press magnate, who happened to be journeying across the Atlantic. With his customary acumen he immediately sent the whole of the staff of his great dailies and weeklies to sea as wireless operators, with the result that they were all thrown on their own resources and no longer spoon-fed by the great news-getting agencies.

Telling the Tale

These marine-trained newsmen became so famous for their efforts that a saying, "Tell it to the marines," came into current use as indicating that some item of news is beyond the limit of credulity of the ordinary man in the street unless it were first licked into shape by one of these professional men.

Eventually it occurred to somebody to eliminate the course of sea training altogether. Nevertheless, the mighty influence of the popular Press and the unrivalled news service which we enjoy to-day is solely of marine origin as I have related, and this is why sailors are proverbially but wrongfully supposed to be highly successful weavers of tall stories.

When broadcasting first began wireless



"Soothing and soporific influence."

ooks Back

1911 AND ALL THAT



manufacturing firms sprang up overnight while local plumbers wired hastily to their foreign agents for supplies of engineering degrees and diplomas for themselves and their assistants. Bankrupt and dying industries such as that of hairpin manufacturing were at once rejuvenated by the demand for wireless parts, the hairpin manufacturers, of course, hastily turning their wares into iron-cores for "hedgehog" transformers.

Passenger Valves

After the first wild demand for radio gear had passed there followed something in the nature of a slump, and certain manufacturers, alarmed at the falling off in their incomes, at once went into a huddle to see what could be done about it, and the result was the birth of our old friend the passenger valve—or HF valve as it was optimistically called—which persisted for several years, the real work of amplification being done by that stalwart stand-by which we call reaction.

These passenger valves contributed little or nothing in the way of true HF amplification, partly because of the inefficiency of the valves themselves, but chiefly because the careless layout of the set and associated wiring caused the HF energy to emulate the birds in spring and hop lightly from twig to twig. Fortunately, this twig-hopping business resulted in instability, and thus gave sensitivity by virtue of a sort of automatic reaction effect.

Now laziness has ever been the mother of progress, and it was this great fact which led to the next important development of receiver design. At that time the portable gramophone was very popular, more especially on the river during the summer, where its raucous roaring was wont to disturb the peace of a perfect summer evening. Unfortunately, this device required winding up every few minutes, whereas a wireless set can drool on for days without attention, as it does in the house next door. What was more natural, then, than the development of the portable wireless set, which, with its good old two passengers, detector and two LF stages, formed the mainstay of the

wireless industry for several years. However, even I must be just and grudgingly admit that at least one manufacturer had the saving grace to put out a passengerless portable, the performance of which set an example to the whole trade and is still a household word even in these days of monotonous excellence.

The weight of many so-called portables was, however, so gargantuan that they became only suitable for the "strong, silent man with a jaw of chilled steel" so beloved of our lady novelists. It is an ill wind which blows nobody any good, however, and Harley Street heart specialists reaped a fortune as a result of the marketing of the "Perspiration Five," the "Picnic Four," and such-like sets.

At one time I thought of starting an action for fraudulent misrepresentation against the manufacturer of one particular monstrosity who had the nerve to apply the word portable to his products. However, I was prevented doing so by looking up the word "portable" in the dictionary where I found that it meant "anything that may be carried." With regard to the method by which the carrying was to be done the dictionary emulated the example of many home-constructed sets of the period and was silent. Some makers had the grace to designate their heavier models by the word "transportable," which was a singularly appropriate expression, since one of the meanings attributed to transport by the dictionary is "to carry away with strong emotion," which I well remember doing with many of these horrors.

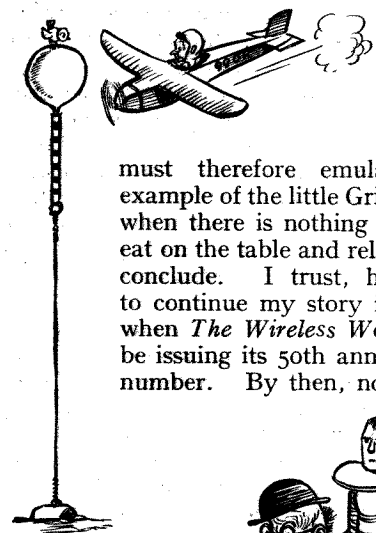
Portables and Pneumonia

For a long time portables were used as the principal household receiver, although when intended for the latter purpose they were usually heavier and more expensive than ever, and frequently had the refinement of grid bias added, and my evenings were, I recollect, frequently spoiled in those days by the sound of "Yes, sir, that's my baby," bawled from the loud speaker of "Messrs. So-and-So's 'Port-deluxe' Receiver, price sixty guineas, grid bias 2s. 6d. extra," as the advertisements termed it. Out in the country and on the river things were little better, the tinny tintinnabulations of these mediæval musical boxes being well in evidence, although it must be confessed that they frequently proved themselves of hygienic value among bathing parties, where the well-modulated tones of the 5XX announcer in the dressing tent frequently nipped pneumonia in the bud by bringing a warm blush to the skin of the members of the less radio-active sex.

After a thoroughly good innings the popularity of this type of receiver began to wane, and there came in its stead a strong demand for receivers having milliammeters stuck in the plate circuit of the output valve. It must be confessed, however, that many dealers, even those who were graduates and fellows of the great universities and engineering institutes overseas, failed to appreciate their purpose, for it was no uncommon sight to walk into the shop of some engineer-cum-plumber to find him pointing out proudly to his customers how merrily the needle of the plate current milliammeter danced and pirouetted under the influence of the B.B.C. programmes. At this time, also, manufacturers began to advertise that the components in their receivers had been tested by being boiled in oil, although it would have benefited their customers more if certain manufacturers themselves had been so treated.

25 Years Hence

This, of course, brings us to the great modern era of peace and plenty concerning which the less said the better, and I



For the
Souvenir
Number of
1961

must therefore emulate the example of the little Grid Leaks when there is nothing more to eat on the table and reluctantly conclude. I trust, however, to continue my story in 1961, when *The Wireless World* will be issuing its 50th anniversary number. By then, no doubt,

we shall have Belisha Beacons for the control of traffic up aloft. It is even possible, but scarcely probable, I think, that the B.B.C. will, by that time, have commenced its experimental television transmissions from the Alexandra Palace.

On the Short Waves

Notes from a Listener's Log

DURING the period covered in these notes, that is from Wednesday, April 8th, until Tuesday, April 21st, conditions seem to have become progressively poorer, although there seemed to be some signs of increasing sunspot activity round about April 18th.

Cloudy conditions during the last few days of the period, however, prevented any solar observations in London, at least so far as my colleagues and I were concerned, but judging purely from short-wave conditions now prevailing I should say that visible sunspot activity is nil, or at least very small; a check on April 22nd showed one spot and a very small faint group only. On the other hand, Abinger reports several well-marked magnetic disturbances during the early mornings of April 18th, 19th and 20th.

It is very interesting to note that, whilst the North American signals have been the most reduced in power, W3XAL on 16.87 metres having very noticeably deteriorated during the evenings, stations lying to the south-west of us, notably the Chilean telegraph transmitter CEA, 17.17 metres, at Santiago, have remained unaffected.

This discrimination in susceptibility to short-wave conditions was also well marked in the case of the Dellinger fade-out on April 14th, when signals from New York were most affected, and those from Montreal slightly less than those from New York. Rio de Janeiro, Buenos Aires, Madrid and Cairo were affected to a lesser degree, and Bombay and Sydney slightly, whilst signals from Shanghai were not affected at all.

Among the other interesting items this month is the news that TG1X, Guatemala, is proposing to start operation on 11 metres about the beginning of May, also the news of the trials of the Australian motor vessel "Kanimbla," the first ship to carry a licensed broadcasting transmitter on board.

The M.V. "Kanimbla" will operate on 25.62 and 49.8 metres, using the call sign VK9MI, and should prove quite a catch for the dx enthusiast. The normal call sign of the ship is VLFS. The broadcasting arrangements on board will be in charge of Miss Foley, who will also act as announcer.

Five-metre Activity

Interest in the possibilities of 5-metre work seems to be growing apace, and now the half-wave of G2NM's 10-metre transmitter has definitely been heard in the U.S. Incidentally, G2MV still maintains that he heard W2JN on 5 metres, as previously reported in these notes, though he does not, of course, claim to have worked the U.S.A. on 5 metres. G2MV's claim in respect of reception of W2JN is, I understand, being investigated by interested parties in America. Unfortunately, reception was not good enough to permit his reading the call of the station with whom W2JN was in contact, possibly, as in the case of G2NM, on 10 metres.

Reviewing ultra-short conditions during the past six months one would be inclined to say that Prof. Appleton is right, and that the highest daylight ionisation levels occur during the winter and equinoxes, for there is little doubt that reception on 10 metres and below was very good from November, 1935, until March of this year. On the other

hand, sunspot activity was much more marked during this period than it has been recently, and it will be very interesting to see what happens this summer if we experience, as we should soon, a considerable increase in activity. Will it be sufficient to counteract the apparent reduction in F layer ionisation which occurs in summer owing to the heating-up and consequent expansion of this layer?

Turning now to our review of the past fortnight, we note that in spite of the 54-day fade-out on April 8th between 4.46 p.m. and 5.06 p.m., conditions during the evening were very good, and W8XK on 19.72 metres was a local station signal, with W3XAL on 16.87 metres very good at closedown, i.e., 10 p.m. G.M.T.

Conditions were again very good on Thursday evening, and W8XK on 19.72 metres was performing well. It was also noted with interest that the Bandoeng telegraph transmitter, PLF, on 16.8 metres was R9+ at 8.10 p.m. G.M.T., and that PPX, Rio, on 14.48 metres, another interesting Morse signal, was still R9 at 9.10 p.m. G.M.T. Interesting news reports were received from W1XAL on 25.45 metres at 10.40 p.m., the station signing off at 11 p.m.

Japanese Reception

Conditions still remained good on Good Friday, and at 7.45 p.m. strong signals were obtained from JVM Nazaki on 27.93 metres, although the companion transmitter JVP on 39.95 metres was inaudible. The type of musical programme radiated by these stations is very fascinating, and the weird interjections by a high-pitched voice are at times almost amusing.

Only poor to fair results were obtained from W3XAL, W8XK and W2XAD in the evening, but by 10.30 p.m. W8XK had again reached excellent strength on 19.72 metres. Good results were also obtained from W2XAF and W8XK on 25.27 metres after 10.30 p.m. G.M.T.

On Saturday, April 11th, conditions seemed to be very good, and slight echo was heard on GSH, 13.97 metres, at 1.40 p.m. Both W8XK and W2XE were audible in the 14-metre band, the former being the better signal. Quite a number of signals were heard around 10 metres, but none below.

Fairly good results were again obtained from W2XE on 13.94 metres at 6 p.m., and W3XAL was a fairly good signal on 16.87 metres at this time. Strangely enough, Nairobi VQ7LO on 49.31 metres was also a good signal and of entertainment value from 6 p.m. onwards.

The Addis Ababa transmitter ETA on 25.09 metres was badly jammed during its Sunday evening broadcast on April 12th by a station which may have been ICY Asmara on normal service, although I note that in some circles the jamming is stated to have been deliberate.

Conditions were noted as definitely poor on April 15th, and no U.S. stations below 25 metres were audible at 11.10 p.m.

At 11.20 p.m. LRX, Radio el Mundo, Buenos Aires, was heard testing on 31.30 metres, there being very strong mutual interference between this station and GSC, both of which work on 9,580 kc/s. It is more

general at the time mentioned above, however, to hear El Mundo using LRU on 19.62 metres, which is a clear channel. Another of the Daventry channels, GSB, on 9,510 kc/s, 31.55 metres, has also recently been used by HJU Buenaventura after midnight, but so far these two stations have not been in operation at the same time.

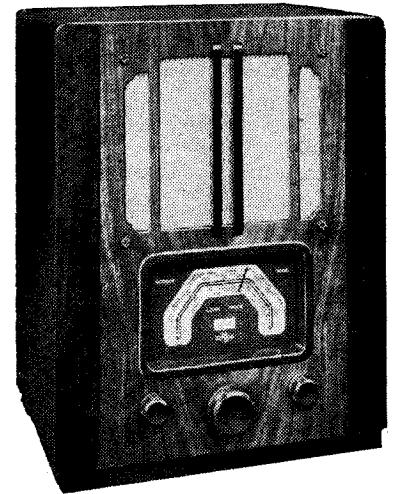
Whilst conditions have slowly deteriorated on the short waves, on April 22nd and 23rd a marked improvement in ultra-short wave signals was noticed, a typical Type B condition, for so far there is no indication of a similar improvement above 10 metres.

ETHACOMBER.

K.B. Model 510

A New "Straight" Receiver for A.C. Mains

MOST listeners' needs are amply fulfilled by a straight HF-det.-LF receiver, and in this new receiver by Kolster-Brandes, Ltd., the efficiency of the circuit is assured by the inclusion of a pentode HF amplifier and a high-slope pentode output valve. Special attention has been given to the design of the tuned circuits to provide adequate selectivity.



Kolster-Brandes Model K.B. 510 AC mains receiver.

An open illuminated tuning scale carries station names and is calibrated in metres. It also includes an automatic indicator showing the setting of the wave-range switch. The energised loud speaker has a diameter of 8in.

The set is housed in a walnut cabinet measuring 17½ × 13½ × 10½ in., and its price is 8½ guineas.

Hartley Turner GA12S Amplifier

IN the review of this amplifier, which appeared last week, it was stated that an input of just under 0.7 volt was needed to give the rated output. This is just ten times greater than the input actually employed, which was 0.07 volt to give an output of 13 watts. As a result the overall gain figure is correspondingly higher than stated and is actually 4,300 to the anodes of the output valves.

High-Definition Television

in Holland

THE
PHILIPS COMPANY
DEMONSTRATE THEIR
405 LINE SYSTEM
ON ULTRA-SHORT
WAVES

By "WANDERING WAVE"



A close-up of the Philips direct television camera.

IN the course of the past few years we have heard of television activity in London, New York, Berlin, and, more recently, in Paris, Milan and Rome. Occasional news items have reached us from Moscow stating that, there too, scientific laboratories are at work on the new medium:

Only a few months ago a certain amount of surprise was caused by a statement issued from Holland that a well-known firm in that country had successfully demonstrated high-definition television with 180 lines on a 7-metre wavelength. I say surprise, because in nearly

all the other television centres mentioned transmission with low-definition scanning had preceded present development. It was, therefore, quite a new departure to find somebody entering the television field with the latest high-definition apparatus. The facts are that the seeming newcomers are not quite so new to the work as the general public has supposed.

The Philips Company at Eindhoven in Holland, to whom I refer, arranged the first public demonstration of transmission on an ultra-short wave from the tower of the Carlton Hotel in Amsterdam in 1930. And as long ago as 1926 the well-known

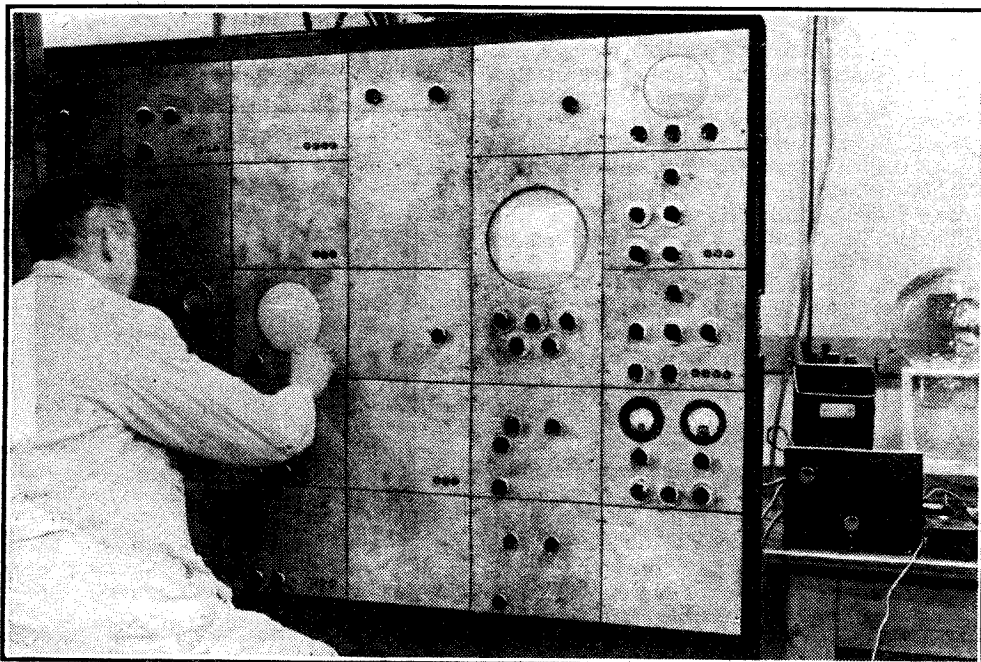
research worker and head of the television laboratories in Eindhoven, Dr. Van de Pol, published interesting work concerning the properties of relaxation oscillators specially adapted to frequency demultiplication.

For practical television purposes Philips have always made use of the so-called electric eye—the Iconoscope. They have a medium-power ultra-short wave transmitter on the roof of one of their factory buildings in Eindhoven, which will handle modulation of up to 3,000,000 c/s in breadth, but the entire installation is of a purely experimental nature. There is no public television in Holland as yet, and there is no immediate intention of introducing such a service, chiefly from reasons of finance. In spite of this, Philips decided not to stand back from international development, and the results achieved are really surprising. All the more so from the fact that they have been working independently of outside aid.

Activity at Eindhoven

In Germany, for instance, the television industry has been greatly aided in its development by Government encouragement. Ultra-short wave transmitters have been bought by the Post Office. A number of television receiving sets has been sold to the authorities. Even if the prices paid can hardly be considered subsidies, the fact remains that a limited market has been created and has made progress possible with less initial capital.

A few days ago I happened to be passing through Eindhoven and interrupted my journey to pay a brief visit to the well-known Dutch wireless factories. I was



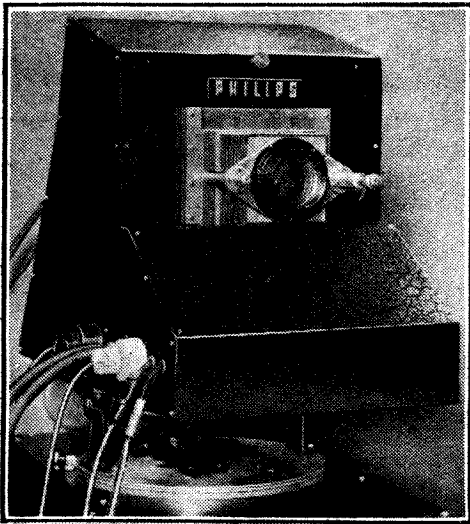
The modulation panel of the experimental television transmitter. The Iconoscope can be seen on the extreme right.

High-Definition Television in Holland—

extremely fortunate as regards television, as I found the engineers busy preparing gear for a larger demonstration. I was not able to see the finished result of transmission by wireless of the new standard Philips television pictures, but was able to gather first-hand impressions of the 405-line inter-lace pictures over a line connection.

The television camera, which employs Iconoscopes made by the Philips works, stood outside the laboratories in a garden. It could be wheeled into a small wooden hut for protection.

Standing in front of a cathode-ray receiver I was able to watch a young man with fair hair and in a white coat walking about the garden. From a head-and-shoulder close-up view he walked away to the wall of another building which was lying in the shadow of the late afternoon sun. I could follow his movements perfectly and was able to distinguish the exact shape and form of the distant building. It must have been about 100ft. from the camera and was quite clear. It showed remarkably more detail than the 180-line pictures I am accustomed to. The man walked up to the lens again, the operator keeping him in focus by altering the lens screw. A microphone had



Television camera employing the Iconoscope.

been placed so that I could hear his steps on the gravel, and he also spoke to me.

The mere turning of a knob was sufficient to produce a number of tricks which will become invaluable in future television entertainment. A slight vertical distortion was introduced which made the engineer become taller and slimmer. No doubt fashion displays will be very grateful for this possibility. Comedians will enjoy the possibility of horizontal distortion which produces the same effect as in those well-known "laughing mirrors" of the fairs. Quite apart from these amusing side-lines, I was able to compare the picture of Marlene Dietrich on a cinema placard televised with 90, 180, 240, 320, 375 and 405 lines, with and without inter-lace scanning.

At close range from the receiver screen,

which was roughly ten by twelve inches in size, the stability of the picture and the straightness of the scanning lines were remarkable, and compared favourably with anything I have yet seen.

For films Philips in Eindhoven make use of the television camera designed for outdoors without alteration. It does not, however, offer the same advantages for the transmission of films as it does for direct television scenes.

This brief outline of my experiences in the Philips television laboratories at Eindhoven will, I hope, give readers some impression of the activity going on behind the scenes in Holland. Eindhoven must now be added to the list of those centres which are capable of producing high-definition television transmitters and receivers suitable for public entertainment once questions of organisation and finance have been solved.

Random Radiations

By "DIALLIST"

Television at Olympia

AT this year's Exhibition, whose period, by the way, has now been fixed for August 26th to September 5th, there should be some interesting television exhibits, and it seems likely that the B.B.C. will have a viewing room capable of accommodating a largish audience. If the London high definition transmitter is at work by that time some of its transmissions may possibly be shown; otherwise the demonstration may take the form of reproducing on the screen and by loud speaker the performances which are taking place in the big theatre.

One hopes that manufacturers who are already prepared to make television receiving apparatus will show not only a variety of models, but also the components used for their construction. If they take this line there will be more inducement for those interested in the technical and experimental aspects of wireless to visit the Exhibition than there has been for the past year or two.

Attracting the Public

I am not trying to carp. What I am driving at is that your real wireless enthusiast, as distinct from the man who is just a broadcast listener, is not specially attracted by rows and rows of stands which contain nothing but ready-for-sale receiving sets of the *multum in parvo* kind, with controls cut down to the smallest possible number and tuning dials that show nothing but a selection of the more powerful European stations. This may be what the general public wants to see; certainly these are the kind of sets that it demands. I wonder, though, what proportion of "ordinary listeners" who visit the Exhibition do so chiefly with the idea of attending a variety performance in the theatre. My own feeling is that those who run the Exhibition would do well if they could find ways of making the stands themselves the main attraction and would place less reliance upon the "side-shows" as fillers of the great hall.

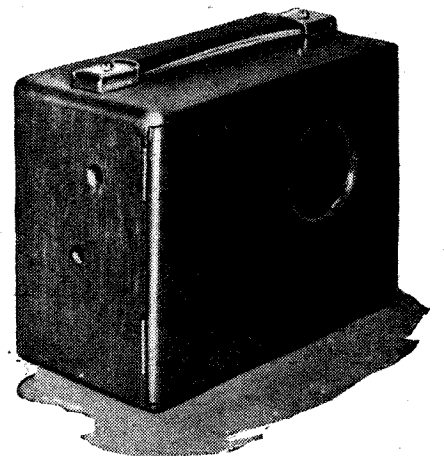
A Suggestion for the N.P.L.

Two years ago part of the exhibit of the National Physical Laboratory at Olympia was a film which explained in the most ingenious manner the way in which the cathode-ray oscillograph works. A good many readers, I expect, saw that film, and those who did will probably agree with me that it would have made the principle of the cathode-ray tube clear to anyone with a glimmering of intelligence and the slightest knowledge of electricity. Now

that the cathode-ray tube is about to make its way into many households in the television receiver that film might well be revived. Some editing and a certain amount of additional photography would have to be done to make it apply specially to the television tube; but this would be well worth while, for it would make a very attractive and useful demonstration.

"Uncle Caractus"

THE name of Cecil Lewis is, I see, being mentioned in connection with the post of Television Programme Producer. I hope that he may accept the appointment, for I can't think of anyone more likely to make a success of it. Cecil Lewis has been identified with broadcasting since its very earliest days in this country. When the sole studio of the British Broadcasting Company (as it then was) was a room in Marconi House, he was right-hand man to Arthur Burrows. A. B. was then programme producer, announcer, leader of the Children's Hour as "Uncle Arthur," and heaven knows what else besides. As "Uncle Caractus" and in other capacities Cecil Lewis soon showed that he had ideas in the matter of broadcasting, and such was the name that he made for himself that he was quickly grabbed by a big broadcasting organisation in the United States. Since then he has written successful plays and directed films in addition to other activities. It would be



An attractive cabinet submitted by Peto-Scott Co., Ltd., which has been specially designed to house the "Hearing Aid for the Deaf" described in the April 17th issue of this journal. The price is 12/6.

In Next Week's Issue

Random Radiations—

an interesting and happy affair if one of the pioneers of broadcasting could return to the B.B.C. as a television pioneer.

Dublin Wants Announcers

THE broadcasting authorities of the Irish Free State are, I hear, finding it difficult to get hold of just the announcers that they want for their broadcasting stations. Many candidates have been tested, but few have been found to possess that rare attribute, a good microphone voice. But there is more in it than that: the ideal announcer for the Dublin and Cork stations must also be a pretty good linguist. He is expected to be able to read and speak well in English and to be thoroughly conversant with the Irish language. He must also have a good working knowledge of both French and German. All things considered, it is understandable that the right men do not grow on every gooseberry bush. Even in this country, where the only language of which a thorough knowledge is demanded is English (with a certain ability to pronounce proper names in a distinctly "foreign" way!) the supply of good announcers is by no means large when vacancies occur.

What of the Crystal?

IT would be interesting to know whether any of those who have made up *The Wireless World* crystal set have tried its possibilities as a long-distance receiver. One hardly regards the crystal as a D X set, but some time ago when I was amusing myself with some experiments on crystal detectors I was surprised to find how many distant stations could be picked up after dark with such apparatus. Radio-Paris could be heard even in daylight, and in the evening I regularly heard the Poste Parisien and Leipzig. In addition to these, quite a number of other stations were picked up at one time or another. The great difficulty with most crystal sets is to be able to obtain the necessary selectivity—often you can hear several foreign stations at once. But with *The Wireless World* set and its variable selectivity this trouble should not arise to anything like the same extent. The most remarkable feat ever performed with a crystal receiver was the direct reception of a KDKA about a dozen years ago. Here's a chance for some D-Xomaniac to go one better!

Late Night News

I GATHER that the late news summary is very much appreciated by many people. It certainly is by me, for (a) I live in the country where the latest obtainable evening paper is printed at about 4 p.m.; (b) I am generally too busy between 6 and 6.30 to listen to the first news bulletin, so that (c) if I went out for the evening before the late news summary was instituted I had nothing to bridge the gap between one morning's newspaper and the next. Now one just switches on at 11.30 and learns the best—or the worst!—before going to bed.

It's curious to notice how broadcasting has increased our thirst for news and our desire to receive it without any waiting. In the pre-broadcasting era country dwellers found it no great hardship to wait several hours for the result of the Boat Race or the Derby or even until the following morning to discover whether the Chancellor of the Exchequer had been up to his old games with the income tax.

Battery Variable - Selectivity

IV.

A Popular Circuit for the Constructor

THE general design of this new receiver follows that of the AC set bearing the same name which has achieved for itself such popularity in the months following its description. A heptode frequency-changer is used and followed by one IF stage operating at a frequency of 465 kc/s and employing a variable-selectivity type of IF transformer. A duo-diode-triode provides detection, AVC and first stage LF amplification, and is transformer-coupled to a triode output valve.

Economical operation is secured with good quality reproduction, and the sensitivity and selectivity are adequate for general broadcast reception of both home and Continental transmissions. The set is easy to construct and adjust; and it is arranged for use with a gramophone pick-up when required.

LIST OF PARTS

- 1 Two-gang condenser 0.0005 mfd. Polar "Midget"
- (Utility.)
- 1 Dial Polar VP Horizontal Drive
- 2 Bulbs for above, 2 volts 0.1 amp. Bulgin B210

Fixed Condensers (continued)

- 1 0.0005 mfd. Bulgin PC305
 - 1 0.001 mfd. Bulgin PC201
 - 2 0.005 mfd. Bulgin PC205
 - 6 0.1 mfd. Bulgin PCP1
- (Dubilier, Polar-N.S.F., T.C.C., T.M.C.-Hydra.)

Resistances, 1 watt

- 1 5,000 ohms Formo "Formowatt"
- 2 20,000 ohms Formo "Formowatt"
- 2 50,000 ohms Formo "Formowatt"
- 1 100,000 ohms Formo "Formowatt"
- 1 250,000 ohms Formo "Formowatt"
- 1 500,000 ohms Formo "Formowatt"
- 1 1 megohm Formo "Formowatt"

(Amplion, Bryce, Bulgin, Dubilier, Erie, Ferranti, Claude Lyons, Polar-N.S.F.)

- 1 Tapered volume control 1 megohm Reliance SG25
- (Eric, Ferranti, Claude Lyons, Magnum, Rothermel.)

- 1 Multi-contact switch Magnum WW7
- 1 Toggle switch on-off Bulgin S80T
- 1 Toggle switch double-pole on-off Bulgin S126

- 2 Valve holders 5-pin (without terminals) Clix Chassis-mounting Type V1

- 2 Valve holders 7-pin (without terminals) Clix Chassis-mounting Type V2

- 6 Ebonite shrouded terminals, A, E, PU (2), LS (2) Belling-Lee "B"

- 1 4-way cable, 30 inch, with terminals and spade ends Belling-Lee

- 1 Connector 5-way Bryce
- 1 Length of screened sleeving Goltone

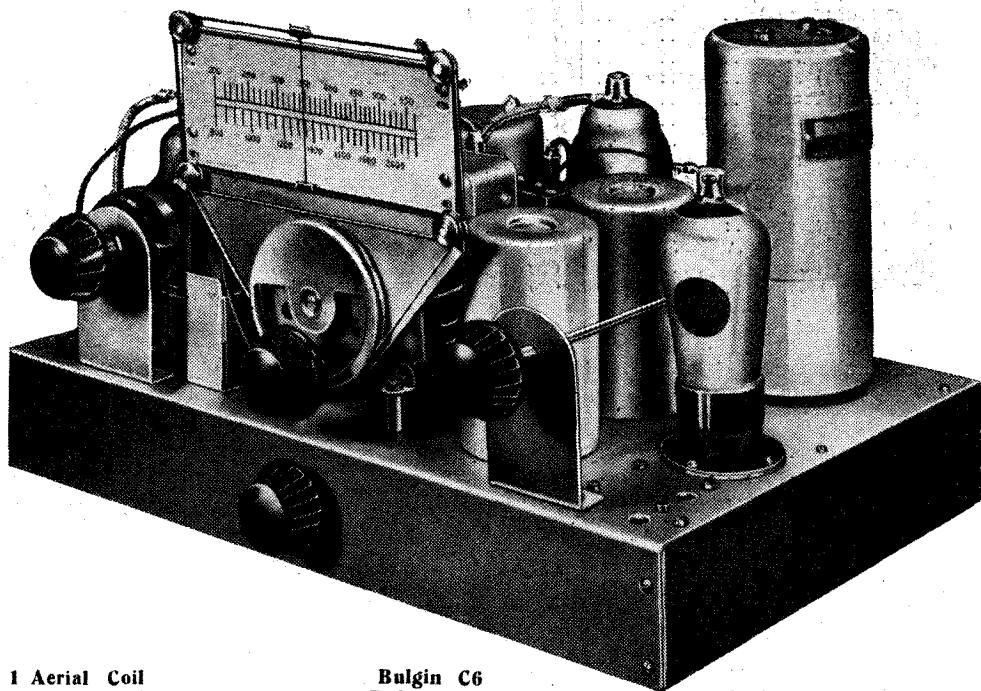
- 3 Plug-top connectors Belling-Lee 1175

- 1 Grid bias battery 4½ volts Bulgin No. 2

- 1 Grid bias clip for above Bulgin No. 1

- 1 pair grid bias clips for above Ealex
- 5 Wander Plugs Bulgin K16
- 3 Knobs Bulgin K16

Chassis, complete with brackets and three spacing pieces B.T.S.



- 1 Aerial Coil Bulgin C6
 - 1 Oscillator Coil 465 kc/s Bulgin C59
 - 1 Aerial loading coil Bulgin C42
 - 1 IF transformer 465 kc/s Bulgin C50
 - 1 IF transformer, variable selectivity, 465 kc/s, with 6in. extension rod and adaptor for ½in. knob. Sound Sales IF465
 - 2 Trimmers 0.0003 mfd. Sound Sales 3VC
 - 1 LF coupling unit Bulgin "Transcoupler" LF10
- Fixed Condensers
- 2 0.0001 mfd. Bulgin PC301
 - 1 0.0002 mfd. Bulgin PC302

- Miscellaneous.— Scientific Supply Stores
- 3 ozs. No. 18 tinned copper wire, 10 lengths Systoflex, etc. Screws: 39 6BA ¼in r/hd. with nuts for chassis. 2 4BA ¼in. r/hd. with nuts, 3 4BA 1in. r/hd. with nuts.
- (Peto-Scott.)

- Valves:—
- 1 Osram HD22. 1 Ferranti VHT2A, 1 Mullard VP2, 1 Mullard PM2A.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an aerial power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions	Metres.	kW.	Station.	kc/s.	Tuning Positions	Metres.	kW.
Ankara (Turkey)	153		1961	5	Graz (Austria). (<i>Relays Vienna</i>)	886		338.6	7
Kaunas (Lithuania)	155		1935	7	Helsinki (Finland)	895		335.2	10
Brazov (Romania)	160		1875	150	Hamburg (Germany)	904		331.9	100
Hilversum No. 1 (Holland) (10kW. till 2.40 p.m. G.M.T.)	160		1875	100	Toulouse (Radio Toulouse) (France)	913		328.6	60
Lahti (Finland)	166		1807	150	Brno (Czechoslovakia)	922		325.4	32
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500	Brussels, No. 2 (Belgium)	932		321.9	15
Paris (Radio Paris) (France)	182		1648	80	Algiers, P.T.T. (Radio Alger) (Algeria)	941		318.8	12
Istanbul (Turkey)	185		1622	3	Göteborg (Sweden). (<i>Relays Stockholm</i>)	941		318.8	10
Deutschlandsender (Germany)	191		1571	60	Breslau (Germany)	950		315.8	100
Droitwich	200		1500	150	Paris (Poste Parisien) (France)	959		312.8	60
Minsk, RW10 (U.S.S.R.)	208		1442	35	Odessa (U.S.S.R.)	968		309.9	10
Reykjavik (Iceland)	208		1442	16	Northern Ireland Regional (Lisburn)	977		307.1	100
Motala (Sweden). (<i>Relays Stockholm</i>)	216		1389	150	Genoa (Italy). (<i>Relays Milan</i>)	986		304.3	10
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100	Torun (Poland)	986		304.3	24
Warsaw, No. 1 (Poland)	224		1339	120	Hilversum No. 2 (Holland). (15 kW. till 4.40 p.m. G.M.T.)	995		301.5	60
Luxembourg	230		1304	150	Bratislava (Czechoslovakia)	1004		298.8	13.5
Kharkov, RW20 (U.S.S.R.)	232		1293	20	Midland Regional (Droitwich)	1013		296.2	70
Kalundborg (Denmark)	238		1261	60	Chernigov (U.S.S.R.)	1013		296.2	5
Leningrad, RW53 (Kolpino) (U.S.S.R.)	245		1224	100	Barcelona, EAJ15 (Radio Asociación) (Spain)	1022		293.5	3
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Cracow (Poland)	1022		293.5	2
Oslo (Norway)	260		1153.8	60	Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Moscow, No. 2, RW49 (Stehelkovo) (U.S.S.R.)	271		1107	100	Paredo (Radio Club Português) (Portugal)	1031		291	5
Tiflis, RW7 (U.S.S.R.)	280		1071.4	35	Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Finmark (Norway)	355		845.1	10	Rennes-Bretagne, P.T.T. (Thourle) (France)	1040		288.5	40
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20	Scottish National (Falkirk)	1050		285.7	50
Budapest, No. 2 (Hungary)	359.5		834.5	20	Bari No. 1 (Italy)	1059		283.3	20
Sverdlovsk, RW5 (U.S.S.R.)	375		800	50	Paris (Radio Cité) (France)	1068		280.9	0.8
Banska-Bystřica (Czechoslovakia)	392		765	30	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Geneva (Switzerland). (<i>Relays Sottens</i>)	401		748	1.3	Bordeaux, P.T.T. (Lafayette) (France)	1077		278.6	25
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100	Zagreb (Yugoslavia)	1086		276.2	0.7
Voroneje, RW25 (U.S.S.R.)	413.5		726	10	Falun (Sweden)	1086		276.2	2
Oulu (Finland)	431		696	1.2	Madrid, EAJ7 (Union Radio) (Spain)	1095		274	10
Ufa, RW22 (U.S.S.R.)	436		688	10	Madona (Latvia)	1104		271.7	50
Tartu (Estonia)	517		580	0.5	Naples (Italy). (<i>Relays Rome</i>)	1104		271.7	1.5
Hamar (Norway). (<i>Relays Oslo</i>)	519		578	0.7	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Innsbruck (Austria). (<i>Relays Vienna</i>)	519		578	1	Fécamp (Radio Normandie) (France)	1113		269.5	15
Ljubljana (Yugoslavia)	527		569.3	5	Alexandria, No. 1 (Egypt)	1122		267.4	0.25
Viipuri (Finland)	527		569.3	10	Newcastle	1122		267.4	1
Bolzano (Italy)	536		559.7	20	Nyiregyhaza (Hungary)	1122		267.4	6.2
Wilno (Poland)	536		559.7	16	Hörby (Sweden). (<i>Relays Stockholm</i>)	1131		265.3	10
Budapest, No. 1 (Hungary)	546		549.5	120	Turin, No. 1 (Italy). (<i>Relays Milan</i>)	1140		263.2	7
Beromünster (Switzerland)	556		539.6	100	Trieste (Italy)	1140		263.2	10
Athlone (Irish Free State)	565		531	60	London National (Brookmans Park)	1149		261.1	20
Palermo (Italy)	565		531	4	North National (Slaithwaite)	1149		261.1	20
Stuttgart (Germany)	574		522.6	100	West National (Washford Cross)	1149		261.1	20
Grenoble, P.T.T. (France)	583		514.6	15	Kosice (Czechoslovakia). (<i>Relays Prague</i>)	1158		259.1	2.6
Riga (Latvia)	583		514.6	15	Monte Ceneri (Switzerland)	1167		257.1	15
Vienna (Bisamberg) (Austria)	592		506.8	100	Copenhagen (Denmark). (<i>Relays Kalundborg</i>)	1176		255.1	10
Rabat (Radio Maroc) (Morocco)	601		499.2	30	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Sundsvall (Sweden). (<i>Relays Stockholm</i>)	601		499.2	10	Nice (La Brague) (France)	1185		253.2	60
Florence (Italy). (<i>Relays Milan</i>)	610		491.8	20	Frankfurt (Germany)	1195		251	25
Cairo, No. 1 (Egypt)	620		483.9	20	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Brussels, No. 1 (Belgium)	620		483.9	15	Lille, P.T.T. (Camphin) (France)	1213		247.3	60
Lisbon (Bacarena) (Portugal)	629		476.9	20	Gleiwitz (Germany). (<i>Relays Breslau</i>)	1231		243.7	5
Trøndelag (Norway)	629		476.9	20	Cork (Irish Free State). (<i>Relays Athlone</i>)	1240		241.9	1
Prague, No. 1 (Czechoslovakia)	638		470.2	120	Swedish Relay Stations	1240		241.9	1
Lyons, P.T.T. (La Doua Tramoyes) (France)	648		463	90	Saarbrücken (Germany)	1249		240.2	17
Cologne (Langenberg) (Germany)	658		455.9	100	Kuldiga (Latvia)	1258		238.5	10
North Regional (Slaithwaite)	668		449.1	70	Rome, No. 3 (Italy)	1258		238.5	1
Sottens (Radio Suisse Romande) (Switzerland)	677		443.1	100	San Sebastian (Spain)	1258		238.5	1
Belgrade (Yugoslavia)	686		437.3	2.5	Nürnberg (Germany). (<i>Relays Munich</i>)	1267		236.8	2
Paris, P.T.T. (Palaiseau Villebon) (France)	695		431.7	120	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	0.8
Stockholm (Sweden)	704		426.1	55	Christiansand and Stavanger (Norway)	1276		235.1	0.5
Rome, No. 1 (Italy)	713		420.8	50	Dresden (Germany). (<i>Relays Leipzig</i>)	1285		233.5	0.25
Kiev, RW9 (U.S.S.R.)	722		415.5	36	Aberdeen	1285		233.5	1
Tallinn (Estonia)	731		410.4	20	Austrian Relay Stations	1294		231.8	6
Madrid, EAJ2 (Radio España) (Spain)	731		410.4	3	Danzig. (<i>Relays Königsberg</i>)	1303		230.2	0.5
Seville (Spain)	731		410.4	5.5	Swedish Relay Stations	1312		228.7	1.25
Munich (Germany)	740		405.4	100	Magyarovar (Hungary)	1321		227.1	1.25
Marseilles, P.T.T. (Realtor) (France)	749		400.5	60	German Relay Stations	1330		225.6	2
Katowice (Poland)	758		395.8	12	Montpellier, P.T.T. (France)	1339		224	0.8
Scottish Regional (Falkirk)	767		391.1	50	Lodz (Poland)	1339		224	2
Stalino (U.S.S.R.)	776		386.6	10	Dublin (Irish Free State). (<i>Relays Athlone</i>)	1348		222.6	0.5
Toulouse, P.T.T. (France)	776		386.6	1.5	Milan, No. 2 (Italy). (<i>Relays Rome</i>)	1357		221.1	4
Leipzig (Germany)	785		382.2	120	Turin, No. 2 (Italy). (<i>Relays Rome</i>)	1357		221.1	0.2
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Basle and Berne (Switzerland)	1375		218.2	0.5
Lwow (Poland)	795		377.4	16	Warsaw, No. 2 (Poland)	1384		216.8	2
West Regional (Washford Cross)	804		373.1	70	Lyons (Radio Lyons) (France)	1393		215.4	25
Milan, No. 1 (Italy)	814		368.6	50	Tampere (Finland)	1420		211.3	0.7
Bucharest (Romania)	823		364.5	12	International Common Wave	1429		209.9	0.5
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100	Miskolc (Hungary)	1438		208.6	1.25
Berlin (Germany)	841		356.7	100	Paris (Eiffel Tower) (France)	1456		206	20
Bergen (Norway)	850		352.9	1	Pecs (Hungary)	1465		204.8	1.25
Sofia (Bulgaria)	850		352.9	1	Antwerp and Courtrai (Belgium)	1465		204.8	0.1
Valencia (Spain)	850		352.9	3	Bournemouth	1474		203.5	1
Simferopol, RW52 (U.S.S.R.)	859		349.2	10	Plymouth	1474		203.5	0.3
Strasbourg, P.T.T. (France)	859		349.2	120	International Common Wave	1492		201.1	0.5
Poznan (Poland)	868		345.6	16	International Common Wave	1500		200	0.25
London Regional (Brookmans Park)	877		342.1	50	Liepāja (Latvia)	1737		173	0.1

SHORT-WAVE STATIONS OF THE WORLD

Arranged in Order of Wavelength and Frequency

(N.B.—Times of Transmission given in parentheses are approximate only and represent G.M.T.)

Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.	Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.
75.0	4,000	CT2AJ	Ponta Delgada (Azores). (Wed., Sat., 22.00 to 24.00.)		31.8	9,428	COCH	Havana (Cuba) (Daily 16.00 to 17.00, 22.00 to 23.00, 01.00 to 02.00.)	
70.2	4,273	RV15	Kharbarovsk (U.S.S.R.). (Daily 06.00 to 14.00.)		31.58	9,501	PRF5	Rio de Janeiro (Brazil). (Daily 22.30 to 23.15.)	
67.11	4,470	YDB	Sourabaya (Java). (Daily 03.30 to 06.30)		31.55	9,510	GSB	Empire Broadcasting	
51.28	5,850	YV5RMO	Maracaibo (Venezuela). (Daily, 22.00 to 02.00.)		31.55	9,510	VK3ME	Melbourne (Australia). (Wed. 10.00 to 11.30, Sat. 10.00 to 12.00.)	
50.60	5,930	HJ4ABE	Medellin (Colombia). (Daily, 16.30 to 18.30, Sun., Tues., Thurs., 23.30 to 03.00 also.)		31.48	9,530	LKJ1	Jeløy (Norway). (Relays Oslo.) (Daily 10.00 to 13.00.)	
50.26	5,969	HVJ	Vatican City. (Daily 19.00 to 19.15, Sun. 10.00 also.)		31.48	9,530	W2XAF	Schenectady, N.Y. (U.S.A.). (Relays WGY.) (Daily 23.30 to 04.00, Sat. 19.00 to 22.00 also.)	
50.16	5,980	HIX	Trujillo (Domenica). (Daily, 12.00, Sun. 00.38 also.)		31.45	9,540	DJN	Zeesen (Germany). (Daily 08.45 to 12.15, 13.00 to 16.30, 22.15 to 03.30.)	
50.00	6,000	XEBT	Mexico City (Mexico). (Daily 00.00 to 09.00.)		31.38	9,560	DJA	Zeesen (Germany). (Daily 13.00 to 16.30, 22.15 to 02.00.)	
50.00	6,000	RW59	Moscow (U.S.S.R.). (Relays No. 1 Stn.) (Daily 20.00 to 23.00.)		31.36	9,565	VUB	Bombay (India). (Sun. 13.30 to 15.30, Wed., Thurs., Sat. 16.30 to 17.30, irregular Mon.)	
49.95	6,005	VE9DN	Montreal (Canada). (Daily 04.30 to 05.00)		31.35	9,570	W1XK	Millic, Mass. (U.S.A.). (Relays WBZ.) (Daily 12.00 to 06.00.)	
49.92	6,010	COCO	Havana (Cuba). (Daily 21.00 to 23.00, 01.00 to 03.00, Sun. 04.30 to 06.30 also.)		31.32	9,580	WV3LR	Empire Broadcasting	
49.85	6,018	HJ3ABH	Bogotá (Colombia) ...		31.32	9,580	VK3LR	Lyndhurst (Australia). (Daily ex. Sun. 08.15 to 12.30.)	
49.85	6,018	ZHI	Singapore (Malaya). (Mon., Wed., Thurs. 23.00 to 01.30, Sun. 03.40 to 05.10.)		31.28	9,590	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 17.00 to 24.00.)	
49.83	6,020	DJC	Zeesen (Germany). (Daily 22.30 to 03.30, 17.00 to 21.30.)		31.28	9,590	VK2ME	Sydney (Australia). (Sun. 06.00 to 08.00, 10.00 to 14.00, 14.30 to 16.30.)	
49.75	6,030	HP5B	Panama City (Central America). (Daily 17.00 to 18.00, 01.00 to 03.30.)		31.23	9,590	PCJ	Eindhoven (Holland) ...	
49.75	6,030	VE9CA	Calgary (Canada). (Thurs. 14.00 to 07.00, Sun. 17.00 to 05.00.)		31.27	9,595	HBL	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)	
49.67	6,040	W1XAL	Boston, Mass. (U.S.A.). (Sun. 22.00 to 24.00, Wed., Fri. 00.30 to 01.45.)		31.13	9,635	2RO	Rome (Italy). (Tues., Thurs., Sat. 00.45 to 02.15.)	
49.67	6,040	W4XB	Miami, Fla. (U.S.A.) Daily 17.00 to 19.30, 22.30 to 05.00.)		31.09	9,650	CT1AA	Lisbon (Portugal) ...	
49.67	6,040	PRA8	Pernambuco (Brazil). (Daily 20.00 to 00.30.)		31.0	9,677	CT1CT	Lisbon (Portugal). (Thurs. 21.00 to 23.00, Sun. 12.00 to 14.00.)	
49.59	6,050	GSA	Empire Broadcasting		30.43	9,860	EAQ	Madrid (Spain). (Daily 22.15 to 00.30, Sat. 18.00 to 20.00 also.)	
49.5	6,060	W8XAL	Cincinnati, Ohio (U.S.A.). (Daily 12.00 to 01.00, 04.00 to 06.00.)		29.24	10,260	PMN	Bandoeng (Java). (Sun., 12.00 to 15.00) ...	
49.5	6,060	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 01.00 to 04.00.)		29.04	10,330	ORK	Ruyseede (Belgium). (Daily 18.30 to 20.30.)	
49.5	6,060	OXY	Skamlebaek (Denmark). (Relays Kalundborg.) (Daily 18.00 to 24.00, Sun. 16.00 also.)		28.01	10,710	JVM	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)	
49.42	6,070	OER2	Vienna Experimental. (Daily 14.00 to 22.00.)		27.93	10,740	JVM	Tokio (Japan). (Tues., Fri., 19.00 to 20.00.)	
49.33	6,080	ZHJ	Penang (Malaya). (Daily ex. Sun., 11.40 to 13.40; Sun. 12.40 to 14.40)		25.6	11,720	TPA1	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 00.00 to 03.00, 04.00 to 06.00.)	
49.33	6,080	W9XAA	Chicago, Ill. (U.S.A.). (Relays WCLF.) (Sun. 19.00 to 20.30.)		25.53	11,750	GSD	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30 also.)	
49.31	6,083	VQ7LO	Nairobi (Kenya Colony). (Daily 16.00 to 19.00, Sat. to 20.00, Mon., Wed., Fri. 10.45 to 11.15 also, Tues. 08.00 to 09.00 also, Thurs. 13.00 to 14.00 also, Sun. 17.45 to 19.00 also.)		25.49	11,770	DJD	Empire Broadcasting	
49.26	6,090	CRCX	Bowmanville, Ont. (Canada). (Mon., Tues., Wed. 20.00 to 05.00, Thurs., Fri., Sat. 12.00 to 05.00, Sun. 18.00 to 02.00.)		25.45	11,790	W1XAL	Zeesen (Germany) (Daily 17.00 to 21.30)	
49.2	6,097	ZTJ	Johannesburg (S. Africa). (Daily ex. Sun. 04.30 to 05.30, 08.30 to 12.00, 14.00 to 20.00 (Sat. to 21.45), Sun. 13.00 to 15.15, 17.30 to 20.00.)		25.45	11,790	W1XAL	Boston, Mass. (U.S.A.). (Daily 23.00 to 00.30.)	
49.18	6,100	W3XAL	Bound Brook, N.Y. (U.S.A.). (Relays WJZ.) (Mon., Wed., Sat. 22.00 to 23.00, Sat. 05.00 to 06.00 also.)		25.40	11,810	2RO	Rome (Italy). (Mon., Wed., Fri. 23.00) ...	
49.18	6,100	W9XF	Chicago, Ill. (U.S.A.). (Daily ex. Mon., Wed., Sun. 21.00 to 07.00.)		25.38	11,820	GSN	Empire Broadcasting	
49.1	6,110	GSL	Empire Broadcasting		25.36	11,830	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 20.00 to 03.00.)	
49.1	6,110	VUC	Calcutta (India). (Daily 07.06 to 08.06 irregular 13.06 to 16.36, Sat. from 12.36, Sun. 04.36 to 07.36, irregular 12.36 to 03.36.)		25.29	11,860	GSE	Empire Broadcasting	
49.02	6,120	YDA	Bandoeng (Java). (Daily 10.30 to 15.00)		25.27	11,870	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 03.00.)	
49.02	6,120	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 03.00 to 04.00.)		25.23	11,880	TPA3	Paris, Radio Coloniale (France). (Colonial Stn. N-S.) (Daily 16.15 to 19.15, 20.00 to 23.00.)	
48.92	6,130	ZGE	Kuala Lumpur (Malaya). (Sun., Tues., Fri. 11.40 to 13.40.)		25.09	11,955	ETB	Addis Ababa (Abyssinia) ...	
48.92	6,130	COCQ	Havana (Cuba) (Daily 23.00 to 05.00.)		25.0	12,000	RW59	Moscow (U.S.S.R.). (Relays No. 2 Stn.) (Sun. 03.00 to 04.00, 11.00 to 12.00, 15.00 to 16.00.)	
48.86	6,140	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 06.00.)		24.83	12,082	CT1CT	Lisbon (Portugal). (Sun. 14.00 to 16.00, Thurs. 20.00 to 21.00.)	
48.78	6,150	CSL	Lisbon (Portugal). (Daily 11.00 to 12.30, 18.00 to 22.00.)		24.52	12,235	TFJ	Reykjavik (Iceland). (Sun. 18.40 to 19.00.)	
48.78	6,150	YV3RC	Caracas (Venezuela). (Daily 20.30 to 01.30.)		24.2	12,396	CT1GO	Paredo (Portugal). (Sun. 15.00 to 16.30, Tues., Thurs., Fri. 18.00 to 19.15.)	
48.78	6,150	CJRO	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30.)		22.94	13,075	VPD	Suva (Fiji). (Daily ex. Sun. 05.30 to 03.60)	
48.4	6,198	CT1GO	Paredo (Portugal). (Daily ex. Tues. 00.20 to 01.30, Sun. 16.30 to 18.00 also.)		22.00	13,635	SPW	Warsaw (Poland). (Daily 16.30 to 17.30.)	
47.50	6,316	HIZ	Trujillo (Domenica). (Daily 21.40 to 22.40, Sun. 16.00 to 17.30 also.)		21.42	14,005		Band of wavelengths allotted to amateur transmitters.	
47.05	6,375	YV4RC	Caracas (Venezuela). (Daily 21.30 to 03.30.)		20.84	14,395			
46.52	6,447	HJ1ABB	Barranquilla (Colombia). Daily 21.30 to 03.30.)		19.84	15,123	HVJ	Vatican City. (Daily 10.00, 15.30 to 15.45)	
46.21	6,490	HJ5ABD	Cali (Colombia). (Daily 00.00 to 03.00) ...		19.82	15,140	GSF	Empire Broadcasting	
46.0	6,520	YV6RV	Valencia (Venezuela). (Daily 17.00 to 18.00, 23.00 to 03.00.)		19.76	15,180	GSO	Empire Broadcasting	
45.31	6,620	PRADO	Riobamba (Ecuador). (Fri. 02.00 to 03.40)		19.74	15,200	DJB	Zeesen (Germany). (Daily 08.45 to 12.15)	
45.0	6,667	HC2RL	Guayaquil (Ecuador). (Sun. 22.45 to 12.45, Wed. 02.15 to 04.15.)		19.72	15,210	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 13.00 to 21.15.)	
42.86 to 41.0	7,000 to 7,300		Band of wavelengths allotted to amateur transmitters.		19.71	15,220	PCJ	Eindhoven (Holland). (Experimental) ...	
41.8	7,177	CR6AA	Lobito (Angola). (Wed., Sat. 19.30 to 21.30.)		19.68	15,243	TPA2	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 12.00 to 16.00.)	
39.95	7,510	JVP	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)		19.67	15,250	W1XAL	Boston, Mass. (U.S.A.). (Daily 15.50 to 18.30.)	
39.37	7,620	ETA	Addis Ababa (Abyssinia) ...		19.66	15,260	GSI	Empire Broadcasting	
38.48	7,797	HBP	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)		19.65	15,270	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 18.00 to 20.00.)	
36.5	8,214	HCJB	Quito (Ecuador). (Daily ex. Sun., Mon. 00.45 to 04.45, Sun. 21.45 to 04.15.)		19.63	15,280	DJQ	Zeesen (Germany). (Daily 04.30 to 06.00)	
34.29	8,750	ZCK3	Hong Kong (China). (Daily 10.00 to 14.00.)		19.60	15,310	GSP	Empire Broadcasting	
32.88	9,125	HAT4	Budapest (Hungary). (Sat. 23.00 to 24.00)		19.56	15,330	W2XAD	Schenectady, N.Y. (U.S.A.). (Daily 19.30 to 20.30.)	
					19.52	15,370	HAS3	Budapest (Hungary). (Sun. 13.00 to 14.00.)	
					16.89	17,760	DJE	Zeesen (Germany). (Daily 13.00 to 16.30)	
					16.89	17,760	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 16.00 to 18.00.)	
					16.88	17,770	PH1	Huizen (Holland). (Daily ex. Tues., Wed. 13.00 to 15.30, Sun., Sat. to 16.30.)	
					16.87	17,780	W3XAL	Bound Brook, N.J. (U.S.A.). (Relays WJZ.) (Daily except Sun. 14.00 to 15.00, Tues. Thurs., Fri. 20.00 to 21.00 also.)	
					16.86	17,790	GSG	Empire Broadcasting	
					16.42	18,270	ETA	Addis Ababa (Abyssinia) ...	
					15.93	18,830	PLE	Bandoeng (Java). (Tues., Thurs., Sat. 15.00 to 15.30.)	
					13.97	21,470	GSH	Empire Broadcasting	
					13.94	21,520	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 12.30 to 16.00.)	
					13.93	21,530	GSJ	Empire Broadcasting	
					13.92	21,540	W8XK	Pittsburg, Pa. (U.S.A.). (Daily 12.00 to 14.00.)	

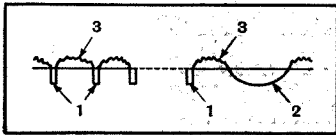
Recent Inventions

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

SYNCHRONISING IN TELEVISION

THE figure illustrates one method of combining line and frame synchronising-impulses with the radiated picture signals in television. The line impulses consist of sharply defined "dips" 1, 1 below the datum line of the picture signals 3. The framing impulses, such as 2, are of longer duration and less "peaky."



Method of combining synchronising and picture signals.

According to the invention, the two sets of synchronising-impulses are fed either to two valves having their cathodes and control grids connected together and to a load resistance, or to a single two-anode valve, which separates them and feeds them to the respective saw-tooth oscillators.

M. Bowman-Manifold. Application date June 25th, 1934. No. 441847.

TO avoid the necessity for synchronising the transmitter and receiver in television, a series of picture-points are radiated simultaneously and without scanning, as so many separate modulations on a number of carrier-waves of different frequency. The carrier-waves are received on separately tuned circuits, and the signals, after rectification, are applied to a bank of lamps forming a viewing-screen. In order to reduce the number of primary carrier-waves required for transmission, the picture signals are applied in groups, first to sub-carrier-waves, which are then modulated on "master" carriers.

L. Gabrilovitch, V. Isnard and R. Berthon. Convention date (France) October 25th, 1933. No. 441896.

BEACON TRANSMITTERS

IN a radio-beacon of the type in which four vertical aerials are set at each corner of a square and energised through feed-lines radiating from the centre, the resulting figure-of-eight field is liable to change its direction slightly under the influence of varying weather conditions.

In order to offset this, and to give the radiated beam a constant shape and direction under all climatic conditions, the constants of each aerial are so proportioned that the current is displaced in phase from the voltage by an amount equal to the electrical length of the feed-line from the HF generator. The principle can be applied to maintain any de-

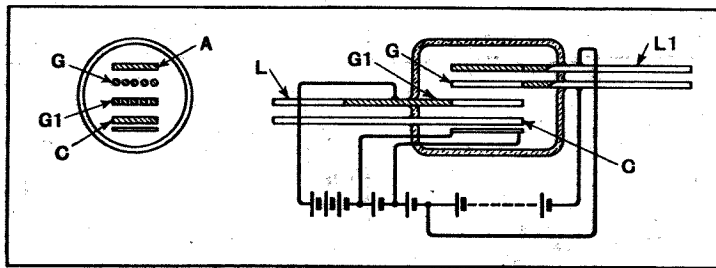
sired relationship between aerial current and voltage according to the required shape of the radiated field.

British Thomson-Houston Co., Ltd. Convention date (U.S.A.) April 29th, 1933. No. 442003.

SHORT-WAVE GENERATORS

A VALVE for amplifying or generating waves less than a metre long comprises a flat cathode C, an apertured control grid G1 carrying a slightly negative charge, a highly positive acceleration grid G, and a slightly-positive braking-electrode A. The valve functions in the Barkhausen-Kurz manner, the electron stream oscillating about the positively charged grid G.

The electrodes are connected in pairs, as shown, to two Lecher wire circuits L and L1, extending from the valve in opposite directions. When used as an amplifier, the short-wave signals are applied to the wires L, and the output is drawn off at L1. The spacing of the electrodes and the operating potentials are such that the time of travel of the electrons through



Micro-wave valve amplifier or generator.

the "exciting" zone near the positive grid G is less than one-half the period of the oscillation that is being amplified or generated.

N. V. "Meaf." Convention date (Germany) February 23rd, 1934. No. 442326.

DIRECTION-FINDING

WHEN DF apparatus is used on a ship or aeroplane, it is subject to the influence of re-radiation from surrounding metallic parts, which has the effect of distorting the true front of an incoming radio-wave, giving rise to what is known as "quadrantal error." From its nature the error is a "cyclic" one, which can be plotted out and compensated for in much the same way as one corrects for magnetic error in a mariner's compass by "swinging the ship."

According to the invention, a specially shaped cam is interposed between the search coils and the indicator, being so arranged that it applies an automatic correction for the quadrantal error on every bearing taken.

L. L. Kaess. No. 2023891 (U.S.A.).

PIEZO-ELECTRIC CRYSTALS

A PIEZO-ELECTRIC crystal is held in position against a series of projecting pins which bear against its lower surface, and an upper contact-bar which is subject only to slight spring-pressure, so long as the crystal is actually in operation.

To prevent the crystal from being damaged in transport, or when it is not actually in use, the upper contact-bar is arranged to be pressed more firmly against it, at such times, by a wedge which is automatically withdrawn when the crystal-holder is fitted in position ready for operation.

J. G. Beard (assignor to Westinghouse Electric and Manufacturing Co.) No. 2023112. (U.S.A.)

"CALLING-UP" SIGNALS

IN police patrol work it is necessary at times to send out a "general" call from a central station to all service cars within range. The invention describes a simple method of doing this by pressing a button switch, which cuts out the microphone-modulating circuit of the transmitter, and replaces it with a back-coupling link consisting of a resistance and capacity in series. This generates a low-frequency "howl" or CW note of constant frequency, which

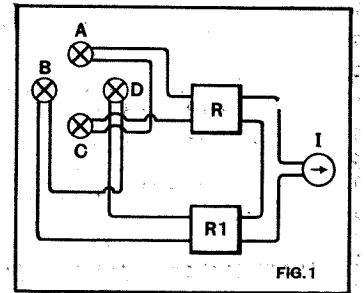
REMOTE TUNING-CONTROL

A WIRELESS set is tuned from a distance by an impulse-sender similar to the well-known dialling-device used on an automatic telephone. The tuning-condenser is rotated, to an extent depending upon the impulses transmitted, through the medium of a cylinder with grooves cut in its surface. This acts partly as a ratchet-wheel and partly as a cam, to give first a rough and then a fine adjustment.

E. Cohn. Application date July 20th, 1934. No. 441851.

DIRECTION-FINDERS

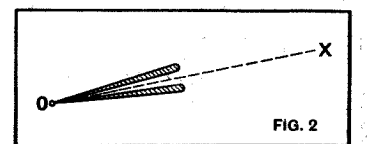
IN direction-finding, it is desirable to get rid of any ambiguity due to re-radiated fields, particularly when bearings are being



Arrangement of the four aerials.

taken in three directions, as is the case, for instance, on an aeroplane. With this object in view, the receiver is so arranged that it can only receive a signal of substantial strength, within a comparatively small solid angle, surrounding the critical "zero" direction, any signals coming from directions outside this solid angle having substantially no effect on the receiving circuits.

The receiving system consists of four sharply directional aerials A, B, C, D (Fig. 1), each consisting of a dipole located at the focus of a long and narrow parabolic reflector. One pair B, D, is set horizontal and the other pair A, C vertical. The pick-up voltage from the first pair is fed in phase-opposition to the receiver R1, whilst that from the vertical pair is similarly fed to a second receiver R. The directional characteristic of the final indicator I is as shown in Fig. 2. It consists of a "zero" line OX, showing the direction of the distant trans-



Directional characteristics of the system.

mitter, and located at the centre of a small solid angle of other signal pick-up. Outside this angle, the receiver is ineffective.

Telefunken Ges fur drahtlose Telegraphie m.b.h. Convention date (Germany) January 24th, 1934. No. 441964.

is superimposed on the radiated carrier-wave and thus serves as an audible alarm signal at the distant receiver.

G. W. Fyler (assignor to General Electric Co.) No. 2023222. (U.S.A.)

LOUD SPEAKERS

THE cone of a moving-coil speaker is designed to give a balanced response over both the high and low notes, without, however, producing any noticeable focusing effect. It has a substantially elliptical cross-section at the larger end, which changes progressively to a circular cross-section at the smaller end. The larger end is made of paper, and the smaller of metal, the velocity of propagation of sound being greater in the latter. The junction between these two materials occurs along a line substantially perpendicular to the major axis of the cone.

For example, the large-end ellipse is 11½ by 6 inches, and the diameter of the small-end circle 1 inch, whilst the major axis of the ellipse at the junction between the metal and paper is 5 inches.

G. F. Dutton. Application date August 3rd, 1934. No. 442165.

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*As many of the circuits and apparatus described in these
pages are covered by patents, readers are advised, before
making use of them, to satisfy themselves that they would
not be infringing patents.*

CONTENTS

	Page
Editorial Comment	457
Battery Variable-Selectivity IV ..	458
Cathode Ray Valve Tester ..	462
Current Topics	464
Valves for Tone Correction ..	465
New Apparatus Reviewed ..	467
Ferranti All-Wave Straight Three	468
Listeners' Guide for the Week ..	470
More About Electronics	472
Random Radiations	473
Letters to the Editor	474
N.P.L. Report for 1935	475
Unbiased	476
Broadcast Brevities	477
Recent Inventions	478

EDITORIAL COMMENT

Television

Is the Standard Too High ?

IT is considerably over a year now since the report of the Television Committee was published, and whilst that report intimated that high definition television had reached a commercial stage where it could be launched for the benefit of the public, we are still waiting to-day, and are likely to wait for many weeks yet, for a service to mature.

In the Committee's report it was stated that it was regarded as undesirable that the facilities of 30-line transmissions should be abandoned until at least a proportion of the observers had the opportunity of receiving a high definition service. In spite of this recommendation, the 30-line transmissions came to an end after a very short while, and since then we have been left with no television of any description.

We ourselves commented that it seemed unsatisfactory that the 30-line transmissions should be discontinued even when a higher definition service came into operation for the benefit of those in the London area. Had we foreseen at that time that so long a delay would occur before the high definition service came into existence, we should have been far more emphatic in our protests against cessation of transmissions.

It seems more than likely that we shall eventually regret that the Television Advisory Committee recommended so high a standard of definition at the outset, not only because it puts up the cost of receivers and probably restricts manufacture to only a few firms, but also because so high a standard of definition in the transmissions seems to preclude the possibility of any alternative such as a mechanical system being developed.

If we have progressed more gradually from 30 lines upwards, there might well have been scope for development of other means of reception than the cathode ray tube, but the sudden leap to 240 lines left us with no known alternative, nor even any other tool as a "runner up."

From the point of view of many of our readers, it must be a matter of regret that the high definition transmissions from the Alexandra Palace will not serve the experimenter to much purpose, as the cost and complexity of the receiving apparatus will, in most cases, place experimenting beyond his reach.

The Ullswater Report

Debate in the House

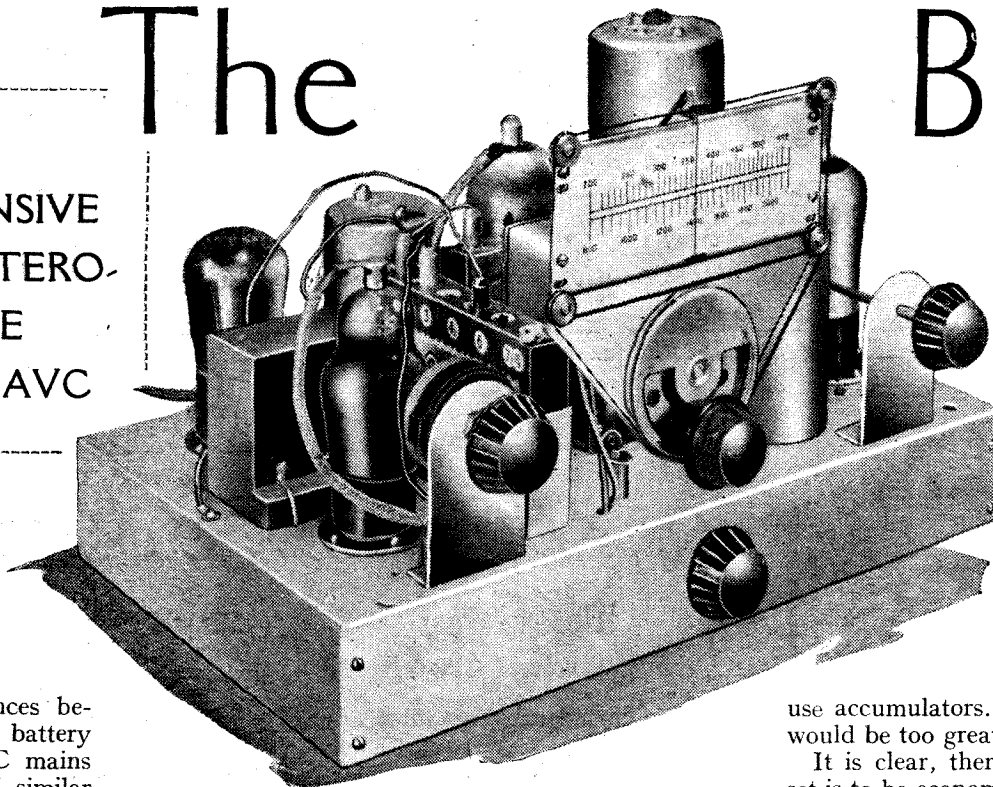
THE debate which took place in the House of Commons recently on the subject of the Ullswater Committee's Report on the B.B.C. was only of a preliminary nature, and this is fortunate, since any high hopes that anything useful would come out of the discussion met with disappointment. The next debate will not, it is to be hoped, continue on the same lines as the first.

It is curious that in spite of the fact that broadcasting is a matter of such enormous importance to-day, and even greater potential importance for the future, the first opportunity of discussing the Report should have been made the occasion for a lengthy discussion of alleged domestic grievances within the B.B.C. organisation itself. If such grievances exist they should certainly be investigated, but it does not seem that their discussion at such length in the House has put them in their proper perspective in relation to the much wider question of broadcasting as a service to the millions who participate in the programmes.

The Battery

AN
INEXPENSIVE
SUPERHETERO-
DYNE
WITH AVC

By
W. T. COCKING



THE differences between a battery and an AC mains receiver of similar general type are very often found to be considerable in practice.

These differences, which are inevitably reflected in performance, are due solely to the smaller power consumption which can be permitted in a battery set. A mains set of quite a modest type is unlikely to consume less than 50 watts, but this necessitates quite a small expenditure for power, since 20 hours' operation can be obtained for one unit. Even if the set is operated from the lighting supply at 6d.

a unit, the cost is only a little over one farthing an hour, while if the heating circuit is used it is much less.

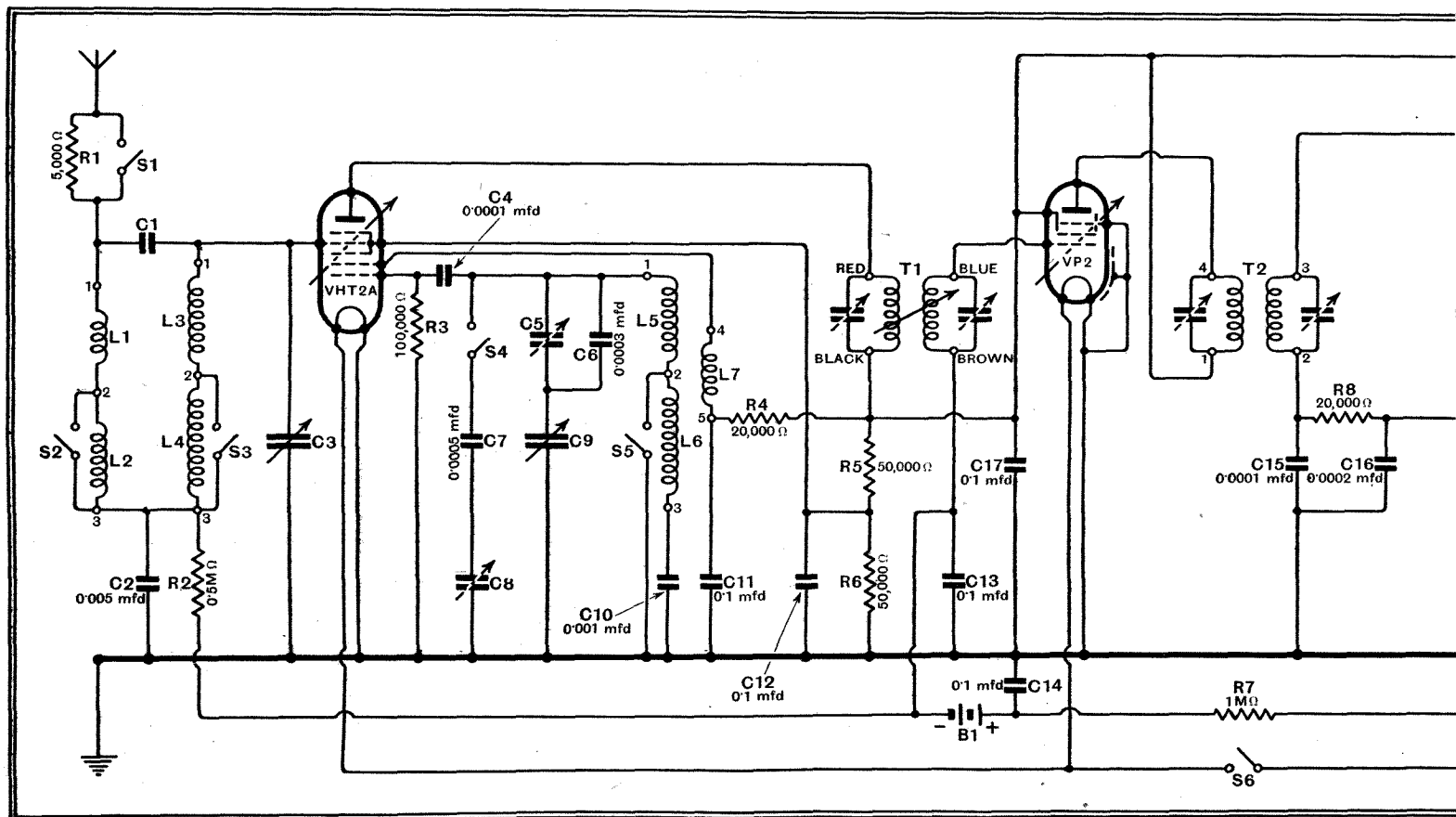
It would, however, be far too expensive to attempt to obtain such power from batteries. Thus, suppose that 25 watts is needed for LT and 25 watts for HT. The LT accumulator would have to be of the car type, and would so represent a heavy

initial cost and require frequent re-charging at a not inconsiderable expense. The HT supply would be even more difficult, for 25 watts at 250 volts represents a current of 100 mA. The impossibility of obtaining this economically from dry batteries is self-evident, and the only practicable course would be to

use accumulators. Even then the cost would be too great in most circumstances.

It is clear, therefore, that if a battery set is to be economical to operate the total power consumption must be much less than can be allowed for a mains set. Directly heated valves having economical filaments must be used, and they are considerably less efficient than mains types, and the difference is accentuated by the necessity for operating them under conditions which give only a small anode current consumption. It is in the output

Fig. 1.—The complete circuit diagram shows that non-delayed AVC is employed in order to reduce distortion, and that its action is augmented by the local-distance switch S1. A triode output valve is employed.

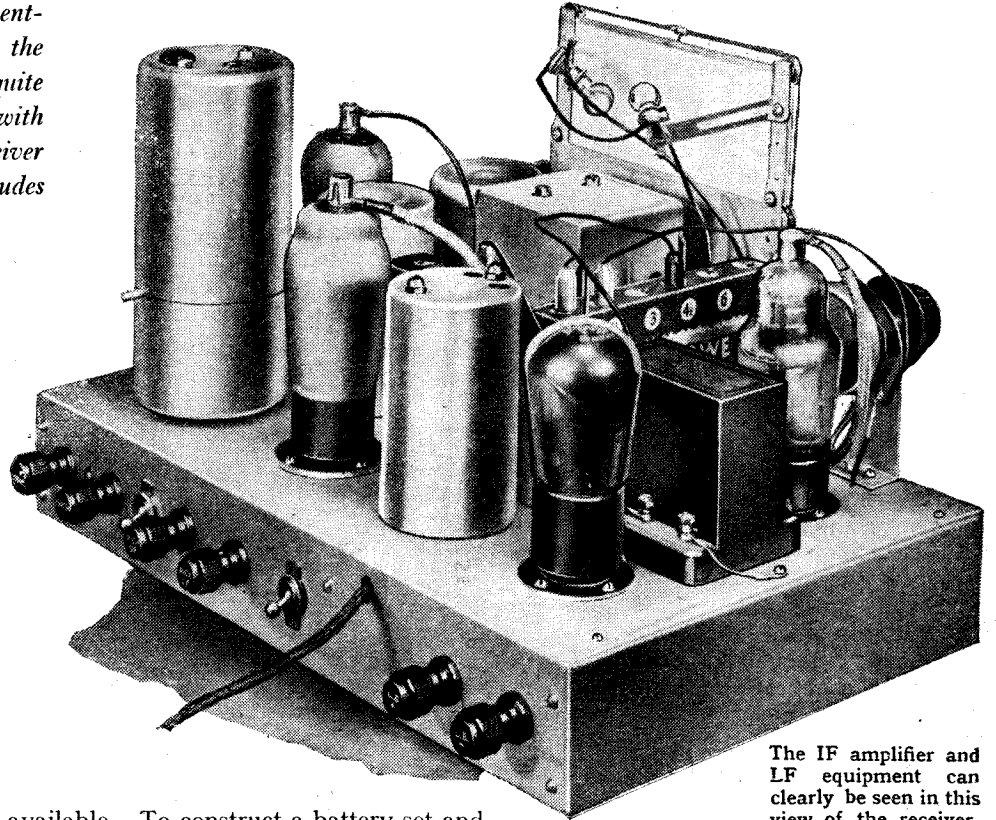


Variable-Selectivity IV

FOR general broadcast reception under present-day conditions it is hard to improve upon the superheterodyne, and with modern technique quite high sensitivity and selectivity can be secured with a moderate number of valves. This new receiver is designed for battery operation, and it includes both AVC and variable selectivity.

stage that the difference becomes most noticeable, however, for power is required from this stage in order to operate the loud speaker, and this power must always be less than that supplied to the valve from the HT battery. If we are limited in the power which we can draw from the battery we are consequently limited in the power available for operating the speaker.

A typical small battery set might consume 0.5 ampere at 2 volts for LT and 12 mA. at 120 volts for HT, or 1 watt LT and 1.44 watt HT. Comparing this total power of 2.44 watts against the 50 watts of a mains set, it is easy to see that the surprising part is not that a battery set gives a poorer performance than a mains set, but that it gives such good results as it does. It follows that it is only worth while to use a battery set when one has no choice—when no mains supply is



The IF amplifier and LF equipment can clearly be seen in this view of the receiver.

available. To construct a battery set and run it from the mains with the aid of an HT eliminator has consequently no justification, for better results can be secured by building a mains set.

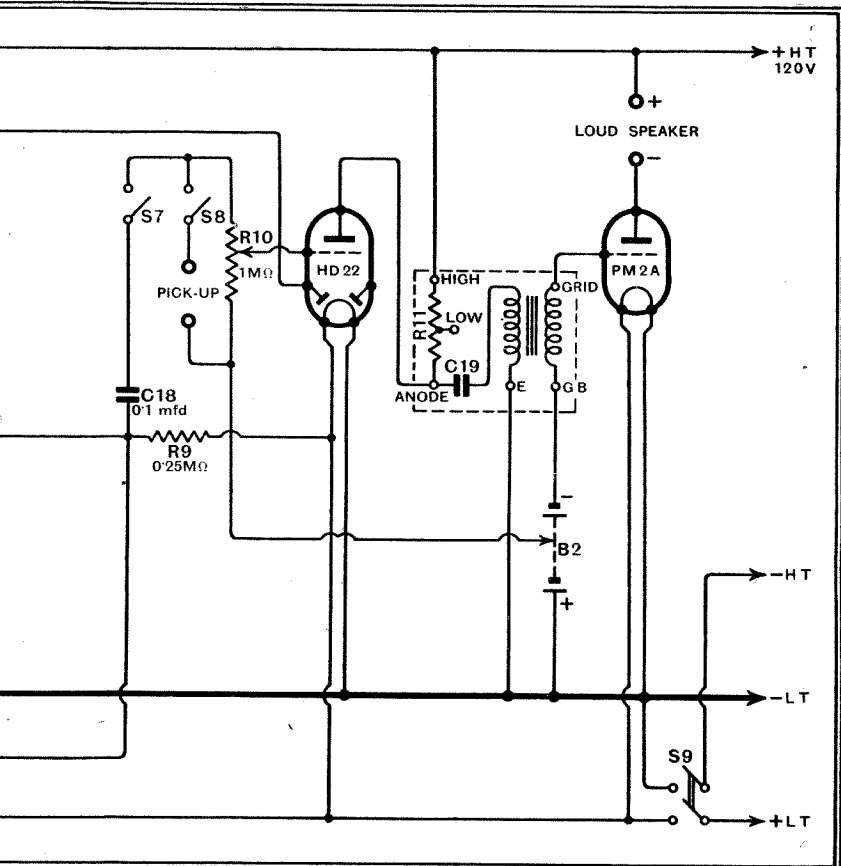
In spite of its obvious drawbacks, there is still a large demand for battery receivers, for there are many houses without a mains supply, and there is then no alternative. The Variable - Selectivity IV, which was described in *The Wireless World* for November 1st and 8th, 1935, represents a highly satisfactory type of small mains set suitable for general reception. A battery version produced by the obvious process of substituting battery-type valves, would fail because it would be either insensitive or uneconomical. More

drastic changes are needed to maintain a good performance without an excessive drain on the HT battery. An additional stage of amplification has accordingly been introduced in the battery model.

The complete circuit diagram appears in Fig. 1, and it will be seen that while the frequency-changer and IF stages are substantially unchanged, a duo-diode triode is used for detection, AVC, and LF amplification and is transformer-coupled to the output valve. In this way good sensitivity can be secured with economy.

The Oscillator Circuit

A heptode is employed for the frequency-changer with a tuned-grid oscillator circuit. On the medium waveband S5 is closed and S4 open; the oscillator tuned circuit then consists of L5 tuned by one section C9 of the two-gang condenser in series with the padding capacity consisting of the fixed condenser C6 of 0.0003 mfd. in parallel with the trimmer C5. When the switch is set for the long waveband, however, S5 is open and S4 closed; the inductance is then increased by the insertion of L6, and the padding capacity reduced by the addition of the 0.001 mfd. condenser C10, while the parallel capacity is augmented by the trimmer C8. Bias for the oscillator grid is obtained by the flow of grid current through the 100,000 ohms resistance R3, while the grid condenser C4 has a capacity of 0.0001 mfd. The



The Battery Variable-Selectivity IV—

reaction coil L7 remains unchanged on the two wavebands, the HT supply being fed through the 20,000-ohms resistance R4 with a 0.1 mfd. by-pass condenser C11.

Since an intermediate frequency of 465 kc/s is used, adequate second-channel rejection can be secured with only a single tuned circuit at signal frequency. The coil L3 is used on the medium waveband and tuned by C3, while on the long waveband the switch S3 is open and the additional coil L4 included. The aerial circuit is resonated at the middle of the tuning range by the coils L1 and L2, both being used on the long waveband and L1 only on the medium. This fixed tuned circuit is coupled in two ways to the tuning circuit—by the common capacity coupling C2 of 0.005 mfd. and by the "top-end" capacity C1 which is extremely small and consists actually of two wires correctly placed relatively to one another. In this way high efficiency, combined with constancy of efficiency over the waveband, are secured, and in addition the possibility of second-channel interference is reduced.

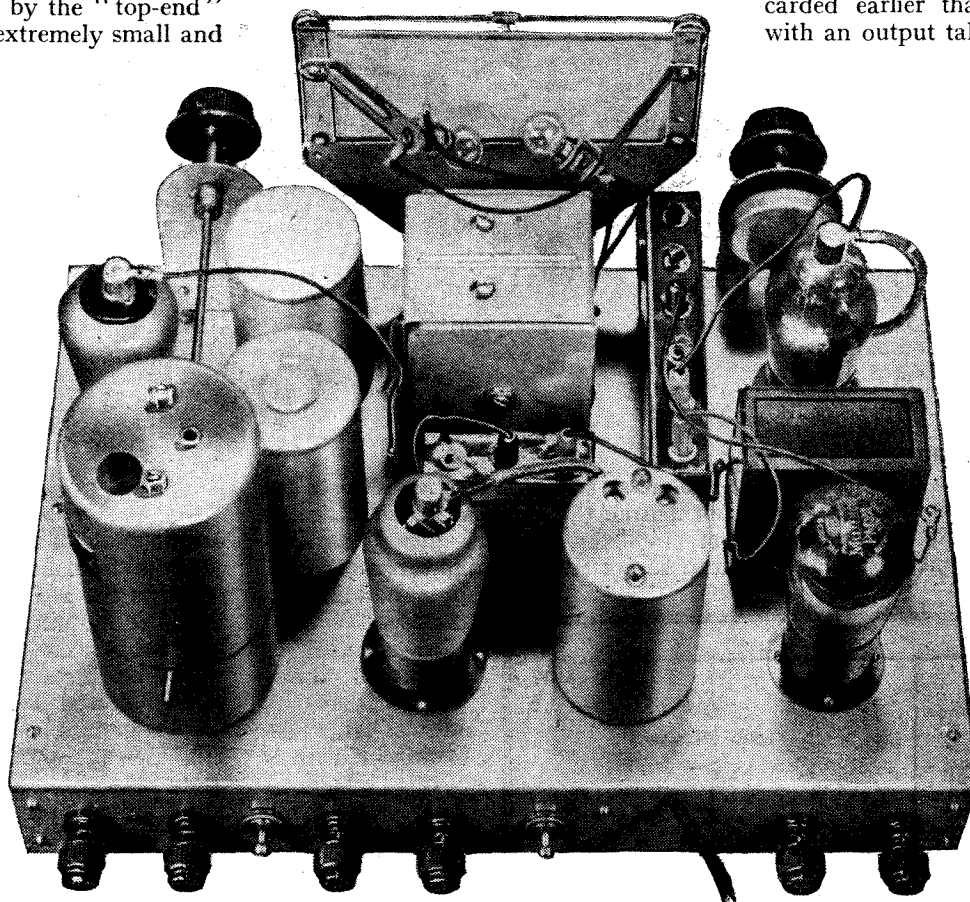
The output of the frequency-changer is applied to the IF valve, which is an HF pentode of the variable-mu type, through the variable-selectivity transformer T1. This stage is coupled to the diode detector by the second IF transformer T2, having fixed coupling between its circuits. The diode detector is one of the diodes of a duo-diode-triode and is fed from the IF transformer in the usual manner, the load resistance R9 and the by-pass condenser C15 having values of 250,000 ohms and 0.0001 mfd. respectively. IF filtering is provided by the 20,000 ohms resistance R8 and the 0.0002 mfd. condenser C16, and the LF output is taken through the 0.1 mfd. coupling condenser C18 and the 1-megohm volume control R10 to the grid of the triode section of the valve.

The AVC System

Only one of the diodes in this valve is used—the detector diode; the one intended for AVC is not employed, since the use of delayed diode AVC has been found to lead to considerable distortion, particularly in cases where the output of the IF

valve is limited, as it is in a battery set. Non-delayed AVC is accordingly used, and the potential developed across the detector load resistance R9 upon the rectification of a signal is applied as grid bias to the frequency-changer and IF valves. Since R9 must be returned to positive LT to secure proper rectification, the detector diode anode is about 1 volt positive in the absence of a signal, and, to avoid positive bias being applied to the controlled valves, it is necessary to insert a bias battery B1 in the AVC line to offset this voltage.

It will be clear from the circuit diagram how this is achieved. The detector output is first filtered by R7 and C14 of 1 megohm and 0.1 mfd. respectively to remove low-frequency potentials, and the steady voltage appearing at the output of this filter is applied in series with the 1.5 volts bias



The signal and oscillator tuning coils can be seen between the gang condenser and the frequency-changer valve.

battery B1 to the grids of the controlled valves. In the absence of a signal the valves have thus a grid potential of about 0.5 volt negative, and this increases when a signal is tuned in.

Turning back again to the amplifying chain, the triode section of the duo-diode-triode is coupled to the output valve by means of a resistance-capacity fed transformer, so that quite high gain is secured at this point. It is in the output stage itself, however, that the departure is made from the usual practice which will be a surprise to many, for it is neither of the quiescent nor the pentode types, but a simple triode.

It need hardly be said that a triode has been chosen because it proved best for the particular conditions in view, but the reasons governing its choice may be of in-

terest. Of recent years QPP and Class "B" have both been so widely used in battery receivers that the simple triode and pentode output stages have become almost extinct. The great virtue of the quiescent types of output stage is that they permit quite a large output—1 to 2 watts—to be secured for a fairly small average anode current consumption, so that operation is apparently economical.

The Output Stage

It is now, however, being generally realised that the economy is not as great as it would appear at first sight, and this for two reasons. The first is that the heavy peak currents have a detrimental effect upon the life of the HT battery, and the second is that the battery must be discarded earlier than would be necessary with an output taking a constant current.

As a battery ages, its voltage falls and its internal resistance increases. With adequate decoupling, the increase in resistance has little effect beyond reducing the voltage on load as long as the mean current is constant. Wide fluctuations in the current occur with a quiescent output stage, however, and the resistance has then a very marked effect upon the quality of reproduction. A partially run-down HT battery causes much more distortion with such stages than it does with a triode or pentode output valve. In addition, such stages are more expensive in first cost, and give lower amplification, while there

is always a risk of distortion at low volume unless the two output valves are well matched.

There is no doubt whatever that very fine results indeed can be secured from a properly designed and operated QPP or Class "B" stage, but there is also no doubt that it is much more exacting than the simpler output circuit. Where an output of more than a watt is needed and the current consumption must be kept at a low figure, there is no alternative. While such outputs are undoubtedly needed for the finest reproduction, much can be done with less for domestic use, and a single output valve can still be made to put up a good performance.

The choice here lies between pentode and triode. The pentode is supposed to

The Battery Variable-Selectivity IV—

give the larger output for a given current consumption, but it is much more critical in its operating conditions. If the load impedance is just right and the tone-compensation circuit is correctly adjusted, good results can be secured. This is by no means easy, however, for small battery pentodes require a load of 20,000-30,000 ohms, and it is quite hard to build an output transformer to suit such an impedance which is efficient and has a good frequency-response characteristic. Quite small changes in the load impedance have a big effect upon quality, so that accurate matching of speaker and valve is essential.

The larger class of pentode not only gives a greater output, but needs a lower load impedance, and is consequently much easier to deal with, good results being obtainable without excessive care in adjustment. Unfortunately, the current consumption from dry batteries is high.

We thus come to the triode. A small triode of the 150-milliwatt class consumes no more, and often rather less, current than a small pentode, but its undistorted output is on paper one-half. It is, however, in no way critical as to its operating conditions, and, although it has an optimum value for its load impedance, it is by no means sharply defined. Provided that the impedance is not too low, wide changes in the output transformer ratio have little effect on quality.

Comparative aural tests, which, after all, are the only ones which matter, between pentode and triode each consuming the same current, showed under average conditions a marked advantage for the triode from the point of view of quality of reproduction. Although the triode is rated for smaller output it would actually give greater volume with less distortion. This is not because the pentode will not give the output which its makers claim under correct conditions, but because it is difficult in practice to operate it correctly.

In the test mentioned no attempt was made to match speaker and valve with extreme accuracy. Reasonable care was used in matching, such as an average constructor might attempt, but the triode

hardly needs as close matching as this, and any load impedance between about 6,000 ohms and 15,000 ohms gives good results, the optimum being about 10,000 ohms. Furthermore, the distortion introduced by a small degree of overloading is much greater with the pentode than with the triode, and this is very important, for

with a small output stage it is hardly possible to avoid some overloading on peaks.

The triode has accordingly been selected for use in this receiver. With a grid bias of -4.5 volts and 120 volts HT, the output valve consumes some 6-7 mA, which is by no means excessive.

Full constructional details next week.

Police Wireless Developments

NEW RECEIVING STATION AT DENMARK HILL



stalled comprises a standard Marconi communication receiver, employing a super-heterodyne circuit with double frequency changing, and a set designed by the Police wireless engineers. This is also a super-het and has been evolved to meet the special requirements of this type of work.

For the present the transmitter will remain at New Scotland Yard, though arrangements are in hand to move it also

WIRELESS plays a very important part in the work of the Metropolitan Police Force, and for over ten years mobile units with radio equipment have been employed on patrol work and for traffic control on special occasions. The movements of the present-day fleet of cars, vans and river launches, and even aeroplanes on occasions, are reported to, and controlled from, the Information Room at New Scotland Yard via the short-wave transmitter installed there.

As a receiving station, this locality is far from ideal, since local electrical interference has now become exceedingly troublesome, so a new receiving site has had to be found.

Denmark Hill, on the south side of the Thames, has been chosen for the purpose, and the new building, flanked by its three 100-foot aerial towers, is now practically ready for occupation.

The receiving equipment so far in-

stalled comprises a standard Marconi communication receiver, employing a super-heterodyne circuit with double frequency changing, and a set designed by the Police wireless engineers. This is also a super-het and has been evolved to meet the special requirements of this type of work.

For the present the transmitter will remain at New Scotland Yard, though arrangements are in hand to move it also to a new site in outer London. Both stations will be in direct control of the Information Room at New Scotland Yard which, as hitherto, will be the transmitting and receiving centre.

Denmark Hill is joined to the control room by two Post Office lines taking entirely different routes, and arrangements are made to handle several incoming and outgoing messages simultaneously by means of special frequency band filters.

The duplication of the inter-station lines is to ensure absolute reliability, for in the event of a breakdown on one, all traffic can be immediately diverted to the other.

It is also proposed to investigate the possibilities of the higher radio frequencies for police work. Communication is carried out in telegraphy on 145 metres and coded messages are used to a large extent.

Although AC supply is available at Denmark Hill, the station will have a small generating plant for emergency use.

- 1 Two-gang condenser 0.0005 mfd., C3, C9
Polar "Midget" (Utility.)
- 1 Dial Polar VP Horizontal Drive
- 2 Bulbs for above, 2 volts 0.1 amp.
- 1 Aerial Coil, L3, L4 Bulgin B210
- 1 Oscillator Coil 465 kc/s, L5, L6, L7 Bulgin C6
- 1 Aerial loading coil, L1, L2 Bulgin C59
- 1 IF transformer 465 kc/s, T2 Bulgin C42
- 1 IF transformer, variable selectivity, 465 kc/s, with 6in. extension rod and adaptor for 1/2in. knob, T1 Sound Sales IF465
- 2 Trimmers 0.0003 mfd., C5, C8 Sound Sales 3VC
- 1 LF coupling unit Bulgin "Transcoupler" LF10
- Fixed Condensers
 - 2 0.0001 mfd., C4, C15 Bulgin PC301
 - 1 0.0002 mfd., C16 Bulgin PC302
 - 1 0.0003 mfd., C6 Bulgin PC303
 - 1 0.0005 mfd., C7 Bulgin PC305
 - 1 0.001 mfd., C10 Bulgin PC201
 - 1 0.005 mfd., C2 Bulgin PC205

- LIST OF PARTS for the BATTERY V-S IV**
- 6 0.1 mfd., C11, C12, C13, C14, C17, C18 Bulgin PCP1
 - (Dubilier, Polar-N.S.F., T.C.C., T.M.C.-Hydra.)
 - Resistances, 1 watt Formo "Formowatt"
 - 1 5,000 ohms, R1
 - 2 20,000 ohms, R4, R8
 - 2 50,000 ohms, R5, R6
 - 1 100,000 ohms, R3
 - 1 250,000 ohms, R9
 - 1 500,000 ohms, R2
 - 1 1 megohm, R7
 (Amplion, Bryce, Bulgin, Dubilier, Erie, Ferranti, Claude Lyons, Polar-N.S.F.)
 - 1 Tapered volume control 1 megohm, R10 Reliance SG25
 - (Erie, Ferranti, Claude Lyons, Magnum, Rothermel.)
 - 1 Multi-contact switch, S2, S3, S4, S5, S6, S7, S8 Magnum WW7
 - 1 Toggle switch, on-off, S1 Bulgin S80T
 - 1 Toggle switch, double-pole on-off, S9 Bulgin S126
 - 2 Valve holders 5-pin (without terminals) Clix Chassis-mounting Type V1

- 2 Valve holders 7-pin (without terminals) Clix Chassis-mounting Type V2
- 6 Ebonite shrouded terminals, A, E, PU (2), LS (2) Belling-Lee "B"
- 1 4-way cable, 30 inch, with terminals and spade ends Belling-Lee
- 1 Connector 5-way Bryce
- 1 Length of screened sleeving Goltone
- 3 Plug-top connectors Belling-Lee 1175
- 1 Grid bias battery 4 1/2 volts Bulgin No. 2
- 1 Grid bias clip for above Bulgin No. 2
- 1 Grid bias battery 9 volts Bulgin No. 1
- 1 pair grid bias clips for above Bulgin No. 1
- 5 Wander Plugs Ealex
- 3 Knobs Bulgin K16
- Chassis, complete with brackets and three spacing pieces B.T.S.
- Miscellaneous:— Scientific Supply Stores
 - 3 ozs. No. 18 tinned copper wire, 10 lengths Systoflex, etc. Screws: 39 6BA 1/2in. r/hd. with nuts for chassis, 2 4BA 1/2in. r/hd. with nuts, 3 4BA 1in. r/hd. with nuts. (Peto-Scott.)
- Valves:—
 - 1 Osram HD22, 1 Ferranti VHT2A, 1 Mullard VP2, 1 Mullard PM2A.

Cathode Ray Valve Tester

CHARACTERISTICS SHOWN AT A GLANCE

By J. H. REYNER, B.Sc., A.M.I.E.E.

THE author describes the design and operation of apparatus whereby the characteristic curves of a valve may be made visible on the screen of a cathode ray tube. This method is, of course, immeasurably more rapid than the normal laborious procedure of plotting characteristics.

THE idea of using a cathode ray tube for plotting valve characteristics is not a new one, and it has, indeed, been used by valve manufacturers for production testing. It is surprising, however, that more general use is not made of the cathode ray tube in this connection, for it is particularly useful in the laboratory, where the valve characteristics may be examined in a moment.

The instrument described herewith was developed in the author's laboratories for such use. It enables the anode current-anode voltage (I_a-E_a) and anode current-grid voltage (I_a-E_g) characteristics to be recorded, a change-over from one to the other being effected by a switch. What is more, it allows three such characteristics to be examined on the screen simultaneously, which is very useful in many instances. It is, for example, possible by plotting the I_a-E_a characteristics for three different biases of zero, normal and twice normal to place a load line across the characteristics and determine exactly whether the valve will suit the conditions

of the valve, and the anode is fed from a steady supply. In this case, since appreciable power consumption is involved, a special eliminator was constructed for the purpose. This eliminator was so designed as to have 5 per cent. regulation from no load to full load of 200 milliamps, while subsidiary voltages were obtained by tapping off through a heavy-current potentiometer, the various tapping points being by-passed with condensers of 16 mfd. each. By this arrangement it was found that during the relatively short period when the valve is conducting, the voltage does not fall appreciably through the current drain, and the error introduced by using a mains unit instead of batteries is quite small.

voltage is applied to the valve under test (V_1) from a transformer operating off the AC mains. It therefore feeds positive and negative alternately, while the grid is biased with a steady negative bias obtained from a battery. The valve conducts on the positive half-cycles, and the current passing through the small cathode resistor R produces a voltage which is amplified by the second valve, producing an anode voltage variation which is proportional to the current flowing in the circuit.

This voltage variation is applied to the Y or vertical deflecting plates of the cathode ray tube, while the X plates are fed from a potentiometer across the AC input to the anode. Thus as the anode voltage increases the spot is moved to the right by the X sweep, while the anode current flowing through the valve generates a voltage through the amplifying valve V_2 , which causes the spot to move vertically. The sinusoidal variation of anode voltage does not introduce any distortion because the X sweep is tied to the same voltage, so the spot movement is proportional to the actual voltage at any instant.

A somewhat similar arrangement is used for the I_a-E_g characteristic. Here the alternating voltage is applied to the

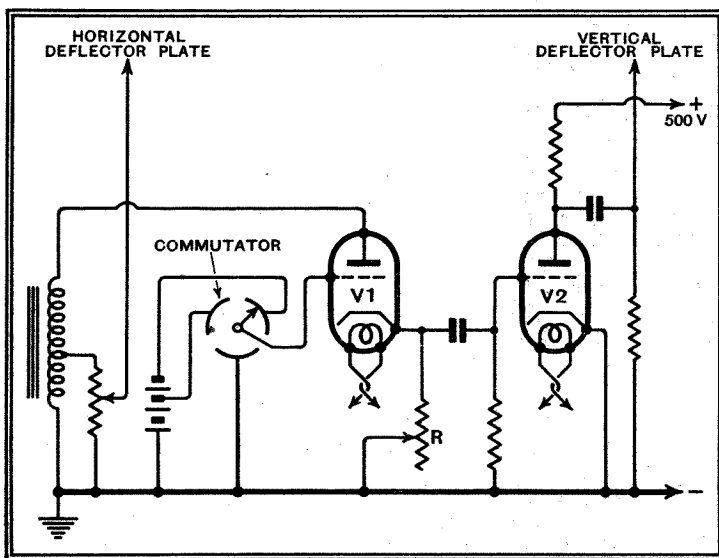
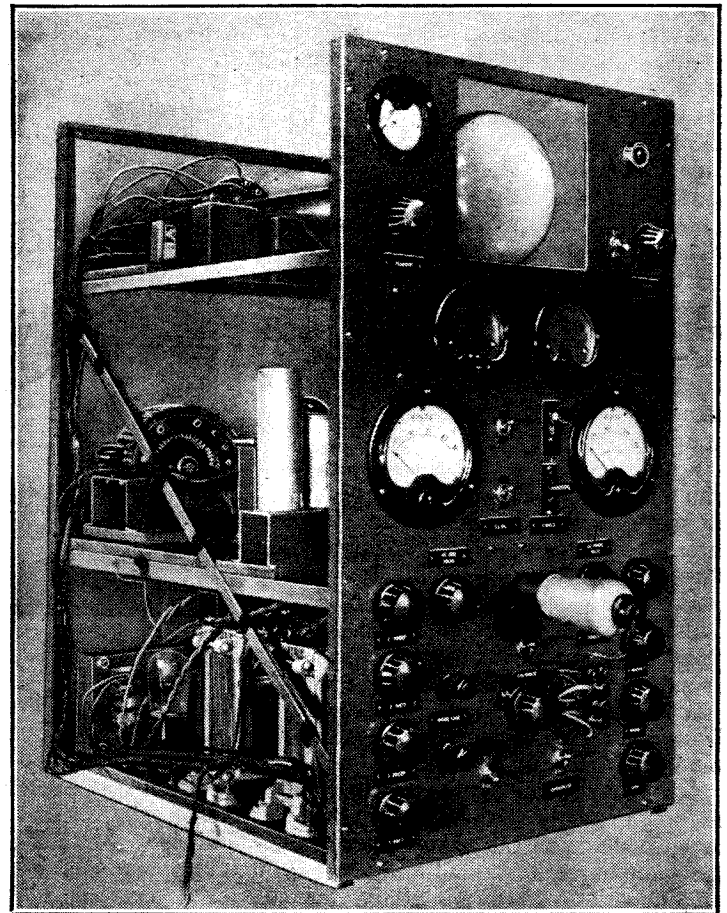


Fig. 1.—Simplified circuit arrangement for viewing anode current-anode voltage characteristics.

under which it is proposed to work it. Fig. 1 shows the simplified arrangement for the I_a-E_a characteristic. The anode



• Front view of apparatus with cover and tube mask removed.

of the valve, and the anode is fed from a steady supply. In this case, since appreciable power consumption is involved, a special eliminator was constructed for the purpose. This eliminator was so designed as to have 5 per cent. regulation from no load to full load of 200 milliamps, while subsidiary voltages were obtained by tapping off through a heavy-current potentiometer, the various tapping points being by-passed with condensers of 16 mfd. each. By this arrangement it was found that during the relatively short period when the valve is conducting, the voltage does not fall appreciably through the current drain, and the error introduced by using a mains unit instead of batteries is quite small.

Avoiding Grid Current

The I_a-E_g characteristic has one further complication, in that it is necessary for the voltage on the grid to be biased negatively, so that the voltage variation sweeps about a fixed negative point (unless the valve is required to run into grid current as in the case of a positive drive). This can be arranged by including a rectifying condenser in the grid lead, in which case the valve automatically biases itself back to the peak value of the AC. Since

Cathode Ray Valve Tester—

with a modern mains valve, however, the grid current commences to flow at a small negative voltage, the portion of the characteristic from about minus one volt to zero is cut off, and a false zero is obtained. It was therefore arranged to include a permanent biasing battery which was adjusted to equal the peak value of the applied AC.

The total amount of the horizontal sweep is determined by the setting of the potentiometer across the AC supply. Voltmeters calibrated in peak volts are provided to indicate the actual voltage swing being applied to either anode or grid of the valve. Over the front of the tube is placed a scale printed on transparent paper, and the length of the voltage sweep is then adjusted by the potentiometer mentioned to correspond exactly to the reading on the scale. The anode voltage swing, for example, is usually 400 volts peak, and the length of the horizontal deflection on the tube is adjusted to spread this voltage from 0 to 400 on the arbitrary scale.

The current calibration is varied by altering the value of the cathode resistance. This resistance in any case is only 100 ohms or so, so that it introduces negligible load into the valve, and by altering the value of this resistor the voltage applied to the amplifying valve, and hence the actual vertical deflecting voltage, can be varied.

Here, since the current is not sinusoidal, the same method of calibration will not apply, but the difficulty is overcome by passing a small AC current through the resistor, at the same time cutting off the horizontal sweep so that a vertical line appears on the tube. The calibrating current is variable in steps to be 10, 25, or 50 mA., and, by adjustment of the cathode resistor, these currents can be made to give any desired length of line on the tube, so that the vertical deflection can again be made to fit the scale.

Once this calibration is effected, the valve under test is plugged in, the switching adjusted for the particular characteristic required, and the curve is then traced instantaneously, enabling the effect of varying the control electrodes to be ascertained without laborious plotting of readings. Where

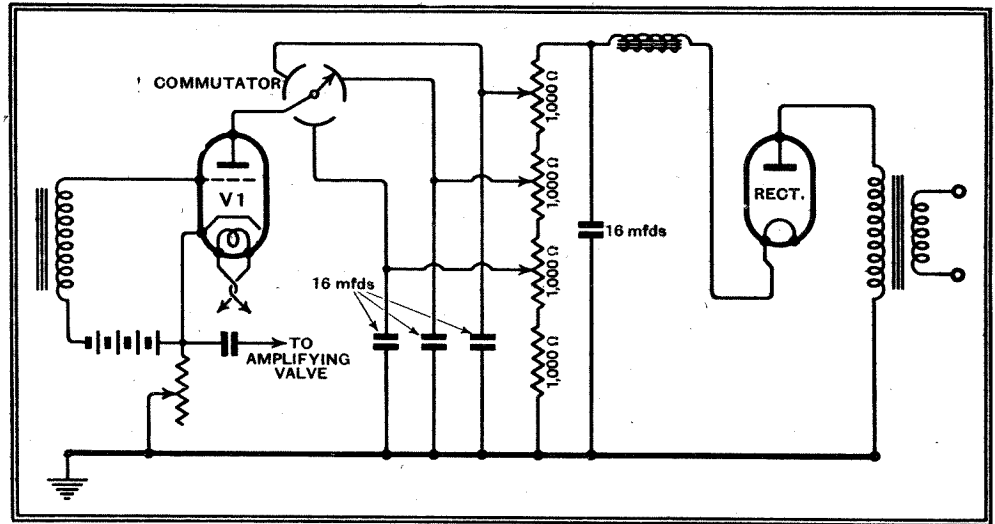
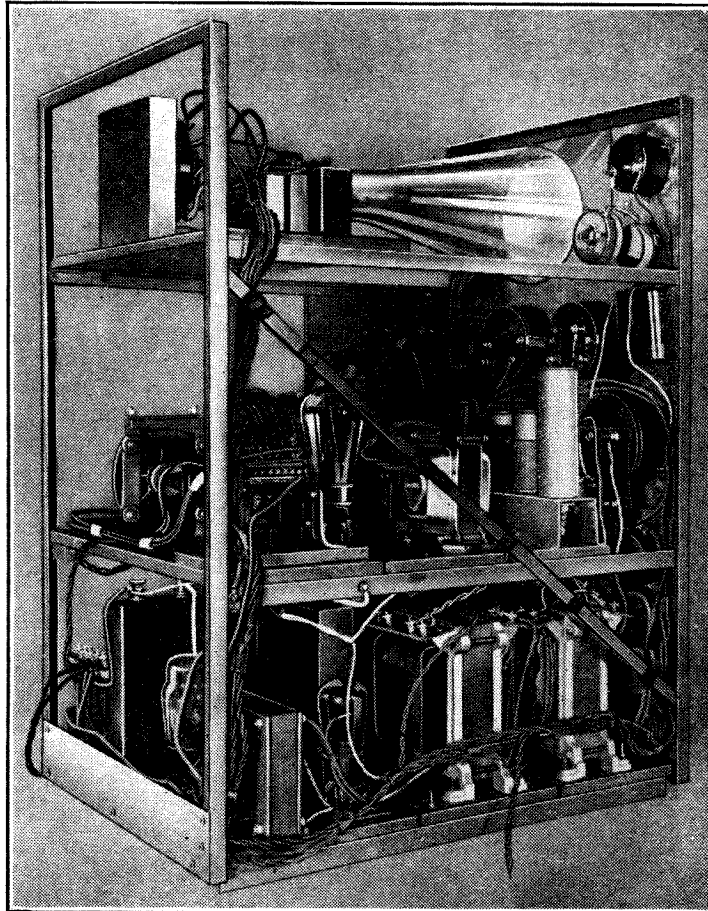


Fig. 2.—Arrangement for examining anode current-grid voltage characteristics.

several characteristics at once are required the voltage to be varied is fed through a commutator. When measuring I_a-E_a characteristics, for example, the steady grid bias is supplied through a commutator to be zero, normal, and twice normal in rapid succession. Provided the change-over is sufficiently rapid, the visual persistence of the eye, aided by the time lag on the screen, gives the impression of three continuous curves. In like manner I_a-E_g characteristics can be plotted for three different values of E_a .

mally rise to dangerous values. To avoid this a special limiting arrangement is incorporated which prevents the current from rising beyond a certain level. This arrangement is so designed that it does not operate until the spot on the cathode ray tube has reached the top of its travel, so that the normal characteristic is unaffected. There were also numerous small difficulties in practice arising mainly from capacity effects. If there is any phase displacement between the horizontal and vertical sweeps the tube does not trace a single characteristic, but a loop, rather like the well-known hysteresis loop, is formed. By suitable attention to detail, however, this effect can be obviated.

The result is an extremely flexible and valuable instrument which saves considerable time in experimental work. The particular instrument in question was constructed for The High Vacuum Valve Company, to which the author is indebted for permission to publish these details.



The main power supply equipment is mounted in the lower tier, with the commutator and bias controls immediately above.

When plotting I_a-E_a characteristics of high-power triodes, the anode current at zero voltage and 400 volts HT will nor-

Wireless Servicing Manual, by W. T. Cocking, 213 pages + x. Price 5s. Published by *The Wireless World*, Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

AS its title implies, this book covers the whole field of "trouble-shooting," to use an expressive Americanism, in receiving equipment. Stress is laid upon the necessity for proper testing equipment and upon its correct use, and examples are given of the traps into which the unwary may fall when performing such apparently simple operations as the measurement of voltage and current.

The major portion of the book is devoted to the location and cure of the defects which may arise in all types of receiving equipment. The important adjustments to receivers which, while not being defects, are often necessary in all classes of apparatus, are very fully treated. Thus the operations of ganging both straight sets and super-heterodynes of all types are fully explained, as also are the methods of dealing with unusual adjustments, such as the balancing of push-pull amplifiers and neutralised sets.

The appendices include much useful information, including commonly used component values, colour codes, and valve base connections for British, American, and Continental valves.

CURRENT TOPICS

EVENTS OF THE WEEK IN BRIEF REVIEW

Voting by Wireless

A NOVEL Bill has been introduced into the French Chamber to secure satisfactory voting on ships at election times. It is proposed that each boat should contain a voting booth with the captain as president. The crew would register their votes in the ordinary way, and the captain would make the count and transmit the result by wireless to the Maritime Administration.

More High-power Broadcasting from America

THE National Broadcasting Company of America is proposing to build a 500-kilowatt transmitter at Bound Brook to replace the pioneer station WJZ now situated there. It is almost exactly two years since the first 500-kilowatt station, WLW, was inaugurated in America. Various other well-known stations in the U.S.A., such as KNX and WHO, have also made applications to the Federal authorities to enter the super-power class.

Russia and Television

RUSSIA is entering the high-definition television field with a 10-kilowatt station

which is being constructed at Moscow. The station will work on ultra-short-waves, and it is hoped that it will be ready for service next year. Actually a test transmitter is already in operation in Moscow, and it is reported that over 2,000 television sets and kits have been completed in one of the Soviet factories in readiness for the anticipated demand.

Cheaper Telegrams to Ships

AFTER July 1st it will be possible to send messages to ships at sea through any British coast station for 8d. a word instead of 11d. In the case of ships engaged on voyages of not more than 200 miles from any port in the British Isles a special cheap rate of 4d. per word has been in operation. This charge remains the same, but the distance has been increased to 1,000 miles.

The long-distance service via the high-power station at Rugby will be available at 1s. a word instead of 1s. 6d.

Reports Wanted

MR. BERTRAM PASHLEY, owner of station G6PJ, would appreciate reports on his seven megacycle transmissions, 'phone and CW, as he is testing out a new transmitter. Any reports sent to him at 124, Nicholson Road, Sheffield, 8, will be acknowledged.

Signor Alfonso Marconi

SIGNOR ALFONSO MARCONI, whose death occurred recently, was the younger brother of the well-known inventor. Although overshadowed by the fame of the Marchese Marconi, he was quite a well-known figure in the wireless industry, and rendered valuable assistance to his brother in his early experimental work.

New Australian Broadcasting Stations

IN Melbourne arrangements are being made for the erection of two National broadcasting stations to take the place of the two existing transmitters. It is expected that the new stations will be twice as powerful as the present ones, and they will be built outside the city limits.

P.A. Installation at Railway Stations

LOUD SPEAKER call systems for directing passengers and announcing trains have recently been installed at Waterloo, Bournemouth Central and Portsmouth Harbour stations by the General Electric Company.

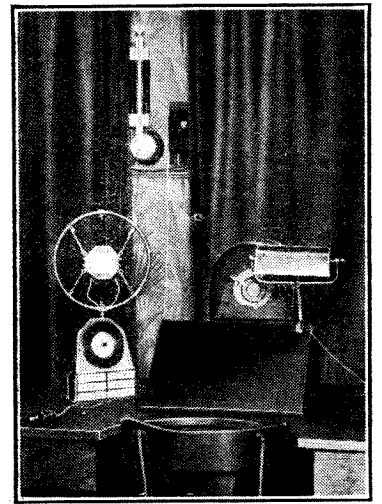
A special control desk is available, enabling the announcer to select any group of loud speakers or to change over to a stand-by amplifier at a moment's notice.

Coloured Wiring for French Sets

IT has just been decided by the French "S.P.I.R.", which roughly corresponds to our own Radio Manufacturers' Association, that, in future, all sets will be wired up according to a colour code, as is already done by most manufacturers here, in order to facilitate the identification of circuits. Different colours will be assigned to the various circuits in a receiver, and it is estimated that this will necessitate a slight increase being made in prices.

Wireless at "Uncle's"

ACCORDING to a French contemporary, the objects which most frequently find their way to the shelves of the pawnshops in Paris nowadays are wireless sets. The business of pawnbroking in France is run by the municipality, and it is said that in Paris the number of wireless sets pledged has been so great that it has been necessary to open a special section to deal with them.



This view of the talks studio at the Warsaw station is made more interesting because of the frequent broadcasts in English that are heard from there.

Short Waves and Snake-bites

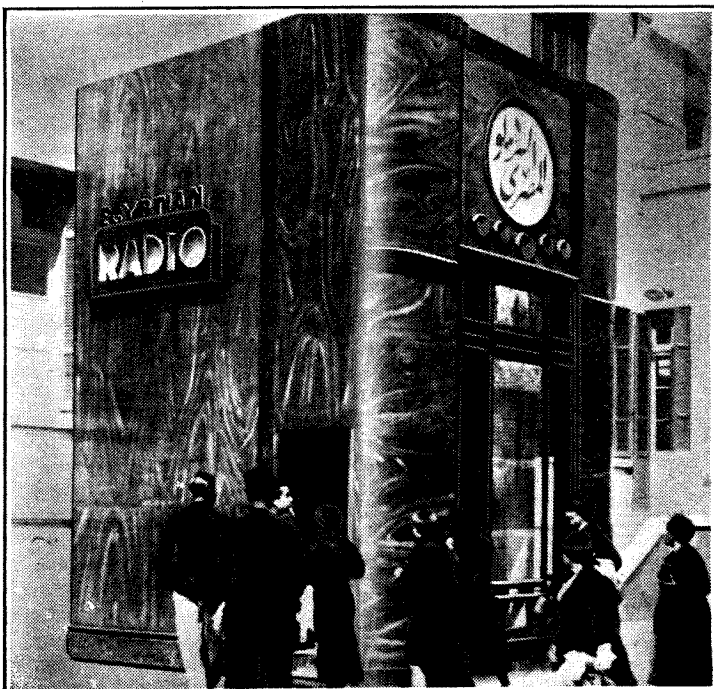
AS many people are aware, the venom from snakes has sometimes been used to alleviate certain diseases of the nervous system, and now it appears that in Paris short waves are being employed to cure snake-bites. The Pasteur Institute is engaged in research work in this direction, and it is said that a considerable measure of success has been attained. No mention is made, however, of any remedy being discovered to counteract the effects of the short waves!

Wireless for Schools

PRACTICALLY all the schools in Dumbartonshire are to be equipped with wireless receiving apparatus as the result of special efforts made by pupils and teachers throughout the county. It was recently decided by the Education Committee that if wireless sets were installed in schools by voluntary subscription they would be maintained by the authority.

A Dangerous News Item

IN a recent issue of the Swedish *Radio Times* a story is told of a very unusual happening as the result of a running commentary on a horse-race. A barber was about to commence shaving a customer when the commentator's voice coming from a loud speaker in the shop announced the victory of a certain well-fancied horse. The barber, who had backed it heavily, was so elated that he gave a violent start, with the result that he was unlucky enough to chop off one of his fingers. The customer, mindful of the bad effects on his throat which might eventuate from the barber's listening to the results of further races, did not wait to be shaved but hurriedly dashed out of the shop.



COME INSIDE AND SEE HOW WE WORK. The unusual design of their stand at a recent agricultural show in Cairo attracted many additional visitors to an enterprising Egyptian radio firm.

Valves for Tone

SUGGESTIONS FOR OVERCOMING A SERIOUS HANDICAP

Correction

IT is generally realised that selectivity and quality do not go hand in hand, and that a receiver designed for the very best reproduction is often suitable only for local station reception. As the scope of such a set is limited, most people are prepared to sacrifice a certain amount of high-note reproduction in the interests of selectivity, so that a wider range of programmes may be obtainable free from interference, and it is in such receivers that the principle of tone correction finds its greatest application.

The principle of variable selectivity, as introduced in the latest *Wireless World* receivers, does, of course, get over the problem in a neat and effective manner, but there are many sets built along the old lines in which it would be difficult to incorporate this latest refinement, so that a few words on tone correction will not be altogether out of place.

Tone correction, as normally applied, consists of giving extra amplification to the higher audio frequencies, to make up for the losses suffered by those frequencies in the selective tuned circuits of the HF and IF amplifier. The two main ways of carrying out this idea in radio receivers are shown in Fig. 1. In diagram (a) the condenser C short-circuits R1 for high notes, and the full output is passed along, but the impedance of C rises as the frequency falls, and only a portion of the low notes is passed forward to the audio frequency amplifier.

Relative Amplification

There are two drawbacks to this scheme, one being that it is not practicable to make the ratio R1/R2 sufficiently large to compensate fully for the losses usually met with. The other is that, unless the value of the bypass condenser is chosen carefully, the result can be a loss of bass, which is by no means the same as a relative increase in treble, although many people think of the two as being synonymous. Actually we want to increase the

high note response, not at the expense of the low notes, but at the expense of the low and middle register. It is the relatively increased amplification over the middle register that matters, and if we merely throw away the extreme bass we get a dip at each end of our response curve instead of at one end only.

In Fig. 1 (a), the values in practice might well be R1=1 megohm, R2=1/4 megohm. For such a ratio Fig. 2 shows the relative response curve for any reactance of the condenser, and the points a, b, c, d, etc., will represent successive octaves. With a condenser of 0.0001 mfd. the points a, b, and c will represent frequencies of 1,500, 3,000, and 6,000 cycles respectively, and the network will therefore be functioning in exactly the right manner. If, on the other hand, a condenser of 0.001 mfd. is used, points a, b, and c will represent 150, 300, and 600 cycles, and all the correction will take place in the middle frequencies, which, of course, is worse than useless.

The other scheme, which allows sufficient compensation for very selective receivers, is to use a special tone-corrector stage as in Fig. 1 (b), in which the anode load consists of an inductance and capacity resonating at about 7,000 cycles. This anode load is at a maximum of resonance, whilst at medium and low frequencies the load drops to the value of R only, and as the amplification from a valve depends very largely on the anode load, high frequencies will naturally receive preferential treatment. This idea is, of course, not new, and the values shown are actually taken from an old number of this journal, but there is one very important point concerning such a

THE anode circuit load of a tone-correction stage is usually so low at certain frequencies that there is a serious danger of severe harmonic distortion. But, as pointed out in this article, such troubles may be minimised by choice of a suitable valve working with the appropriate circuit constants.

By W. WINDER

stage that has not previously been given the prominence it deserves.

Criticisms of the results obtainable with a tuned corrector stage have been made to the effect that reproduction becomes "shrill," "harsh," or "peaky." Now, such symptoms at once suggest amplitude or harmonic distortion, and a reference to Fig. 3 shows how easy it is to get harmonic distortion under the loading conditions imposed on the valve. Fig. 3 shows the anode volts-anode current curves for the triode portion of a double-diode-triode, which is the type of valve often employed in such a corrector stage. With a load of 30,000 ohms the harmonic distortion is no greater than normal, but with our tuned circuit the anode load at low and medium audio frequencies is in the order of 1,000 ohms, and if reference is made to Fig. 3 it will be seen how unequal are the voltage swings along the 1,000-ohm load line.

Severe Distortion

With a standing grid bias of -3 volts and with a signal of 2 volts peak, the grid voltage will of course swing from -3 to -1 with the positive impulses, and from -3 to -5 with the negative impulses. For distortionless amplification these

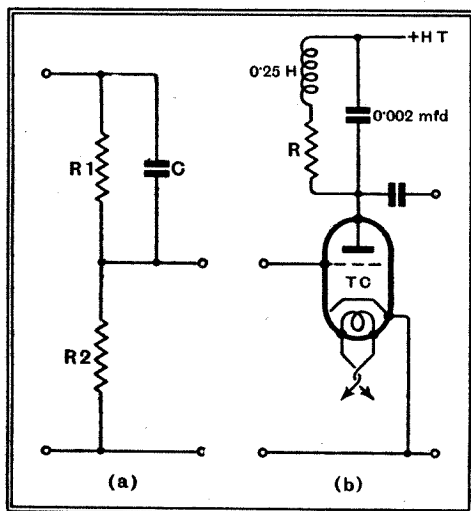


Fig. 1.—Circuits for tone correction.

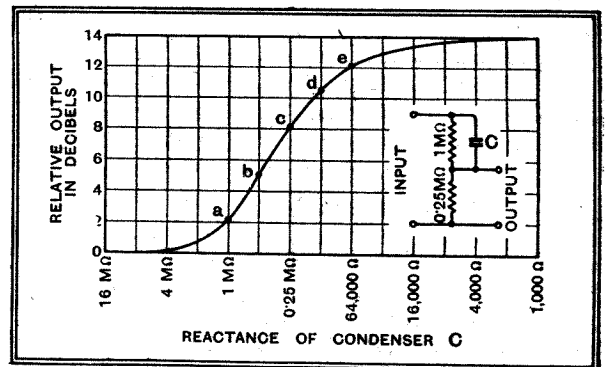


Fig. 2.—Correction introduced by the arrangement of Fig. 1 (a) with various values of capacity.

voltage swings should be of equal length along the load line, but the diagram shows how unequal they actually are, and this

Valves for Tone Correction—

inequality is ample explanation of the harshness of reproduction noticed in practice.

A palliative is to use less grid bias than normal and to limit the signal input to a fraction of a volt, but it would obviously be better to look round for a more suitable valve. Such a valve is not too hard to find. All triodes will suffer from the

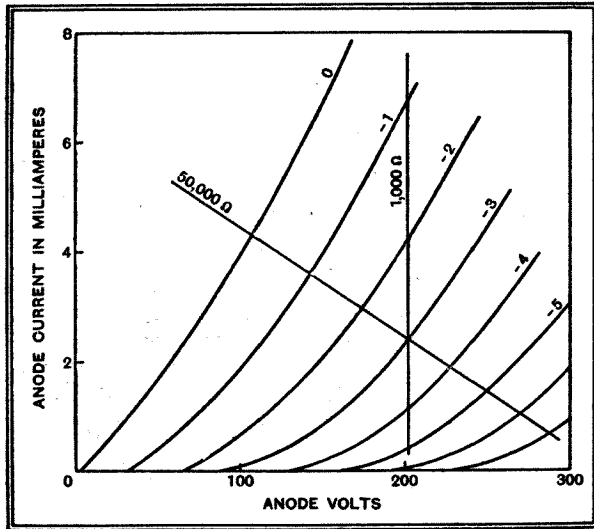


Fig. 3.—Load-line curves for the triode section of a double-diode-triode, showing how distortion is introduced with a low value of load resistance.

same unequal response along a low load line, but the curves of four- and five-electrode valves turn over nicely at the top and are better suited for dealing with "straight up and down" load lines. We therefore look amongst the HF pentodes and screen grid valves for a suitable specimen, but as the

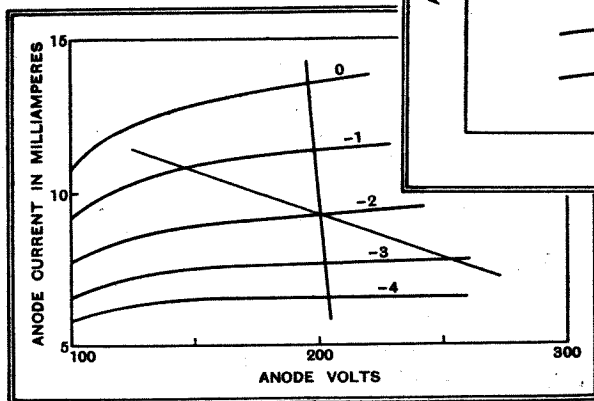


Fig. 4.—Load-line curves of a tetrode valve (VMS4) suitable for tone correction.

normal function of this type is high frequency amplification, where harmonic distortion is of secondary importance, it behoves us to be careful. It will be convenient for our valve to accept a signal of 1 volt peak without running into grid current, so we shall have to bias it at two volts negative, and the grid voltage must be capable of swinging between -1 and -3 volts without producing appreciable harmonic distortion.

Figs. 4 and 5 show suitable and unsuit-

able tetrodes respectively. The valve of Fig. 5 would be quite suitable for its intended function of high-frequency amplification, but for our present purpose it is unsuitable, the -3 curve being too near the -2 curve. Harmonic distortion would be almost as severe as with a triode. The VMS4 shown in Fig. 4, however, has its -2 volts curve equally spaced from its -3 and -1 volt curves, and undistorted amplification can be obtained at all loads imposed by the tuned anode circuit. Actually the results obtainable by using such a valve as tone corrector are audibly superior to those obtained from a triode, as long as the anode and screen voltages, especially the latter, are kept well up to the recommended maximum.

With due precautions tone correction can be well worth while. The higher audio frequencies are becoming more and more recognised as essential to high-quality reproduction, and as long as no other evils are introduced in the process, the putting back of high notes to their correct relative proportion is bound to be of value.

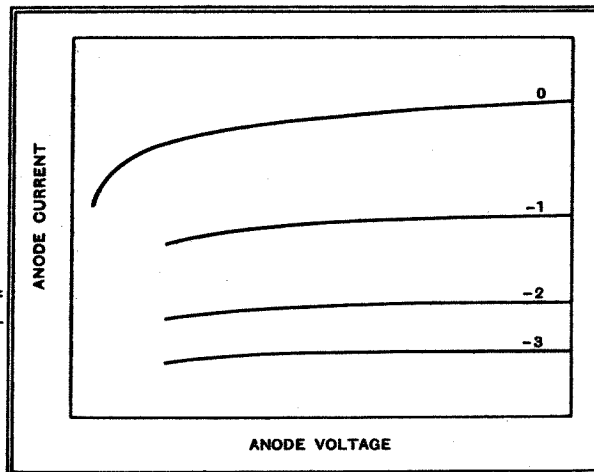


Fig. 5.—Anode voltage/anode current curves of a valve which is well suited for its normal function, but which would be unsatisfactory in a tone-correction stage.

DISTANT RECEPTION NOTES

THE number of stations on the medium-wave band whose output rating will go up to 100 kilowatts or rather more, in some cases quite soon, in others at a date not yet decided, is amazingly large. In France alone there are five. Radio-Toulouse is to grow from 60 kilowatts to 100 and possibly more; Bordeaux Lafayette will be converted from 25 kilowatts to 100; Toulouse P.T.T. is to exchange its 1.5

transmitter for one rated at 100 kilowatts; Rennes, now 40 kilowatts, is likely to treble its power, and Limoges may multiply its present 0.5 kilowatt two hundred times. Algiers, though geographically outside Europe, comes under the Lucerne Plan; it will soon go from 12 to 100 kilowatts.

Other notable stations which will shortly attain the 100 kilowatts that now seem necessary for any transmitter if it is to be ranked in the first class are Rome I and II, Lisbon, Brno, Bratislava, Moravská-Ostrava, Brussels I and II, Hilversum II and Belgrade. In Russia both Minsk and Kiev are to follow suit.

This makes a total of 17 genuine European stations—18 if we count Algiers—on the medium waves which are to increase their power largely. On the long-wave band the Madrid station, now building, will be rated at 150 kilowatts; the new French National station to replace the 80-kilowatt Radio-Paris will radiate at least 150 kilowatts; Motala, already a 150-kilowatt station, is going to be bigger still and Reykjavik will sooner or later, as funds permit, reach at least 100 kilowatts.

Spain's New Regional Scheme

In addition to the stations mentioned there are numbers which will shortly inaugurate new transmitting plants rated at from 20 to 60 kilowatts. Spain alone has half a dozen under her Regional scheme and there are comparatively few European countries which have not one or more.

The outstanding question from the point of view of the man who likes to be able to make use of Continental stations for entertainment when he feels so minded is "How will these numerous increases in power rating affect reception in this country?" On the whole they will, I believe, be beneficial. In some cases sideband splutter may become so severe that certain stations that were good enough in the past are no longer worth tuning in. All things considered, though, I feel that we shall have in, say, twelve months a larger number of alternatives available than is now the case.

The most important aspect of this rush towards high power is probably that it will end once and for all the old idea that summer is the season for local listening only. Actually for several years now the number of foreign stations that could be received right through the summer with good quality and volume has been a pretty useful one. But old superstitions die hard and the idea that the "wireless season" begins more or less with the change from B.S.T. to G.M.T. in October and ends when we put our clocks forward in April has persisted stubbornly, despite cold hard facts. I can't help feeling that though it has been an unconscionable time a-dying it will come to an end before much more water has flowed beneath the bridges.

There is only one aspect of these widespread power increases that causes me misgivings. This is the advent—long awaited, but soon to be a fact—of the Spanish National transmitter and the rise to anything from 100 to 200 kilowatts of three other long-wave stations. There are few long-wave stations that are not fairly bad offenders in the matter of harmonics that fall within the limits of the medium-wave band. Any long-distance enthusiast who cares to go in for that very interesting pastime, harmonic hunting, may be surprised to find how many he can track down.

D. EXER.

New Apparatus

Reviewed

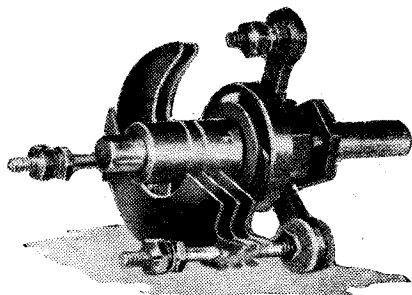
Recent Products of the Manufacturers

NEW EDDYSTONE ULTRA-SHORT-WAVE CONDENSERS

STRATTON & CO., LTD., have decided to withdraw the Types 942 Scientific Condenser and the 900 Microdenser and replace them by new components designed to be more efficient on the short- and ultra-short wave-bands.

In the new Type 900 a single bearing and the same shaped vanes as hitherto are still employed but the design has been considerably altered in all other respects.

It has a brass spider back-plate and the stator assembly is supported in insulating bushes made of a material described as Calit. Both sets of vanes are now secured by soldering. The rotor spindle is extended and reduced to $\frac{1}{2}$ in. diameter for ganging two or more models. Three sizes are made and these have nominal capacities of 22.5, 45.5 and 103 m-mfds. respectively.



The new Type 900 Eddystone ultra-short-wave condenser.

A specimen of the smallest size has been tested and its measured capacities found to be 6.5 m-mfds. at minimum and 20.5 m-mfds. at maximum. The minimum capacity is somewhat higher than in the nearest equivalent size in the early Microdenser series, but the new design embodies so many useful features, and is so obviously a better component, that the higher minimum is of little consequence by comparison.

No change has been made in the price other than that the early models of 15 and 25 m-mfds. are replaced by one of 22.5 m-mfds. at the price of the old 25 m-mfds. model, namely, 3s. 9d.; the others cost 4s. 3d. and 5s. each respectively.

A few details only of the new Scientific condenser are available at present and it seems that this is of the all-brass construction, as in the case of the new Type 900, while Calit insulation is also employed. Likewise, provision is made for ganging.

It is stated to have a minimum capacity of 13.5 m-mfds. and a maximum of 192 m-mfds., so it is obviously for short-wave use and the price is 7s. 6d.

PILOT ALL-WAVE AERIAL

THE Pilot All-wave Aerial is of the doublet type and consists of a 66ft. horizontal span divided by an insulator into

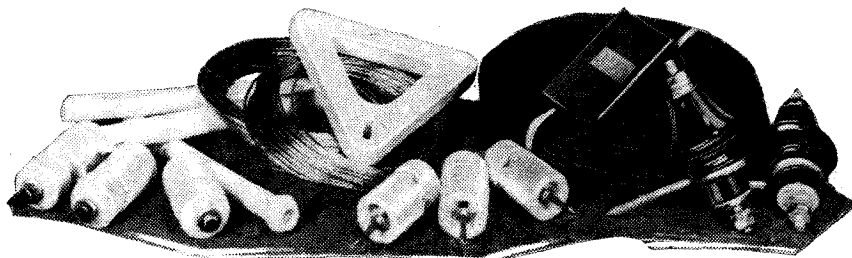
two equal parts. To the centre is connected a transmission line down-lead, and this is joined at the receiver end to a special matching transformer. This unit should, wherever possible, be fixed to the cabinet of the set, but it must be accessible, as it includes a two-way switch marked SW and BC, these being for short-wave and broadcast reception respectively.

From tests made, it would appear that in the short-wave position the system is employed as a true doublet, but in the broadcast position the transmission line is joined direct to the receiver, so that in effect the aerial becomes a more orthodox "T" type. As a diagram of the transformer connections is not available, this point cannot be definitely verified.

The transformer has two spring terminals for the transmission line, which, incidentally, is a twisted pair 75ft. long, and three short flexible wires which can be connected to the receiver in several different ways, and the various combinations should be tried to find that which best suits the particular set in use.

Included in the kit are two lightning arresters for fitting to the lower end of the transmission line, preferably outside the building, aerial insulators, a porcelain lead-in tube, and six short stand-off insulators for clamping the down-lead to the wall.

An important feature of this type of aerial system is that the down-lead portion is a very poor collector, and if the horizontal part is high, or well clear of all buildings, is less responsive to local electrical interference than the single-wire pattern. Used as a true doublet, it is also directional, giving best results when erected at right-angles to the direction from which signals are arriving. In this connection it should always be remembered that signals from a far-distant station take a great circle path which will be very different from that obtained by examining an ordinary map of the world.

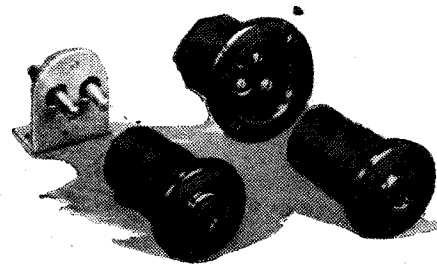


Pilot Doublet all-wave aerial kit, comprising a transmission line lead-in, lightning arresters, insulators, receiver transformer and aerial wire.

The Pilot Aerial can be arranged in several different ways, but this is dealt with very fully in the instructions supplied with each outfit. It is obtainable from Stream-line Radio, Ltd., 146, Theobalds Road, London, W.C.1, and the price is 27s. 6d.

BULGIN MAINS PLUGS AND SOCKETS

THE baseboard style mains connector-plug made by A. F. Bulgin and Co., Ltd., Abbey Road, Barking, Essex, for fitting to receivers or amplifiers has been slightly modified, and the head of the socket-part that joins to the flexible leads increased in diameter to afford a better grip when removing it from the fixed portion. The raised ring on the head also answers another purpose; it enables the socket to be inserted through a hole in the back of



New-pattern Bulgin mains plugs and sockets. A three-pin type is now made.

the cabinet and prevents access to the interior of the set, *via* a removable back, without first withdrawing the mains connector. Known as the P76 connector, it costs 2s.

A non-reversible mains connector similar to the Bulgin P.20 model, but fitted with three pins so that an earth lead can be included in the mains cable is now available. The removable part carries the sockets, and the fixed part the three pins, which are fully protected by a moulded bakelite shell.

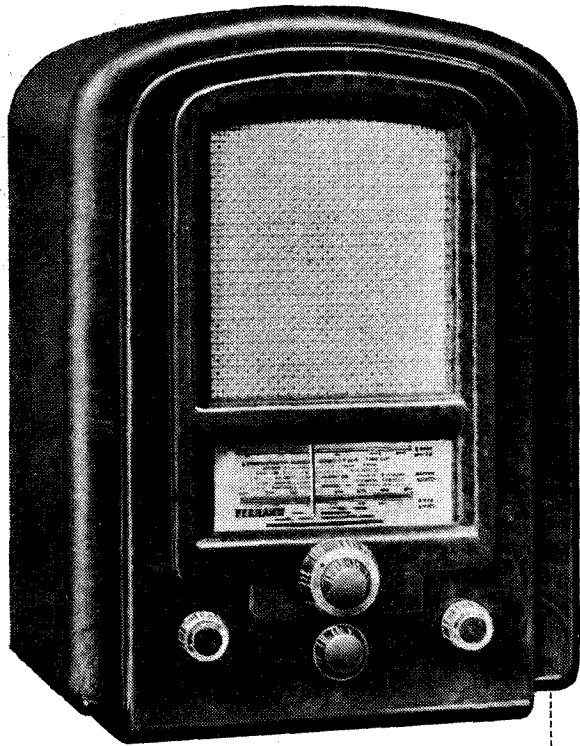
The new-type moulded head is also fitted to this connector, and its price is 2s. 3d. A two-pin model on similar lines costs 2s.

All these connectors are fitted with the 3-amp. size pins, and in their new form are a marked improvement over the earlier pattern.

LYONS-HICKOK ALL-WAVE OSCILLATOR

WE have received from Claude Lyons, Ltd., a copy of a supplementary leaflet it is proposed to include with the operating instructions of the Type OS-7 service oscillator, which was reviewed in our issue of April 17th last. This relates to the

use of the instrument for power output measurement with British receivers, using the attachment described as the C1 lead, and which is included among the accessories. No additional adaptors are required, and the procedure is quite straightforward.



Ferranti

ALL-WAVE STRAIGHT THREE

Many Detailed Refinements in an Essentially Simple Receiver

At one time the "straight" HF-det-
LF receiver was the standard
general purpose set for broadcast
reception. Our preoccupation with
superheterodynes during the last year or
two is probably the reason for the fact that
the merits of the simple straight receiver
have been rather overshadowed. In
drawing a comparison between the two
types many people fall into the error of
comparing present superheterodyne per-
formance with their recollection of the

results they used to obtain with
earlier straight receivers. This is
hardly fair to modern sets of the
latter type, for improvements in
the efficiency of valves and the
design of tuning coils obviously
apply equally well to both types.
The straight receiver is free from
the minor interference troubles
inherent in economically pro-
duced superheterodynes, and
there is no doubt that at the

alternative aerial terminals are provided,
and between these is a wavetrap tuned
to the Droitwich high-power transmitter.
Normally the direct aerial connection is
used, but listeners in the Midlands will be
able to get rid entirely of any interference
which they might otherwise experience
when listening, say, to Luxembourg, by
using the terminal which includes the
wavetrap. The aerial circuit is tuned on
medium and long waves, and on the short
waverange a switch connects the untuned
aerial coupling coils across the
grid circuit of the HF valve to form a
choke input circuit.

The high-frequency amplifier is a
pentode of the variable- μ type, and
control of volume is effected in
this stage by a variable
cathode bias resistance. The
screen feed of this valve,

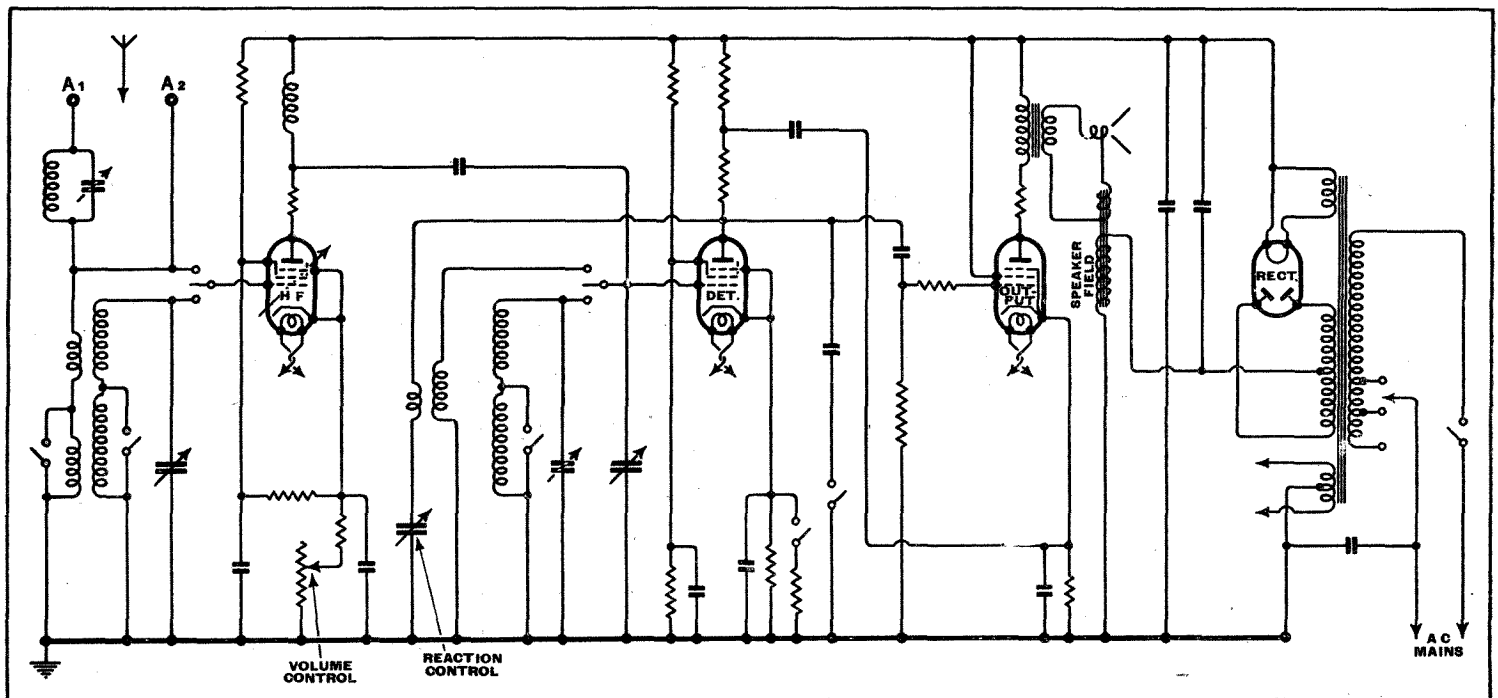
and, incidentally, also that of the detector,
is derived from a separate fixed poten-
tiometer. The coupling between the HF
and detector stages is of the tuned-grid
type with choke-capacity feed from the
HF valve. A stopping resistance is in-
cluded between the anode of the HF
amplifier and the choke to suppress
parasitic oscillations.

The detector is a screen-grid valve,
and the bias conditions are adjusted
for anode bend rectification. On short
waves the bias is reduced by switching
the additional resistance in parallel
with the cathode bias

FEATURES.—Type.—Table model straight receiver
for AC mains. **Waveranges.**—(1) 19-51 metres.
(2) 200-550 metres. (3) 900-2,000 metres. **Circuit.**—
Var- μ pentode HF amplifier—screen-grid detector
—pentode output valve. Full-wave valve rectifier.
Controls.—(1) Tuning. (2) Volume and on-off switch.
(3) Reaction. (4) Waverange. **Price.**—9½ guineas.
Makers.—Ferranti Ltd., Moston, Manchester.

present time a surprisingly good performance
is provided at very moderate cost.

In the receiver under consideration the
designers have succeeded in introducing a
number of points of originality directed
to give refinement of performance. Most
of these are the result of the inclusion of
a short waverange, and they are really
logical developments of what is essentially
a well-tried and simple design. It is not
necessary to delve deeper into the circuit
diagram than the aerial input to realise
the forethought which has been shown in
drawing up the plans of this receiver. Two



Complete circuit diagram. On the short waverange the HF amplifier is aperiodic and reaction is introduced in the detector stage.

Ferranti All-Wave Straight Three—

resistance. The HF by-pass condenser on the anode is also disconnected on short waves, as reaction is applied to the short-wave grid coil through a capacity-controlled circuit.

A pentode-type valve is used in the output stage and is coupled to the detector through the usual resistance-capacity network. A fixed degree of tone correction is applied by means of a condenser shunt across the primary of the output transformer. A hum-bucking coil is included in series with the secondary, and the field of the loud speaker is connected in the negative HT line for smoothing. The rectifier is of the full-wave type, and a by-pass condenser is connected between one side of the primary of the mains transformer and earth to minimise mains interference.

The controls are simple, and the well-known Ferranti indicating dial is employed. In this set, however, the only subsidiary pointer is that showing the setting of the waverange switch. There is a two-speed slow-motion drive for the tuning scale, which, incidentally, is remarkably accurate on all three waveranges.

Lively Performance

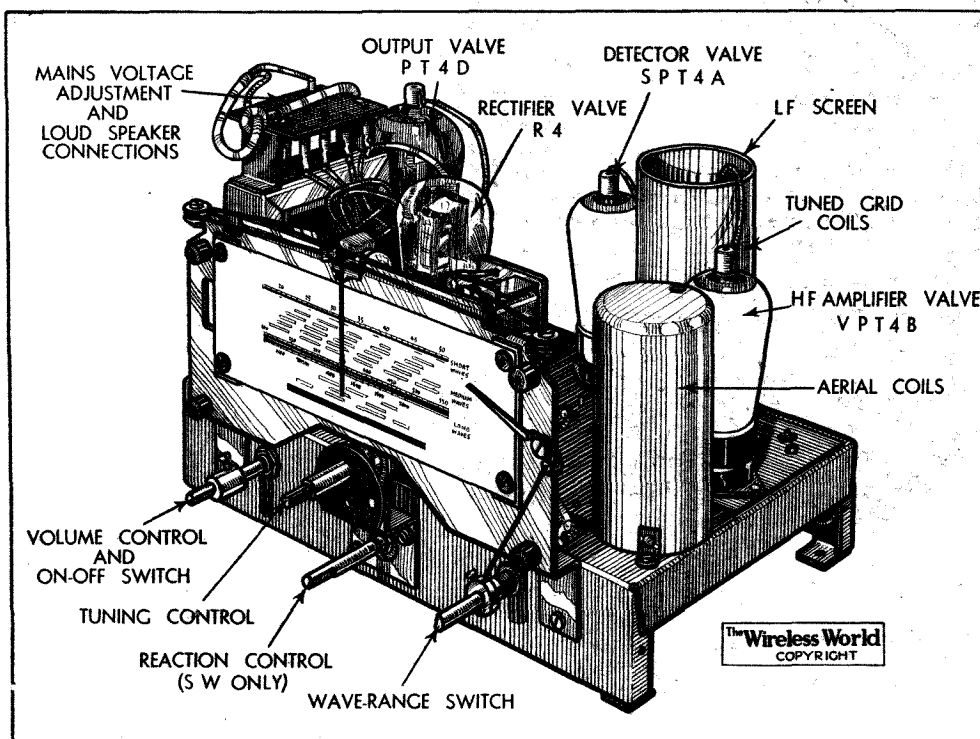
The performance on the medium and long waveranges is such that the inclusion of reaction would have been superfluous. Selectivity, of course, is not up to super-heterodyne standards, but will provide the service most general listeners require. Radio-Normandie, for instance, is easily separated from London National, and Droitwich from Radio-Paris when using the set in daylight in the London area. Although under these conditions the Droitwich wavetrap is not required, the alternative aerial terminal was used as a matter of interest and resulted in all but complete extinction of the Droitwich transmission.

The range on medium and long waves, without reaction, gave promise of an exceptionally good performance on the short waves where this additional aid to sensitivity is provided. Zeesen, Vatican City, and all the principal European short-wave programmes were received with a steadiness and volume worthy of the medium waverange, and there can be no question of the set's ability to receive American transmissions when conditions in the upper atmosphere over the Atlantic are good.

Some care is necessary in manipulating the volume and reaction controls on the short waverange, as to some extent these are interdependent. If the reaction is adjusted close to the oscillation point a decrease in the setting of the volume control will cause the set to cross the threshold into oscillation. Were it necessary this might form a useful fine adjustment for reaction, but actually the reaction control is quite smooth and free from backlash. However, it is advisable for another reason to avoid running too near to the oscillation point on the short waveband, as with the untuned aerial circuit there is a possibility of break-through of long-wave interference at the resonant frequency of the choke in

the anode circuit of the HF valve. Interference of this type was also found on the long waverange, but only with the volume control near its maximum position, where all the popular long-wave transmissions would in any case have overloaded the output stage.

commendable feature from the serviceman's point of view is the provision of plugs and sockets for the loud speaker connections. Thus the chassis can be removed for inspection with the minimum of trouble and without the necessity of heating up a soldering iron. Another item of technical



A heavy metal cylinder over the grid coil screening-can removes the last trace of mains hum.

The quality of reproduction is well balanced, but in the absence of automatic volume control the manual volume control must be used with restraint on powerful transmissions if harshness due to harmonic distortion is to be avoided.

The chassis, with its cadmium finish throughout, is neat and workmanlike. As in the circuit arrangements, there is ample evidence of the attention which has been given to the short-wave aspects of the design. The components under the chassis are carefully grouped, and separated by subsidiary screens. There is also a screen between the sections of the special rotary-type, low-capacity waverange switch. A

interest is the provision of additional screening in the form of a heavy gauge cadmium-plated iron cylinder over the grid coil screening-can. This has been fitted to eliminate 50-cycle pick-up from the mains transformer, and as a result the set is exceptionally free from mains hum.

The instruction booklet, in addition to giving helpful advice on the tuning of the set on short waves, gives a very clear explanation of the principles underlying the propagation of short-wave transmissions and a table showing the wavelengths which are most likely to provide entertainment from long-distance stations at various times of the day and night.

The Radio Industry

HALF-WAVE Westectors, Types W4, W6 and WX6 have now been reduced in price from 7s. 6d. to 5s.

The Trix Electrical Co. recently encountered unusually difficult conditions in installing amplifying equipment for staff control purposes in a large ice-cream factory. The speakers are installed in cold storage rooms.

Bookings for a summer cruise organised by the Electrical Industries Benevolent Association must be closed by May 13th. Applications should be addressed to Mr. A. Hugh Seabrook, Executive Officer, E.I.B.A., 6, Southampton Street, Holborn, W.C.1. The Association's new address should be noted.

After tests carried out for H.M. Office of Works, the Ardent Acoustic Laboratories have been given an important contract for installing sound-amplification equipment in the Bandstand in Hyde Park. The object is to give

listeners in the open air "music as the conductor hears it" rather than to provide high general amplification, and it is claimed that this has been achieved without conveying any impression of artificiality.

Multitone Electric Co., Ltd., have opened West End consulting rooms at 17, New Cavendish Street, London, W.1, with the object of demonstrating deaf aids and appliances under conditions of greater comfort and privacy than were formerly possible.

Radio Rentals, Ltd., of 92, Regent Street, London, W.1, have recently opened a new service depot with floor space of over 10,000 square feet for the maintenance of hired sets.

Surplus Apparatus Wanted.—The vicar of a very poor parish in the East End of London is appealing for an AC mains-operated gramophone amplifier and for records of dance music and songs. A microphone would also be appreciated. All offers of help should be addressed to the Rev. J. Ough, M.A., at St. Jude's Vicarage, London, E.2.

Listeners' Guide for the

Outstanding Broadcasts at Home and Abroad



UNDERGROUND. In the programme to-night at 8 o'clock an attempt will be made to give listeners an impression of the men, ticket machines, escalators and organisation behind the name which has become, in London, a household word.

used for this championship, in which each competitor must meet every other, so that the element of chance is reduced to the mini-

mum. The winner of each contest is he who gets the best of nine hits.

A COLOSSAL CONGLOMERATION

THE eighth of Stanelli's popular Bachelor Parties will be given in the Regional programme at 9.45 on Monday. Among those invited to the party are Norman Long in some more patter about "Teeth and Trousers," Russell and Marconi, Al and Bob Harvey and Lloyd Shakespeare (no relation to William). The producer is again John

Sharman, and the title, "A Colossal Conglomeration of Capable Comedians Calculated to Convulse the Community," should certainly convey the type of entertainment to be expected.

EDWARD II

THE National programme on Sunday will include at 5.20 a performance of "The Tragedy of King Edward II," by Christopher Marlowe, which was first broadcast in 1931. An extremely strong cast will include Robert Speaight as Edward, Jean Forbes-Robertson as Queen Isabella, Esme Percy as Piers Gaveston, and Richard Ainley as the Earl of Kent. The production will be in the hands of Barbara Burnham.

CARUSO

IN the sixth of the series, "Voices of Yesterday," to be radiated Nationally at 6.45 on Saturday, will be heard recordings of that great master of operatic song, Caruso. With the re-recordings of his old records the brilliance of his wonderful control will, I am sure, be unimpaired.

EVEN a Londoner who is constantly using the means of transport afforded by the Underground is non-plussed by the multiplicity of passages, escalators and machines which go to make up the most famous subterranean railway in existence. Who has not asked himself while being hurtled through tunnels such questions as: Why is it the trains never collide? Where does the conditioned air come from? What happens if all the lights go out? and many other such queries. In the broadcast, "Underground," which is being given on the National wavelengths to-night (Friday) at 8 o'clock, under the direction of Felix Felton with the co-operation of the London Passenger Transport Board, listeners will be given an insight into the working of this great organisation. Local colour will be introduced by recordings of sounds only to be heard in the labyrinth of London's Underground.

ROYAL OPERA HOUSE

THE opera lover will not have to search the ether for his fare during the next seven days. The B.B.C. are giving relays on four occasions from the Royal Opera House, Covent Garden. On Friday Act II of Wagner's "Die

Walküre" will be relayed on the Regional wavelength at 8.20. On Monday at 8.30 (Nat.) will be heard Act I of Puccini's "La Tosca." Act II of Wagner's "Siegfried" will be relayed Regionally on Tuesday at 8.20, and the third act from Wagner's "Götterdämmerung" will be given in the Regional programme on Thursday at 10.5. On each occasion the broadcast will be preceded by a five-minute introduction. The Wagner operas will be conducted by Sir Thomas Beecham and Puccini's work by Vincenzo Bellezza.

SABRE CHAMPIONSHIP FINAL

SURPRISINGLY large numbers of people are interested in fencing. It appeals very strongly, of course, to members of His Majesty's Forces, but its supporters are found in every walk of life. On Saturday at 10 o'clock (Nat.) a running commentary on the National Sabre Championship Final Pool will be broadcast from the Salle Bertrand.

The American pool system is

FENCING. Listeners will not only hear the rasp of rapier against rapier but will also be given a description of the finer points of the game in the commentary on Saturday.



Week

HIGHLIGHTS OF THE WEEK

FRIDAY, MAY 8th.

Nat., 8, "Underground." 8.50, Oscar Rabin and his Romany band.

Reg., 7, Sandy Powell programme. 8.20, Royal Opera House Relay.

Abroad.

Radio-Paris, 8.30, Concert from the Palais des Beaux-Arts, Brussels.

SATURDAY, May 9th.

Nat., 7, The Saturday Magazine. 8.30, Variety.

10.15, B.B.C. Theatre Orchestra and Ina Souez (soprano).

Reg., 6.30, Band of His Majesty's Royal Marines. ¶Reginald King and his Orchestra with Henry Gill. ¶Henry Hall's Hour.

Abroad.

Hilversum, 7.10, "Lohengrin" (Wagner).

SUNDAY, MAY 10th.

Nat., Marlowe's "Edward II." 9, B.B.C. Theatre Orchestra and Revue Chorus.

Reg., London Palladium Orchestra. 9.20, The Laurance Turner String Quartet and May Busby (Chamber Music).

Abroad.

Munich, 8.40, Light Orchestral Concert with the Munich Vocal Quartet.

MONDAY, MAY 11th.

Nat., Camp Fire on the Karroo. 8.30, "La Tosca" (Covent Garden).

Reg., Recital: Max Meile (tenor), Hermann Loebe (lute) and Beatrice Harrison (cello). 8.45, Stanelli's Bachelor Party.

Abroad.

Hamburg, 8.10, "Fresh Mai-Bowle" (a programme of words and music).

TUESDAY, MAY 12th.

Nat., Beethoven Piano-forte Recital: Friedrich Wührer. 8.30, Romance and Rhythm.

Reg., "The Table Under the Tree." 8.20, "Siegfried" (Covent Garden).

Abroad.

Munich, 8.15, Liszt Anniversary Concert.

WEDNESDAY, MAY 13th.

Nat., 7.30, "Twinkle" Concert Party. 8.30, Symphony Concert. ¶B.B.C. Theatre Orchestra and George Baker (baritone).

Reg., "From the London Theatre." ¶Guitar Recital: Emilio Pujol and Matilde Guerras. 8.30, Brian Lawrance and his Dance Orchestra.

Abroad.

Copenhagen, 8, Concert of Russian and Czecho-slovakian music.

THURSDAY, MAY 14th.

Nat., Music from the Movies. ¶"The Vagabond Lover."

Reg., 7, "Twinkle." ¶Oratorio programme. 8.50, Charles Ernesco and his Quintet. 10.5, "Götterdämmerung" from Covent Garden.

Abroad.

Frankfurt, 8.10, "Falstaff" (Verdi) from the State Theatre, Cassel.



ENGLISH TALK FROM DENMARK. General Evangeline Booth will give a talk from the Danish stations on Saturday from 5.50 to 6.20, on the international relief work carried out by the Salvation Army. She is the first woman to be at the head of this great army.

ROAD SENSE

A DEBATE is included in the Regional programme at 8 on Wednesday entitled "The King's Highway," during which will be heard the views of four different and characteristic users of the road.

This will undoubtedly be of great interest to all, from the Minister of Transport down to the poor pedestrian. For each road user has, at some time or other, had a desire to assert his or her rights to the King's Highway.

A HAPPY HOLIDAY SHOW

MANY listeners will have heard Clarkson Rose's "Twinkle" Company during their holidays at South Coast resorts. This well-known concert party will broadcast on Wednesday at 7.30 (Nat.) and on Thursday at 7 (Reg.).

WOMAN CARILLONEUR

AN interesting broadcast will be included in Monday's Regional programme at 6.30, when Miss Nora Johnston will be giving a carillon concert with the Victor Olof Sextet. Miss Johnston may have been heard when she gave thirty-one recitals on the Jubilee Carillon in 1935. She uses a bell clavier specially constructed for the stage. It is a copy of the one at Malines Cathedral belfry, which dates back to 1556.

ORATORIO

AN Oratorio programme from the works of Gounod, Spohr, Walford Davies, Frédéric d'Elinger, and A. R. Gaul has been compiled by Joseph Lewis, who will conduct

section E of the B.B.C. Orchestra and the B.B.C. Chorus "B." Margaret Godley (soprano), Bradbridge White (tenor), and Stanley Riley (bass), with Berkeley Mason at the organ, are included in this programme from the Regional transmitter on Thursday at 8.

OPERA ABROAD

TO-NIGHT (Friday), at 9, Sotens is relaying from the Comedy Theatre, Geneva, the two-act opéra-bouffe, "The Music Master," by Pergolesi.

This is a Festival Performance in honour of the bicentenary of the composer's death. He is still venerated in Italy as a composer whose death, at the tragically early age of twenty-six, undoubtedly deprived the world of many masterpieces.

From Stuttgart

MISS JOHNSTON, who broadcasts on Monday, comes of a family associated for generations with the making of Church bells. She is here seen at the clavier in the belfry of Malines Cathedral.



on Sunday at 8 comes "Carmen." The Station Choir, Children's Choir and Orchestra will be conducted by Görlich.

Acts I and II of Mozart's "Il Seraglio" will be relayed by Kalundborg at 8 on Monday from the Theatre Royal, Copenhagen. Act III will be

relayed on Wednesday at 10.10 from the same theatre.

OPERETTA

A STUDIO performance takes the place of the usual Friday relay from the Opera at 6.30 by Budapest (No. 1). This will be "Mädchenmarkt" (Jacobi). Another studio performance, from Vienna, on Saturday, at 7.25, will be "The Geisha."

One of the most acceptable and "hearable" of Offenbach's operettas, "La Belle Hélène," will be given on Monday at 6.30 by Moscow.

"BARN DANCE" MUSIC

NORWEGIAN listeners have a strong liking for dance music of the "barn dance" type, and broadcasts of this style of music frequently take place. Saturday, for instance, provides an example when an extremely popular band called Slattekara broadcasts folk dance music at 10.15 from Oslo.

MOTHER'S DAY

SUNDAY, May 10th, is known in Germany as "Mother's Day," and German stations will be devoting special programmes to it. At 6.50 Hamburg gives "Mother Legend," a play describing true happenings in the Middle Ages at the time when the Slavs owned the land east of the Elbe.

"LOVE—HEAVEN ON EARTH"

FAVOURITE operetta duets with love dialogues in the intervals constitute the programme under the above heading to be broadcast by Berlin (Funkstunde) on Wednesday at 8.45. THE AUDITOR.

More About Electronics

By "CATHODE RAY"

IN a certain massive engineers' handbook of not very distant date (since the War, anyway) the whole of electrical engineering is relegated to a chapter right at the end; in fact, unlike such other branches of engineering as "Steam Boilers," it is given room in a sort of scrap-heap for odds and ends under the title "Electrical Engineering, including Gas and Oil Engines." One would judge from this that the author considered electrical engineering to be hardly worthy of a serious man's attention as a full-time job, but one to be supplemented with gas and oil engines to keep him busy.

So far have we moved in a few years from this condition of affairs that the other night I went to an I.E.E. meeting, for

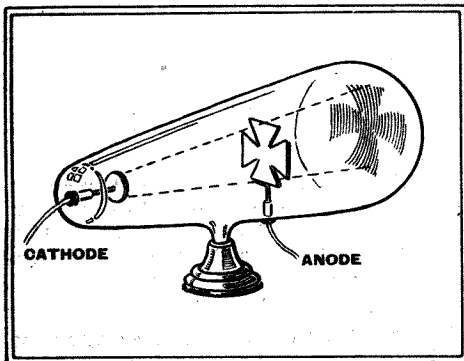


Fig. 1.—Crookes's tube for demonstrating the resemblance of a beam of electrons to a beam of light—both travel in straight lines and cast shadows having the form of the obstruction.

which the subject announced was the superimposing of carrier waves on distribution systems, and found myself among a crowd of strangers who knew as little about what we call carrier waves as I did about their sort. Yet we were all electrical engineers. To you and me the title would signify the distribution of radio programmes over electric supply mains—a scheme for which permission was sought from Parliament some time ago. To other sorts of electrical engineers it meant a system of working switches (e.g. of street lamps) from the central power station.

The Age of the Specialist

So far, then, from electrical engineering being a part- or even a full-time job, it has been subdivided into many branches quite foreign to one another. Of these, radio engineering is one. Until recently a young and despised offshoot, it has now itself been subject to the same process of subdivision, so that among half a dozen radio engineers there might be no two with much knowledge of each other's work. Last November I called attention to one of the most recent but most virile of these sub-

divisions—Electronics. Now already it may be congratulated on attaining the status of parenthood, having entered into an alliance with the apparently remote science of Optics to form the very interesting and rapidly growing Electron Optics.

Some hint of the subject is contained in the use of the word "focusing" in connection with cathode ray tubes. Even people who have used them, and who are familiar with the focusing adjustment, may not all realise how close the parallel is with the focusing performed by the photographer. Some of the mathematical formulæ, even, are exactly analogous. Already we have the electron microscope, the electron telescope, and the electron camera, all with their electron lenses. These are in addition to the cathode ray tube, the iconoscope, the image dissector, and the electron multiplier, all of which apply the same principles. And the list is a rapidly growing one.

Sir William Crookes prettily demonstrated one point of resemblance between a beam of light and a beam of electrons—the casting of shadows by an opaque object—with his famous "Maltese Cross" experiment (Fig. 1), which has long since passed into scientific history. Crookes's tube showed that when left to themselves electrons move in straight lines. The modern developments result from not leaving them to themselves but bending them, in the way that light rays are bent by lenses and other devices. The equivalent of a lens, for this purpose, is a specially arranged electrostatic field—in other words, the mysteriously abnormal condition into which a piece of empty space gets when it finds itself between boundaries at different electrical voltages. There is an electrostatic field of, perhaps, one volt per inch in between the terminals of an ordinary accumulator. If you bring the 230-volt electric light mains within a hundredth of an inch of one another there is a field of about 23,000 volts per inch, which is so strong that the air between is in danger of being broken down by the strain.

A ball shot over a perfect billiard table moves in a perfectly straight line until it reaches the cushion. But if you introduce hills and valleys into the surface of the table you can make the ball go any way you like. You could so shape the surface that balls cued from a certain spot at a certain speed in any direction would all arrive at one particular spot at the other end of the table. This is just as light spreading out from, say, Garbo's eye is made, by means of a lens, to converge again on a particular spot on the screen instead of being dissipated futilely all over it. And just as the electrons spreading

BEAMS OF LIGHT AND BEAMS OF ELECTRONS

out from a cathode are bent, by means of rings and cylinders kept at appropriate voltages, until they converge into a tiny spot on the fluorescent screen (Fig. 2). Voltage in many ways corresponds to height, so it is fairly easy to picture the electron lenses formed in this way as sloping hills designed to direct the beam into the proper directions. Also it is possible to bend the beam as a whole, or scatter it, or reflect it, as desired.

The Electron Multiplier

Vladimir K. Zworykin, who, with his merry men in the R.C.A. research labs., seems to be able to order the movements of electrons with the effectiveness of a sergeant-major, and with considerably less effort, actually makes them perform twelve successive leap-frog hops down a tube only five inches long. Each electron gathers

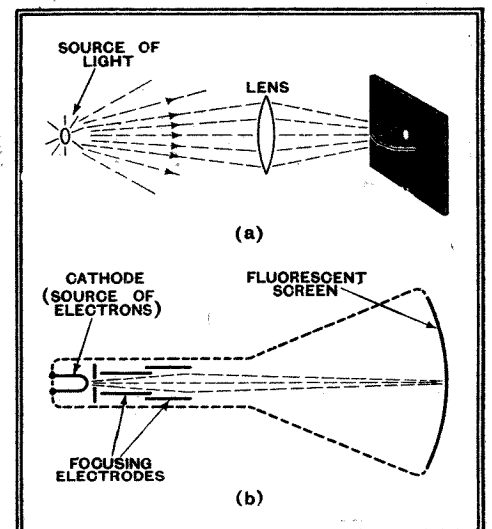


Fig. 2.—Another comparison between light and electrons—(a) the action of a simple lens (e.g., a "burning glass"), and (b) the "electron lens" for focusing in a cathode ray tube.

seven or eight others with him each time he hops, so for every electron that leaves the starting line there are (say) seven that get away from the second landing, 49 from the third, 343 from the fourth, 2,401 from the fifth, . . . and 1,977,325,000 from the twelfth. That is *amplification!*

In the hands of any less expert trainer these performing fleas would merely stam-pede from one end of the tube to the other in about 0.0000001 second, without accomplishing anything worth mentioning.

More About Electronics—

Still more clever things have already been accomplished in the interests of television. Imagine you have an illuminated window, about three inches square. You stick a lantern slide in front of it, and of course the light coming through is varied from point to point over the surface, so that when you look at it you can see the picture. But put a screen up at a short distance away from this luminous picture and no image is visible on it; merely a

electrical focusing, to reproduce the picture on a sensitive screen. Of course the picture to be set up in electronic form need not be in the form of a slide or film; it can be transmitted direct from an actual scene by means of an ordinary camera. That is one ingredient, so to speak, of the Farnsworth television system. But it has other uses. Instead of setting up the picture by visible light it can be set up by ultra-violet or infra-red or any other sort of "light" which is effectual in releasing electrons; in

divert the attention of the public from ordinary broadcasting during the Radio Exhibition. I sincerely hope that no such foolish course will be taken.

Let's Be Sensible

Already it has been dinned into the ears of the public that television and ordinary broadcasting are two quite different things; that the television receiver will not bring in the daily programmes of speech and music; that television, to begin with, is going to be a rather expensive hobby. The public knows all this; it isn't going to refuse to buy "broadcast" receiving sets because a start is made with television. But it does want to see something done, and if the radio manufacturers want to have a bumper attendance at this year's Olympia Exhibition they should use all their influence to ensure the earliest possible opening of the London television station and the best possible demonstrations of television reception at Olympia. In my humble view a hundred visitors to the exhibition who come to see what television can do are worth a thousand who attend merely to witness a performance in the B.B.C.'s theatre.

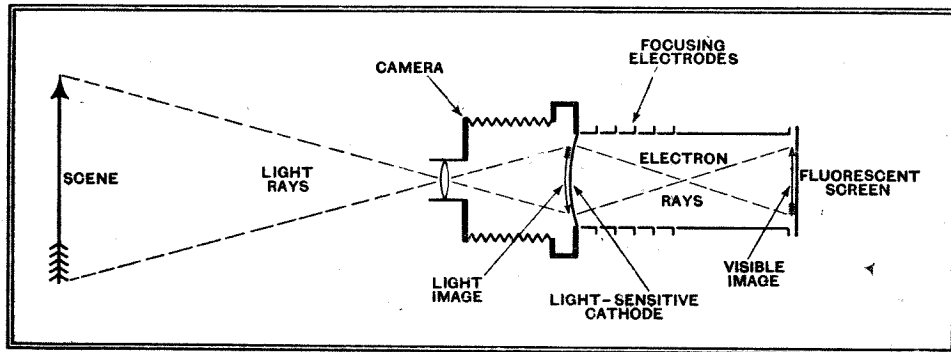


Fig. 3.—Diagram of the Zworykin "electron telescope." The light image is converted into an electron image and back again into light; the final light is visible even if the original light illuminating the scene is not, because electrons respond to a much wider range of light wavelengths than does the human eye.

uniform illumination. It requires a lens in between to direct the light rays so as to recreate the picture on the screen. Instead of transmitting the picture across the space to the screen by means of focused light, the light can be used to release electrons—more, or less, according to the intensity in different parts of the picture—and this jumble of electrons streaming off from the surface can be sorted out, by means of

other words, the scene may be in total darkness or in fog; yet it is rendered visible on the electron screen. That begins to open up interesting possibilities, does it not? Even a limited degree of fog penetration ought to be worth much to navigators of all kinds. And will we ever be able to use these electron telescopes on our cars in November fogs of the years to come?

RANDOM RADIATIONS

By DIALLIST

Television in the U.S.A.

IT was announced some time ago that one big radio manufacturing company in the United States intended to spend no less than £200,000 upon television research and development over a period of little more than a year. A company, mark you, whilst the B.B.C., owing to the absurdly small proportion of the wireless licence fees that it now receives, can afford to allocate no more than £180,000 to the building of the first high-definition broadcasting station, the provision of its programmes and all the research work that is entailed. It seems something more than a pity that though during the past ten years private enterprise in this country has given the world a lead in the matter of television developments, we are being left behind when it comes to putting this new and most important department of wireless to practical use. Germany, France and Russia have had high-definition television services in operation for some while; we do not yet know when the first of our stations will make its first transmission. In New Jersey a 10-kilowatt transmitting station will be in full operation very shortly. Already a very ambitious test has proved most successful. Only the other day a specially staged fire scene was arranged. A building of the cinema set kind was reduced

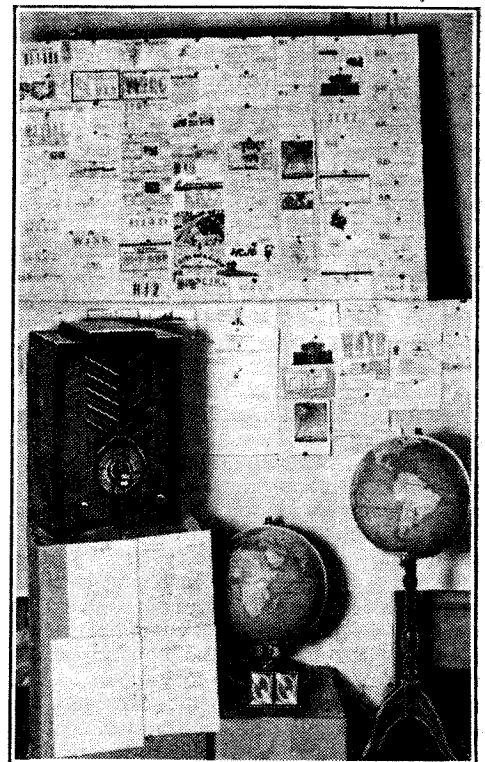
to ashes, despite the efforts of the fire brigades to save it. The whole scene was televised by means of an Iconoscope camera, and the reception is reported to have been excellent. Every detail could be seen on the viewing screen, and sounds, such as the crackling of flames, the bells and sirens of the fire engines, the splash and the hiss as water from the hoses met the flames, the orders of fire brigade commanders, and even the comments of spectators, were reproduced in perfect synchronisation from loud speakers.

We Must Get on With It

Meantime the history of television in this country from the point of view of the man in the street is just a series of promises followed by delays, and then more promises followed by more delays. The London high-definition station was originally to have been at work early this year—and even that would have been more than twelve months after the publication of the report of the Television Committee. Then it was stated that transmissions would begin on July 1st. All the indications now show that we shall still be waiting when July 1st comes along. It has even been suggested that the opening of the London station should in any event be deferred until the autumn so as not to

More Piracy

IT'S curious how attractive it is to certain kinds of youngsters to rig up small transmitters and to use them for sending out programmes of their own. Prosecutions by the G.P.O. are surprisingly frequent and one of these took place recently in the Midlands. The owner of the set, who had no transmitting licence, had been sending out gramophone records, and his working naturally caused interference with other people's reception of broadcasting. He was fined five



PRIZES FOR SHORT WAVE LISTENERS. A group of the awards presented in connection with the first DX contest held in this country and arranged by the International Short Wave Club of London. The prizes went to the listeners logging the greatest number of short wave broadcasting stations during a specified period

Random Radiations—

pounds plus three guineas costs. During the hearing of the case the G.P.O. officials stated that they tracked him down without much difficulty by the use of DF apparatus. Anyone who indulges in pranks of this kind must know that he'll be spotted pretty soon and that a smart fine awaits him. Yet, still they come.

I suppose that as often as not they are real wireless enthusiasts with a burning desire to experiment but without sufficient knowledge to enable them to apply successfully



SIX HUNDRED AND TWENTY POUNDS (lbs.) OF RADIO. A giant receiver comprising 40 valves and 5 loud speakers built for a resident in Chicago (America, of course). Knowing our own neighbours we are glad we do not live near his country

for a transmitting licence, to obtain which it is necessary to pass stiffish tests. One's sympathies are with them to some extent in their yearning for experiment; but as soon as they start "broadcasting" they become nuisances, and nuisances must be suppressed.

A Confession

I will confess that I did once break the law in this way myself. I have never held a transmitting licence because I have always been much more interested in the problems of reception and in the experiments concerned with them. Still I did *once* transmit, but that was to end a nuisance and not to cause one. It all happened more than a dozen years ago, when broadcasting was very young in this country. In those days the worst form of interference was caused by the man with a small single-valve or two-valve set who tuned by the squeal with his set oscillating merrily, and often spent a large part of the evening in seeing whether he couldn't improve his tuning by a hairs-breadth. A particularly bad offender was disturbing my locality, and appeals broadcast from 2LO for him to look to his set fell upon deaf ears. In exasperation I rigged up a rough-and-ready transmitter, tuned it to 2LO's wavelength and waited for one of those long programme intervals which were fairly frequent in those days. When it came, he still kept merrily at work, not realising that the studio was silent for a few minutes. Switching on, I spoke winged words which proved so effective that no more disturbance of the peace from that source took place.

The Ice Patrol

EVERY year since the *Titanic* met her fate the two vessels which form the Ice Patrol sail from their port in the United States at the beginning of the iceberg season and remain on duty right through the spring and summer. Their business is to spot icebergs, to note the direction in which they are travelling, and to warn all shipping by means of radio to keep out of their way. Smaller 'bergs may be blown up, but you can't do much with a really big fellow hundreds of yards in length. So far as possible

the patrols keep track of the larger icebergs as long as they are anywhere near the usual shipping routes and report constantly where they are located. Thanks to their good work, which would be impossible were it not for wireless, disasters due to floating ice at sea are now rare.

Frightened Off

IT is rather sad to reflect that the battery set, not so long ago the most popular of receivers, has developed in the past year or two more slowly than it could and should have done. The crux is the problem of high-tension current supply. So long as the public at large insists upon a set which can be worked from a small-capacity dry high-tension battery, not very much can be done. The utmost that such batteries can supply with any approach to really economical working is 10 milliamperes (I should place the limit much nearer 5), and you cannot have first-rate all-round performance if the high-tension current is limited to an amount so minute as this. Actually, not a few sets have placed a much higher drain on the HTB, but, since they were sold with small-capacity batteries and there was no room within the cabinet for anything bigger, running costs were so high that many people, to my knowledge, have been frightened off.

This is all wrong. I know from experience that you can run a set drawing 25 milliamperes or more of HT current at comparatively small expense if only batteries suitable for the work are employed. Could manufacturers put their heads together to

rid the public of its present standard-capacity battery complex, the battery-operated receiving set would command a far wider market than it does now.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

"The Wireless World" 25th Birthday

IT gives me considerable pleasure to write and congratulate you upon the attainment of the twenty-fifth birthday of *The Wireless World*—your Silver Jubilee. At the same time I congratulate you upon your splendid record with *The Wireless World* since you took over the editorship.

Some of our advertisements which appeared in the early issues of *The Wireless World* remind me not only of the flight of time, but also of the amazing developments that have taken place. Only those who have been connected with the radio industry since its inception can fully appreciate the rapidity and extent of this progress.

I consider that the great interest evinced by the public in radio technique has been fostered and assisted by your excellent journal in no mean way, and I extend my best wishes for your continued success.

DUBILIER CONDENSER CO. (1925),
LTD., F. H. McCrea,
Deputy Managing Director.
London, W.3.

I THINK that the twenty-fifth birthday number of *The Wireless World* is a fitting occasion for me not only to convey my sincere and personal congratulations upon the achievement of such a publishing record, but to pay a tribute, as a radio apparatus manufacturer, to the manner in which your periodical contributes towards the advancement of some of the leading firms of to-day.

When I founded my present company in 1926 the first and only advertising medium I used was *The Wireless World*. During the ensuing ten years, which have seen a very considerable expansion of the Tannoy organisation, we have consistently made use of your columns in an advertising capacity; and we have concrete proof that the stability and high standing of your periodical has been contributory in no small measure to our progress and success.

May the same lead which you have held for so long be maintained during the next twenty-five years!

TANNOY PRODUCTS,
Guy R. Fountain,
London, S.E.27. Governing Director.

CONGRATULATIONS! I have enjoyed your valuable journal ever since its first number. Best of luck for the next twenty-five years!

Portsmouth. ALBERT PARSONS.

AS far as my knowledge goes you have been the Editor of *The Wireless World* for not less than seventeen years, and I am certain that you must feel a great pride in the fact that the journal which you have guided through various and tortuous channels of radio development is now celebrating its twenty-fifth birthday.

To you and your staff, many of whom are known to me, I offer my personal congratu-

lations for the high standard of editorial quality which has been so consistently maintained.

PARRS ADVERTISING, LTD.,
H. FREEMAN, Director.

London, W.C.2.

VOLUME EXPANSION

A Reader's Experiences

FOR three days I have been listening to what radio will sound like in 1940, thanks to the article "Simplified Volume Expansion" in *The Wireless World* of April 24th.

I tried the system first with a record, the piece being "Presto," from Beethoven's No. 9 Symphony, chosen because of the depth of the loud parts as contrasted with the small light melodies. I was astounded; here at last was recorded music with all the atmosphere of the concert hall. Soft passages were really soft, while the loud crashes were a revelation.

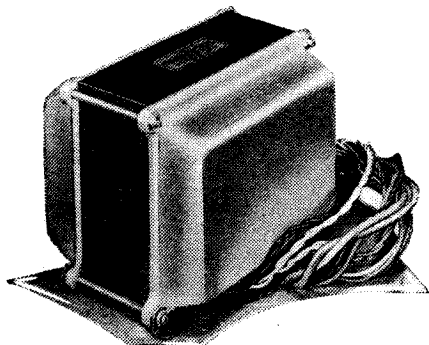
It was just the same on radio, with the added advantage that background noise was entirely absent during soft passages and only present during the peaks, which does not matter. This also applies to needle scratch when using a pick-up. For R1 and R2 (Fig. 2 of the article) I used 12-inch lengths of No. 28 resistance wire, while the lamps were of the 6.2 volt, 0.3 amp. type. Chokes were not employed.

My speaker has a speech-coil resistance of 15 ohms and is fed through a *Wireless World* multi-ratio transformer. It is important that the resistances R1 and R2 should be of exactly the same value.

LESLIE F. MEDLOCK.

Transformer for the PA Amplifier

A MAINS transformer designed for use in *The Wireless World* PA Amplifier has been received from Paramount Mains Transformers, of 66, Hartfield Road, Wimbledon, London, S.W.19. It is of massive construction and fitted with colour-coded leading-out wires for the various connections.



Paramount Mains Transformer

On test the component proved entirely satisfactory and delivered its rated output from all windings under full load. Two models are available—one open and the other shrouded. The open type is priced at 37s. 6d., while the shrouded model is listed at 40s. Incidentally, it is understood that the latest pattern is fitted with a modified shroud having cast feet instead of the brackets of the earlier type.

N.P.L. Report for 1935

Work of the Radio Department

THE Report of the National Physical Laboratory for 1935 which was published early this week includes, as is usual, an account of work carried out by the Radio Department. We give below a summary of the radio work under the several headings into which the work has been divided.

THE ionosphere has been studied by projecting wireless signals vertically and studying the properties of the echo which arrives back at the earth's surface. Signals from a transmitting station several hundreds or even thousands of miles away are utilised, and the manner in which they arrive at a receiver are studied in detail in the Report. The results obtained from this work are of considerable importance both in practical wireless communication, and in extending our knowledge of the upper atmosphere.

(a) *Sounding the ionosphere at vertical incidence.*—For this portion of the work wavelengths between 30 and 250 metres are employed. The transmitting and receiving stations are located about 50 yards apart, and are linked together so that the whole of the observations may be carried out by one operator, or alternatively the apparatus is arranged for automatic control. As a result of the signals sent out from the transmitter photographic records are obtained on the receiver from which the height of the reflecting layer and its reflecting properties (density of ionisation) may be deduced. The main objective of the present programme of regular recording is to study the diurnal and seasonal variations which take place in the ionosphere. As a result of observations of this type it has been found that there are at least three fairly well-defined reflecting regions in the atmosphere. The reflecting power of these regions is generally greater in summer than in winter, but this factor depends greatly upon the frequency of wavelength in use.

(b) *Study of Downcoming Waves of Distant Origin.*—Measurements have been made in England of the angle of arrival and strength of signals from transmitting stations in America, South Africa, and Germany using wavelengths between 15 and 40 metres. In the case of the American and South African stations the received waves arrive at an angle to the earth's surface of between 5° and 25°, the actual value varying in some cases from day to day and with the season. The signals from the station in Germany arrive at a steeper angle of about 42° to the horizontal. Photographic recording is now used to study the properties of these arriving waves, and the results show that in some cases the waves are reflected two or three times in the course of their travel. The knowledge so obtained is of considerable interest in investigating the mode of propagation of the waves, and is of direct value to radio communication in indicating the best angle of elevation to be used at beam stations.

DIRECTION FINDING.—The laboratory has continued its extensive work in the development of radio direction-finding apparatus of greater accuracy and in the use of this apparatus for the study of the reliability of direction finding. Special attention has been given to the design and construction of apparatus using spaced vertical aerials, and to the application thereto of the cathode

ray oscillograph. A recent model of this type of visual direction-finder covers a wavelength range of 40 m. to 230 m., and is considered to have an instrumental accuracy of the order of 1°. The manner in which such objects as power and telephone cables and metallic objects affect the observed bearings has been studied systematically to provide data for the choice of station sites.

Observations taken on two types of aural medium-wave direction finders have been made over a considerable period, using the transmissions from the Kalundborg Broadcasting Station on a wavelength of 1,260 m. The results showed that under these conditions about 90 per cent. of the bearings were less than 2° in error, while the maximum errors were about 10° and 16° in the case of the two models.

CONSTANT FREQUENCY OSCILLATORS.—In many cases it is desired that the frequency of a transmitting station shall be adjustable, and that it shall remain very constant at any value to which it is set. Work has been proceeding at the laboratory for some time on the development of a constant frequency oscillator suitable for this purpose. It has been ascertained that the major factors causing frequency variations are the effect of temperature in varying the inductance and capacitance of coils and condensers respectively, and extensive measurements of this effect have been made on a variety of coils and condensers. As a result of this work it has been possible to design and construct a coil and a condenser, the electrical values of which are almost independent of temperature.

ELECTRICAL PROPERTIES OF THE EARTH'S SURFACE.—An accurate knowledge of the electrical properties of the earth in different places and at various depths is of importance in various branches of electrical and radio engineering, as well as in the study of geophysics. Previous work conducted at the laboratory has shown that the properties of the ground at any site can be examined by extracting samples of the soil and measuring the electrical resistance and dielectric constant with the aid of a special method developed for this purpose at radio frequencies. In the recent work the measurements have been made over a frequency range of 1 to 100 megacycles per second, thus covering the medium, short and ultra-short wavelengths between 300 and 3 metres. As a result of this work it may be stated that the resistivity of the sandy loam soil found in the laboratory grounds at Teddington is about 9,000 ohms per centimetre cube for all frequencies from 50 cycles per second up to 1 megacycle per second, falling to about half this value as the frequency is raised to 100 megacycles per second. Over a more restricted frequency range similar measurements have been made on samples of different kinds of soil taken from various sites in Great Britain, and the results are in reasonably good agreement with measurements made by other methods on the spot.

UNBIASED

A Reprehensible Practice

AT this time of the year, when the clock has gone on, one of the biggest curses of existence is the bovine bellowing of the loud speaker which so many thoughtless people stick in their back gardens. There are signs of this sort of thing starting up again already in spite of the fact that we are still in the very early days of so-called summer. Not only does this garden loud-speaker habit annoy non-listeners, but, what is far worse, it upsets the enjoyment of listeners who want to hear another programme. Protests are usually of little avail and sterner methods are usually called for in most cases. Personally, I have always found that a little smart work with a catapult is all that is needed, but the method does, I must admit, lack finesse, and I must award the palm to a youthful acquaintance of mine who

By

FREE GRID

developed a very effective method of dealing with the nuisance last summer. As the method is one which offends against the law, naturally I cannot endorse it, but then, of course, it is my duty merely to record facts whether I like them or not. It is not mine to reason why.

The good folk who live next door to my juvenile acquaintance, in addition to a fondness for having the loud speaker in the garden, were always strongly addicted to the sponsored programmes from the various Continental stations which indulge in this pernicious practice, but otherwise showed no signs of mental aberration. Naturally, this interfered with the Sabbath calm of the B.B.C. Sunday programmes, of which my young friend was very fond, and he sought to end the nuisance by temporarily connecting his aerial and earth system across the make-and-break of an electric bell.

This reprehensible practice naturally interfered with his own listening as much as it did with that of the next door neighbours, and so he speedily sought some other method. Eventually he adopted the idea of forcing the London programme on to his noisy neighbours whether they liked it or not, and this he did in a highly ingenious manner.

Using a superannuated one-valve set he tuned it to the wavelength of a particularly offensive "sponsored" station to which they were listening and then modulated its

output with the London programme from his own set. The result was that the two transmissions were inextricably mixed up in their set, although his own reception was not interfered with.

The noisy neighbours made one or two feeble attempts to pollute the back garden atmosphere with other equally offensive stations, but my youthful acquaintance quickly followed them up with his oscillator and eventually they were compelled to switch off in disgust.

Seasick Singers

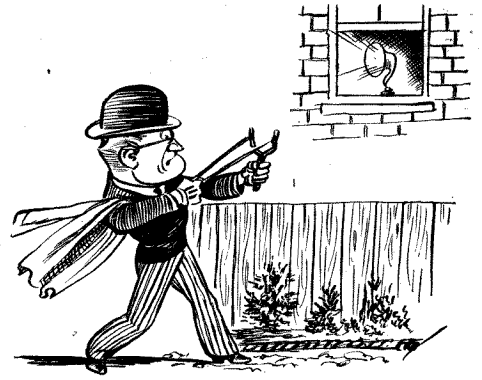
THE daily press seem to be getting very excited over the fact that some company or other is supposed to be in the course of formation with the object of chartering a ship and taking it three miles off the coast—and therefore out of territorial waters—and giving sponsored programmes. It is interesting to note that nearly all these journals, while deprecating the idea, are hailing it as something very novel.

In view of this fact I cannot help pointing out that I was the first to give publicity to this idea in the pages of this journal over four years ago, and even then the idea was as old as the hills, it having been first mooted by my grandfather. As I pointed out at the time, there are several difficulties in the way. If the ship picks up its artistes at any British port the Postmaster-General can easily stop the whole affair by refusing to grant a wireless transmitting licence. It is true that the ship could use a foreign port as its base and the artistes could be conveyed from this country to the port of embarkation by means of an aeroplane, or even by means of a seaplane which could alight by the side of the ship just outside the three-mile limit.



Hold it!

This would, however, be a highly expensive business, and if the sea were at all rough it would be impossible for a seaplane to land on the water. Even if the artistes



... smart work with a catapult ...

embarked at a foreign port they would probably be seasick, and no prima donna can hold a top note when indisposed in this manner, although it must be confessed there is very little difference between the sound of a person being seasick and the vocal efforts of some of the B.B.C. crooners.

Radiearl's Court?

THE dates of Radiolympia have at last been announced, and it is interesting to note that the powers that be have taken part of my advice and made the Show a fortnight later than last year and have included a portion of September.

In reply to my own and other people's complaints that the middle of the summer holiday season is entirely unsuitable for the Show, the R.M.A. officials have usually replied that they have already booked the dates with the Olympia people for several years ahead, and, in any case, Olympia was booked up by other exhibitions for the remainder of the year.

After this present year's exhibition both these excuses will no longer hold water. In the first place the R.M.A.'s original contract, which started in 1932 when they first took over the main hall, should by now be concluded, and, unless they have been foolish enough to sign up a fresh contract for the same dates, they have the opportunity of haggling for accommodation during a more suitable period of the year. In the second place, the new exhibition hall at Earl's Court must be expected to relieve the pressure of bookings at Olympia.

Thus there will be spare dates at Olympia for the R.M.A. to bargain for, and in the event of their not getting a satisfactory agreement they might do worse than consider the question of moving to Earl's Court themselves. However, I expect it's far too late for all that now, and in all probability, like Jacob of old, they have bound themselves hand and foot for another term of years.

I cannot help thinking that the R.M.A. might do worse than consult their customers as to the time of year when it would be most pleasing to the majority of them for the exhibition to be held. This could be done by making admission to Olympia threepence cheaper to all who took the trouble to fill up a voting coupon.

Broadcast Brevities

Television Staff Names

AN important batch of Television Staff appointments is announced officially by the B.B.C., and it contains some interesting names. Hyam Greenbaum, husband of Sidonie Goossens, harpist in the B.B.C. Symphony Orchestra, is to be Music Director. He has worked for Diaghileff ballet, has been recording manager of a gramophone company, and has done a lot of work as music director both with Cochran productions and film companies.

Stephen K. Thomas and Dallas Bower are to be producers. The former was at one time stage director for Nigel Playfair and Dion Boucicault. As technical and artistic adviser on lighting to the Exhibitions Division, Overseas Trade Department, he superintended exhibitions in Toronto, Antwerp, Paris and Brussels. He is a prolific play producer. Mr. Dallas Bower was formerly engaged in sound film recording, having been identified with several of the leading film organisations and has contributed articles to *The Wireless World*. He should be a valuable acquisition to Television.

Not Novices

The two stage managers will be Harry Pringle and Peter Bax. The former has had a varied stage career, playing and stage managing in many types of show, pantomime, musical comedy, revue and variety. Bax was assistant stage manager at Drury Lane from 1924-1930; designed scenery for "Mary Tudor," and has written a book on stage management.

G. More O'Ferrall, assistant producer, has been an actor, stage manager, stage director and producer. He also has experience of film directing. The film assistant will be Major L. G. Barbrook, who has been in the film business in Hollywood, and from 1931 to 1935 was in charge of cinematograph arrangements for various expeditions in South America, France and Africa.

Photogenic Ladies

Two or three other key positions remain to be filled, and the names of the persons selected will be announced later. They are the special feature producer, the male announcer and the two woman announcers. Public interest is probably concerned chiefly with the latter; but beyond indicating that one is dark and the other fair; that one is twenty-three years of age and the other

NEWS FROM PORTLAND PLACE

a year older; that both spent the greater part of their early life in the country, and that both are what the Director of Television, Mr. Gerald Cock, would term photogenic. I am unable to give any information at the moment, except of a negative kind. For instance, various "authorities" have mentioned Renee Houston, Elizabeth Scott (Henry Hall's vocalist) and Sheila Borrett, formerly woman announcer at Broadcasting House, as the fortunate selections. All these guesses are wrong.

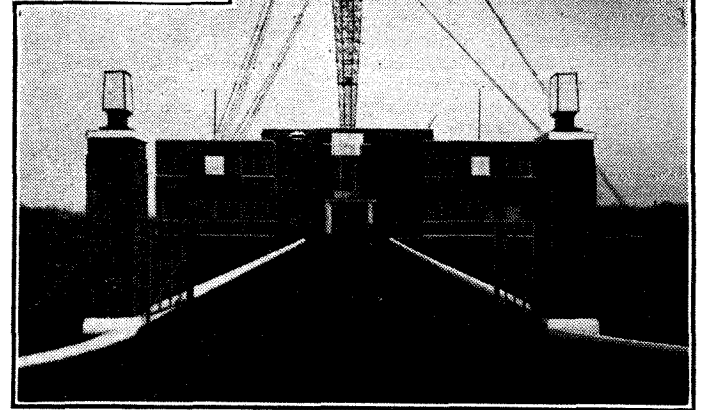
The Public's Choice

THE tumult and the shouting die," and the five hundred women who attended the recent conference at Broadcasting House to discuss whether women want morning talks, whether they want them in the morning or the afternoon, and what they shall be about, are back in their homes awaiting the outcome of their four hours' discussion. It will be good news for them that the Controller of Programmes, Mr. Cecil Graves, was so impressed by the views expressed by women delegates that he is studying closely the question of revised timings in connection with the plans which are now being formulated for next autumn and winter. The conference was regarded by the B.B.C. as so successful that it will almost certainly be the prelude to other public discussions of a similar kind, both in London and the provinces. The question of the types of talk to be given will not be decided as the outcome of the women's conference. That must wait until a men's conference has been arranged.

"Overworked" Producers

ONE is told occasionally of the hard lot of B.B.C. producers, who are said to be driven to death through overwork; but rumour is not sustained by fact. "Bill" Hanson, "Saturday Magazine" Editor, has certainly been through a tough time, but his illness, which made an operation necessary, was a not unusual complaint, even among the idle. John Watt has recently had an abscess in the hand, and Gordon McConnel had a bad "go" of 'flu last winter; but the rest of the variety team, John Sharman,

An imposing view of the aerial and station building of the Northern Ireland transmitter at Lisburn, which is now officially christened Lisnagarvey.



Harry Pepper, Doris Arnold, and Bryan Michie, are bearing up very well under their load.

New Variety Battalions

However, lest the Corporation be thought to be hard taskmasters, plans are being considered for an increase in strength next autumn, when Eric Maschwitz, Variety Director, gets his new schedule under way. Among the additional staff of some twenty assistants required will be eight or nine junior producers, who will relieve the seniors of a good deal of detail work. St. George's Hall, home of broadcast variety, will not accommodate all these additions, and office premises may have to be found for them in an adjacent thoroughfare off Regent Street.

What's in a Name?

HAVING settled the nomenclature of the Northern Ireland transmitter and christened it Lisnagarvey, although Lisburn, original baptismal name, or Blaris, first substitute, tripped more readily from the tongue, the B.B.C. has now decided to drop national and regional designations from the official titles of transmitters. For the future "Brookman's Park Transmitting Station" or "Moorside Edge Transmitting Station," for example, will indicate the originating points of London National and Regional programmes and of North National and Northern programmes, as

the case may be. Up to now, to take yet another example, a programme has been variously described as being transmitted from Cardiff, from the West, or from the West of England. In future, "Washford Cross Transmitting Station" will leave no geographical doubt in anyone's mind, and at the same time the current unofficial usage will be regularised.

Trying it on the Dog

SCOTTISH Regional listeners will heave a sigh of relief at the termination of the experiments which have been going on during the past few weeks in connection with the investigation of field strength distribution. The temporary aerial erected for this purpose has now been taken down, and the original aerial is swaying again in the gentle breezes of Westerglen. The number of breakdowns should consequently diminish, and no one regrets more than the engineers the necessity, when experiments of the kind are in hand, of "trying it on the dog." Another experiment which Scottish listeners will not find such a disturbing element in their listening is just starting with microphones; in this case, however, it means merely that the ribbon microphone is to be introduced into the Scottish studios. Perhaps one need not regard this as an experiment, as this particular type of instrument is now standard in London, where it has proved its worth.

Recent Inventions

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

CATHODE RAY TUBES

IN order to focus the cathode ray stream, a series of tubular electrodes, usually arranged coaxially along the tube, are maintained at different potentials so as to create a field of force which acts more or less as a lens upon the stream. In operation it is also necessary to feed the deflecting electrodes of the tube with scanning voltages, and the leads conveying these fluctuating voltages are found to introduce a disturbing factor into the focusing fields.

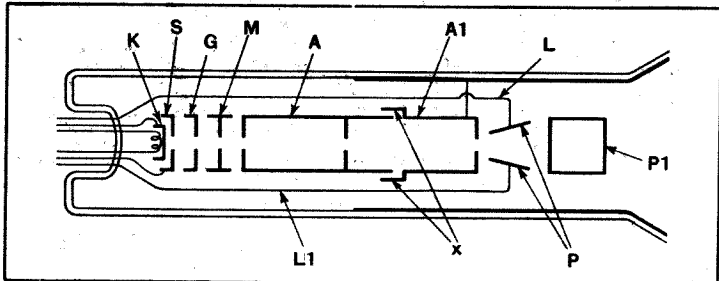
The invention is directed towards preventing such distortion. As shown in the drawing, the cathode K is followed by a cathode-shield S, an accelerating electrode G, a modulating electrode M, and first and second anodes A, A1, which serve to focus and direct

the load impedance, and, at the same time, to reduce the proportion of harmonic frequencies produced under modulation, a part of the output is rectified, and the resulting DC voltage is fed back to bias the inner grid of the dynatron. This results in an automatic regulation of the output energy.

P. O. Farnham (assignor to Radio Corporation of America). No. 2011290. (U.S.A.)

AERIALS

A LINE of dipole aerials can be energised with all the elements in-phase, so that the system radiates a directional beam of energy. According to the invention a series of such aerial "lines" are arranged one behind the other,



Electrode assembly of Cathode Ray Tube described in Patent No. 442103

the stream. The chief disturbing influence is the presence of supply leads, such as L, L1, which pass from the glass stub inside the tube to feed scanning-voltages to the first pair of deflecting-electrodes P, a second pair of leads being, of course, provided to feed the second pair of deflectors P1. To minimise their disturbing effect, the gap between the two anodes A, A1 is screened by an overlapping extension X of the anode A1.

F. H. Nicoll and L. F. Broadway. Application date December 7th, 1934. No. 442103.

POWER GENERATORS AND AMPLIFIERS

TO regulate the grid-bias in high-powered amplifiers or generators, one or more discharge tubes are inserted in series between the grid and filament. The "breakdown" voltage of the tubes is at least equal to the minimum biasing-voltage required on the grid. A separate safeguarding source of EMF is applied to the grid on the main oscillator, in parallel with the discharge tubes.

J. J. Numans (assignor to Radio Corporation of America). No. 2010881. (U.S.A.)

DYNATRON OSCILLATORS

IN order to maintain the output voltage of a dynatron oscillator constant, in spite of fluctuations in

so as to form a three-dimensional system. The aerials are then energised so that each individual line or array is in-phase, whilst successive arrays are energised in phase-opposition. Normally two beams are radiated in opposite directions. If one is suppressed, the other forms a clear-cut beam having only a small inclination to the vertical.

R. Bechmann (assignor to Telefunken Ges. für drahtlose Telegraphie m.b.h.). No. 2018342. (U.S.A.)

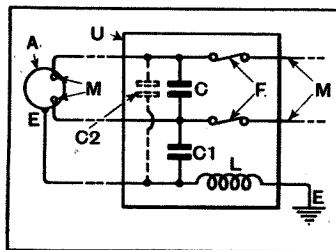
THE aerial is located at an elevated point, remote from the receiver, and is connected to a balanced two-wire transmission-line, or down-lead, through a coupling which is designed to be resonant to a wide band of frequencies. The down-lead balances-out inductive pick-up, though the signal frequencies are applied additively to the receiver. The input transformer to the receiver is centre-tapped to earth, and an earthed screen is inserted between its primary and secondary windings.

W. M. Macalpine (Assignor to International Communications Laboratories). No. 2021734 (U.S.A.)

INTERFERENCE "SUPPRESSORS"

INTERFERENCE due to the "sparking" of small electric motors and other electrical labour-

saving devices is minimised by the suppressor unit U shown in the drawing. A condenser C is shunted across the two mains supply leads M, and a second condenser C1 across one of the mains and the lead E, which earths the frame of the motor or other appliance A. The earth lead also contains a series inductance L, housed inside the suppressor unit.



Details of the Suppressor Unit.

The unit may comprise a third condenser C2 shunted across the mains and the common earth wire. Each of the supply mains is fitted with a fuse F which will "blow" before any dangerous heating of the choke L can take place. The condensers C, C1 are relatively small, say 0.01 mfd., so that even if the earth lead should be accidentally disconnected their impedance at the supply frequency is sufficiently high to prevent any dangerous shock being received from the unearthed frame.

Belling and Lee, Ltd., and E. M. Lee. Application date November 6th, 1934. No. 442099.

FLUORESCENT SCREENS

THE screen of a cathode-ray tube is commonly made of fluorescent material laid on a backing of paper or card. In order to improve its light-reflecting power, the paper has been coated with white pigments prepared from kaolin or barium sulphate; but this is said to be detrimental.

According to the invention, the white pigment is formed of the oxide or carbonate of a metal having an atomic weight not greater than that of zinc. Titanium dioxide is preferred in combination with a collodion film containing fluorescent zinc sulphide.

F. F. Renwick and F. J. Shepherd. Application date October 31st, 1934. No. 441898.

RADIO BEACONS

A WELL-KNOWN type of radio beacon, used for aircraft navigation, consists of a pair of vertical loop aerials set at right angles to each other and supplied with "interlocking" signals, such as the Morse letters A and N. These merge together so that they are heard by the pilot as a continuous "dash" along the centre line of the field of radiation. Such an aerial system, however, is subject to the practical disadvantage of the so-called "night effect."

According to the invention, the frame aerials are replaced by an

Adcock type of directional aerial having screened horizontal feed-lines. This is not affected by horizontally-polarised waves, such as produce "night-effect" error.

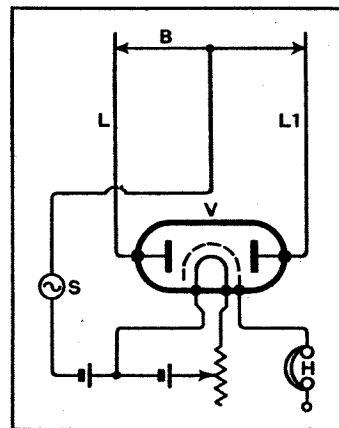
In operation at least two vertical aerials are spaced apart by a half wavelength and are energised by in-phase currents during the marking periods of one of the interlocking signals, and with out-of-phase currents for the other signal. This gives the pilot of an aircraft good and substantially-equal discrimination on each side of the centre or equi-signal line, either on a short-wave or long-wave navigational beacon.

Marconi's Wireless Telegraph Co., Ltd., and S. B. Smith. Application date August 3rd, 1934. No. 442164.

SUPER-REGENERATIVE CIRCUITS

RELATES to a super-regenerative receiver suitable for receiving wavelengths of from one to four metres. The valve V contains two grids (or a single grid as shown in the drawing) and two anodes arranged symmetrically about a central cathode. It is operated in the Barkhausen-Kurz manner that is, with a highly-positive bias on the grid and a slightly-negative charge on the anode.

The two anodes are connected to leads L, L1 forming a Lecher-wire system, which is tuned by a bridge connection B. The wires L, L1 may, of course, be replaced by the two limbs of a dipole aerial. Quenching frequencies from a local source S are supplied to the anodes through a mid-point tapping to the bridge wire B. The headphones H are inserted in one of the grid leads, as shown.



Ultra-short Wave Super-regenerative Circuit.

An advantage claimed for the circuit is that the quenching oscillations slightly broaden the tuning of the main oscillatory circuit, so that the super-regenerative effect is spread over the entire side-band of a modulated signal wave, instead of being concentrated more or less sharply around one particular frequency.

Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. Application date August 14th, 1934. No. 442741.

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*As many of the circuits and apparatus described in these
pages are covered by patents, readers are advised, before
making use of them, to satisfy themselves that they would
not be infringing patents.*

CONTENTS

	Page
Editorial Comment	479
Battery Variable-Selectivity IV (Concluded)	480
Unbiased	484
Acoustic Distortion at High Amplitudes	485
Making an "Exponential" Cone	487
Broadcast Brevities	489
Listeners' Guide for the Week ..	490
Still More About Electronics ..	492
Review of Burndept Portable ..	494
Random Radiations	495
Letters to the Editor	496
New Apparatus Reviewed	497
Current Topics	498
Readers' Problems	499
Recent Inventions.. ..	500

EDITORIAL COMMENT

Broadcasting

What is the Aim?

IS the success of Broadcasting in this country to be assessed on the basis of the number of licences issued and the rate of growth, or could we still regard the service as successful if a change in the character of the programmes brought about a reduction? The answer to this question cannot be given until we can first reply to the challenge, "What is the aim of broadcasting?"

If the object is primarily to entertain listeners, then popularity of the service is the aim, and success in the enterprise should be estimated by the number of persons who listen-in.

But as soon as educational and less popular material begins to replace items of entertainment we should expect to see this reflected in a loss of licences, and consequently a reduction in the revenue of the broadcasting authority.

The temptation must always be to increase the popularity of the programmes so long as the appetite for funds on the part of the broadcasting machine remains unsatiated.

The further development of the Empire service will mean heavy expenditure, and the cost of the new television service is difficult to estimate, but that it will tax the financial resources of the B.B.C. is plainly visible even at this early stage.

What, then, will happen when saturation in the field of licences begins to be evident? The B.B.C. will then be in the position of having to "sell" licences to maintain revenue. To effect sales of licences will mean more and more popular programmes, in spite of the fact that they are the most costly to produce.

The approach of saturation will also synchronise approximately with the peak of expenditure on both television

and the Empire service, neither of which are in themselves potential sources of revenue to the B.B.C.

It seems that B.B.C. expenditure cannot be regarded as an expandable figure unless it is to look for some Government grant beyond its revenue. We conclude, therefore, that whatever aims the B.B.C. might wish to have, it is committed to a policy of popular programmes rather than programmes of a more elevating or educational character, if only for the reason that sooner or later the public will cease to buy more licences or even renew them unless the B.B.C. "sells" them, and only popular programmes will achieve this object.

Story of an SOS

20,000 Miles to Cover 5

WE wonder how many of his listeners really appreciated the amazing testimony to the achievements of wireless communication when Mr. Bingham, the American Ambassador, related the other day the circumstances in which the members of the American Legation in Addis Ababa were rescued.

The American Legation had a small portable wireless set, but they were unable to communicate with the British Legation only five miles away, presumably because the wavelength ranges of the respective sets were unsuitable. The American Legation's SOS, therefore, was picked up by an American warship at sea, transmitted to the Philippine Islands, thence to San Francisco, and so to Washington.

Washington used the transatlantic telephone to talk to the American Embassy in London. The Ambassador got through to the Foreign Office and five minutes later the British Minister in Addis Ababa was informed of the American Legation's plight.

The Battery Variable

CONSTRUCTION AND OPERATION OF AN INEXPENSIVE SUPERHETERODYNE

Concluded from last week's issue

A CHASSIS ready drilled is available for this receiver, so that the construction involves nothing more than assembling the components on the chassis and then wiring. Mounting the components is entirely straightforward and calls for no comment, but there is more chance of error in wiring. In this set, as in any other, it is not sufficient merely to connect together the various points in haphazard fashion. If stray circuit couplings, and their natural adverse effect upon the performance, are to be avoided, it is necessary that the various wires be correctly placed relatively to one another. It is important, therefore, to follow the drawings closely not only with respect to the actual connections, but also in the way in which the various wires are run.

One condenser, C1, is not a component as such, but is manufactured in the wiring. One straight length of wire is attached to terminal 1 of L1 and cut so that it extends to within about one-half inch of terminal 1 of L3, and another length of wire is joined to terminal 1 of L3 and cut so that it almost reaches terminal 1 of L1. The two wires are then sleeved, using systoflex which is a snug fit over the wire, and tied together with thread. A condenser is thus formed having wires for the two plates and systoflex sleeving for the dielectric.

The HT supply should be taken from a battery of not less than 120 volts, and a higher voltage up to 150 volts can be used with advantage. Since the IF valve is of the type requiring the same voltage on the screen-grid as the anode, it is unnecessary to provide a tapping for this. It should be noted, however, that if a different type of valve be used for any reason it will be necessary to provide such a tapping. This can be done by disconnecting the screen-grid socket of the valveholder from positive HT and attaching a flex lead to it so that it can be joined directly to the appropriate point on the battery, usually 60-80 volts. A condenser of 0.1 mfd. should, of course, be joined directly between the screen-grid and negative LT sockets of the valveholder.

The LT supply should be a 2-volt accumulator, and, since the current consumption of the set without the dial lights is 0.68 ampere, it should have a capacity

of not less than 10 ampere-hours. Actually, a capacity of double this figure is better. Two grid bias batteries are provided, and the precise voltages employed will depend upon the HT voltage used. With a 120-volt supply the output valve should normally have a bias of 4.5 volts, but where extreme economy of anode current is desired 6 volts may be used, with some deterioration in the quality of reproduction. With a 150-volt supply, however, the bias should be about -6 to -7.5 volts. In either case, the triode section of the duo-diode-triode should have a bias of -1.5 volts.

The other bias battery controls the initial bias on the frequency-changer and IF valves, and under normal conditions it should not be less than -1.5 volts. A greater bias than this is not usually permissible with a 120-volt HT supply, since it is likely to reduce the sensitivity to an excessive degree. When a higher HT voltage is used, however, a greater bias may sometimes be permissible, depending upon the degree of initial sensitivity required.

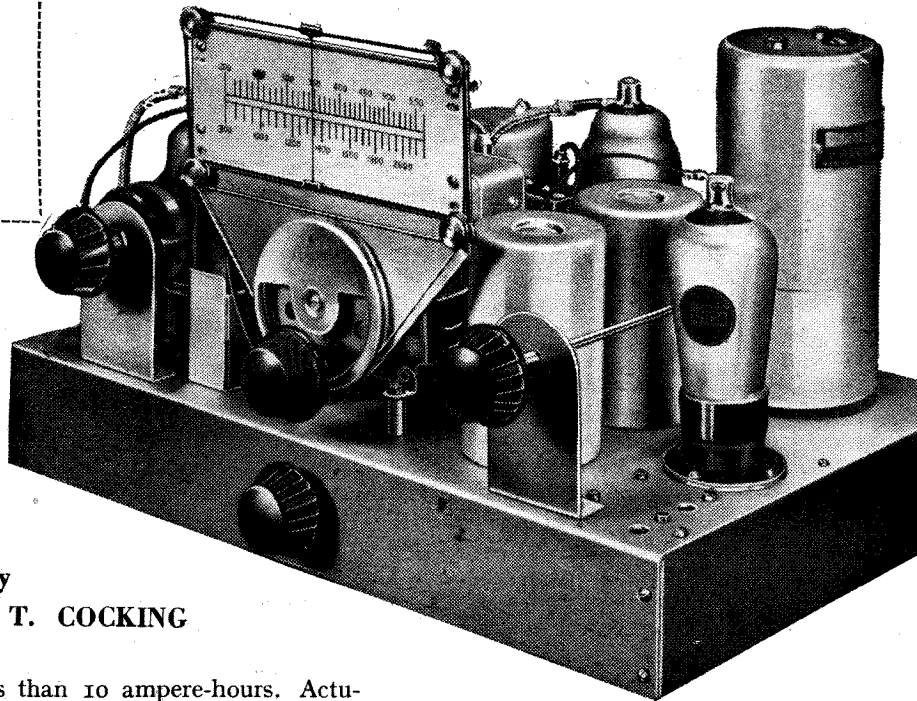
Trimming the IF Amplifier

Any type of loud speaker can be used, but the best results will naturally be secured with a sensitive type of moving-coil instrument. This will normally be a permanent magnet model to avoid the difficulty of providing a field supply. Whatever the impedance of the speech coil, it can be matched to the output valve by means of a transformer, and it is quite easy to calculate the ratio required. The optimum load of the output valve is about 10,000 ohms, and the required ratio is obtained by dividing this figure

by the speech coil impedance and taking the square root of the result. Thus, with an impedance of 2.5 ohms, a common value, the transformer ratio should be $\sqrt{10,000/2.5} = 63.3-1$. As the valve is a triode, very accurate matching is unnecessary, and an error of as much as 30 per cent. in the load employed is not likely to have much audible effect, which means that the output transformer ratio can differ from the optimum by something like 14-15 per cent. The transformer should, however, be of good quality with a high inductance primary, low leakage, and a low DC resistance.

Turning now to the adjustments, it is necessary before good results can be secured to set the four trimmers in the IF amplifier so that the circuits are resonant at 465 kc/s, and to adjust correctly three trimmers on the medium waveband and one on the long. If a calibrated test oscillator is available, this is an easy matter. A milliammeter should be joined in the anode lead of the IF valve to act as a tuning indicator; not, of course, in the actual lead from the IF transformer to the valve, but between positive HT and the transformer. When a signal is tuned in the reading of the meter will decrease, and precise resonance is indicated by the lowest current reading obtainable, that is, maximum change of current. In what follows, this condition will be called the one of maximum response, since it corresponds to the greatest sound from the loud speaker.

The earthy side of the output of the test oscillator should be joined to the chassis and the other output terminal taken through a standard artificial aerial



By
W. T. COCKING

Selectivity IV

FULL details of the theoretical considerations underlying the design of this new receiver appeared in last week's issue of "The Wireless World," and in this article the construction and initial adjustments are described. A résumé of the performance of the set on test is also given.

or a 0.0002 mfd. condenser to a flex lead terminating in a crocodile clip. Set the oscillator to 465 kc/s, and clip the output lead to the grid of the IF valve; then adjust the two trimmers on the IF transformer T₂ for maximum response. The volume control R₁₀ should at first be at maximum, for the first indication that one is approaching resonance will probably be the sound of the modulation on the oscillator appearing in the loud speaker. When both circuits come into resonance, however, quite a good indication should be obtained on the milliammeter.

Adjust both trimmers precisely, and then transfer the clip lead to the grid of the frequency-changer, set the selectivity control for maximum selectivity, that is, fully rotated in a clockwise direction, and adjust the two trimmers in T₁ in an exactly similar manner for maximum response. This completes the IF adjustments, and the next step is to adjust the medium waveband trimmers. The output of the oscillator can now be connected to the aerial terminal and left there for the remainder of the adjustments.

Ganging the Receiver

Set the oscillator to 1,500 kc/s and connect terminal 1 of L₅ to the chassis by a short lead terminating in crocodile clips, thus throwing the set oscillator out of action by short-circuiting the tuning coil. Then with the wave-range switch set for the medium waveband (fully anti-clockwise) adjust the trimmer on C₃ for maximum response on the milliammeter with the tuning condenser set at minimum. No sound will be audible in the loud speaker, and the indication on the meter will only be small, so that the full output of the test oscillator will be needed. Now set the oscillator to 1,400 kc/s and tune the set to it by the main tuning control, again relying on the meter to indicate resonance. The next step is to remove the short-circuit from the set oscillator and to adjust the trimmer on C₉ for maximum response. Quite a small output from the test oscillator can be used, and the setting should be determinable both aurally and by means of the meter.

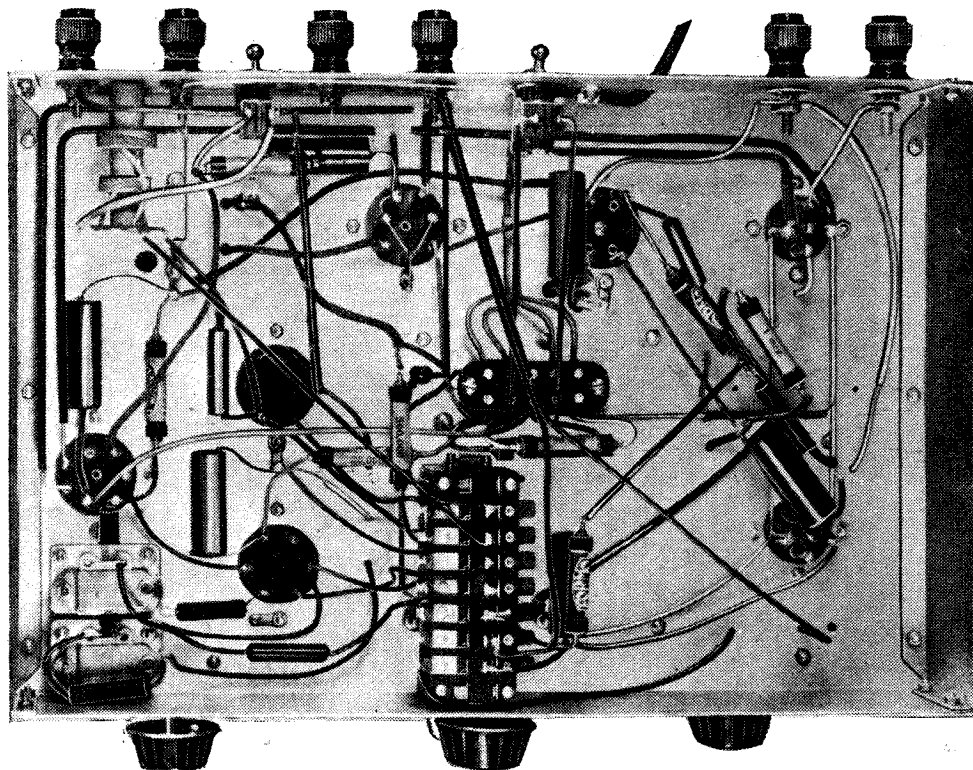
Now set the test oscillator for full output at 600 kc/s, re-apply the short-circuit to the set oscillator, and tune the set to it by the main tuning control. Again, there will be no response in the loud speaker, so that the milliammeter must be relied upon to indicate the resonance point. When this has been found, remove the short-circuit from the set oscillator and

adjust C₅ for maximum response. Since the adjusting screw of this trimmer is live, the use of a screwdriver with more than a minute metal blade will affect the setting. It may consequently be necessary to find by trial and error the setting which gives resonance with the screwdriver removed; this will be with the trimmer screwed up slightly more than necessary with the screwdriver on it.

On the long waveband there is only one trimmer to adjust, and this is readily done. Set the test oscillator to give full output at 300 kc/s and tune the set to it by the main tuning control with the set oscillator short-circuited. Then remove the short circuit, and adjust C₈ for maximum response.

ing the main control backwards and forwards over a few degrees until the optimum combination of settings is found. The same procedure is adopted on the long waveband. With the oscillator at 300 kc/s, tune the set to it and adjust C₈ while rocking the main control.

Although this method seems somewhat simpler than the one recommended, in practice it is less easy, so that the first system is advised where possible. Of course, if no test oscillator is available these methods cannot be used. The adjustment must be carried out entirely on signals. It will usually be possible to find some signal upon which the four IF circuits can be adjusted, and then with the increase in sensitivity other signals can be found at each end of the waveband upon which the ganging can be carried out by the second method described. The only difficulty in the process is that one cannot tell to what frequency the IF circuits have been adjusted, so that if one finds that accurate ganging cannot be secured the presumption is that the frequency is wrong. The IF trimmers should all be screwed further home or more fully unscrewed, according as to whether one anticipates that a lower or higher frequency is required, and a further



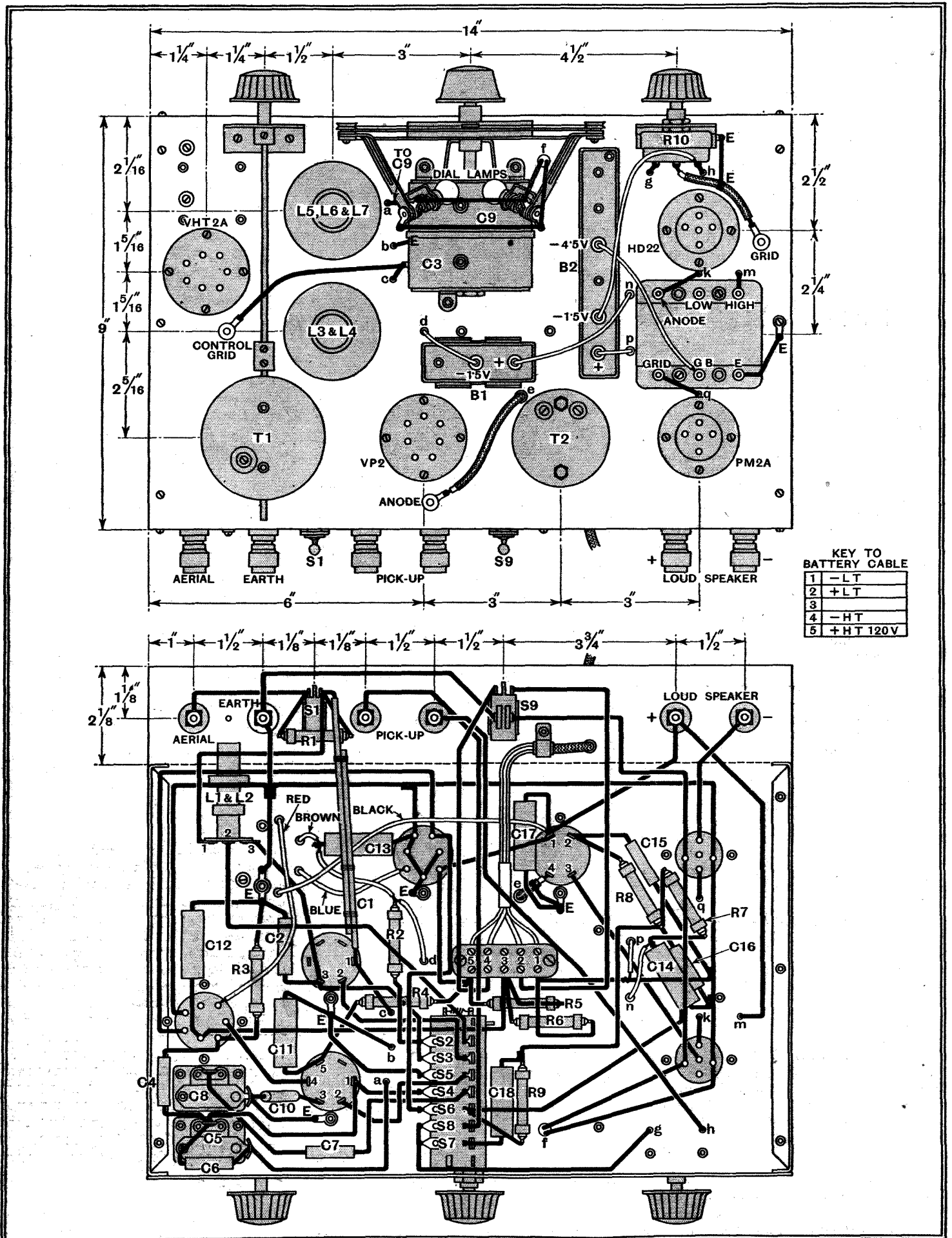
An underview of the chassis showing the wiring.

Should it be found that because the output available from the test oscillator is insufficient no indication can be obtained with the set oscillator short-circuited, then this method of ganging cannot be adopted. The alternative procedure is to set the main tuning control to read 1,400 kc/s (214 metres) on the wavelength scale, and with the test oscillator set at this frequency to adjust first C₉ and then C₃ for maximum response. Then set the oscillator to 600 kc/s and tune the set to it; C₅ is then adjusted with one hand while rock-

attempt made to obtain accurate ganging.

It may be remarked that one should not expect the wavelength calibrated scale on the dial to hold with this receiver. The scale is designed for use with coils of 157 μ H. on the medium waveband, and, although the signal-frequency coil of this set has approximately this inductance, the use of the coupling condenser C₂ renders the calibration inaccurate. Actually, the calibration holds quite well over the lower half of the medium waveband, but gradually runs out over the upper half until at

PRACTICAL WIRING DIAGRAM



KEY TO BATTERY CABLE

1	- LT
2	+ LT
3	
4	- HT
5	+ HT 120V

Full details of the construction and wiring are given in these drawings.

The Battery Variable-Selectivity IV.

the upper end of the band the scale reads about 15-20 metres high.

On test the receiver gave a good account of itself, the sensitivity being adequate for general reception, while the selectivity was found to be high enough to permit most Continental stations of entertainment value to be well received. Within the limits of the output valve the quality of reproduction reached a high standard. For local reception it was found essential to make use of the local-distance switch S_1 if distortion due to overloading the early valves was to be avoided. Incidentally, the optimum value of R_1 may vary in different localities. When the set is used very close

A full-size blue print of the wiring diagram is available from the Publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. post free.

to the local, a higher value resistance may be needed to reduce the input sufficiently. On the other hand, when the set is operated at a great distance, it may be found that the signal strength is not enough with S_1 at "local," but that there is distortion with it at "distance." A lower value for R_1 is then indicated. It may be remarked that it is inadvisable to change the position of this switch; although it is at the back of the chassis it can be conveniently reached.

On the Short Waves

Notes from a Listener's Log

THE appearance of Type B ultra-short-wave conditions on Wednesday and Thursday, April 22nd-23rd, was mentioned at the end of my last notes, and it is thought that a few further notes on this phenomenon might be of interest.

One station, namely, the half-wave of PMA, Bandoeng, on 7.8 metres, proved to be the most interesting signal heard below 10 metres on the Thursday, and it was noted that conditions below 27 metres were particularly poor by 11 p.m., especially as far as U.S. short-wave broadcasters were concerned.

Visible sunspot activity, however, did not reach a minimum until Wednesday, April 29th, on which day no spots were visible at all; after April 29th solar activity seemed to be increasing again slowly, and during the first few days of May a number of small spots have been observed.

From about May until September, however, we are not so dependent upon sunspot activity for good short-wave conditions, at least before midnight, owing to the great increase in the hours of daylight.

It is for this reason that conditions have remained fairly good during the period under review, in spite of apparently adverse solar conditions, which would have been more marked had they occurred during the winter period.

Directional Aerials

In spite of the relatively low levels of ionisation prevailing, it has been observed that 19-metre reception from the States is not at its best until after 10 p.m. BST, even the high-power Rocky Point commercials between 18 and 23 metres being weak in the early evening.

The excellent performance of the T.A.T. transmitter WLA on 16.36 metres shows what excellent results we might obtain from W3XAL on 16.87 metres if this latter transmitter used an aerial suitable for transmission to this country and Europe generally; WLA has often been an excellent signal until midnight.

A further study of conditions indicates that reception recently has been consistently good down to 11 metres, the usefulness of this band extending quite late into the evening for stations lying to the west of us.

In view of this drift of conditions, obvi-

ously connected with the 11-year sunspot cycle, to the shorter short waves, the programme value of short-wave reception in this country seems to have fallen off, at least during the hours of daylight.

The reason for this is not hard to find; most of the stations radiating regular short-wave programmes are now working on wavelengths which are too long. W2XAF on 31.48 metres, for example, cannot be expected to give a good signal in this country until after midnight. W2XAD should be used instead on 19.56 metres from 9 p.m. onwards or earlier.

It is a pity, too, that W8XK does not make more use of its 14-metre wave during the early evening, especially if an efficient array could be used orientated on this country.

New Stations

One at present is forced to the conclusion that, apart from England, Germany, and Holland, no real effort has yet been made to develop short-wave broadcasting generally.

Among the new stations worth looking for this month are VJZ, Radio Rabaul, New Guinea, which works on 21.61 metres irregularly near 11 a.m., and HS8PJ, Bangkok, on 27.38 metres, which has recently recommenced operation on Mondays only from 2-4 p.m. It is doubtful, however, whether good reception of HS8PJ will be obtained, as the wavelength is too long for this time of the day.

Our reception report for the fortnight begins with VK9MI, the M.V. Kanimbla, testing on 49.85 metres at 10.10 p.m. on April 23rd, a weak signal but excellently modulated; overall result just fair.

At 8 p.m. on Friday, April 24th, a deeply fading, unmodulated signal was observed on 5 metres, at about R7-8, but unfortunately it was not identified; higher up the wavebands W3XAL on 16.87 metres was observed to be very poor.

Later, at midnight, LRX was a strong signal on a new channel just below GSB, and W8XK was fairly good on 25.27 metres.

It was noted that, in spite of a relatively weak signal, W3XAL on 16.87 metres was the best of the U.S. stations at 10 p.m. on April 25th, both W8XK and W2XE being weak on 19 metres, with W2XAD inaudible.

The half-wave of Moscow on 12.5 metres has been a fairly regular performer recently in the early evening, as, for example, at 7.30 p.m. on April 27th, but the best signal this evening was W8XK on 19.72 metres at 11 p.m.

Apart from Rome and Berlin, the best signal on Tuesday evening was the quasi-local CT1AA, all the Americans having been fair only, except for W3XAL, which was fairly good for a short period around 5 p.m.

An improvement in conditions appeared to take place on April 30th, W8XK being really excellent on 19.72 metres at 11 p.m., with W3XAL also good from 8 p.m.

The M.V. Kanimbla was also fair at 8.10 p.m., working on 25.6 metres, but troubled somewhat by key clicks from FYR. VK9MI was again a fair signal at 8 a.m. on Friday morning, also on 25.6 metres.

In the evening of May 1st VQ7LO was noted as a good signal on 49.31 metres, though spoilt by static. Incidentally, this station has improved enormously, both in strength and quality.

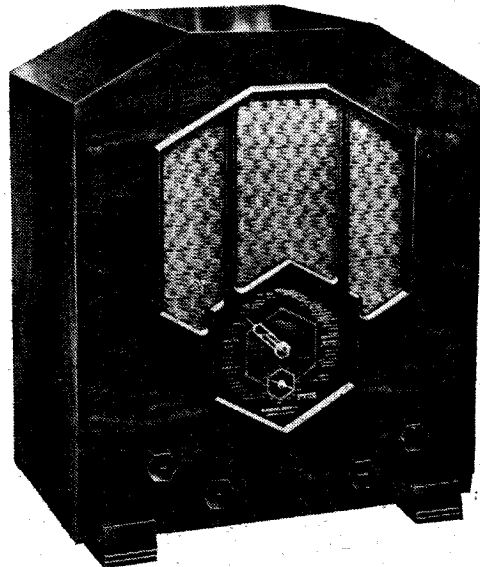
Recently, W2XAF on 31.48 metres has existed only as a faint heterodyne on LKJI, but appeared as a good signal by midnight on May 2nd. W8XK on 19.72 metres was also very good at this time.

Similar conditions prevailed on Sunday, May 3rd, when W2XAF was again a good signal at 11.30 p.m., and earlier in the evening W8XK on 19.72 metres had provided an interesting programme lasting for thirty minutes from 10 to 10.30 p.m., dealing with the history of the founding of the settlement by Master Roger Williams, which later became known as Rhode Island. Three hundred years ago Roger Williams was banished from the State of Massachusetts, an order which was rescinded only a few weeks ago, according to the Pittsburg announcer!

During the last few days conditions have remained fairly good, but an increase in static has spoilt stations, the reception of which might otherwise have been good, in particular W8XK on 19.72 metres.

ETHACOMBER.

A New McMichael Superhet



The Model 361 AC superhet, employs an adaptation of the McMichael Giant Dial for tuning indication. It is housed in a new design of cabinet with "piano" finish and the price is £11 7s. 6d.

UNBIASED

A Missed Opportunity

THE other afternoon a very striking instance of the lack of forethought and enterprise, both among wireless dealers as well as among ordinary members of the public, came before my notice.

I had arrived outside the Stadium with one of the little Grid Leaks with intent to see the sporting event which was taking place therein, and which was being broadcast. To my chagrin I found on arrival that I had left my tickets at home and was unable to get in. Naturally I had with me my vest-pocket portable, which always accompanies me when outside broadcasts of this nature are given, since I always find that by listening as well as looking, I can usually form a much better idea of what is going on than I could



Making the best of a bad job.

otherwise. In addition I had several old earphones in my pocket, as I have found, in the past, that my apparatus always arouses interest among my immediate neighbours.

Accordingly, in order to make the best of a bad job, the little Grid Leak and I seated ourselves on a mouldering ruin of the great exhibition of 1924-5 and proceeded to listen in. The crowd was considerable and my spare earpieces were soon requisitioned. It suddenly occurred to me to wonder whether any other people were equipped with sets, and so, leaving the little Grid Leak in charge of the apparatus, I fought my way through the vast concourse all around the building without finding a single receiver, although wild rumours were flying about among the mob concerning the happenings on the other side of the wall.

It struck me as curious that people hundreds of miles out at sea and even in distant America would be listening in, and therefore in possession of very much more accurate information of what was happening a few yards away than was the case with this crowd. Not one of the large number of people present had had the enterprise to bring a portable of any description, yet most of them were haggling

with ticket profiteers who were doing a very brisk business with half-a-crown tickets at 15s. apiece. It seemed to me that if people were prepared to stand this prodigious over-charge for tickets, they would be perfectly willing to pay for the hire of a pair of headphones to listen, and yet not a single local wireless dealer was present to seize this opportunity.

Possibly, I thought, the dealers might be afraid that any such activities on their part might come under the B.B.C.'s official ban on the dissemination of news to the public; but, even so, there was nothing to prevent their dodging it by hiring out complete sets instead of headphones only, or even of selling outright cheap crystal sets.

Actually, I do not think I should have been breaking the B.B.C. regulations even had I been using a loud speaker set instead of headphones, but, in order to test the legality of the position, I hastened to a 'phone box in order to invite the B.B.C. to send down one of their sleuths in a fast car to catch me in the act of broadcasting the commentary.

My overtures on the 'phone were, however, not at all well received. After getting through to many different departments, I was finally asked to send my invitation by letter. When I pointed out that an express letter, or even a telegram, would not be quick enough, as there was not much more than an hour for them to act, I was told, in the manner of a school-master reproving a small boy, that I ought to have thought of it before and written to them the previous day concerning my evil intentions. As there are ladies included among my readers, I must, I fear, refrain from comment.

Record-changers for Nine-inch Discs

IN past years when discussing radio-gramophones and record-changers, I have often moaned about the fact that none of the various makers of these latter devices have had enough sense to make them so that they will accommodate the huge number of nine-inch records which are sold annually by the sixpenny stores.

You can therefore imagine my delight the other day when, on drifting up to the gramophone counter of one of these popular emporiums, I saw a record-changer in full action. I was more delighted still to find that it was not some instrument of foreign make, but one turned out by a firm which has already made a name for itself for the construction of these devices.

Naturally I could not buy one in the store in question, but I bought a gross of new records there and then, in anticipation of possessing one of these new record-changers. The following morning I gave the order for one to my local

By FREE GRID

dealer, but was considerably astonished when he told me a day or two afterwards that none of the big wholesalers had heard of such a device. At my instigation he corresponded directly with the makers, but again drew a blank.

He began to express doubts concerning my veracity when I told him that only the other day I had seen one in action in the local sixpenny stores. In order to uphold my reputation for truth at all costs, I at once set out with him for the emporium in question. A few minutes later found us before the counter, and I pointed with pride to the instrument churning out the daily ration of Bach and Henry Hall. Considerably astonished the dealer was about to tender me an apology when suddenly he turned on his heel and dived behind the counter, despite the expostulations of the formidable female in charge.

With a shout of triumph he beckoned me to him, and I saw to my disgust that the record-changer was a normal standard instrument playing ordinary ten-inch records. Being a person of single mind myself, the possibility of such duplicity had never occurred to me; when I first saw the apparatus at work I had at once jumped erroneously to the conclusion that nine-inch records, similar to those displayed on the front of the counter, were being used.

To give the manager of the place his due, I do not think that he really intended to deceive, for in a subsequent interview he explained that the music, which was distributed throughout the store by various loud speakers, was intended not so much to sell gramophone records as to provide a musical background for the staff. This was an idea, he added, that



He dived behind the counter.

had been adopted by the manager of a large factory and which he had seen reported in *The Wireless World* some time before. The record-changer was merely adopted as a labour-saving device. I believed him, though thousands wouldn't.

Acoustic Distortion at High Amplitudes

A Possible Cause of Distortion at the Throat of Horn Type PA Loud Speakers

By N. W. McLACHLAN, D.Sc., M.I.E.E.

MOST calculations in acoustics are based on the assumption that the variations of sound pressure are small compared with the atmospheric pressure. At the throat of a high-powered horn loud speaker this condition does not necessarily apply and care in design is necessary if distortion is to be avoided.

THE subject of distortion in sound-reproducing systems is one on which many millions of words have been written. The ventilation of views in media like *The Wireless World* has resulted in distortion in various parts of either radio broadcasting or public address systems being reduced to an almost negligible quantity. There is, however, another possible source of distortion which has been above suspicion until recently. In any sound-reproducing system it is essential that the characteristic of each component shall be a straight line, i.e., the output must be strictly proportional to the input. After the loud speaker there is the air which conveys the sound vibra-

When a sound wave from a loud speaker passes through the air the latter is compressed at the crests and reduced in pressure at the troughs, as indicated in Fig. 3. In the case of sounds of moderate intensity the compression and rarefaction are very small compared with the normal pressure of the atmosphere as measured by a barometer, this being approximately

causes a fluctuation above and below this of 5 dynes per sq. cm., which is far too small to be shown to scale on the diagram. In fact, from a practical point of view the movement of the working point M on the curve during the passage of the sound wave can be regarded as being along the tangent to the curve at M, i.e., the line TMS. When the sound pressure is infinitesimal, the working line is the tangent to the curve. The theory of sound which was formulated some seventy or more years ago was based on this assumption, i.e., that the pressure due to sound waves could be regarded as infinitely small and therefore inaudible.

Amendments to Classical Theory

The coming of powerful loud speakers for public address and kindred purposes has given the good old theory of sound a great shock. Acoustical power of the order 10 to 100 watts cannot be radiated from a loud speaker without the creation of large pressure variations in the air. For instance, the pressure variation at the throat of a public address speaker having a diaphragm two inches in diameter may be as high as $\frac{1}{10}$ th atmospheric pressure, that is to say, it may reach a value of 100,000 dynes per sq. cm. This is colossal

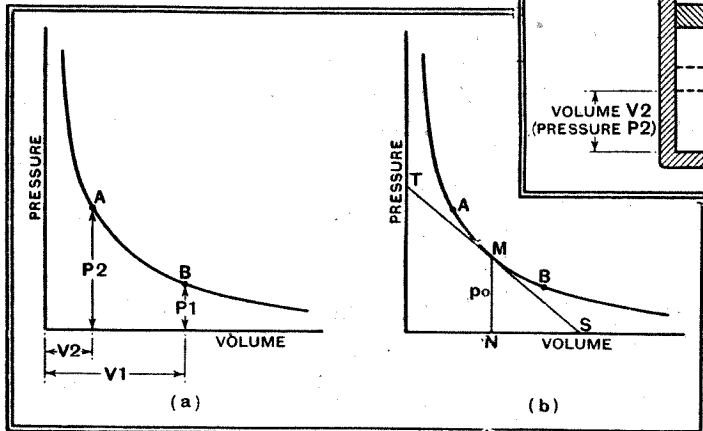


Fig. 1.—(a) Curve showing relation between the pressure and volume of air under adiabatic conditions. (b) For sound pressures of small amplitude the tangent TMS gives sufficiently accurate results.

14.7 pounds per square inch or one million dynes per square centimetre. For example, a pressure of 5 dynes per sq. cm., or one two-hundred-thousandth part of the atmospheric pressure in the ear canal, gives the sensation of a loud sound. Referring to the pressure/volume curve of Fig. 1 (b), if MN represents the normal atmospheric pressure of 10^6 dynes per sq. cm., the sound wave

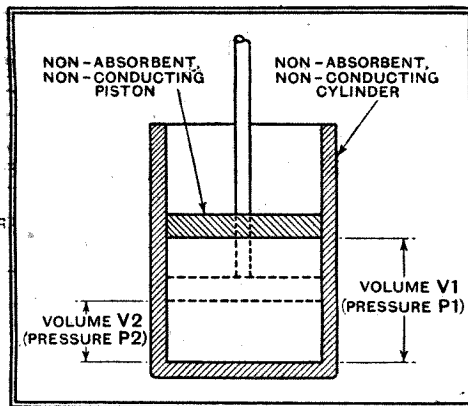


Fig. 2.—Simple piston and cylinder giving adiabatic conditions of compression and rarefaction shown in Fig. 1.

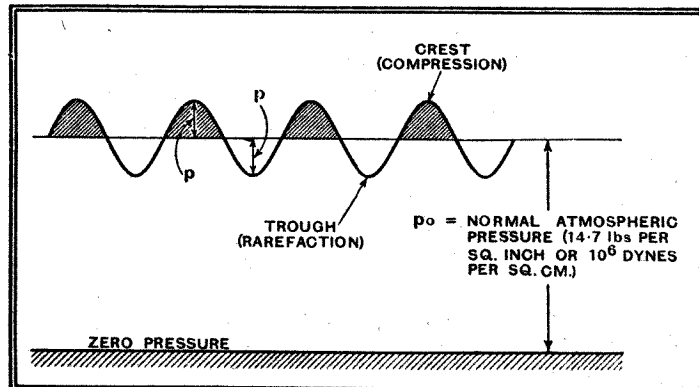


Fig. 3.—Fluctuation of air pressure during the passage of a sound wave. The ripple is exaggerated many hundreds of times.

tions to the ear. What can we say about the linearity of this fluid medium?

To answer this question we require the characteristic curve for air, namely, the adiabatic pressure/volume curve shown in Fig. 1 (a). This curve shows the relationship between the pressure of air in a cylinder (which neither absorbs heat, nor from which heat can escape) when it is increased, say, by pushing down the piston in Fig. 2, thereby reducing the volume below it, and taking measurements of P and V at a number of positions. For instance, P_1V_1 and P_2V_2 correspond to the points indicated at A and B in Fig. 1 (a).

compared with the puny pressure of 5 dynes per sq. cm. which, when it tickles our ear drums, causes the sensation of a loud sound. With a pressure of 100,000

Acoustic Distortion at High Amplitudes—

dynes per sq. cm. the air is worked over the arc AMB of the pressure/volume curve of Fig. 1 (b). Now the arc is far from being a straight line, so on general grounds we should expect distortion to occur, and this is so in practice. The extent of the distortion can be calculated, and it can also be measured.

Suppose we have a diaphragm two inches in diameter vibrating at one end of a uniform tube of equal size several hundred feet long, there being a steady loss in energy as the sound travels down the tube, so that little is reflected back or emerges from the open end. At equal intervals along the tube suppose we place microphones, and take the output from each microphone to an amplifier, thence to a cathode ray oscillograph, so that the wave form at each point can be made visible. Let the power delivered by the diaphragm to the tube be 30 watts, this being large enough for an appreciable arc of the pressure/volume curve of Fig. 1 (b) to be brought into action. The wave form obtained (on the oscillograph) from the microphone near the diaphragm will be very nearly a sine wave. At a distance of 100 feet the wave will not be sinusoidal, but will have the shape indicated on the right of Fig. 4. The shape suggests that the crest of the wave travels faster than the trough, and tends to overtake it as the distance from the diaphragm increases. This, in fact, does happen, owing to the

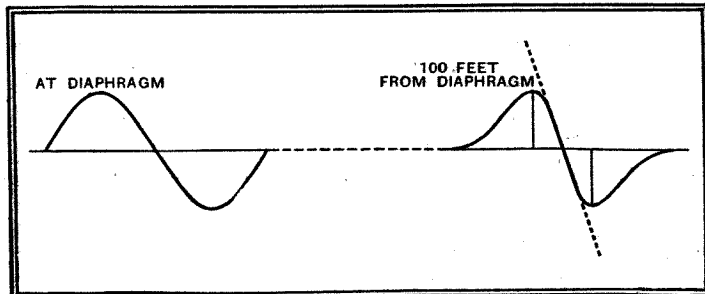


Fig. 4.—Distortion of a sound wave of large pressure as it travels through the air.

density of the air at the crest exceeding that of the trough by an appreciable amount, provided the sound pressure variation is large enough compared with that of the normal atmosphere.

Harmonic Distortion

The curve of Fig. 4 can, of course, be resolved into a fundamental and a series of harmonics of which the second is the most important (see Fig. 5). In practice we use a flaring horn on a public address loud speaker (not a long uniform tube), so we should expect the distortion of the sound wave due to high pressure would differ from that of the preceding case. The effect of expansion of the sound waves, as they pass down an expanding horn, is to cause a fall in pressure, owing to the energy being spread over a greater area. Since the pressure falls steadily the tendency to distortion gradually decreases. Meanwhile, however, distortion occurs at the narrow part of the horn near the diaphragm, and it

reaches a certain stage after which the horn opens out so rapidly that further distortion is checked. To avoid noticeable distortion it is essential that the output from the speaker should be restricted to a value such that the sound pressure at the throat of the horn does not exceed a certain (calculable) pre-determined value. This is one way of keeping the

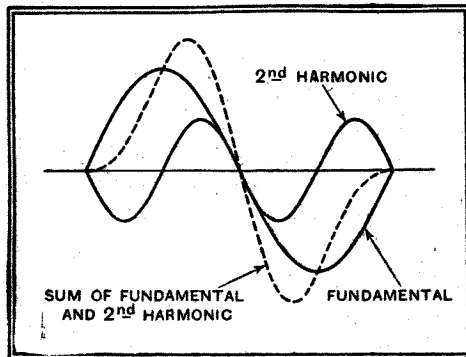


Fig. 5.—Analysis of the wave form of Fig. 4 shows the second harmonic to be the most important.

distortion within bounds; another way is to increase the size of the horn throat and also the size of the diaphragm. Thus, large acoustical power can be radiated for a moderate value of throat pressure.

The above points to the fact that to avoid distortion it is better to use a number of speakers of moderate size rather than one overworked giant. Furthermore, a plurality of speakers also enables a much better sound distribution to be obtained, especially where large areas have to be covered.

This is but an outline of the problem of non-linear distortion due to the air. Those readers who desire to study the matter in greater detail will find it treated in *The Wireless Engineer*, p. 582, November, 1935. A formula is given there from which the size of the horn throat for negligible distortion can be calculated. When the second harmonic is to be not less than 30 decibels below the level of the fundamental sine wave oscillation impressed at the throat of the horn, the throat area must

not be less than $0.148 P (n/n_c)^2$ sq. cm., where P is the acoustical power in watts, n is the frequency radiated and n_c is the cut-off frequency of the horn, both the latter being cycles per second.

The Radio Industry

FOR increasing the range of standard single-range instruments, Ferranti has recently produced a series of units, including shunt boxes and multipliers. Details are available from the Instrument Department at Hollinwood, Lancs.

Leaflets describing selenium and electronic light-sensitive cells are issued by Barnham and Adolph, 35, New Cavendish Street, London, W.1. The larger size of electronic cell generates as much as 15 to 20 milliamperes in strong sunlight.

The latest "Kits and Sundries List" issued by Scientific Supply Stores (Wireless), Ltd., 126, Newington Causeway, London, S.E.1, deals largely with kits of parts for receivers and other apparatus described in this journal. Various accessories and materials are also included.

F. W. Lechner & Co., Ltd., have been appointed agents for the Singen Aluminium Works, which produce aluminium foil in thicknesses of from 0.005 mm. upwards for paper and electrolytic condensers.

Electric Circuits and Wave Filters. By A. T. Starr. Pp. xiv + 375. Sir Isaac Pitman and Sons, Ltd., 39, Parker Street, London, W.C.2. 1934. 21s. net.

THIS is a book for electrical engineers who, either as teachers or designers, have specialised in telegraphy and telephony or in radio communication. It deals for the most part with two-terminal impedances, four-terminal networks, and wave filters. The mathematics required for the theory of these subjects is of a somewhat advanced nature, but the author has had in mind the type of reader who possesses but a modest mathematical equipment, and the first two chapters are devoted to a very clear exposition of the special mathematics which the subject demands. Considerable attention is given to the design of resistances, condensers, and coils, including dust cores and Ferrocart and screened coils. The radio worker will be particularly interested in the chapters on wave filters of all kinds, especially band-pass filters for which an abac is given to allow of rapid design. The important question of the effect of transients in filter systems is adequately gone into, and formulæ are given for the calculation of damping in filters due to coil resistance.

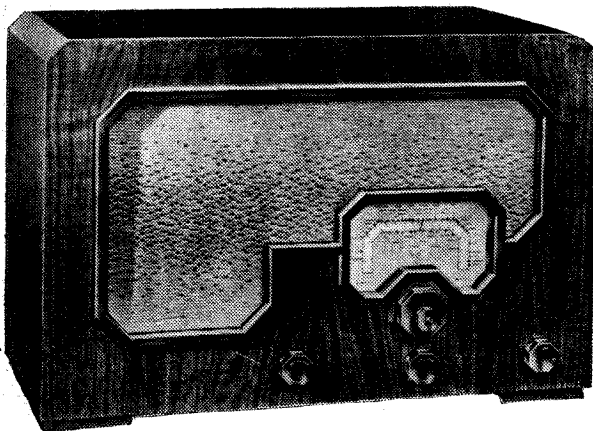
R. T. B.

COSSOR MODEL 378

A NEW style of cabinet design has been adopted for the latest addition to the Cossor range of receivers. The set is of the horizontal type and the loud speaker grille has been carried round the tuning dial.

Pentode valves are used in all three stages of the "straight" circuit, and iron-cored tuning coils are included to give good selectivity.

The set, which includes an 8-inch moving-coil speaker, is for use on AC mains, and the price is 8 guineas.



Making An "Exponential" Cone

CONSTRUCTIONAL DETAILS FOR THE AMATEUR MECHANIC

By E. C. RICHARDSON

IN an article entitled "Sub-harmonics" (*The Wireless World*, December 27th, 1935) Dr. McLachlan has shown that the curved-sided form of cone is to be preferred to the normal straight-sided form in loud speakers, and he there described how such a cone might be constructed out of a special type of chemically treated cloth, first by forming an ordinary cone and then by stretching it by means of a weight.

As this method of construction appeared to be difficult, and as no special kind of cloth was to hand, it was decided to experiment in other directions.

Stockinette was the material selected, because it can be bought at any draper's shop, and because it is fairly evenly elastic in all directions. It was thought that if this could be pressed out to the required shape, and if it were then to be given a coating of some suitable dope, it would "stay put." After a few failures, this anticipation has been realised. The means adopted were as follows:—

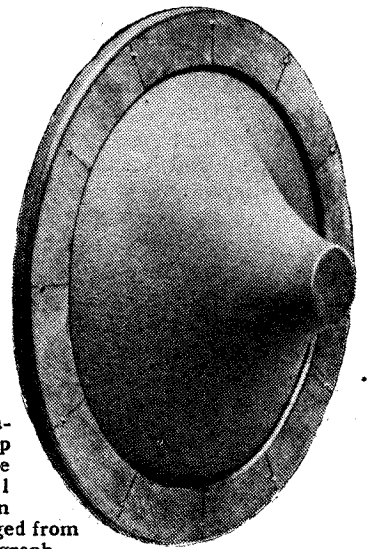
It was decided to construct a cone with a base of 11 in. diameter. Two circular discs, 13 3/4 in. diameter, were cut out of six-ply wood. One of these was converted into a ring, having an interior diameter of 11 in. On the other a stick, attached to a hinge, a small wooden cleat and a central guide were mounted. Next, a plunger was made, the base of which should be cut from six-ply, and its diameter made slightly smaller than that of the moving coil.

It is fixed to six inches of 2 B.A. rod, as shown. The gadget below the plunger in the sketch is cut out of thin cardboard,

coloured to match the cone. When its serrated edge is bent round it forms a little crownless hat which fits over the bottom of the plunger. This is to prevent the plunger from sticking to the cone and also to add some extra strength. All wooden parts are given a thin coating of vaseline, also to prevent sticking.

The cardboard "hat" is then placed on the plunger, to which it is attached temporarily by a spot of vaseline. The other

The curvature taken up by the cone material under tension may be judged from this photograph.



should be used with a view to avoiding wrinkles, but the stockinette should be loose, i.e., not pulled quite taut. The ring is then screwed down firmly by means of wood screws placed close to its outer margin.

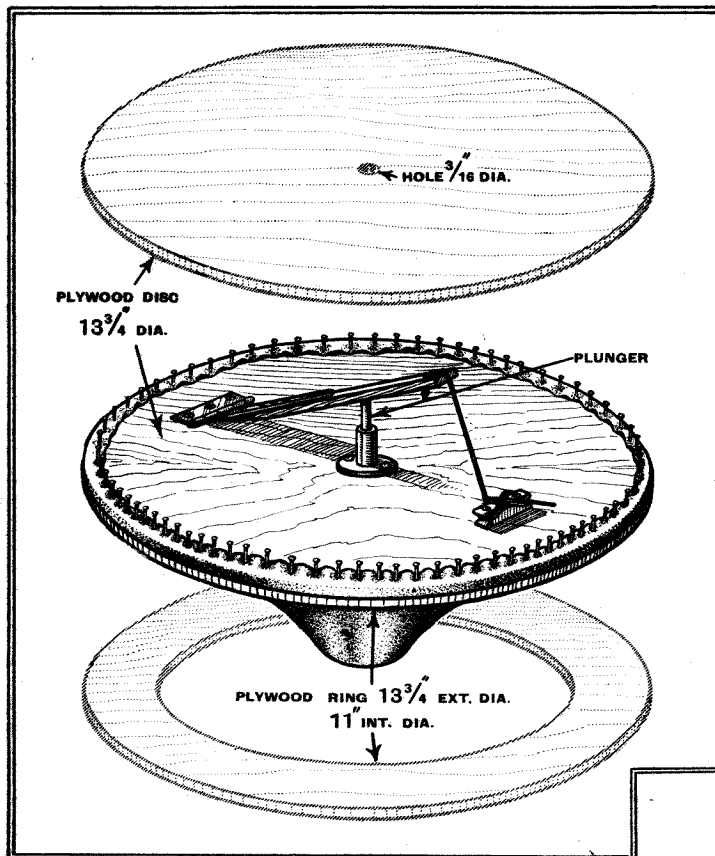
The stockinette is now pressed out by the plunger, which may be kept in position as shown in the main sketch. Considerable, but not excessive, force may be used, and the depth of the truncated cone so formed should be about 4 1/4 in.

Experiences with Dopes

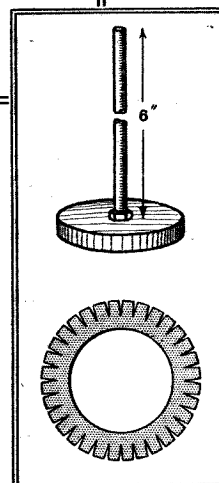
The question of a suitable dope now arises, so that, when the plunger is withdrawn, there may be little or no alteration of shape. Celluloid dissolved in amyl acetate was the first dope to be tried, but it was found that, even after six coats of this, applied to the outside of the cone, there was some degree of contraction. Moreover, this dope takes a considerable time to dry out, and the odour of "pear-drops" which is emitted during drying is not calculated to increase one's popularity with the domestic authorities. Accordingly, a second attempt was made with shellac dissolved in methylated spirits. This, however, was a failure. The cone at first seemed fairly firm, but in the course of a day or two it assumed a form reminiscent of the dying frog of the pavement hawker. Thirdly, an attempt was made with very hot, strong glue, and this

turned out to be quite satisfactory. The cone dries out very hard, and, when removed from the former, does not seem to contract or otherwise lose its shape in any appreciable way. A coating of celluloid dissolved in acetone (which has the advantage of drying very quickly and of emitting very little smell) was, indeed, given to both sides to keep out damp; but except, perhaps, in very damp surroundings, this is probably unnecessary.

Next with regard to the surroundings. The cone could, of course, be mounted on leather or rubber in the usual way; but



Component parts of the framework for stretching a curved-sided diaphragm. (Above) Dimensions of the main disc and retaining ring and suggested method of securing plunger. (Right). Plunger and reinforcing ring for apex of cone.



side of the hat is covered with Seccotine, and the rod is passed through the central guide. A circular piece of stockinette is then spread over the hat and one side of the disc, bent over, and secured to the other side of the disc by means of tin-tacks. Plenty of tacks

Making an "Exponential" Cone—

a simpler plan is to use the surplus stockinette itself as a surround. This was given several coatings of rubber solution, and the result seems to be quite satisfactory from the point of view of flexibility.

Lastly, the coil is mounted on the apex, and the diaphragm is complete.

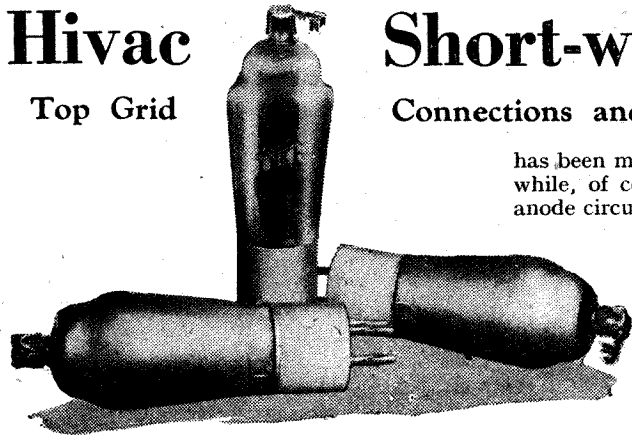
As to results, the writer has tried very many straight-sided cones of various degrees of angularity and size, and made out of many different kinds of paper; but, judged by ear, this "exponential" type of cone, made from stockinette, appears to be considerably superior to any of them. The bass is specially well produced, and the instrument seems to deal kindly with

transients. An unexpected feature is the comparative excellence of the top, for the finished cone is rather heavy. This may be due to the fact that the cone is hard and thinner close to the moving coil. Used in conjunction with a "tweeter" furnished with a suitable system of condensers and a variable resistance (as described in *The Wireless World*), very good results have been obtained.

To sum up. This type of cone seems to have the following advantages: (1) Correct shape. (2) Absence of seams. (3) No special surround required. (4) Handy platform for mounting the coil. (5) Great strength and rigidity in proportion to weight. (6) Ease of construction.

Hivac

Top Grid

**Short-wave Valves**

Connections and Frequentite Bases

has been made in the grid-filament capacity, while, of course, the losses in the grid and anode circuits will be appreciably lower.

The low-loss construction of the power valve of the series, the PX230SW, would be redundant were it intended only for LF amplification, but this valve is eminently suitable as a master oscillator, or HF amplifier, in low-power transmitting circuits on both the

short and ultra-short wavebands. It can be employed, also, in frequency doubling circuits, and it is for these functions that the special form of construction has been adopted.

MENTION has already been made in *The Wireless World* of the latest series of Midget valves produced by the High Vacuum Valve Co., Ltd., which by virtue of their low inter-electrode capaci-

Type.	Filament.		Max. Anode Volts.	Optimum Screen Volts.	Anode Current (mA.).	Grid Bias.	At Zero Grid Bias and 100 Volts HT.	
	Volts.	Amps.					AC Resistance.	Amplification Factor.
D210 SW ...	2	0.1	150	—	3.5	— 3	12,000	16
PX230 SW ...	2	0.3	150	—	17.5	— 15	1,850	6.5
SG220 SW ...	2	0.2	150	70	3.3	— 1	*330,000	*500

* At anode volts = 120, screen volts = 70, grid bias = 0.

ties and small physical dimensions are eminently suitable for use in ultra-short-wave sets. Amateur experimenters will be interested to learn that this firm are now manufacturing some of their standard-sized battery valves especially for short-wave use, the modifications made consisting of bringing the control grid out to a plug contact on top of the bulb and fitting a frequentite base in place of the usual moulded bakelite one.

The layout of a short-wave battery receiver could often be improved were a triode available with the grid connections at the opposite end of the valve to that of the anode, so that the new models can be said to fulfil a long-felt want. There are three valves in the new series and they consist of a triode, with characteristics suitable for use as a leaky-grid or anode-bend detector, a power output triode giving about 450 milliwatts, and a screen-grid HF amplifier.

Their principal characteristics are given in the table above.

Measurements made with the new type show that with this method of assembly a reduction of between 30 and 40 per cent.

This valve can, of course, be operated as a high-efficiency power amplifier in the manner familiar to transmitting amateurs and will give a considerably larger AC power output than the figure already mentioned, though the usual precautions must be observed.

Considering the special construction of these valves their prices are very reasonable. The D210 SW costs 5s. 6d., the PX230 SW 12s., and the SG220 SW 12s. 6d.

M.S.S. recording equipment comprising dual turntables, amplifier and control panel.

M.S.S. Recorders

New Home Equipment

FOR several years past the M.S.S. Recording Co., Ltd., 99a, Charing Cross Road, London, W.C.2, has been manufacturing gramophone recording apparatus of an advanced design, the equipment being capable of producing records of an exceedingly high standard.

Whilst this apparatus is not, strictly speaking, home recording equipment, the firm in question has in hand a programme, now well advanced, of modified apparatus embodying the salient features of the large recorders, but designed specially for home use.

Their experience in the development of recorders points to the need for an amplifier of ample power output and equipped with bass and treble correcting circuits if a satisfactory record is to be made.

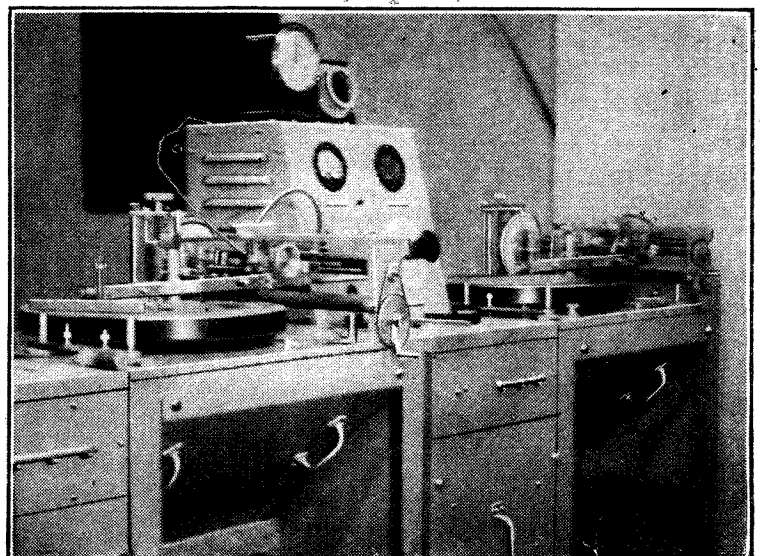
Whilst the new equipment is designed as a whole, it will be built in unit form, there being five parts in all, yet each part is complete in itself and may be used separately.

The main recording unit is fitted with an $\frac{1}{8}$ h.p. electric motor, tracking mechanism, cutting head and pick-up, the inclusion of a pick-up for reproducing being deemed advisable so as to ensure the use of one of suitable characteristics. The AC-operated amplifier will provide ample power output and have variable correction for bass and treble. These will cost about £30 each.

A wireless receiver unit is included and designed to suit the LF amplifier; its price is to be in the region of £10. There will be also a recommended loud speaker unit and an electrical playing desk, though the latter is optional since the recorder can be employed in its place. These two will each cost about £7. Thus the cost of the complete equipment, as at present visualised, but excluding the playing desk, will be in the region of £80. Double-side 10-inch recording blanks cost 2s. 6d. each.

Special cutting needles are required for recording, but ordinary trailing steel needles, or fibre needles, can be used for reproducing.

Records made with the firm's apparatus are exceptionally good, and those we heard were particularly free from surface noise. The apparatus demonstrated to *The Wireless World* was of the type used by film companies and the like, but there is every reason to believe that the home recording version will be every bit as efficient and as reliable as the more expensive equipment.



BROADCAST

News from Portland Place

BREVITIES

"Queen Mary" a Permanent O.B. Point

PUBLIC buildings, churches, restaurants, cinemas and so forth, to the number of approximately one hundred, are permanently wired for broadcasting, and now, for the first time, the B.B.C. has treated a ship, the *Queen Mary*, in a similar manner. Most of the 5,000 yards of wiring to be used for the broadcasts during the maiden voyage had to be done before the final panelling and painting work. This wiring will remain a permanent feature, even though it may never be required again in connection with broadcasting; but the more mobile apparatus, microphones, control unit and transmitter, will be removed after the *Queen Mary's* return from her maiden voyage. All this apparatus belongs to the B.B.C. The transmitter is naturally not comparable with Droitwich; but is simply a transmitter of moderate power such as one finds on the big transatlantic ships.

Maiden Voyage

The main programme arrangements in connection with the maiden voyage of Britain's premier liner are as follows:—

A half-hour departure programme, starting at 3.15 p.m. on May 27th.

Programme from 2-2.20 p.m. for schools on May 29th.

A "round-the-ship" programme from 8.15-9 p.m. on the same day.

Five-minute news flashes each night in the home programmes.

News flashes in the Empire programmes at 2 a.m. each day.

An arrival programme; the *Queen Mary* being scheduled to reach New York at 9 p.m. B.S.T. on June 1st.

A Select Band

TO be a "special correspondent" of the B.B.C. has a special significance these days, for it betokens a rare and touching contact with the Corporation. The special correspondents are a select little band of devotees whose letters to the Programme Correspondence Section are so numerous that they deserve a file to themselves.

The Week-end Letter

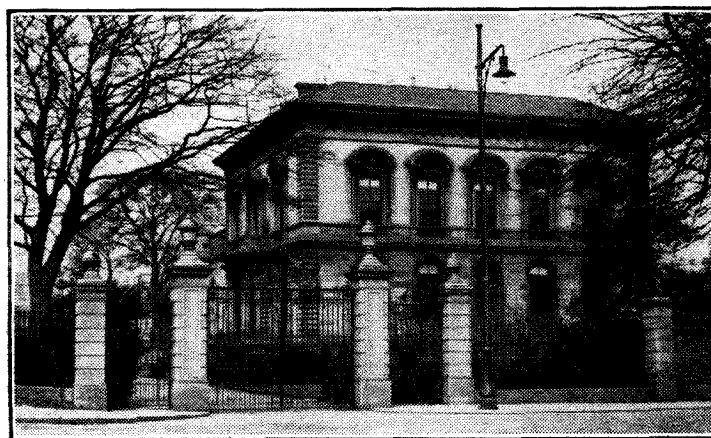
Every programme letter reaching Broadcasting House is read with interest and sympathy, duly receiving a reply, and it is because of this sympathetic treatment that quite a number of listeners keep up the correspondence as a pleasant habit;

their week-end would not be complete without a letter to the unknown "Uncle" at Portland Place, and Tuesday would be desolate if the gently worded answer failed to arrive.

"C'est magnifique," as the French general remarked, "mais ce n'est pas le broadcasting."

The New Colour Bar

IT has frequently been stated that the red-haired will find themselves unpopular in the neighbourhood of the Alexandra Palace television plant, for red transmits as a murky, ineffectual



GLASGOW'S NEW HEADQUARTERS. Queen Margaret College, an old University hostel, near Botanic Gardens, Glasgow, which is being converted into a thoroughly up-to-date Broadcasting House to accommodate the Glasgow staff.

white. In fact, we can say: "Like a red rag to television."

Fortunately, the red-haired are a very small minority of the population of this country, and heads that are literally "red," as distinct from ginger or "sweet auburn," are so rare that their possessors should be able to command high salaries for simply appearing on the variety stage, without bothering about television.

Seeing Red

Red will certainly be taboo in television make-up; in fact, the order has gone forth that the colour is to be avoided as far as possible in all television shows.

This is not to say that the looker will be denied the visual sensation of redness, for the blue or black lipstick and other dark effects will give the impression of ruddiness despite its absence.

There may be minor difficulties. Whether in the cookery transmission, for example, a good red beef-steak will have to be "made up" blue is one of those little problems we can safely leave to the producers.

Othello on the Mat

THIS is the tale of an artist's agent. He called at Broadcasting House the other day to interview one of the publication editors. Through a slight misunderstanding the messenger took up in the lift the right name but the wrong person. When "Mr. Smith" was announced, the editor, knowing his man, prepared to greet a very mild and lovable personality. His astonishment was therefore the greater when a 6ft. 8in. negro stood on the mat and insisted on reciting large

and presentation at the studio end, and Philip Brown, a newcomer from the Midlands, will take charge of outside contacts. He will be the Dance Band Assistant, while Askew will be Dance Band Producer. And the music will continue to go round and around in growing volume.

South Africa and Empire Day

THE first of a series of Empire Day programmes was broadcast from Great Britain in 1933, under the title of "News from Home." Since then the principal broadcasting organisations of the Empire have taken it in turns to provide the programme. In 1934, Australia was the source; last year, Canada; this year it is to be South Africa.

Programme Details

The programme on May 24th will begin at 4 p.m. with the chimes from the Union Buildings at Pretoria. Descriptions follow of scenes at the old Free State Raadsaal (House of Parliament) at Bloemfontein, and from the top of the 200ft. campanile commemorating the landing of the 1820 settlers at Port Elizabeth. From Durban listeners will hear a commentary from the Bluff, including a short talk by 92-year-old Captain A. Anderson, last survivor of the Natal Pioneers. From Pietermaritzburg a description will be broadcast from the Voortrekker Room in the Museum; in which now stands the old ox-wagon actually used in the great trek over the Drakensberg Mountains to the Transvaal in 1834. The Hon. P. G. W. Grobler, Minister of Native Affairs, will speak from the steps of the late President Kruger's house in Pretoria.

Via Radio-Telephone

The Johannesburg headquarters of the African Broadcasting Service will act as control point throughout the programme, which will be received in London by means of the radio-telephone service.

A Bright Boy

ALL sorts of amusing stories are received by the Central Council for School Broadcasting of incidents which occur in the class-rooms where broadcasts are being listened to. Here is the latest. Every Thursday there is broadcast a talk in the series called "Regional Geography." At the end of one such talk the teacher turned to his class and asked if there were any questions. "Yes, sir," cried one radio-minded scholar, "why do we listen to Regional Geography on the National Programme?"

chunks of "Othello," concluding with "I kissed thee ere I killed thee." Of course, it all ended happily.

Dance Band O.C.

PAUL ASKEW, who was originally Music Director of the B.B.C.'s Aberdeen Station, and, subsequently, for seven years, senior officer of the Balance and Control section at Broadcasting House, became Dance Music Assistant of the B.B.C. in October last. He has been responsible for several hundred auditions of dance bands in the studios during the past seven months, and has travelled about Great Britain, from Glasgow in the North to Torquay and Bristol in the South and West, in search of new talent. He has also been responsible for the "presentation" of studio dance band performances.

"The Music Goes . . ."

The work has become so onerous that it is now to be split up. Askew will concentrate on dance band production

Listeners' Guide for the

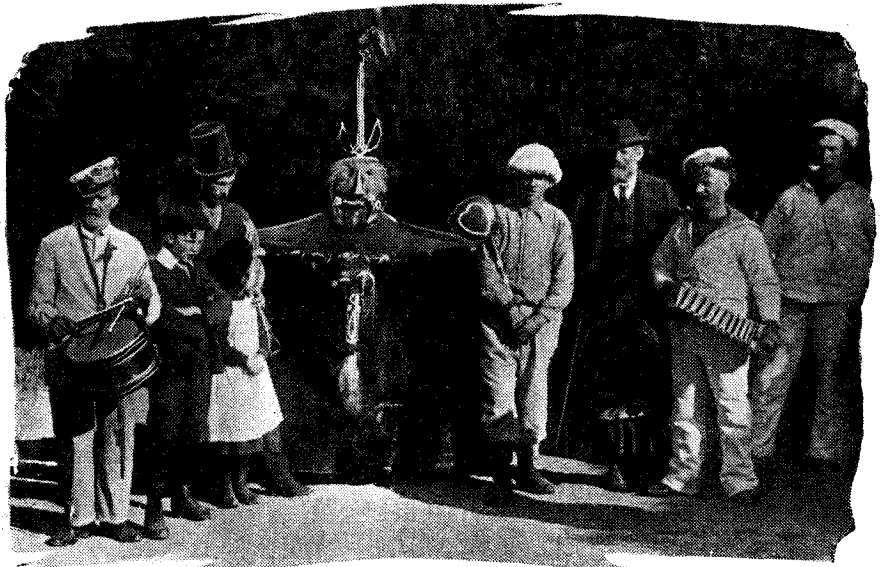
Outstanding Broadcasts at Home and Abroad

MANY old customs of English village life have survived in spite of the changes in the mode of living. To the town-dweller most of these are either unknown or merely just names conveying little or nothing. The B.B.C. Mobile Recording Unit has visited Cornwall and Somerset and recorded some of these age-old celebrations, and in the National programme on Monday at 8 "West Country Calendar" will be a composite picture of the welcome of summer, and the scenes of the Padstow Hobby Horse, Minehead Hobby Horse, and Heston Furry Dance. The recordings of the actual festivities will be punctuated by John Betjeman's impressions of the scenes.

"WAGADU DESTROYED"

AN oratorio in two parts, "Wagadu Destroyed," by Vladimar Vogel, is based on an epic legend of North Africa which was collected from native sources by Leo Frobenius and translated by Nancy Bush. The first English performance will be given before an audience in the Concert Hall, Broadcasting House, and is included in the Regional programme for Saturday at

PADSTOW HOBBY HORSE. The gruesome object with which villagers of Padstow paraded the streets on May Day, seen with a few of the inhabitants prior to the start. Descriptions and sounds of this and other celebrations will be heard from the National transmitter at 8 on Wednesday.



8.40. The soloists will be Laelia Finneberg (soprano), Muriel Brunskill (contralto), and William Parsons (bass). Albert Coates will conduct a quintet of saxophones, from the B.B.C. Orchestra, and Leslie Woodgate is chorus master with Section A of the B.B.C. Chorus.

VICTORIAN

"DREAM FACES," a one-act play in the Victorian convention, was first produced at the Garrick Theatre, London, in 1890, with the late Sir Johnston Forbes-Robertson in the part of Robert. This dramatic fancy by Wynn Miller is to be produced by Robin Whitworth,

and will occupy forty minutes of the 'Regional programme from 8.20 to-day (Friday).

THE NIGHTINGALE

THIS nocturnal songster has again consented to sing before the microphone, at least it is hoped so. A daylight rehearsal broadcast from a wood on the borders of Surrey and Sussex takes place on Sunday in the National programme at 7.45, and then each night when possible during the late dance music period.

"LONDON WALL"

THE Office has always been a good hunting ground for the playwright as a background for comedy and intrigue. Such is the case in John van Druten's three-act comedy, "London Wall," which takes place in the London offices of Messrs. Walker, Wendermere and Co., solicitors. The adaptation for broadcasting of this popular play has been carried out by Owen Reed, and is to be radiated by the Regional transmitter on Tuesday at 7.15, and again on Wednesday at 8.15 (Nationally).

[Courtesy: Theatre World]
IN THE OFFICE. A scene from John van Druten's "London Wall" which is being transmitted on Tuesday and Wednesday of this week.



BASEBALL

MR. "DICK" CARPENDALE, who spent some years in the States, will give a talk on Baseball at 6.30 in the National programme on Saturday. This will enable the listener, who has only a hazy idea of the game, to understand the rudiments of this unfamiliar sport, and thereby enjoy the first running commentary to be broadcast in this country on the occasion of a match on May 23rd.

M.C.C. v. ALL-INDIA

DESCRIPTIVE commentaries from Lord's will be given by C. B. Fry at 5.45 (Nat.) on each day of the match, that is on Saturday, Monday and Tuesday. Cricket broadcasts are very popular in Australia, and it is hoped to discover during the coming season the best method of making cricket commentaries of wider appeal in England.

GLAZOUNOV: 1865-1936

ALEXANDER GLAZOUNOV, who died on March 22nd this year, was one of the most notable of the older school of Russian composers. Sir Henry Wood, with whom he was on terms of intimate friendship for many years, will conduct Section B of the B.B.C. Orchestra in a memorial concert on Thursday at 8.0 (Nat.). Berkeley Mason will be at the organ, and the programme will include the Symphony No. 6, Overture "Carneval," and the Prelude in Memory of Strassov.

Week

NO SPEED LIMIT?

A FEATURE programme devised by Lauri Wylie, entitled "Sixty Smiles an Hour," will be heard on the National wavelength at 8.30 on Tuesday and again Regionally at 7 on Thursday. Included in this hour among others are Billy Merson, Marjorie Lotinga, Dick Francis and Babs Valerie. The show is produced by Max Kester and the Variety Orchestra will be conducted by Kneale Kelley.

REMINISCENCES.

THE first transmission of a new feature, under the heading "The Memory Lingers On," takes twenty minutes of the National programme from 10 o'clock on Wednesday, and



MARJORIE HOLMES, who was recently married to Eric J. Barker, the pianist in Lloyd Shakespeare's band, is among the artistes who take part in the Regional Variety on Wednesday, at 8.30, when Billie Houston will also be heard.

will consist of reminiscences of Leslie Stuart. Some of his well-known songs will be sung by Marie Burke, who is the soloist, with the B.B.C. Revue Chorus and Variety Orchestra conducted by Charles Shadwell.

OPERA

At home; from the Royal Opera House, Covent Garden, will be relayed in the Regional programme, on Monday at 6.35, Act I of Wagner's "Tristan and Isolde," when the conductor will be Fritz Reiner. The following evening, in the National programme at 10.40, Act III of Puccini's "La Tosca" will be

HIGHLIGHTS OF THE WEEK

FRIDAY, MAY 15th.

Nat., 8, London's Pleasure Gardens—Vauxhall. 10.20, Chamber Music: The Roth String Quartet. Reg., 6.30, Bentley Colliery Silver Band. 8.20, "Dream Faces." ¶"Continuous Performance": B.B.C. Dance Orchestra.

Abroad.

Brussels II, 8.40, Honegger Festival from the Palais des Beaux-Arts, the composer conducting.

SATURDAY, MAY 16th.

Nat., 5.45, M.C.C. v. All-India. 7 The Saturday Magazine. 8.30, Music Hall. 10, "A Sunny Morning." Reg., 6.30, Edward German programme. 8.40, "Wagadu Destroyed." 10.30, Billy Cotton and his Band.

Abroad.

Prague, 9, Part II, "H'ahol" Choir anniversary concert from the Smetana Concert Hall.

SUNDAY, MAY 17th.

Nat., Italian and English Madrigals and Folk Songs. 7.45, Nightingales at the Microphone. ¶Albert Sandler and the Park Lane Hotel Orchestra. Reg., Eugene Pini and his Tango Orchestra. 6.45, Commodore Grand Orchestra. 9.30, B.B.C. Orchestra (D) and Howard Jones (pianoforte).

Abroad.

Kalundborg, 8, "La Bohème."

MONDAY, MAY 18th.

Nat., 5.45, M.C.C. v. All-India. 8, West Country Calendar. ¶Dance Music from the Continent: the Café Colette Orchestra. Reg., Royal Opera House Relay. 7.55, B.B.C. Dance Orchestra. ¶Recital: Arthur Fear (baritone) and Kathleen Long (piano).

Abroad.

Eiffel Tower, 8, Symphony Concert.

TUESDAY, MAY 19th.

Nat., 5.45, M.C.C. v. All-India. 8.30, "Sixty Smiles an Hour." ¶Pianoforte Recital: John Wills. 10.40, "La Tosca" (from Covent Garden). Reg., B.B.C. Military Band. 7.15, "London Wall." ¶Albert Sammons and the B.B.C. Orchestra (E).

Abroad.

Poste Parisien, 9, Wagner Festival.

WEDNESDAY, MAY 20th.

Nat., "Melody Out of the Sky": Jay Wilbur and his Band." 8.15, "London Wall." ¶"The Memory Lingers On" No. 1, Leslie Stuart. Reg., 7, Massed Children's Choirs from the Royal Forest Hotel, Chingford. 8.30, Variety. ¶Leslie Bridgewater Quintet and Anne Thursfield (mezzo-sop.)

Abroad.

Strasbourg, 9, Soudant Concert from the Salle Braun, Metz.

THURSDAY, MAY 21st.

Nat., Carroll Gibbons and the Savoy Hotel Orpheans. 8.30, Glazounov Memorial Concert. ¶B.B.C. Theatre Orchestra and John Dudley (tenor). Reg., The Vario Trio. 7, "Sixty Smiles an Hour." ¶Organ Recital: G. D. Cunningham. ¶"On the Sunny Side" (variety).

Abroad.

Paris, PTT, 8.30, "The Blue Bird" (Maeterlinck).

conducted by Vincenzo Bellini. Both of these will be preceded by the usual five-minute introduction.

From the Continent, among others, will come Puccini's almost unknown "The Girl of the Golden West," which

will be conducted by Vincenzo Bellini. The picture will be remarkably colourful and the transmission should, therefore, convey to the listener the people's *joie de vivre*.



THE BROSIA STRING QUARTET, who with Esther Colman, soprano, are to give a programme of chamber music in the Sunday National programme at 5.30.

Vienna will give at 7.25 tonight (Friday). This opera was created after the composer had visited New York to supervise the production at the Metropolitan of "Manon Lescaut."

Grace Moore, the famous film star operatic singer, is singing Mimi's part in Puccini's ever-popular four-act opera "La Bohème," which will be relayed from the Royal Theatre, Copenhagen, in the Kalundborg programme at 8 on Sunday. If only to hear Miss Moore this should be well worth tuning in.

SACHA GUITRY

To the listener with a knowledge of French, Thursday's 8.55 transmission from Poste Parisien will be of special interest. Sacha Guitry, his wife, Jacqueline Delubac, and Pauline Carton will be heard in the leading rôles of his "Mon père avait raison."

NATIONAL AND FOLK PROGRAMMES

ON Saturday, at 8.10, Munich gives a relay of the May Festival from the Festsaal, Hohenaschau. This programme is one to be recommended, for the occasion is that of an age-old festival held annually in the valley of the Chiemsee, also known as the Bavarian Sea, which lies between two chains of the Bavarian Alps dividing Mu-

Folk music of the villages on the Swabian section of the Danube is included in the Berlin (Deutschlandsender) programme at 5.30 on Sunday.

OLIVER CROMWELL

ENGLISH history naturally interests English listeners, and more so when they have an opportunity to see it through the eyes of other nations. Tonight (Friday) at 8.30 Munich gives "Oliver Cromwell" by a very modern playwright, Engasser. The play, which lasts an hour and a half, is the interpretation of purely historical events, and should therefore be of interest.

INDEPENDENCE DAY

AN opportunity to obtain a sound picture of the Norwegian capital will occur on Sunday when there will be a number of O.B.s relayed from all parts of Oslo during the festival celebrations of Independence Day in Norway.

MISCELLANY

ON Saturday, at 7.38, Paris PTT includes a programme of unpublished light music which is to be played by the composers themselves.

"I am in Love" is the title given to an evening of musical and literary variety from the Deutschlandsender on Thursday, at 8.10.

THE AUDITOR.

Still More About Electronics

By "CATHODE RAY"

HOW THE VALVE AND CATHODE- RAY TUBE ARE MERGING TOGETHER

EDINBURGH and Leith started off as separate towns, several miles apart, with quite different origins and histories. In more recent times they grew until only the burgh surveyor knew where one ended and the other began. So in the end they became officially amalgamated.

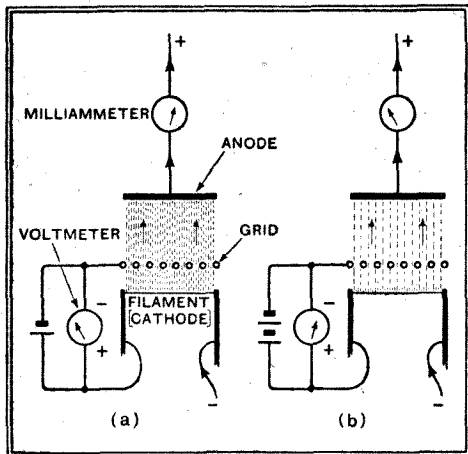


Fig. 1. Showing diagrammatically how the electron flow through a valve, and consequently the anode current, is controlled by the grid bias voltage, as water by a tap; while . . .

Much the same thing has been happening with valves and cathode-ray tubes. They have their roots in very different plots, but it is getting increasingly difficult to define a boundary between them, and soon nobody will try to do so.

The valve is a descendant of the ordinary low-voltage filament lamp. The filament was the first part; the other electrodes have been gradual elaborations. The cathode-ray tube sprang from the same source as those pretty glass affairs worked on spark coils, with which popular science lecturers used to delight and impress their audiences a generation or two ago. One of the chief improvements has been to fit it with a filament and run it at manageable voltages, like any valve. Now it has more or less numerous control electrodes, also just like any valve.

Cathode-ray Offshoots

One of the first hybrids was the tuning indicator tube that Standard Telephones brought out some years ago. More recently there is the "electric eye" of the R.C.A., described in *The Wireless World* of October 18th last, which is even closer to conventional valve construction, and finds its place in the American valve catalogue as the 6E5. But it at least retains the cathode-ray family distinction of a visual purpose. The Renode, on the other

hand (see issue of November 8th), both bears the appearance and does the work of a valve, and its cathode-ray strain can be discerned only by intelligent dissection.

More recently still the possibilities have been revealed of devices that inextricably fuse the two principles of action, because both operate simultaneously! Before we go farther, what, in the last analysis, are the valve and cathode-ray principles? Both depend on the innumerable things that can be done with electrons released from a cathode. This can be compared, in the time-honoured manner, with a jet or spray of water. There are two ways in which the flow of water through the air can be controlled with regard to some distant object, person, or receptacle. The flow can be varied at will by a tap, which controls the whole quantity of water moving. Or the flow can be maintained at a steady volume, and deflected away from or towards the target. The first of these methods is adopted in the valve; the

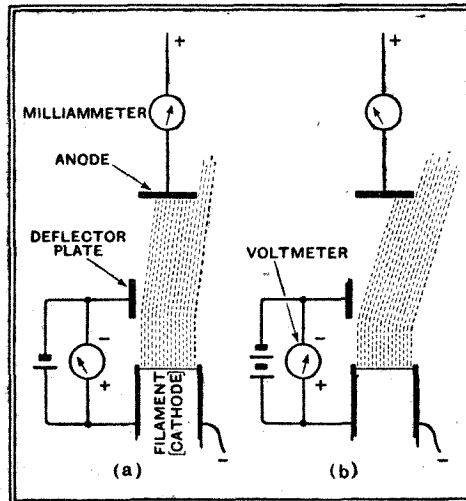
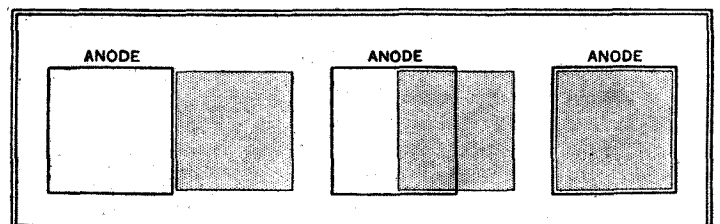


Fig. 2. . . . in a cathode-ray tube the same sort of result is achieved in a different manner by use of the deflection principle.

second in the cathode-ray tube. It is therefore more sensible to refer to them as emission-controlled and deflection-controlled devices respectively. That gets

Fig. 3. Proportionate deflection of a broad electron beam, giving a corresponding control of anode current (which depends on the number of electrons reaching the anode).



down to fundamentals, instead of hanging on to names that have ceased to mean anything very much. (But we shall no doubt

all continue to call them valves and cathode-ray tubes just the same.)

In the emission-controlled tube (valve, to you) the stream of electrons from cathode to anode is checked or encouraged by varying the voltage of the grid, which can be looked upon as a tap (Fig. 1). Unfortunately, the effect is not perfectly proportional to the cause. The change in the quantity of electrons reaching the anode is not truly proportionate to the change in voltage at the grid. That is another way of saying that valve curves really are curved, and at best are not straight lines. So it is necessary to take a good deal of care in order to ensure even approximately true amplification.

Deflecting the Electron Stream

In the deflection-controlled tube the stream of electrons is attracted or repelled by the grid (to use the same term for the sake of comparison) in such a way as to make more or fewer of them reach the anode (Fig. 2). Now anybody who has had anything to do with cathode-ray oscillographs knows that, except for very minor and generally avoidable effects, the movement of the spot of light on the screen (which shows where the jet of electrons hits it) is very exactly proportional to the voltage applied to the deflectors.

Suppose that, instead of the electrons being concentrated into a narrow jet, they are spread out into a broad beam of square cross-section—say, two inches square, giving four square inches. And

suppose that there is an anode of the same size, and that when no voltage is applied to the deflector plate the beam just misses

Still More About Electronics—

the anode (Fig. 3 (a)). Then there is no anode current. Now suppose that the beam moves over the screen one inch per deflector volt (that is a rather absurdly optimistic figure, but it will do for illustration). Then, when one volt is applied, half of the beam lands on the anode (b).

Apply another volt, and the whole lot stands on the anode (c). Up to this point it is obvious that the anode current is exactly proportionate to the deflector voltage, giving perfect amplification. Beyond it,

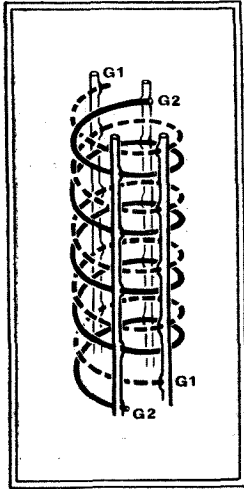


Fig. 4. Construction proposed by Hazeltine of a pair of grids for a deflection-controlled valve.

the current starts to decrease, so amplification ceases.

Of course, this is a highly simplified arrangement, and takes no account of such awkward complications as the controlling effect of the anode. But it does show, roughly, how a very desirable amplifier might conceivably be made on the deflection-control principle.

The practical form suggested by Hazeltine (of neutrodyne fame) is at first sight indistinguishable from that of an ordinary valve. What looks like a single grid of the common helical pattern is really a pair of grids, forming a push-pull input system; and what looks like an outer

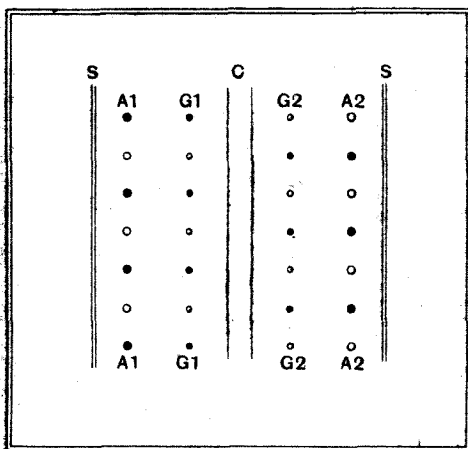


Fig. 5. Sectional diagram of a complete valve.

grid is really a pair of anodes, forming a push-pull output system. Such a pair consists of two wires wound parallel to one another so as to interleave, and the supports would hold alternate turns of wire so as to join only turns of the same wire (Fig. 4). A section of such a valve would thus look like Fig. 5, in which grids 1 and 2 (and anodes 1 and 2) are distinguished by being drawn black and white

respectively. S is a cylindrical screen around the whole lot.

When the valve is connected in a push-pull circuit (Fig. 6), and a signal is applied to the input, one grid (say G1) goes negative, and the other, G2, positive with respect to whatever voltage they may have originally held due to grid bias or the absence of it. Electrons are negative. Unlikes are attracted; likes repelled. So the electrons, which originally divided equally between the two anodes, are steered towards the turns of wire behind G2, which happen to belong to A2 (Fig. 7). More current flows through the upper half of the output transformer primary winding, and correspondingly less through the lower half, giving a resultant voltage in the secondary, in the same manner as any push-pull amplifier. The total anode current through the HT source remains the same (if everything is theoretically correct); it is deflected first *via* one anode and then *via* the other as the signal alternates.

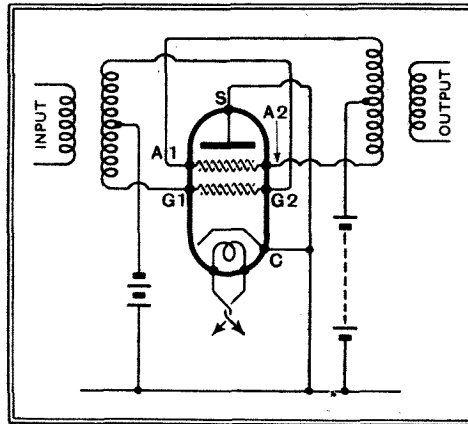


Fig. 6. Simple push-pull circuit for making use of a deflection-controlled valve.

One disadvantage of such a construction is that, owing to the two grids being so close together throughout their length, there is a fairly high capacity between them, which would add to the tuning capacity if the input were an HF transformer. The same applies to the anodes. On the other hand, owing to the fact that when one anode or grid goes negative the other goes positive to an equal extent, capacity effects between anodes and grids cancel out, which is a distinct advantage.

Amplifying Two Signals

Imagine now that the circuit of Fig. 6 is amplifying away to itself quite comfortably, and somebody starts meddling with the grid bias. So long as it is not altered enough to cut down the anode current supply, or to cause grid current, amplification can still go on. The only effect is to change the current flowing in both halves of the output transformer in such a way as to cancel out so far as the secondary is concerned. But if a transformer were inserted in series with the HT supply any current changes due to variation of grid bias would have to pass right through it. It is quite easy to see, then, that if an input transformer were connected in series with the grid bias it would

produce an amplified signal in the second output transformer, without affecting the first (push-pull) output transformer (Fig. 8). So two lots of signals could be

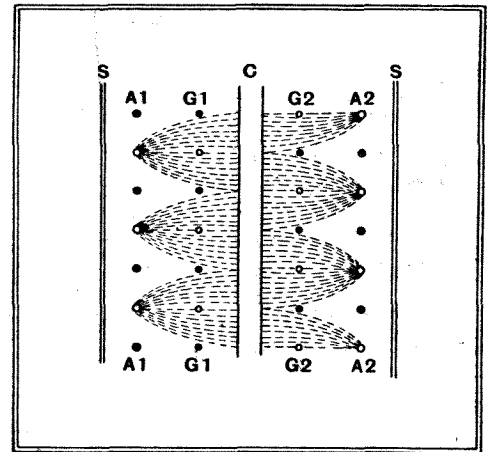


Fig. 7. Showing the deflection of electrons away from A1 and towards A2 at an instant when G1 becomes more negative and G2 becomes less negative.

put into the same valve and then separated out again without confusion!

Actually, everything would have to be balanced extraordinarily well to work according to plan. I tried this circuit with a pair of push-pull valves many years ago, and it was *very* tricky. But the same circuit can be used in a different manner to obtain a useful result without such practical difficulties. If the initial grid bias is adjusted so that the negative swings of signal No. 2 shut off the current, then signal No. 1 is periodically quenched. That suggests the super-regenerative receiver, and no doubt the valve could be used for it. But it also suggests a superhet frequency changer; signal No. 1 is what is coming from the aerial, and signal No. 2 is the usual local oscillation. Such a frequency changer has, theoretically at any rate, certain advantages which are rather too complicated to go into here.

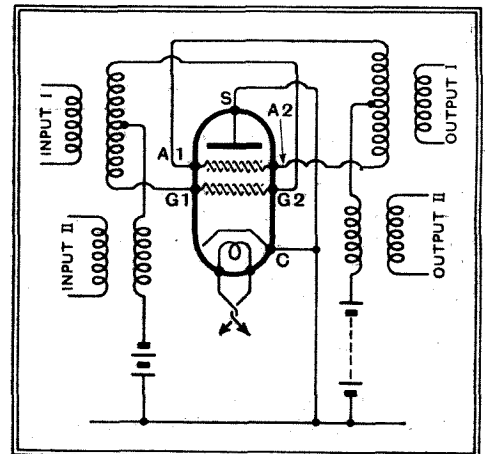
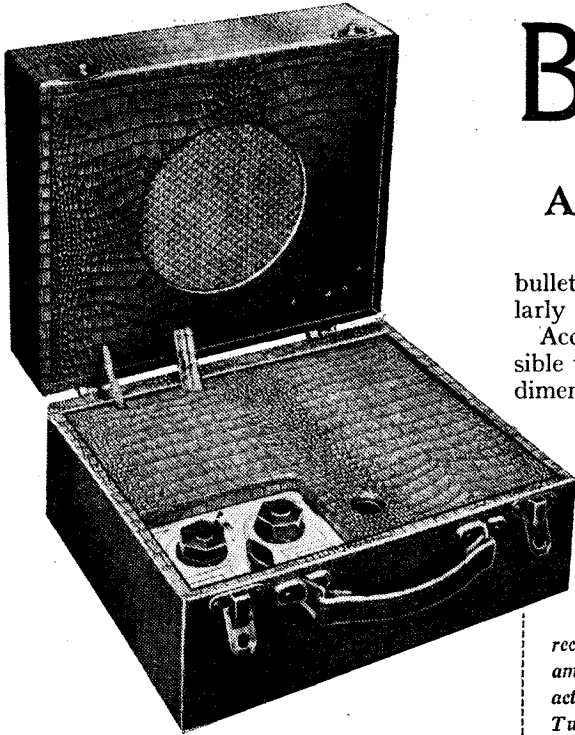


Fig. 8. Circuit making use of deflection control and emission control simultaneously.

And there are still other interesting possibilities with a valve of this sort. By the time it has received as much experimental attention as the ordinary type, the ordinary type may be on the way out. Who knows?

Burndept Portable

A Good Example of the Modern Compact Portable



bulletin or other item which we particularly wish to hear.

Accepting these limitations, it is possible to design a set of very much smaller dimensions and weight, and the Burndept receiver is an excellent example of what can be achieved in this direction. It measures only $11\frac{3}{8} \times 6\frac{7}{8} \times 9\frac{1}{2}$ in., and the weight is under 15 lb. This includes

view of reproduction are undoubtedly due to the fact that the unit is open both at the back and the front, and although this may have meant sacrificing some of the lower frequencies, the reproduction in the middle register, which is, after all, the most important in a set of this type, has undoubtedly benefited.

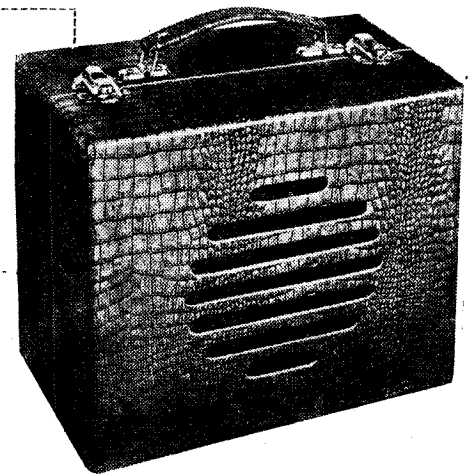
Although the frame aerial is small the long-wave performance is equal to, if not

FEATURES.—Type.—Battery portable receiver. **Circuit.**—Screened Grid HF amplifier—screened-grid detector with reaction—pentode output valve. **Controls.**—(1) Tuning. (2) Volume (reaction). (3) Waverange and on-off switch. **Price**—(including batteries) £5 8s. 6d. **Makers.**—Burndept, Ltd., Erith, Kent.

WITH the coming of summer there is a revival of activity among the manufacturers of battery portables, and this new model by Burndept, Ltd., is typical of the trend of portable receiver design. At one time manufacturers seemed to think that it was necessary to provide a performance comparable with that of ordinary domestic receivers working on an outdoor aerial, and as a result the "portables" of a year or two ago, although admittedly providing an astonishing performance in the matter of range and choice of stations, were so heavy and bulky that it is easy to understand why for a time the portable seemed to be on the wane. Most of us when we take a trip into the country are not in the mood for serious long-distance reception and the close application which it implies, and all we ask is a set which can be quickly switched on to hear a news

batteries and a permanent magnet moving-coil loud speaker. The latter is contained in the lid of the case, and it employs a nickel-aluminium alloy magnet and has an exceptionally powerful flux for its small dimensions and weight. The case is covered with grey "crocodile" material of light and attractive appearance which appears to have exceptionally hard wearing qualities.

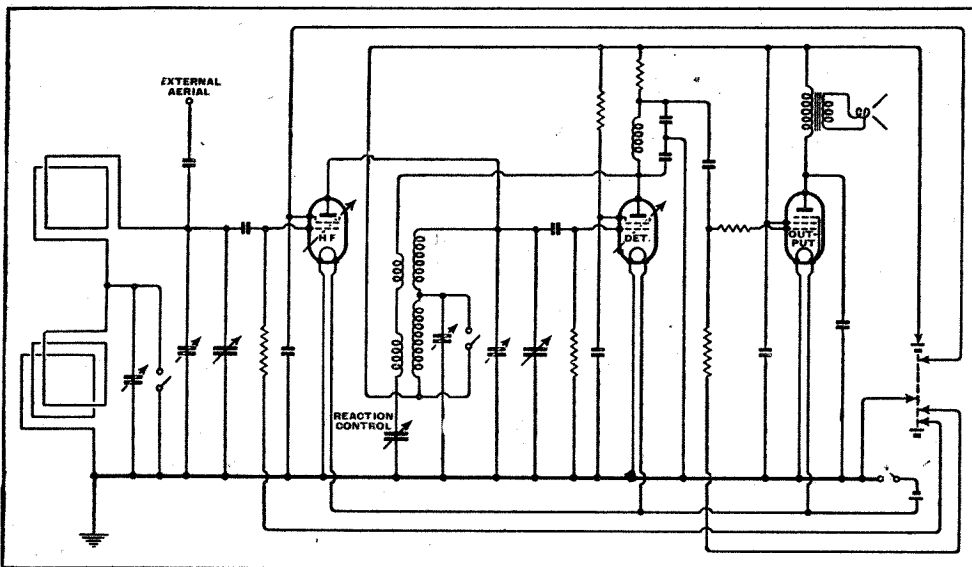
The moving-coil loud speaker gives really excellent balance of tone in view of the small baffle area available, and the amplification from stage to stage in the receiver itself is such that it is difficult to produce any serious degree of distortion even if one deliberately tries to do so. The good results obtained from the point of



a little better than, that on the medium waveband, and most users will find that the high-power transmitter at Droitwich is their principal station. In the South of England the news bulletin from this station should be plainly audible within a radius of ten or fifteen yards when using the set in the open air under average conditions of surrounding noise. The reception of Radio-Paris and Luxembourg is also well within the capacity of the set without the necessity of resorting to the attachment of an elevated aerial, though, naturally, one would have to be nearer to the loud speaker for the proper enjoyment of these programmes. In Central London the Brookmans Park Regional station gives about the same signal strength as Droitwich, and the National is comparable in volume to the two long-wave stations previously mentioned.

A Simple Circuit

The circuit employed is a straight three-valve HF-det-LF, and the efficiency of the HF amplifier, with the help of reaction from the detector stage, accounts for the satisfactory results which are obtained from so small a frame. A two-ganged condenser simultaneously tunes the frame and the tuned anode coupling between the HF and detector valves, and the difficulties of aligning the frame with the compact tuned anode circuit have been successfully overcome by the provision of suitable trimmers

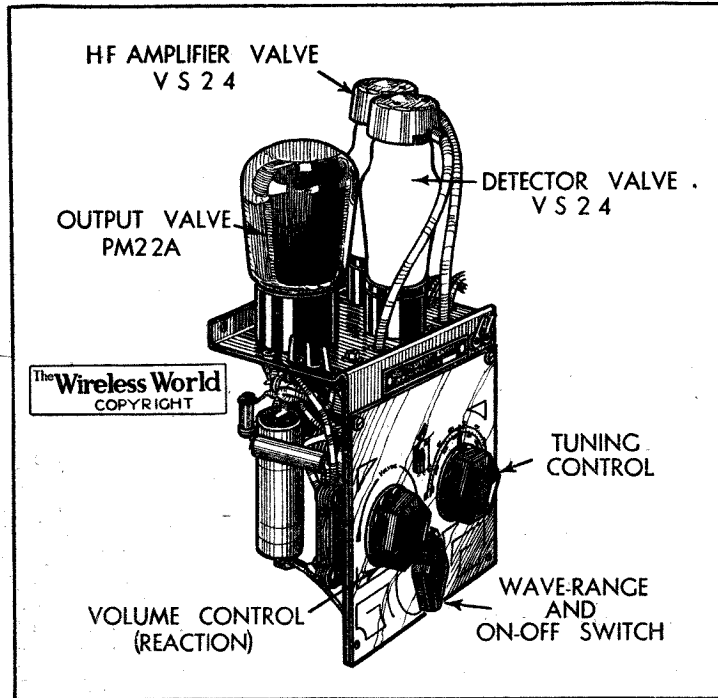


The essential simplicity of the circuit hardly does justice to the skill of the designer in producing a stable and efficient receiver on so small a scale.

Burndept Portable—

across the long- and medium-wave sections of the frame. In order that the body of the ganged condenser may be "earthed" the bias to the screened-grid HF valve is fed through a resistance and by-pass condenser. A separate tapping on the HT battery supplies the screen potential for the HF valve, but in the case of the detector, which, incidentally, is also of the screened-grid type, the auxiliary grid is connected to the main HT line through a decoupling resistance and condenser. No decoupling is, however, provided in the anode circuits

The chassis occupies no more space than the valves themselves.



of the valves, and to answer the question which this inevitably raises it may be stated that the introduction of a resistance of 1,000 ohms in the positive HT lead does not result in any form of instability, nor does it increase the damping of the tuned anode circuit more than can be made up by the range of reaction provided. In compact portables of this type the restriction of HF currents to their proper channels is an important matter, and in the Burndept set short battery leads, a double by-pass condenser across the HF choke in the detector anode, a series resistance in the grid circuit of the output valve, metallised HF and detector valves, and thorough screening of their grid caps all contribute to this end. The HT battery, incidentally, is specially designed with side contacts, and the colour code in conjunction with simple instructions inside the lid should divest battery renewals of any difficulties for the least technical among users of this set.

The receiver chassis itself is a remarkably compact piece of work, and an examination of the individual components suggests reliability of a high order. The wave-range switch, in particular, is mechanically and electrically well up to the hard wear which it will receive during the course of the life of the set. No volume control other than reaction is provided, but if by any chance one were to choose a site for a picnic within sight of one of the B.B.C. main stations excessive volume could always be reduced by making use of the directional properties of the frame. At the other extreme provision has been made for the attachment of an aerial wire, but we imagine that there would be few situations calling for this additional aid to reception. There is no provision for an earth connection as the bottom of the

case is covered inside by a sheet of metal foil which acts as a capacity earth return when the set is placed on the ground.

The two-volt accumulator is of the unspillable jelly-electrolyte type and has a

capacity of $8\frac{1}{2}$ ampere hours. The filament current taken by the valves is just over $\frac{1}{2}$ amp., and the measured total HT current was 5.5 mA.

Random Radiations

By "DIALLIST"

The DC Problem

A WEEK or two ago I mentioned in these notes that many homes in this country were supplied with DC either so rough or of such low voltage that it could not be used for the operation of a mains receiving set. The Milnes Accumulator people tell me that they have now made a special study of such problems, and that though their standard HT accumulators are designed for charging from a 6-volt or 8-volt source they can supply units to charge direct from any DC supply.

An interesting example is that of the ship with a 100-volt DC lighting system. In this instance the HT battery takes the form of two 75-volt units, connected by a switch in parallel for charging and in series for radio set operation. Units can, in fact, be obtained for use with any DC supply with a voltage of from 12 to 250. Many country houses have their own lighting plants supplying low-voltage DC. Milnes HT units can be obtained to suit such plants, and in many instances the battery can be so arranged that it will charge and balance from the lighting system. I know one house with a 32-volt lighting plant where a 200-volt Milnes unit has been in use for a good many years with the most satisfactory results.

An Idea for Manufacturers

I HAVE often wondered why some manufacturer does not develop a receiving set on the lines of car radio for use in houses which make their own current. The car radio set has many of the advantages of mains apparatus, and one excellent point is that it requires only one battery to operate it, this being either a 6-volt or a 12-volt accumulator. Such an accumulator could be charged from the household plant at times when few lights or none at all were in use. The probable drain from a 12-volt accumulator would be between four and five amperes, and if the set was in use for four hours a day on the average, a 60 ampere-hour accumulator would give three days' working at one charge, or, better still, it could be kept "full up" by being given a 5-ampere charge for a few hours each day.

The set would not need to be so sensitive as the average car radio receiver since a good aerial could probably be provided. It could also have a much larger loud speaker than is generally used for the car radio: the small speaker is all very well inside a car, but it would probably not sound too good in a fair-sized room.

A Misnomer

IT seems to me a pity that we ever adopted the term "all-wave" for receivers which cover short-wave, medium-wave and long-wave bands. Most of them range from about 15 to 60 metres, 200 to 570 metres, and 1,000 to 2,000 metres. Considering that wireless transmissions, not counting those on the ultra-shorts, are made on wavelengths ranging from 10 to something over 20,000 metres, all-wave receiving sets are a very long way from living up to their name. In America there is a movement on foot to get rid of this misleading description and to substitute in its stead 2-band, 3-band or 4-band receiver. That seems to me a pretty good idea, and I pass it on to set manufacturers in the hope that they will give it a thought. As a matter of fact, American receivers come much nearer than our own to deserving the description "all-wave": many of them do actually cover not just bands here and there, but every wavelength between about 12 and 2,400 metres, without any gaps at all.

The Indian Broadcasting Scheme

MR. H. L. KIRKE, head of the B.B.C.'s Research Department, and one who has been connected with broadcasting in this country since its very early days, has just presented a report upon the Indian broadcasting service which he has prepared after three months' intensive study of the problem on the spot in company with Mr. Lionel Fielden.

The report recommends the erection of eight new medium-wave stations of medium power, which will bring the total of such stations in India up to eleven, or one for each province. In addition, it is proposed that there shall be a high-powered central station whose announcements, talks, speeches, and so on, shall be in English. The eleven provincial stations will employ the language spoken by the greatest number of people in the areas which they serve. In this way it should be possible to cover the whole of the country very thoroughly.

The central station will be concerned mainly with providing entertainment for British residents and those Indians who, besides speaking English, are able to appreciate and enjoy the music of the West.

The other stations will correspond roughly to our Regionals, except that their programme will mainly be their own.

In addition to the language difficulty there are many other problems in a huge country such as India. Music of the North is, for example, entirely different from that of the South and tastes in drama, talks, and so on, show considerable variations in different parts of the land. It will be very interesting to see how broadcasting develops in India. At the present moment this great country is almost virgin soil, having but three broadcasting stations, only one of which is rated at 20 kilowatts. The position there is very much the same as that of Europe in 1921.

Poor B.B.C.

AT the annual meeting of the Association of British Chambers of Commerce it was mentioned that protests had been re-

ceived against two broadcast talks. In these talks, which were meant to be interesting (and they certainly were) and to a certain extent instructive, it was said that some of the matter was not too accurate and that certain firms received undesirable free advertisements.

I am quite sure that the B.B.C., if, indeed, it did offend, was a completely unwitting offender. The Association is more than willing to co-operate in the future to ensure that whatever is said before the microphone shall be accurate.

The question of advertisement is a most difficult one. The B.B.C. has always set its face against radio publicity in this country, and on this score listeners are in complete agreement with them so far as the principle is concerned. But there are times and occasions when it is extremely hard to avoid giving valuable publicity simply because it is to the interest of listeners that it should be given.

valves trouble was experienced with certain adaptors; which were obviously originally intended for battery valves, due to excessive resistance in the heater cores causing a serious voltage drop, but to-day I believe the actual contact resistance between heater pins and sockets is greater than the heater core resistance.

EXPERTO CREDE.

Chiswick, W.4.

Short-wave Conditions

NOTICE "Ethacomber" reports minimum sun-spot activity around March 21st and "Northern lights" at Alberta on March 20th. It may interest you to know that Washington reported in one of their Cosmic Data messages that the following sun-spots were observed:—

March 19th, 105 spots; 20th, 110; 21st, 109; 26th, 97; 27th, 107; 28th, 107; April 1st, 109; and April 2nd, 108.

Tokio reported on March 22nd, 107 spots and April 7th, 106.

If you compare your short-wave experiences with a daily weather chart I think you will notice some interesting correlations.

For instance, March 25th to 6 p.m. 29th there was a depression West of England which moved slowly to the North of Scotland, the movement accelerating from 6 p.m. 29th. Then the isobars became farther apart and were in a direction favourable to transatlantic reception.

You report a strong GSB signal 7 p.m., April 2nd. The isobars ran parallel to a London and GSB direction at 6 p.m. that day.

On April 3rd fluttery conditions were noticed. Here the isobars had narrowed, and wind velocities of 21 to 35 m.p.h. were recorded W. and N.W. of London. My records showed sharp barometric variations indicating sharp intermittent changes in the direction of the isobars between Brentwood and Brookmans Park. Conditions improved on the afternoon of the 4th.

Incidentally, you might advise your colleague "D. Exer" that the true bearing of Chicago is 298°, or 62° W. of N. New York is 288° approx.

W. H.

London.

A Correction

I SHOULD be very pleased if you would kindly correct the statement in your issue dated April 10th that I am "a daughter of Alfred Lemare, the famous blind organist." My father's name was not Alfred, nor was he ever blind. I think your correspondent must have confused my father, Edwin H. Lemare, with Mr. Alfred Hollins, who is a well-known blind organist.

London, W.11.

IRIS LEMARE.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

Wavebands and Nomenclature

WITH reference to the letter of Mr. A. W. Stephen, of Southend-on-Sea, in the *Wireless World* issue of March 13th, 1936.

Despite the prevalence of the use of meters when measuring the waves of broadcast stations, and also the calibration and marking of tuning scales for commercial broadcast receivers, it has long been an accepted fact that the behaviour (i.e., refraction, attenuation, etc.), of an emanated radio wave is dependent on the frequency of the transmission and not on the length of the wave; the latter, though inextricably bound up with the former, is of little or no importance with either the propagation or reception of the wave concerned. Practically the only application of the "wave-length" is in connection with the design of aerials for VHF transmission and reception, and then only as regards the physical length, etc., of the aerial itself.

The use of metres was superseded by the use of kilocycles (or megacycles) per second on January 1st, 1929, in the Royal Navy.

In addition to the frequency nomenclature of waves tabulated by your correspondent, the following terms are also used in H.M. Services.

Radio-frequency (R/F) applicable to all currents directly produced by an incoming signal, in lieu of High-frequency, and when referring to the components, e.g., R/F choke, R/F by-pass condensers, etc.

Supersonic-frequency (S/F) in place of Intermediate-frequency to denote oscillatory frequencies within the wireless range generated by the action of the receiver itself (super-heterodyne, quench receivers).

Audio-frequency (A/F) replacing Low-frequency in connection with post-detector amplification.

These three terms appear to be more descriptive of what is actually taking place in the circuits to which they apply than those in more frequent use in "broadcast" circles.

JOHN LAWN,

Leading Telegraphist, R.N.
Changsha, China.

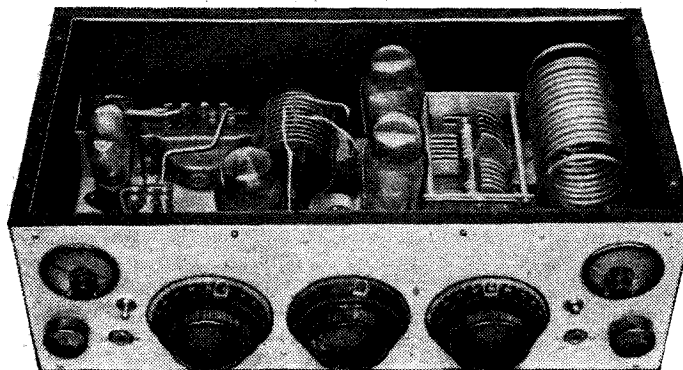
Radio Set Testers

I WONDER whether you would allow, and Mr. H. Elliot would agree, to break the usual rules of etiquette for once by telling me the name of the maker of the high-grade test gear referred to in his letter in your issue of April 24th? This firm must have a good job vacant for someone if they cannot explain the full use of their own products to potential customers!

Whereas it is, no doubt, the most scientific way to take anode current readings as near the power supply as possible, viz., at the "earthy" side of the circuit, this procedure may not always be practicable or may prove to be cumbersome during ordinary servicing. It is here where either the service test set or valve adaptor, with multi-core connecting cable, comes in to take quick and sufficiently accurate readings for any service engineer who knows his job. The added capacities existing between cores, usually around 0.0001 mfd., need not give rise to worry, even in HF circuits, so long as the wonted practice is observed to short-circuit tuning inductances associated with the particular valve under test. This may usually be accomplished with a short piece of flex to which crocodile clips are attached.

In the early days of the indirectly heated

FIRST-PRIZE HOME-CONSTRUCTED TRANSMITTER



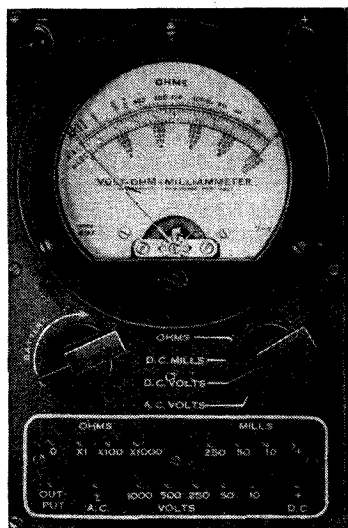
THE photograph reproduced shows the crystal controlled transmitter constructed by Messrs. Pugh and Leggett, which was awarded first prize at the recent exhibition of home-constructed apparatus of the Southend and District Radio and Scientific Society. The Society's Challenge Trophy was awarded to the winners.

New Apparatus Reviewed

LYONS-HICKOK VOLT-OHMS-MILLIAMMETER

THIS is a self-contained versatile measuring instrument of sturdy construction and suitable both for serviceman's and experimenter's use. By means of a switch and a series of socket connectors it provides no fewer than seventeen different ranges, five of which are for AC voltage measurements, while the remainder serve for DC voltage, current, and resistance measurements. In addition, the AC voltage ranges could be employed for power output measurements.

The nucleus of the instrument is a large high-grade moving-coil milliammeter fitted with a dial on which is engraved 3in. long scales.



Lyons-Hickok multi-range testing and measuring instrument.

Used as a voltmeter, the instrument has a resistance of 1,000 ohms per volt on all ranges, and so consumes only one milliampere for a full-scale deflection. AC and DC voltage ranges are the same, viz., 0-10, 0-50, 0-250, 0-500, and 0-1,000 in each case.

The normal current ranges are for full-scale deflections of 0-10, 0-50, and 0-250 mA., but it is possible to use the 0-10 DC voltage range for measuring currents of less than one milliamp. with high accuracy.

The ohmmeter scale is calibrated from 0-10,000 ohms, but it can be extended by two built-in multipliers to measure up to 10 megohms, though on the highest range an external battery of 67½ volts is needed, for which two terminals are provided just above the meter.

The instrument has been checked against standard laboratory meters, and no fault can be found with its calibration, for all measurements made with the Hickok model agree to within one per cent. of those made with other meters.

Owing to the large number of scales provided, all readings can be made with a high degree of accuracy, and this is greatly assisted by the thin knife-edge pointer fitted. The meter is very well damped, and "snap" readings are easily obtained, since the pointer comes to rest immediately.

A zero adjuster is provided for the pointer, and it should be mentioned that a control marked "Battery" is fitted for setting the pointer correctly for resistance

measurements. This must be adjusted on each of the three resistance ranges if accurate readings are to be obtained, since separate batteries (two are in the unit) are employed.

It is an accurate and most serviceable instrument, and is obtainable from Claude Lyons, Ltd., 40, Buckingham Gate, London, S.W.1, the price being £10 10s.

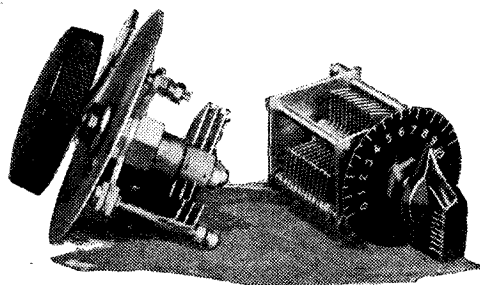
EDDYSTONE BANDSPREAD TUNING OUTFIT

THIS short-wave tuning outfit consists of two variable capacitors, one being of the order of 150 m-mfds. and the other approximately one-tenth the capacity. The larger model, which is described as the tank condenser, is fitted with a special control that enables its capacity to be changed in steps, each movement of the knob being equal to approximately one-tenth its total capacity.

They are joined in parallel across the tuning coil, and the capacities are so nicely judged that the vernier, or bandspread unit, gives an overlap on each of the ten positions of the tank condenser.

Short-wave listeners, being familiar with the normal criticality of tuning on these high frequencies, will readily appreciate the advantages of the system, as it is often the practice to employ two ordinary condensers to serve the purpose, though it is not always possible to make an accurate calibration of the bandspread condenser, owing to the uncertainty of repeating the setting of the main condenser.

With the positions for the tank condenser definitely fixed, in this case by a ball engaging with holes in a circular plate, calibrating the bandspread member accurately is quite possible.



Eddystone short-wave bandspread tuning outfit.

The tank condenser is fitted with a pointer-type knob and a dial plate with ten numbered divisions, while the bandspread member has a 3in. dial with a 0-100 graduated scale. Embodied in its construction is a slow-motion drive giving a reduction of approximately 8½ to 1.

The measured capacity of the tank model is 171 m-mfds. at maximum, i.e., No. 10 position, and 23 m-mfds. at minimum, i.e., at 0 on the scale. Each of the ten divisions represents an increase in capacity of 15 m-mfds.

The bandspread unit tested had measured capacities of 7.5 m-mfds. at minimum and 26 m-mfds. at maximum, so that the effective change is 18.5 m-mfds., thus giving an adequate overlap between the steps on the tank model.

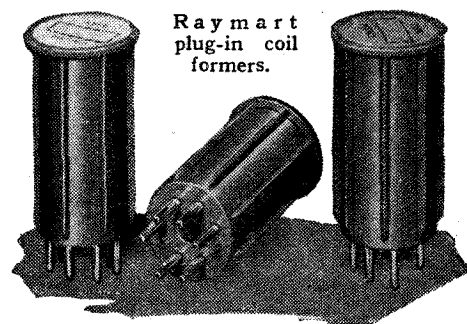
Both condensers are made from brass throughout, and the complete outfit as

Recent Products of the Manufacturers

illustrated costs 12s. 6d. They can be purchased separately, the prices being 6s. for the tank condenser and 6s. 6d. for the bandspread unit. The makers are Stratton and Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham, 5.

RAYMART NEW COIL FORMERS

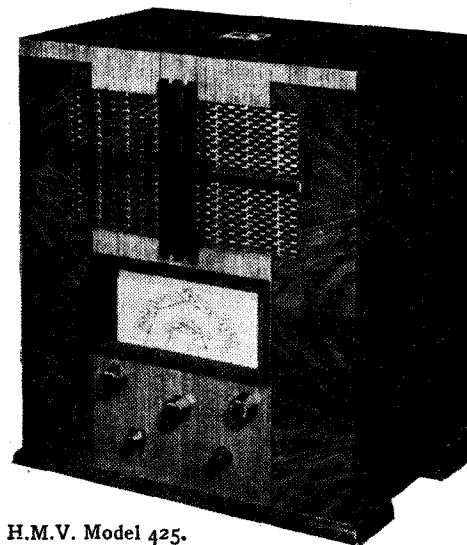
THE Radio Mart, 44, Holloway Head, Birmingham, 1, has now introduced a new ribbed coil former of the plug-in variety to replace the earlier type, the latest pattern being moulded from a higher-grade material and having lower dielectric losses on the short waves.



They are available fitted either with four, six or seven pins, or with plain or threaded ribs for a spaced winding of sixteen turns per inch. The prices are the same as for the earlier type, viz., 1s. 6d. with four-pin base and 1s. 9d. with six-pin base and plain ribs. The threaded-ribbed models cost 2d. extra.

Recent H.M.V. Products

TWO new receivers are announced by the Gramophone Co., Ltd. The Model 425 is a simplified version of the Model 445 without the station selector device and is a table model superhet priced at 11 gns. The other new model is a radiogram incorporating the Model 480 all-wave chassis. The specification includes an automatic record changer and wide-range pick-up. The price of the radiogram (Model 485) is 36 gns.



H.M.V. Model 425.

CURRENT TOPICS

EVENTS OF THE WEEK IN BRIEF REVIEW

Italy and British Music

THE Italian ban on British music has been lifted. Thanks to representations made by Mr. Leslie Boosey, chairman of the Performing Right Society, to the International Confederation of Authors and Composers



The rapidly approaching debut of the Alexandra Palace transmission adds interest to this illustration of the modulation unit of the Berlin television transmitter.

Societies, the veto imposed by the Italian Government as part of their counter-sanctions policy has been removed.

Simultaneous Relay in Three Languages

AN interesting sound amplification installation has been undertaken by the General Electric Co. at St. Andrews for the fourth international conference of agricultural economists. This installation consists of a three-channel headphone relay whereby members of the conference can listen to speeches either in English, French, or German through the medium of translators speaking *via* auxiliary amplifier channels. It is believed that this is the first relay of its kind ever undertaken in this country, and the value of its application to international meetings of this nature is obviously very considerable.

Wireless Telephone Service Between China and Japan

A RADIO telephone service between China and Japan was recently inaugurated. For the time being Shanghai will be the only point in China connected with the service. In Japan calls can be made to and from a large number of towns, including Tokio, Osaka, and Kobe. The charge for a three-minute conversation works out at approximately £1.

P.M.G. Receives R.M.A. Deputation

THE Postmaster-General has received a deputation from the Radio Manufacturers' Association to hear their views on certain points arising from the report of the Ullswater Committee on broadcasting.

Interesting Russian Experiment

A VERY interesting experiment in a new form of simultaneous broadcasting took place recently in Russia on the occasion of a special musical festival. This festival was commenced by the singing of the "Internationale" by choruses situated in four widely separated cities. The sopranos and the orchestra were located in Moscow, while the altos, tenors, and basses sang in Leningrad, Kiev, and Minsk respectively. After this the song was repeated from a large number of stations in the U.S.S.R., a chorus at each station singing one verse in turn.

Television for Volga Boatmen

A REPORT comes from Russia concerning a novel use of television which sounds as though it needed to be taken with the customary grain of salt. According to the report, the canal now in course of construction between Moscow and the Volga will be the first in which television will be employed to assist in operating it. It is said that the locks will be controlled from a central point, and the

simpler means in the case of other world-famous canals such as that at Panama.

Indian Television Activities

ACCORDING to reports received from India, television will soon be introduced in Hyderabad State. The project will first be tried in Hyderabad city and later extended to the rest of the State as part of the Government rural broadcasting campaign.

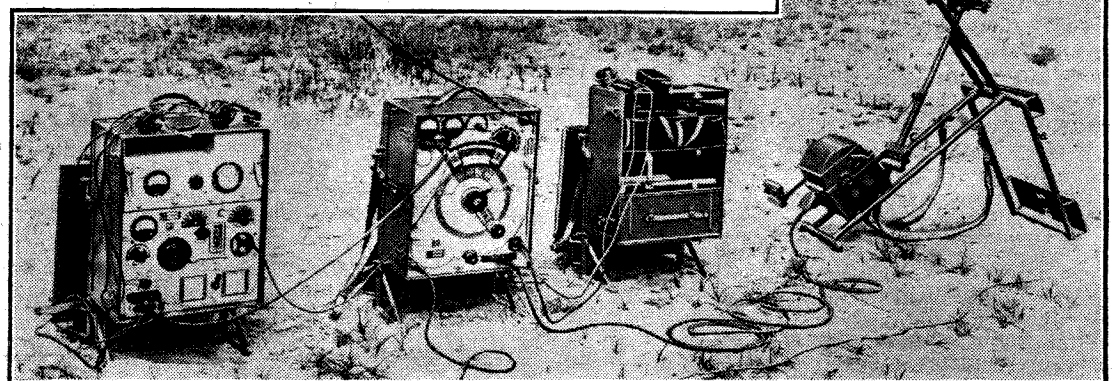
Norway's "Canned" Music

DURING the past year 18.3 per cent. of Norway's broadcast programme time was occupied with gramophone records. "Live" performances amounted to 25.5 per cent. of the total transmission time. Norway is believed to broadcast more "canned" music than any other European country.

A Rival to AVC

ACCORDING to news received from the U.S.A., a new method of eliminating fading has made its appearance. It is stated that the method is one which has been in use by commercial stations for some time, it being based on the fact that signals picked up on any one aerial do not necessarily fade at the same time as those received on another aerial a comparatively short distance away. However, the simple expedient of connecting the two aerials to the same receiver would not eliminate fading, but would make it

The latest Telefunken-type field service wireless station shown here is so arranged that it can be conveniently carried by four infantrymen.



official on duty will be able to observe the entry of ships into the lock by gazing at a television screen. It seems hard to understand why such a roundabout way as television should be employed to accomplish something which is done quite efficiently by much

worse; the signals must be combined, but ordinarily this would require two separate receivers with the added complexity and expense of such an installation.

The American innovation, however, simplifies and reduces the apparatus required and en-

ables single control tuning to be used. The receiver has two separate channels, one for each aerial, and a common output system. When the signal is strong on one aerial and channel the gain of the other channel is reduced, and in this manner a better signal-to-noise ratio is achieved than is the case with the ordinary receiver.

Pirate Round-up Causes Trouble in France

THE French authorities are taking drastic measures in their war on wireless pirates. They have now imposed upon wireless dealers the obligation of keeping special registers containing the names and addresses of persons to whom they sell wireless sets. This procedure is very naturally proving highly unpopular both among dealers and their customers, and it will not be surprising if the authorities find themselves in possession of a large list of false names and addresses.

An inhabitant of Nantes recently received a form from the postal service calling upon him to pay 50 francs annual tax as a sequel to his buying a set from a dealer in Paris. The alleged Nantes buyer refused indignantly to comply with the request, giving as his reason that he had not purchased a receiver. The question of whether the dealer or the postal administra-

tion has made the mistake is now under investigation. Nobody seems to have thought of the possibility that the dealer may have received the name and address from a third party who deliberately gave it as his own when purchasing a receiver.

Readers' Problems

"Earthy" Ends Together

A READER, who proposes to modify his superheterodyne in order to obtain variable selectivity, asks whether the rules applying to an ordinary two-circuit tuner with variable coupling hold good in the case of an IF amplifier.

We take it that the specific rule which our correspondent has in mind is that relating to the placing of the coils, which says

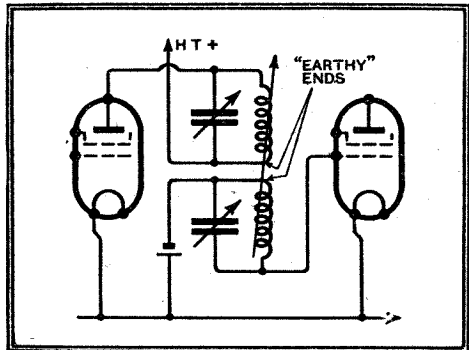


Fig. 1.—Low-potential ends together: illustrating a rule applicable to all kinds of magnetically-coupled 2-circuit tuners, whether HF or IF.

that their "earthy" ends should be adjacent, as shown in Fig. 1. The reasons for this were touched upon in reply to another reader's query in our issue of April 10th.

Mains-driven Deaf Aid

IT is asked whether a compact deaf-aid amplifier on the lines of that recently described in this journal might be satisfactorily operated from AC mains.

There is no inherent objection to this plan, and the only difficulty likely to be encountered is mains hum, especially if the components are unduly crowded. It must not be forgotten, however, that this question of hum is often not so important in a hearing aid as in apparatus for ordinary purposes, as a deaf user can often ignore hum which would be intolerable to those with normal hearing.

Lubrication

GENERALLY speaking, the mechanical details of a receiver are neglected, but as they seldom have any exacting duty to perform they do not resent it. Still, the smooth working of the controls, which adds much to the pleasure of operating a set,

The Wireless World

INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

would be assured by the occasional application of a spot of oil, which, after all, is necessary for all forms of mechanism.

The writer of a letter on this subject asks whether the presence of a thin film of oil on an electrical contact is likely to increase resistance.

Experience shows that the oil itself is unlikely to do any harm, but the trouble is that it is apt to collect dust and dirt. Again, impurities in oil are likely to be harmful in delicate apparatus, and one of the safest oils to use seems to be high-grade medicinal paraffin.

Still More Power

A READER who wishes to double the output power of the PA Amplifier described in our issue of April 3rd will not find very great difficulty in making the necessary modifications; these relate solely to the output stage.

Two parallel-connected valves will be used in each arm, and to cope with the extra load a mains transformer with HT winding rated at 500-0-500 volts, 240 mA will be required, as well as a pair of parallel 460BU rectifying valves. In addition, it would be desirable to provide separate filament windings on the mains transformer for the additional output valves and to include separate bias resistances and condensers for them.

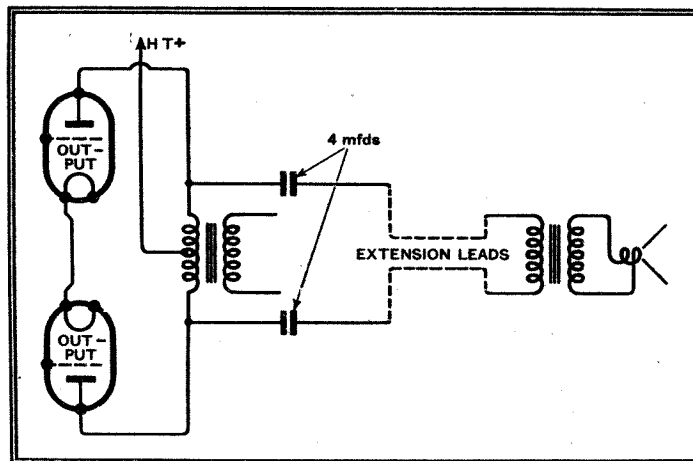


Fig. 2.—Connecting an extension speaker to the Quality Amplifier: the extension leads are isolated from the HT supply by large blocking condensers.

North Regional Interference

A NORTH-COUNTRY user of the 1936 Monodial describes a form of interference that leads him to believe that the IF amplifier of the receiver is being directly affected by signals from the North Regional transmitter, which operates on 668 kc/s.

Direct pick-up of the local station by the IF amplifier should be almost impossible if it is adjusted to the correct frequency of 465 kc/s, and we can only think that the interference is due to the fact that the amplifier is actually adjusted to a much higher frequency—i.e., to a frequency nearer to that on which the station is working.

As a rough guide, it should be pointed out that the trimmers controlling the tuning of the IF circuits should generally be screwed nearly right home.

The Warming-up Process

SEVERAL users of superheterodyne receivers of various types have recently complained of a tendency towards wander-

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

ing of the oscillator frequency. Generally, this becomes noticeable through the need arising for retuning the receiver after it has been in use for some little time.

Such an effect is by no means abnormal, and it is explicable by the fact that the oscillator system is not completely stable until the valve (and, to a lesser extent, associated components) have attained their normal operating temperature.

We find that when frequency instability under normal working conditions becomes evident, fluctuations in the mains voltage is nearly always to blame. There is no entirely satisfactory cure for this, but the use of generous decoupling in the oscillator HT supply line will often help to minimise the effect of voltage fluctuation.

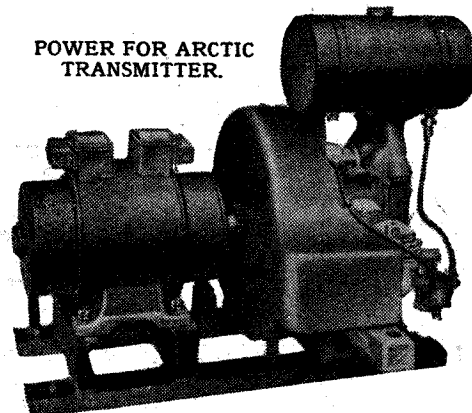
An Extension Speaker for the "QA"

WE are asked to say how an extension speaker of the permanent-magnet type may be connected to the Quality Amplifier in such a way that the external wiring does not carry high-tension voltage.

The usual method of connecting an external speaker is shown in Fig. 2; reasonably long leads can be employed, but as this is a high-impedance circuit,

capacity between the wires should not be excessive.

POWER FOR ARCTIC TRANSMITTER.



Power for the Oxford University Arctic Expedition's station is supplied by a 1-KVA 50-cycle alternator, driven by a 2 HP air-cooled Petter engine

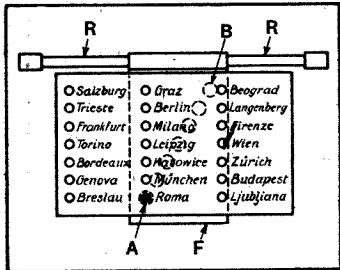
Recent Inventions

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

TUNING DIALS

THE names of stations adjacent to each other on the wave-length scale are arranged in vertical columns on a transparent dial, as shown. At the side of each name is an aperture covered by a coloured sheet of translucent material. At the back is a frame F, pierced with a series of corresponding holes along a line inclined upwards from A to B.

The frame F carries a lamp and is mounted to slide along a guide R. It is geared to the tuning control so that it moves horizontally from side to side. In this way each of the inclined holes A . . . B is made to coincide with the aperture at the side of the station that is being received, and



Details of the tuning scale described in Patent No. 441259.

illuminates it. In the position shown the circuits are tuned to "ROMA."

F. Hubner and "Minerva-Radio." Application date July 30th, 1935. No. 441259.

GLOW-LAMPS FOR TELEVISION

IN some television receivers it is usual to connect the glow-lamp in series with the low-frequency amplifier and a resistance. Since the glow-lamp has a negative-resistance characteristic, the combination is likely to produce undesirable oscillations. In order to prevent this, and to stabilise the operation of the lamp, a part of the series resistance is tapped through a capacity across to the cathode of the amplifier. The remainder of the resistance in circuit then serves to damp out any undesired oscillations.

G. Schubert (Assignor to Fernseh A.G.) No. 2026915. (U.S.A.)

AUTOMATIC "DISTRESS" SIGNALS

THE Radio Telegraphic International Conference has adopted a "distress" signal for use at sea which consists of twelve dashes of 4 seconds duration separated by intervals of one second. This is intended to operate an automatic relay which gives a warning signal on any receiver within range, even if the operator is absent or off duty. In order to prevent stray sig-

nals or atmospheric from accidentally setting the alarm into operation, the receiver is designed so that it will only respond if the emergency signal is transmitted with considerable accuracy. But under the stress of excitement—when the vessel in distress may be on the point of sinking—this is not always easy.

To meet this situation the transmitter is arranged so that it can be set into operation by the mere turning of a handle. This brings into play two tuned reeds and a keying wheel, which transmits the required sequence of signals and maintains them indefinitely.

R. W. Hart (Assignor to Submarine Signal Co.) No. 2024219. (U.S.A.)

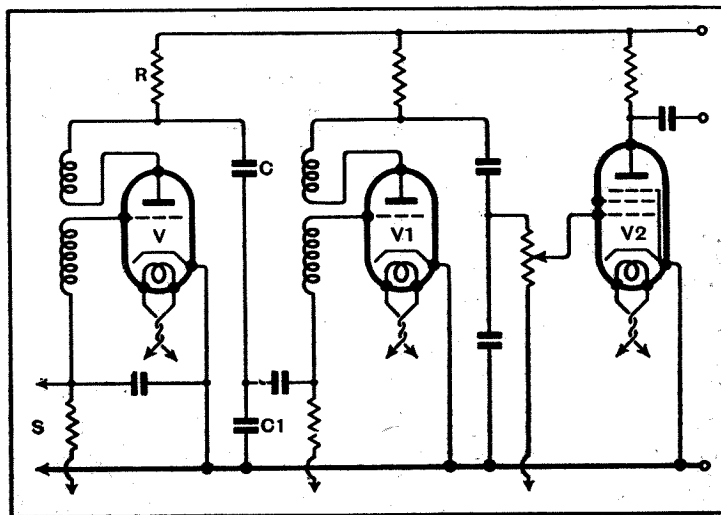
RESILIENT "EARTHS"

AN oval or rectangular pad of resilient material, such as sponge-rubber, cork, or the like, is moulded around a number of turns of wire, so as to form an indoor "earth" for a wireless set. At the same time it serves as a resilient base which protects the set from mechanical vibrations transmitted through the floors and walls of the building.

Madeline Gray. Application date August 14th, 1934. No. 442739.

GENERATING OSCILLATIONS

SAW-TOOTHED oscillations, suitable for use in scanning, are generated by slowly charging-up a pair of series condensers C, C1 through a resistance R, and



Circuit of the time base.

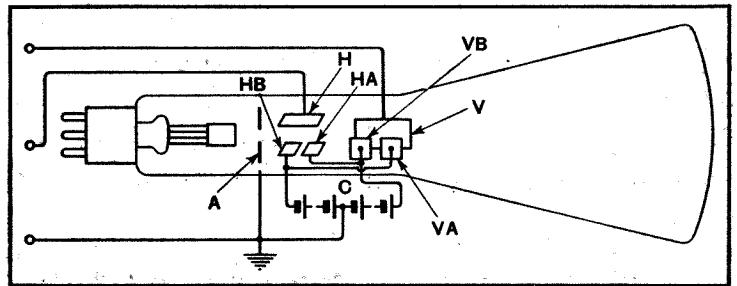
then discharging them rapidly through a back-coupled valve V under the control of synchronising impulses S applied to the grid of that valve. The resulting oscillations are applied from C to the grid of a second similar valve V1, arranged to have a natural fre-

quency somewhat lower than that of the valve V. The output voltages from an amplifier V2 are applied to the scanning-electrodes of a cathode-ray tube, and show a strictly linear rise of potential followed by comparatively short "fly-back" period.

L. R. Mervler and Baird Television, Ltd. Application date October 13th, 1934. No. 442686.

WIRED WIRELESS

IN a "rediffusion" system for distributing broadcast programmes to a circle of sub-



Electrode assembly in the cathode-ray tube.

scribers over line-wires, it is difficult to prevent undue attenuation of the higher audio-frequencies particularly when feeding a large number of subscribers over long supply lines. Even when the feed-lines are terminated by shunt circuits comprising resistance and capacity, there is a more or less complete cut-off above 6,000 cycles.

To overcome this difficulty, impedance-matching transformers, preferably step-down, are inserted between the feeder-lines and the subscriber's apparatus so as to reduce the capacity losses. Another advantage of such a coupling is

CATHODE-RAY TUBES

THE invention is directed to the elimination of the so-called "white cross" effect produced on the fluorescent screen of a cathode-ray tube. With this object in view, the scanning potentials are applied to plates V, H, which lie wholly on one side of the electron stream, whilst steady potentials, of opposite polarity, are applied to the corresponding pairs of plates VA, VB and HA, HB from a battery C. The result is to throw the undesired "cross effect" completely

outside the picture frame. The midpoint of the battery C is connected, as shown, to the anode A of the tube, which is kept at earth potential. If the deflecting plates are inclined to each other, in order to give a wider angle of movement to the electron stream, the two split portions of each plate are arranged to have equal sensitivity.

A. C. Cossor, Ltd. (Assignees of M. von Ardenne). Convention date (Germany) July 22nd, 1933. No. 442513.

MAGNETRON OSCILLATIONS

IN using a magnetron valve for generating ultra-short waves, it has generally been accepted that the adjustment of the biasing-potentials and the superposed magnetic field should be such that the "transit" time taken by an electron to reach the anode from the cathode is substantially equal to one half-cycle of the generated wave, or an odd multiple of that time.

The present invention is based on the discovery that oscillations can be generated at higher efficiency if the adjustments are so made that the transit time of the electrons is substantially increased beyond that mentioned above. In other words, the superposed magnetic field is made of such strength that the electrons do not, in fact, return to the cathode. The explanation put forward is that the true action of a magnetron generator is to be found, not in the return of the electrons to the cathode, but in the creation of extra "space" charges due to the fact that the electrons travel in a spiral instead of a straight path.

Marconi's Wireless Telegraph Co., Ltd., and W. E. Benham. Application date June 14th, 1934. No. 442776.

that it allows the signals to be transmitted at a higher voltage, with a corresponding reduction of ohmic losses.

Standard Radio Relay Services, Ltd., and P. Adorjan. Application date October 10th, 1934. No. 442384.

The Wireless World

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS

	Page
Editorial Comment	501
Is Automatic Volume Control Worth While?	502
Coast-Guard Radio	505
Inexpensive Volume Expansion	507
Loud Speaker Baffles	508
Current Topics	510
Tracing Troubles in AC-DC Sets	511
Hints and Tips	513
A Story of Public Address	514
Listeners' Guide for the Week	516
Home Recording, Historical Notes	518
Broadcast Brevities	519
Unbiased	520
Letters to the Editor	521
Random Radiations	522
New Apparatus Reviewed	523
Recent Inventions	524

EDITORIAL COMMENT

The Standard Set

B.B.C. Must Not Sponsor It

THE suggestion contained in the Report of the Broadcasting Committee that "The B.B.C. and the wireless trade should jointly examine the possibility of designing and putting on sale at a low fixed price a standard receiving set" meets with strong opposition from wireless manufacturers. The views of the Radio Manufacturers' Association are contained in a statement issued recently, and although this statement touches on a number of other matters in connection with the Broadcasting Committee's Report, we propose to confine our attention here to the standard receiver.

We do not think ourselves that this was the intention of the Committee, but rather that the B.B.C. should act only in an advisory capacity and approve a standard design. If the proposal was to go further and suggest that the B.B.C. should be financially concerned, then we feel confident that such an idea would never be seriously entertained. But, assuming that the B.B.C. only commits itself to approval of the standard design and recommends the set to listeners, even to go as far as this would, in our view, be a very unwise course on which to embark our broadcasting authority. One outstanding reason why those responsible for the transmitting side should never attempt to standardise receivers is that transmission and reception are so closely associated that you cannot contemplate standardising the receiver unless you are equally prepared to standardise transmission.

Broadcasting conditions to-day are by no means ripe for standardisation on the transmitting side, and for the B.B.C. to commit itself in this way would be to preclude the possibility of

free development of the broadcasting service in the future.

If we look back only a few years, we find that the B.B.C. did at one time very nearly commit itself to a policy of planning its broadcasting service to meet requirements of crystal-set users everywhere. Fortunately the stagnating effect that such a policy would have had was made apparent to them in the early stages, with the result it was abandoned.

Television provides another example of how the sale of receivers suitable for one standard type of transmission could place the B.B.C. in the position of being committed to a service to those who have purchased such receivers, making it difficult to introduce changes or improvements on the transmitting side if these should happen to render existing receivers unsuitable.

Advantages of Variety

The broadcasting authority in this country must, in our view, remain unfettered to the receiving side so that changes in transmission organisation can be introduced as necessity arises. We recognise that the B.B.C. must continue to make any changes guardedly so as to disturb as little as possible the conditions of reception, both in the interests of listeners who have invested in receivers and in fairness to the manufacturers who produce them.

The wide variety of types of sets to-day helps to keep the receiving side elastic. Quite apart from the merits of competition between manufacturers and constant aim towards improvement, it is highly undesirable that at any time the majority of the listening public should be committed to a particular type of set.

To make any attempt to standardise the receiving side at this stage of broadcasting development would be little short of a disaster, and the B.B.C. must at all costs avoid having a hand in bringing it about.

Is Automatic Volume Control

A FRANK DISCUSSION OF THE EFFECTS OF AVC

By W. T. COCKING

AT a time when receivers including AVC had not made their appearance in this country, the writer dealt with many aspects of the fitting in an article which appeared under the same title in *The Wireless World* for August 12th, 1932. Few had then any practical experience with automatic volume control, and most were inclined to hail it as a very definite advance in technique which would result in the removal of the evil effects of fading and so would greatly extend the service area of broadcasting stations. The writer was less sanguine, however, and in the article referred to he pointed out that while a good AVC system will undoubtedly smooth out the volume variations of fading, it can do nothing to reduce any distortion which fading may introduce, and it will substitute for the fading signal a varying background of noise. From the onset, therefore, he has been rather sceptical about the value of AVC in broadcast reception.

During the past few years, however, automatic volume control has become so popular that it is now a standard fitting, and the receivers which do not include it in some form are very few and far between. In view of this, it would appear that AVC really is an advantage, but unfortunately popularity is little guide to the real value of anything. There are fashions in wireless as in other things, and those who remember the days when most HF amplifiers did anything but amplify will not quarrel with the writer when he asserts that the present popularity of AVC cannot alone be taken as an indication of its value.

Assuming for the moment that AVC is completely valueless, which the writer most certainly does not believe, it is not difficult to see how it could become fashionable. No one has ever believed it to be perfect, but in the excitement attendant upon the development of anything new it is all too easy to overlook disadvantages, and indeed, some of them only appear after extensive use under a wide variety of conditions. Consequently, the benefits to be derived from its use may have been overstressed without any conscious dishonesty on the part of anyone; then the sales literature and publicity of the pioneer firms impresses listeners with

the idea that AVC is essential. The idea gets about that sets without AVC are out-of-date, and other manufacturers are naturally forced to come into line. The result is that in a surprisingly short time all sets are fitted with AVC. It becomes an accepted thing with public and designers alike, and few think of questioning whether its inclusion is really worth while. It becomes a tradition, to be fitted as a matter of course to every new model.

The great difficulty about judging the value of AVC is that one cannot express its advantages and disadvantages in figures; one can only describe its effect in words. There is consequently a greater chance of misconceptions and the path is made smoother for those with an axe to grind. Let us, however, consider the question in all its aspects as fairly as possible and let us see how a receiver fitted with AVC differs in its performance under varying circumstances from a similar set which is not so equipped. Perhaps we shall then have sufficient data upon which to base an opinion.

Now in all practical AVC systems the carrier of the wanted signal is arranged to control the grid bias applied to variable-mu valves in the HF or IF amplifier and so to affect their amplification. An increase in the carrier amplitude causes a higher bias to be applied to the valves and the amplification is reduced. Ideally, the amplification would be inversely proportional to the strength of the signal so that the detector input would be the same on all signals. In practice, this can rarely be achieved and in nearly all cases the detector input is larger with a strong signal than with a weak, but very much less so than it would be without AVC.

Distortion on a Fading Signal

The result of this is that with a sensitive receiver all stations give nearly the same volume from the loudspeaker for any given setting of the manual volume control. One can tune straight from a weak continental transmission to the local station without being forced to use the volume control. Naturally, if stations of widely differing strengths are all receivable at the same volume, any variations in the strength of the carrier of the wanted

signal will be smoothed out, and the volume variations of fading will largely disappear. There is no doubt whatever that even simple AVC systems will, with a sensitive receiver, smooth out most irregularities in volume which are due to fading.

This is not all, however, for a modulated carrier involves a band of frequencies extending about 10,000 c/s on either side of the carrier, and all the frequencies in this band are not treated the same way in the refracting layer, the variations in which are responsible for fading. As a result, the signal actually received may be severely distorted and its modulation depth may be affected to some degree. The change in modulation depth may prevent the AVC system from maintaining constant volume, but the variations found in practice are usually unimportant. Not so the distortion, however, for AVC does, and can do, nothing to reduce this.

It should be clearly understood that this distortion will be present whether AVC is in use or not. AVC will keep the volume constant, but will not affect the distortion. Now distortion is usually most objectionable when the volume is great, so that it is clear that if the distortion is greatest on the peak of a fade it will be more unpleasant with a non-AVC set than with one incorporating AVC, for the volume will be greater with the former. On the other hand, if the distortion occurs in the trough of a fade, it will be the more noticeable with the set having AVC, for the normal volume level will be maintained, whereas it will fall off with the other set.

In general, distortion seems to occur in the trough rather than on the peak of a fade, and is probably at its worst when the ground and reflected rays are of the same order of magnitude at the receiver. When this is so, fading distortion is likely to be more unpleasant with a receiver fitted with AVC than with one which is not.

This is not all, however, for we have yet to consider the matter of the signal-noise ratio. Some noise is always inevitably present, due partly to the receiver itself and partly to external sources; in some cases receiver noise predominates,

ALTHOUGH AVC has become a standard fitting in broadcast receivers, its advantages are not always as great as is commonly supposed and in some cases it may be responsible for a poor performance. The pros and cons are discussed at some length in this article and the answer to the question which is asked in the title is left to the reader.

Worth While ?

in others the external noise, but the fact remains that there is always a limit at which signal and noise are of equal strength. This limit varies with different localities and with different receivers, but whatever it may be weaker signals cannot be received. For good intelligibility the signal should be stronger than the noise, and for really high quality reception the signal should be so much stronger that the noise is negligible in comparison.

The Noise Level

Now under normal conditions the noise level is fairly constant; it does not usually fade like a signal. When receiving a fading signal with a set having AVC, however, the amplification is varying in inverse ratio to the signal to maintain constant output from the signal. As the noise input is constant, and the amplification varying, the noise output must vary, and we find that AVC converts the volume variations of fading into equal variations in background noise. Even if distortion be absent, therefore, the presence of fading can be detected by the varying background to the signal.

When receiving fairly strong signals and when fading is not severe, this effect may not be noticeable, for even at its worst the background may then be below audibility. Fading usually occurs most on weak signals, however, and the background will then be very important. It is quite possible to have conditions such that background noise is audible but not

AVC system tries to keep the output constant by increasing the sensitivity of the set, with the inevitable result that the background noise rises to an objectionable degree. With severe fading the noise may be greater than the signal; with a sensitive set and a large output stage the effect is very unpleasant indeed. A noise output of 4 watts or so can be tolerated by very few!

These effects inevitably occur whatever the type of receiver—be it straight set or superheterodyne—and, however perfect the AVC system, as such, may be. There are, however, other effects which may be found and which have a deleterious effect upon the performance—effects which would not be present with a perfect AVC system.

The simplest method of obtaining AVC is to utilise directly the DC output of a diode detector in the manner shown in Fig. 1. As a consequence of rectification of the modulated carrier in the diode there appear across R1 a steady voltage and an alternating voltage corresponding to the modulation. This alternating voltage is taken off to operate the LF amplifier through C1 and the volume control R2. The steady potential is employed as additional grid bias for the early valves, and the LF potentials are removed by the filter R3 C2. The magnitude of the steady voltage, or AVC bias, is, roughly, 90 per cent. of the peak carrier input to the detector.

Now a diode detector may distort on deep modulation if the AC load resistance is less than the DC load, particularly at large inputs. The DC load is R1, perhaps 0.25 MΩ, and the AC load is R1 in parallel with both R2 and R3. In general, R2 cannot be greater than 2 MΩ and R3 about 1 MΩ. The AC load is then 0.182 MΩ, and distortion will occur when

the modulation depth exceeds 72.6 per cent., whereas if the set did not include this form of AVC R3 would not be present, and there would be no distortion until the modulation depth exceeded 89 per cent. The use of AVC thus tends to increase detector distortion, but not to any very serious degree.

In order to avoid distortion through

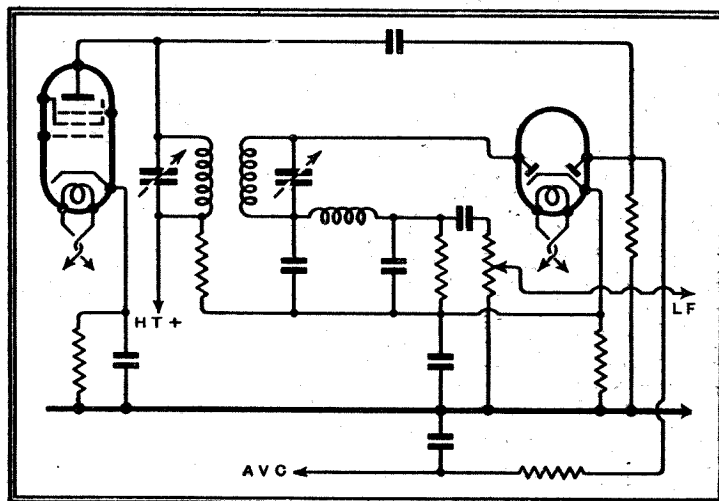


Fig. 2.—Delayed diode AVC is the most widely used system but it can cause a considerable degree of distortion.

overloading in the last IF valve, this valve must be capable of giving an undistorted output of nearly twice the detector input. When receiving the local station the controlled valves may require 30 volts bias or so, and the valve must then be capable of giving an undistorted output of rather more than 60 volts. This is by no means impossible, but there is always an upper limit to reception; signals greater than a certain strength cannot be received without distortion. With such an AVC system, therefore, distortion may occur when receiving the local station unless a local-distance switch is fitted.

This system is not used as often as the delayed diode method, for the latter gives better AVC characteristics and greater initial sensitivity. The AVC bias, however, is generally considerably less than 90 per cent. of the diode input—very roughly, it can be taken as 80 per cent. of the peak input less the delay voltage. A large delay voltage is advantageous from the point of view of constancy of output, and 20 volts is a common value. If 25 volts bias is required, the diode input must be about 56 volts, and for the avoidance of distortion due to overloading in the IF valve, it must be capable of an output of 112 volts peak.

It is thus clear that there is a much greater risk of distortion through overloading the last IF valve with the delayed diode AVC than with the non-delayed system, in spite of the fact that detector distortion is slightly reduced. This is not all, however, for the AVC diode damps the tuned circuit to which it is connected and renders the IF valve less capable of giving a large output, while as the degree of damping depends on the signal voltages across the tuned circuit it varies with the

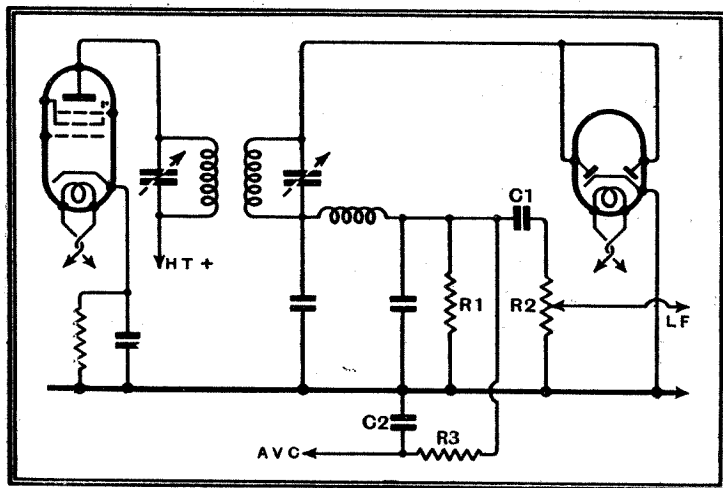


Fig. 1.—The simplest form of AVC is one of the best from the point of view of quality of reproduction.

objectionable on the normal level of a weak to moderate signal. If there is no fading good enjoyable reception can be obtained. Now suppose that fading occurs; the signal rises, but AVC keeps the output constant so that the background falls, which is entirely satisfactory. When the signal falls below its normal level in the trough of a fade, the

Is Automatic Volume Control Worth While?—modulation, and amplitude distortion results. It is easy to show that the distortion increases for an increase in the carrier amplitude, the delay voltage, and the modulation depth. The distortion so introduced is by no means merely a theoretical amount of negligible practical importance. The exact amount naturally depends on the design of the whole receiver and its conditions of use, and it is at its worst in a sensitive set used for local reception with a good aerial. It can then be very severe indeed.

There are, of course, various forms of amplified AVC which are in many respects a great improvement. Much better AVC characteristics can be obtained, and it is not nearly as difficult to avoid distortion through overloading the last IF valve on a strong signal. In fact, if the particular method adopted in the QA Super¹ be employed, very nearly perfect AVC action can be obtained with complete freedom from any distortion introduced by AVC. Amplified AVC, however, is much more costly than the simpler arrangements, for an extra valve and more components are needed. In general, therefore, it can be used only in the more expensive class of receivers.

Is AVC Necessary?

It is clear from the foregoing that AVC is by no means an unmixed blessing. If we want AVC without distortion we must choose between simple non-delayed AVC and the expensive but more perfect amplified system, for it would seem that the widely used delayed diode method is undesirable. But do we want it? We have seen that its greatest advantage, the reduction of fading, is more apparent than real, for although we may have constant volume we are left with a varying background and any distortion which may accompany fading. Which is the worse, varying volume and constant background or constant volume and varying background? Again, we should not forget that the process of tuning is noisier in a set fitted with AVC than in one which is not, unless the volume control is turned down while tuning, for the sensitivity rises greatly between stations. So bad is this effect at times, that QAVC systems have been devised completely to silence the receiver when it is not tuned to a station. Most of these, however, are expensive, finicky, or introduce more distortion, so that they are not for general use.

The writer thus tends to the view that AVC is hardly worth while for general broadcast reception on the medium and long wavebands. The aim is then to obtain high quality reproduction for entertainment purposes, and it would seem that if a station is fading too badly for its programme to be enjoyable with a set not having AVC, the distortion and background will be too great for good results even with AVC.

The matter is, of course, different when

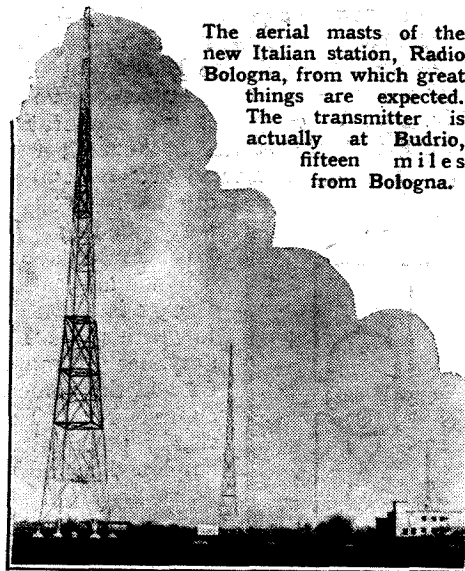
the aim is the reception of intelligence only, and distortion and noise are unimportant as long as speech can be understood. There is then no doubt that AVC can be very helpful indeed, and it becomes almost essential in short-wave reception, where fading is very prevalent. It may then make all the difference between the reception of a news bulletin and unintelligibility.

Reception in this country on the medium and long wavebands is different,

however, and there is much less advantage to be derived from AVC. Whether or not there is sufficient advantage to be derived from it to justify its inclusion in a set probably depends on many factors, the locality in which one listens, the stations one chooses, the type of receiver, as well as the individual importance one attaches to the points stressed in this article. What does the general listener and experimenter think about it? Is AVC worth while or is it not?

DISTANT RECEPTION NOTES

UP to the present Greece has been the most ill-served country in Europe in the matter of broadcasting. Her only existing station is a very small affair at Salonika, which operates only now and then—and if I may so put it, it is usually then rather than now. In any event, a glance at the map shows that Salonika is hardly the ideal situation for the only station in Greece, a country whose queer shape, in addition to its mountainous character and its enormous family of islands of varying size, must present some pretty problems to anyone who endeavours to work out a broadcasting scheme of the regional type. It is really worth while to have a look at the map at Greece to see what a difficult business the evolution of any such scheme must be. The mainland itself is a good solid chunk running roughly from north to south with a long thin tail lying eastwards of its most northerly part.



The aerial masts of the new Italian station, Radio Bologna, from which great things are expected. The transmitter is actually at Budrio, fifteen miles from Bologna.

And then the islands! There is one group to the west and literally dozens in the Aegean Sea to the east. The eastern islands alone are dotted over an area measuring roughly 200 by 300 miles.

It was announced recently that the Greek Government is going ahead at once with the erection of three stations. One of these, rated at 100 kilowatts, is to be at Athens. There will be a 10-kilowatt station at Salonika and one of about the same power rating on the Island of Corfu. A station at any rate could be placed in a more central position on the mainland.

French governments come and go with bewildering rapidity, but luckily for listeners in France, M. Mandel has been a fairly permanent institution as Minister of Posts and

Telegraphs. It is mainly to his good work that France owes the progress that has been made in the last few years with her Regional scheme. Many of the stations are now completed and the Rennes-Bretagne 120-kilowatt transmitter has been testing for weeks with something less than the power that it will eventually use. The Bordeaux station of the same output rating is now under construction, and if all goes according to plan its first tests may be heard at the end of this year or soon after the New Year. The National transmitter, which will replace Radio-Paris, should come into operation at about the same time. The two remaining stations, Central France and Grenoble, have not yet got beyond the draughtman's office, but a start is soon to be made with their construction, and I expect that we shall hear them before the end of next year. I hear that the new Empire short-wave station which France is putting up will be the most powerful in the world. Its kilowatts are likely to run into three figures. Speaking of French stations reminds me that Agen has recently changed its wavelength, moving up to 360.6 metres. It shares this channel with Moscow No. 4, but when the Russian station is silent it is often well received, though its power officially is only 0.5 kilowatt. Judging by the way in which French stations credited with low power in the official lists are received in this country, I cannot help thinking that the French kilowatt must be nearly as elastic as the wavelengths used by private stations in that country!

Except that the new Deutschlandsender is under construction, there are few developments to record in Germany, whose broadcasting scheme is already pretty complete. It should be noted though that Stuttgart is still using the old 2-kilowatt transmitter from its early morning physical jerks at 6 a.m. until 4 o'clock in the afternoon. After that time the 100-kilowatt transmitter is at work. Since the French 40-kilowatt station at Strasbourg has a very large service area, and in many parts completely overshadows the 17-kilowatt Saarbruecken, it is only natural that Germany should desire a more powerful plant for the Saar and the adjoining territory. Work on the new Saarbruecken transmitter is being pushed forward very rapidly, and I expect to record it in my log before the end of this year.

A word about long-distance reception at the moment. Despite the approach of the sunspot maximum, conditions on the medium-wave band remain extraordinarily good. Almost any station of reasonable power can be brought in, and it is rather surprising to find that on most days there is very little trouble from atmospheric interference.

D. EXER.

¹ The Wireless World, Feb. 28 and Mar. 6, 1936.

Coastguard Radio

MODERN METHODS ON AMERICAN PLANE PATROLS

WITHOUT radio, the patrolling planes of the American coastguard Service would sacrifice ninety-ninths of their efficiency in rescue work and the pursuit of smugglers. This first-hand account of "Uncle Sam's" latest radio arm includes interesting details of the technical equipment fitted to the various types of aircraft.

DURING a hurricane a man on an American coastguard patrol boat severed an artery in his arm and was in danger of bleeding to death. The boat was many miles from its base. A coastguard 'plane, flying some forty miles away, picked up the patrol boat's radio signals, changed its course, located the vessel, and descended close by on the sea. The man was transferred to the 'plane and, in less than an hour after the accident, had been flown ashore and was receiving at an inland hospital the medical attention which saved his life.

This is just one instance of the mobility of the United States coastguard service, which now has a total of fifty-one aircraft in operation. They patrol the country's entire coast line up to a distance of two hundred miles off-shore to provide assistance to vessels in distress and to enforce

maritime and preventive laws in general.

The 'planes work from seven established air stations and four operating bases, in

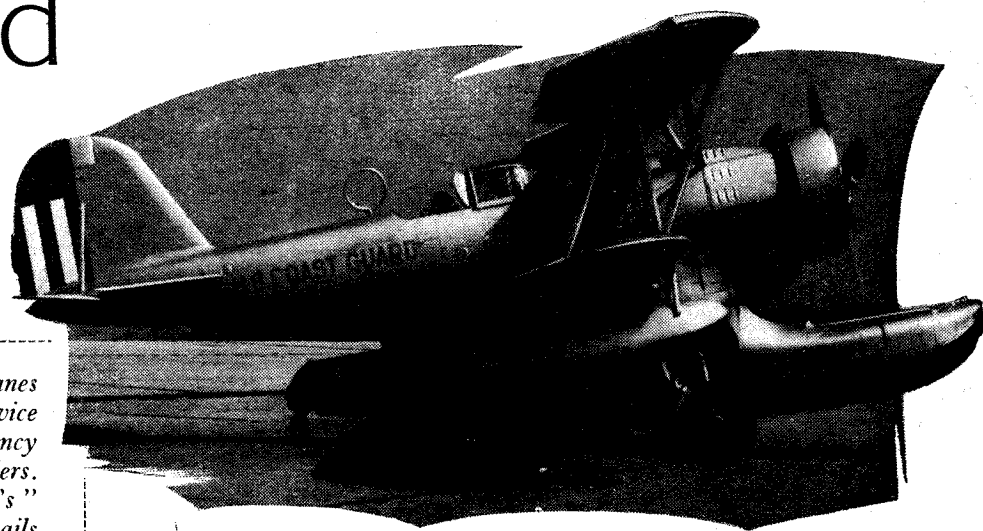


A unique "shot" showing a patrol plane seen through the D.F. loops of another plane on the ground.

conjunction with surface craft stations located along the Atlantic and Pacific coasts and the Gulf of Mexico shore line.

It is only because of radio, in which field the coastguard

Operating a 75-watt transmitter on a Douglas amphibian flying boat.



A typical American coastguard plane fitted with loop aerial for direction finding.

By "BEE-LINE"

service has been expert for the past ten years, that this work can be accomplished successfully. The aircraft are at constant call, ready to fly day or night in all sorts of weather for the purpose of reconnaissance, locating distressed vessels and rescuing their crews, survey work—particularly after storms—the enforcement of the law, and the tracking of smugglers.

To be effective in such work the wireless apparatus must be beyond reproach, and therefore the American coastguard Service has built up an enviable reputation for the excellence of its radio work and equipment.

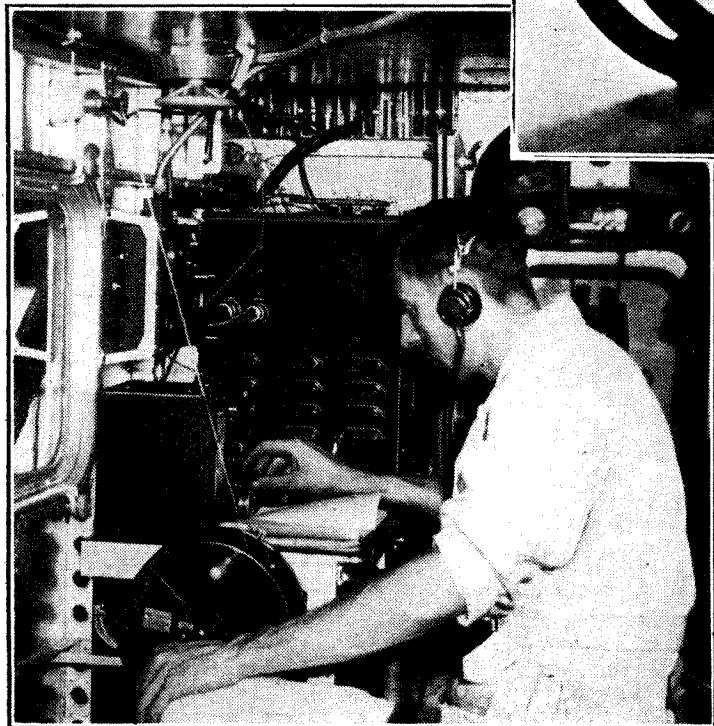
The latest heavy patrol and rescue flying boats are of the Douglas amphibian type and carry 75-watt transmitters for code working. These have a frequency range of 275 to 600 and from 2,600 to 8,100 kilocycles. ICW and CW operation are provided for on the intermediate and high frequency bands.

Transmitter Details

A master-oscillator power amplifier circuit forms the basis of the HF section of the transmitter, a Colpitts oscillator being used on both frequency bands. The power amplifier works at the same frequency as the master-oscillator. One set of controls serves both circuits, thus simplifying operation. High voltage current is supplied by a pair of mercury arc rectifiers designed for 800-cycle operation.

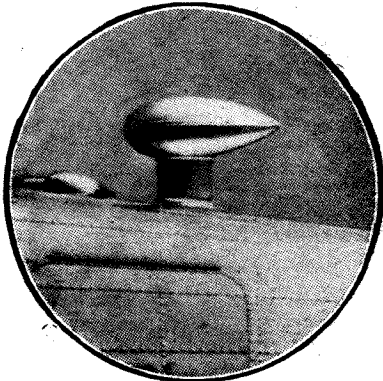
A trailing wire aerial is used on the 275- to 600-kilocycle band. The trailing antenna is paid out from a reel containing 300ft. of wire, a turn counter being fitted on the reel cover to enable the operator to release a definite length of wire. The reel is completely covered and always at earth potential to prevent burns and reduce danger of fire.

Included is an auxiliary transmitter-receiver for both telephony and telegraphy. This operates on a number of frequency bands between 2,660 and 4,050 kilocycles. The frequency indicator comprises a master-oscillator operating in a limited frequency range of 1,000 to 2,023



Coastguard Radio—

kilocycles, which by harmonic combinations is capable of checking transmitters in the frequency range of from 250 to 8,100 kilocycles. There is also a radio direction-finder-homing device, working between 200 and 750 kilocycles and between 2,000 and 5,000 kilocycles.

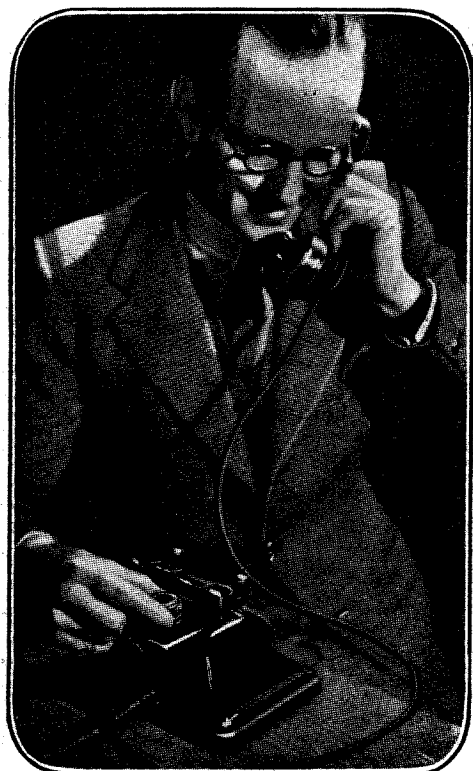


The "tear-drop" housing for the rotating D.F. loop.

The receiver unit is actually mounted in the tail section of the 'plane, with remote control cables connecting up to the operator's panel in the cabin. When the receiver is used as a homing device consecutive bearings are taken on the home station, the pilot following the minimum signal until the destination is reached. It can also use any broadcasting station for this purpose.

For High-speed Machines

The entire apparatus carried in the Douglas 'plane weighs 318lb. It is too heavy to be carried in the fast patrol 'planes of the single-motored Grumman amphibian type, so the coastguard radio men have developed a combination transmitter-receiver-direction finder all con-



tained in one unit. The transmitter delivers 10 watts when using the normal full power supply derived from a wind-driven dynamo, and 5 watts when worked off the emergency system of storage batteries. Telephony emission is 100 per cent. modulated. The total weight of the equipment is only 120lb.

The latest radio development to be installed on the high-speed 'planes is a streamlined housing for the DF loop antenna, which reduces the wind resistance of the loops almost to vanishing point and is stated to increase the speed of the 'plane by about five miles an hour. To use the picturesque American phraseology, the radio loop antenna consists of a hollow "tear-drop" made of bakelite, about 10in. in diameter and some 18in. long. It

comprises two sections riveted together. Secured to the fuselage, the DF loop rotates freely inside the housing, completely protected from the force of the air stream.

Never has the radio coastguard service proved its worth more effectively than during the last hurricane in Florida. On this occasion the patrol 'planes located many stranded fishing vessels and their crews in the Gulf of Mexico; the positions of the distressed vessels were transmitted to shore stations, with the result that lifeboats were able to effect rescues with the minimum of delay. Without the aid of the air service this work of discovering the whereabouts of the stranded ships would have consumed many valuable hours, with a probable loss of life.

A Telephone for the Deaf

Post Office Service to Subscribers

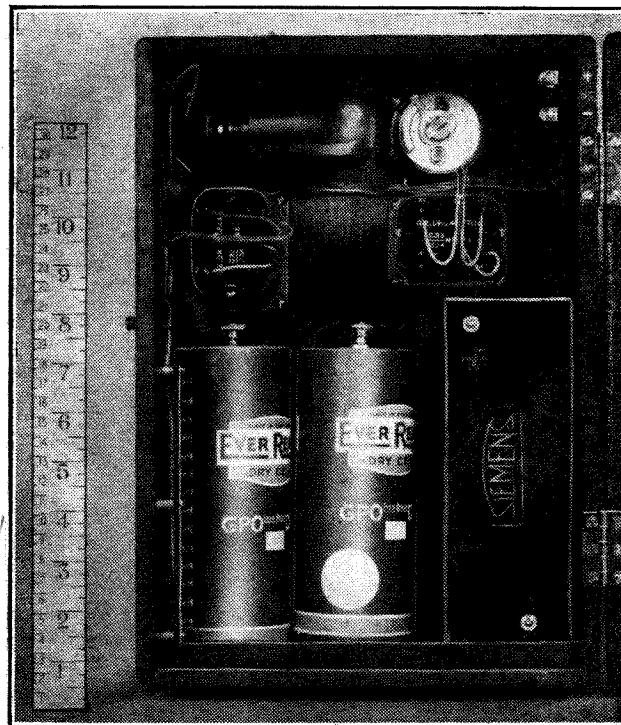
DEAFNESS is usually a bar to easy conversation on the telephone, and may, indeed, deprive the sufferer of many of the beneficial uses of the telephone in

best suited to the listener's requirements.

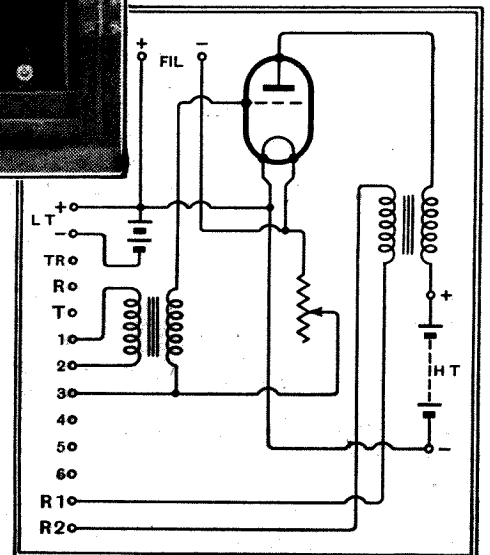
This special telephone, with its speech-amplifying equipment, is effective in all but extreme cases of deafness, and it is equally effective for use either on local or long-distance calls. The amplifying equipment is contained in a small, nicely finished cabinet measuring 13½in. by 10in. by 5in., which can easily be accommodated in any out-of-the-way position near the telephone.

Low Cost

A telephone of the pattern illustrated can, with the amplifying apparatus, be fitted on any telephone installation served by an automatic exchange, or by a manual exchange of the type provided in the more populous areas, at an extra charge of ten shillings a quarter.



Interior view of the separate amplifier. The circuit is shown on the right. Volume adjustment is made by the subscriber at the receiver as seen on the left.



social and business relationships. It frequently leads to the undue prolongation of telephone conversations, which, when long-distance calls are concerned, may prove expensive.

Post Office engineers have produced a special type of telephone to overcome the difficulties in telephoning hitherto experienced by persons whose hearing is below the usual standard. With this telephone, speech reaching the listener at normal strength may be increased in volume under his own control, merely by the turn of a knob, to the particular strength

This charge covers the provision of a black hand-microphone similar to that shown in the illustration. Much interest has already been shown in this instrument.

Inexpensive Volume Expansion

HOW TO APPLY THE NEW SIMPLIFIED SYSTEM

By R. H. TANNER, A.C.G.I. and V. T. DICKINS

SYSTEMS for automatically restoring contrasts, normally lost in transmission, between soft and loud musical passages have hitherto been somewhat complex and expensive. But a much simpler method has recently been devised in America, and this article deals with its practical application to existing receivers

IN the issue of *The Wireless World* of April 24th there appeared an article dealing with the Crosley system of volume expansion. The method of operation was described, but no practical details were given. The authors of this article have investigated the theory of the method, and have carried out practical experiments, the results of which may be helpful to anyone who wishes to try this circuit, especially as trial and error is not likely to lead to a satisfactory result.

The fundamental circuit is reproduced in Fig 1, where R1 and R2 are plain resistances, normally of equal value, while

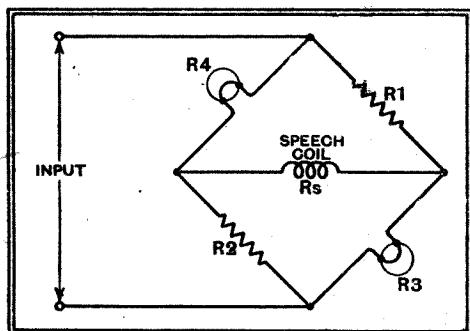


Fig. 1.—The Crosley volume expander in its simplest form, without low-level bass booster.

R3 and R4 are lamps, the resistance of which depends on the filament temperature. Thus the degree of balance of the bridge, and therefore the power loss in the circuit, depends on the power input. It can be shown quite simply that the loss introduced is: $20 \log \frac{2R_s + R_3 + R_1}{R_3 - R_1}$ db., provided that the opposite arms are equal. (Rs = speech coil resistance.)

Experiments showed that the ratio of resistance hot to resistance cold of the lamp filaments was about 10 to 1. The design of a circuit to give almost any required degree of expansion is not difficult, but the minimum loss must be kept low, or the method will be very wasteful of power.

A Practical Case

In order to get a design in which the loss is limited to 3 db., the authors took a definite case and assumed a power output of 3 watts and a speech coil resistance of 3.5 ohms. This is quite a common set of conditions, and thus provides a suitable starting point. Moreover, it is doubtful whether the circuit would work at all successfully on outputs of less than 3 watts,

as the power taken by the lamps would be too great.

Now a loss of 3 db. on 3 watts is a loss of 1.5 watts. It is a fairly safe assumption that, for minimum total loss, the losses in the resistances will be equal to those in the lamps. Thus the power lost in R1 on peaks will be about $1.5/4 = 0.4$ watts.

Now power in Rs = 1.5 watts, so that current in Rs = $\sqrt{1.5/3.5} = 0.7$ A. Assuming that on peaks the lamp resistance is fairly high, this current will pass through R1. Therefore current in R1 = 0.7 amps approx.

Resistance of

$$R_1 = \frac{0.4 \text{ (watts)}}{(0.7)^2} = 0.8 \text{ ohms.}$$

Then voltage across R1 = $0.8 \times 0.7 = 0.6$ volts.

Then voltage across Rs = $3.5 \times 0.7 = 2.4$ volts.

Thus voltage across R3 = $2.4 + 0.6 = 3.0$ volts.

Whence resistance of R3 when hot = $3.0^2/0.4 = 22.5$ ohms.

From this it will be seen that both the resistance and the wattage of the lamp are specified, and it remains to be seen whether such a lamp can be bought or whether a compromise must be made. Fortunately, the Osram pilot lamp, 3.5V, 0.15A suits the requirements quite well, having a wattage of 0.5 and a resistance of 23 ohms.

We can now calculate the expansion that such a circuit will give:

$$\text{Minimum loss} = 20 \log \frac{7 + 23 + 0.8}{23 - 0.8} = 20 \log 1.4 = 2.9 \text{ db.}$$

$$\text{Maximum loss} = 20 \log \frac{7 + 2.3 + 0.8}{2.3 - 0.8} = 20 \log 6.7 = 16.5 \text{ db.}$$

Therefore expansion range = 13.5 db. (The Model 800 H.M.V. employs a 12 db. expansion.) Bigger or smaller ranges can be got by increasing or reducing the value of R1; in fact, by using two 1-ohm variable resistances ganged together, the range can be easily controlled. It should be remembered that if the range is increased the minimum loss is also increased.

The modification of these results to suit other cases is simple. If the speech coil has a resistance of Rs and the output of the amplifier is W, then the lamp resistance should be $23 \times \frac{R_s}{3.5}$ ohms, and the

value given to R1 should be $0.8 \times \frac{R_s}{3.5}$ ohms. The wattage of the lamp should

be $0.4 \times \frac{W}{3.0}$. From these figures the current and voltage rating of the lamp may

be found; a study of the makers' lists should result in a suitable lamp being bought. In some cases it will be necessary to use a number of lamps in series or parallel in order to obtain the correct ratings. For instance, a *Wireless World* Quality Amplifier modified to give a 12-watt output, and feeding a 10.5-ohm speech coil, has been working very satisfactorily with 3 lamps in series in each bridge arm.

Mismatching Effect Negligible

The article of April 24th referred briefly to the effect this circuit would have on the matching. A formula can be evolved for the effective resistance presented by the circuit to the output transformer, and this shows that on peaks the error in matching is about 1 per cent., while at zero volume the resistance has fallen to about $\frac{1}{3}$ Rs. It would seem, then, that this is not very important and that the effect would be negligible.

The time constant of the circuit appears satisfactory. It is probable that the lamps heat up quicker than they cool down, and so quick build-up on chords is obtained. The complete period of operation, however, is long enough to ensure that there is no modulation of the signal by the bass notes. Certain types of programme are not very suitable for expansion, but the switching arrangements for cutting out the system are simple and were given in the previous article. It is probably on gramophone reproduction that the system shows to its best advantage, for the needle scratch is reduced greatly during quiet passages and ceases to be at all noticeable.

Loud Speaker Baffles

SIZE AND SHAPE IN
RELATION TO FRE-
QUENCY RESPONSE

A *BAFFLE* is used primarily to improve the output from a loud speaker in the extreme bass, but unless it is properly designed it may introduce peaks and troughs higher up in the frequency scale.

WHEN we examine the response curve of a loud speaker it is as well to bear in mind that the baffle upon which it was mounted is just as essential a part of the complete instrument as the diaphragm itself. Without some means of preventing short circuiting of the compressions and rarefactions generated at the back and front of the diaphragm, the cut-off in the bass would be so sharp that nothing would be revealed of the loud speaker's performance in this region.

The problem from the testing point of view is to devise a baffle which will lift the bass to a convenient level in relation to the rest of the curve without modifying the response higher up in the frequency range. So long as the baffle is small compared with the wavelength of the sound emitted, the modification of the response curve by the baffle is perfectly regular; but as the frequency is increased and the wavelength becomes shorter, certain well-defined frequencies are reached at which the wavelength bears a simple relation to the path between the back and front of the baffle and peaks and troughs are superimposed on the curve of sound output as measured by a microphone on the axis.

The mechanism of this effect is shown diagrammatically in Fig. 1. First we have the familiar sine wave (a) showing the rise and fall of air pressure, and immediately below it a representation of the corresponding compression and rarefactions. Compressions are represented by heavy lines, and rarefactions by dots. On this convention the condition of the air adjacent to a diaphragm at the moment when it is moving in a forward direction, as shown by the arrow in the plan view at (b), may be represented by a rarefaction at the back and a compression at the front. This may be taken as the state of affairs when the diaphragm starts to move from rest. But supposing that we catch the diaphragm during a forward movement while it is vibrating at a frequency such that the shortest distance round either side

of the baffle is equal to the wavelength of that particular note: a previous rarefaction from the back has arrived at the front just as a compression is leaving. There will be mutual cancellation between the two waves, and even if this does not amount to complete extinction, at least there will be a dip in the response curve at this frequency. At other frequencies compressions from the back will coincide with the front compression, and reinforcement with a consequent peak in the response curve will occur. The case of a

lated from the following simple formulæ:—

$$\text{Minima at } f = \frac{Nv}{d}$$

$$\text{Maxima, } f = \frac{(2N - 1)v}{2d}$$

Where f = frequency, d = length in feet of shortest path between back and front of diaphragm, v = velocity of sound = 1,125 ft. per sec., and N is any whole number.

As might be expected, this effect is most noticeable when a symmetrical baffle affording several back-to-front paths of equal length is employed. It is also found that the first frequencies at which maxima and minima can occur show more definite peaks and dips than the higher multiples derived from the formulæ.

In order to sift the matter thoroughly, a loud speaker with a smooth frequency response was chosen and a series of curves taken, starting with a baffle 2ft. square and gradually building up the area and altering its shape until a point was reached where modifications due to the baffle became of secondary importance. Three of these curves have been chosen for illustration, and they provide striking confirmation of the theory of the interference effects between the sound from the back and front of the diaphragm.

In the case of the 2ft. baffle, the shortest distance between back and front of the diaphragm, allowing for the radius of the cone, is 1ft. exactly. From this we should expect the first maximum to occur at 562 c/s and the first minimum at 1,125 c/s. The positions of these peaks and troughs, as indicated by arrows on the curve show agreement with the calculated frequencies.

Increasing the baffle to 34 inches square brings up the minimum path to 2.16ft. and gives first maxima and minima at 260 and 520 c/s. The minimum is well marked, but the maximum does not appear, as it is masked by a slight drop in the loud speaker output, which is seen at about 260 cycles in the curve of the third baffle and has been superimposed for reference.

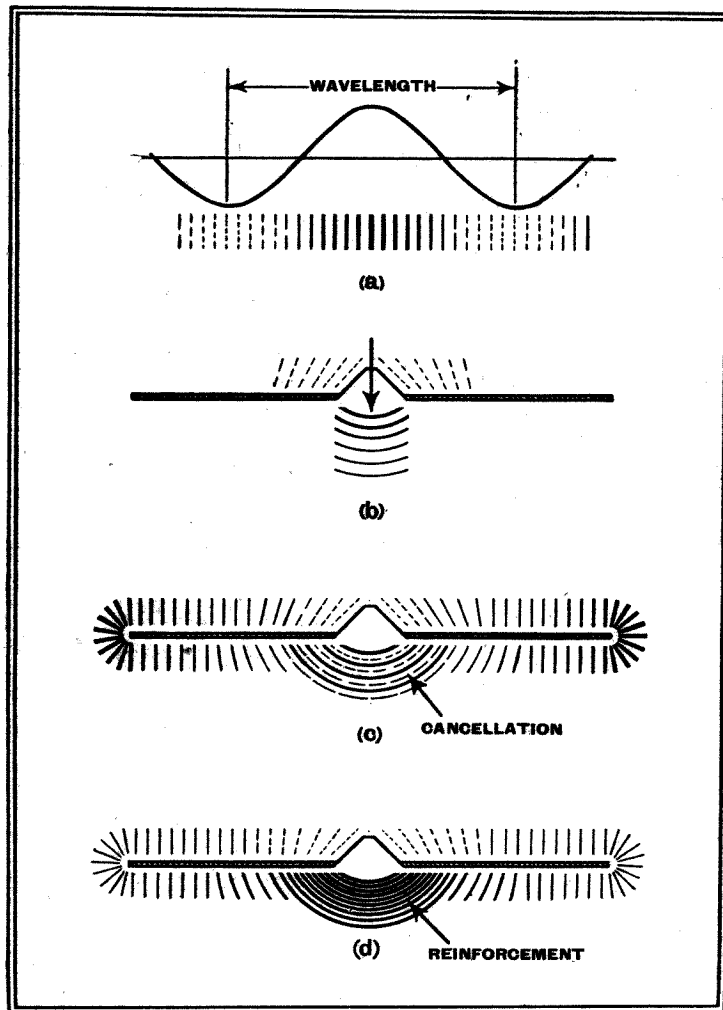
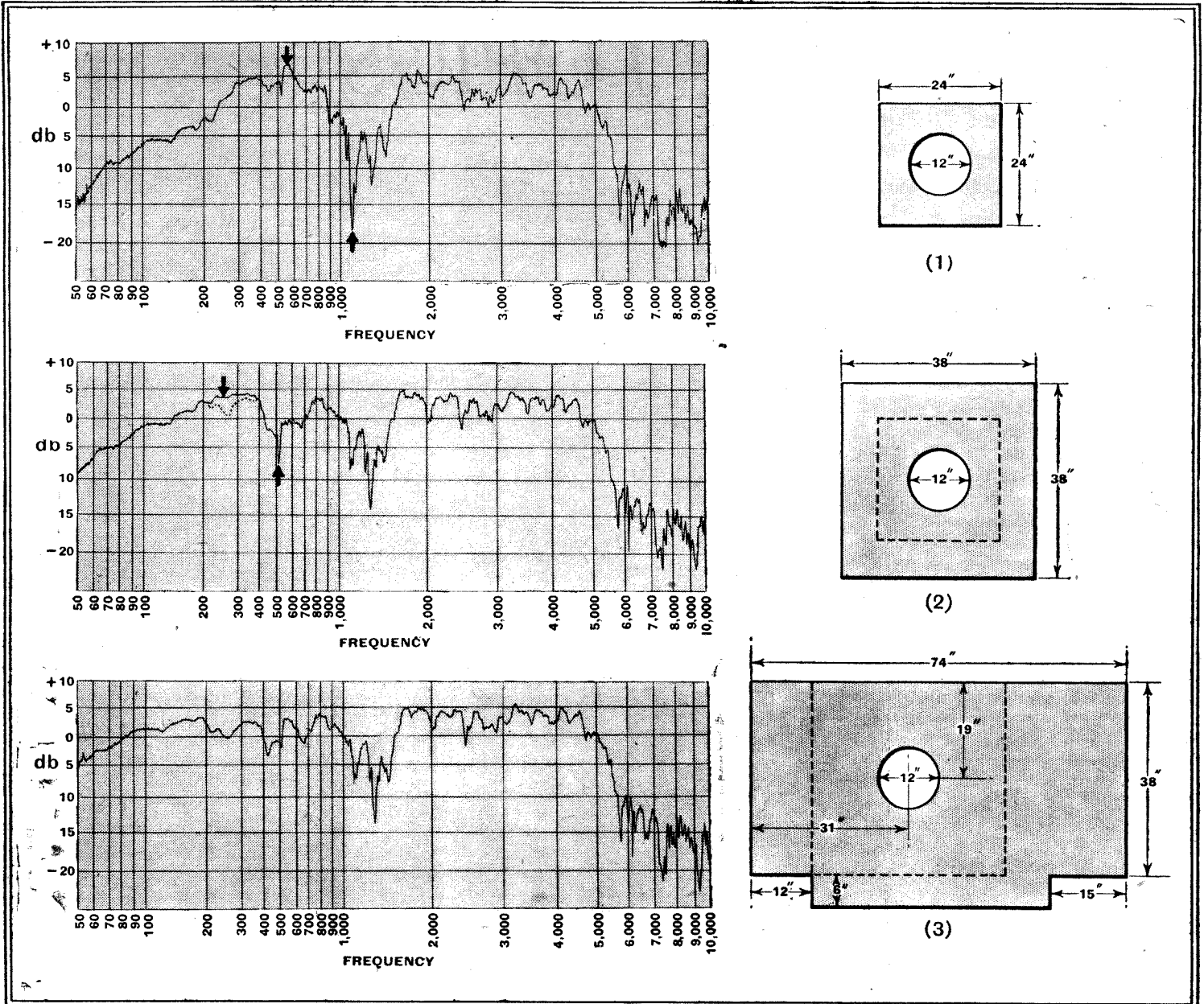


Fig. 1.—Illustrating the origin of irregularities in an axial response curve of a loud speaker caused by interference between the radiation from the two sides of the diaphragm.

frequency such that the distance from back to front of the diaphragm is equal to half a wavelength is shown at (d) in Fig. 1.

Given the size of the baffle, the frequencies at which peaks and troughs may be expected to occur may be calcu-



Axial response curves of the same loud speaker taken on baffles of different size and shape. In the case of the square baffles irregularities in the response due to interference effects occur at the frequencies indicated by arrows.

So far symmetry in the shape of the baffle has been preserved to show up the interference effects to the best advantage; they would have been still more marked if a circular baffle had been employed. Unless we resort to an "infinite" baffle of the hole-in-the-wall type, modification of the response on the axis may be expected, but the "infinite" baffle brings its own troubles, as room resonances and reflections will be imposed on the back of the diaphragm. We can, however, break up and distribute the interference effects associated with a finite baffle by making it irregular in shape. The final curve taken on an asymmetrical baffle of the dimensions given is noticeably more regular than those taken with the symmetrical baffles.

The rise in the bass response as the baffle area is increased is worth noting. There is an improvement of as much as 7 db. at 50 cycles when the baffle is enlarged from 2ft. to a little over 3ft. square, and only another 3 db. for the considerably greater area of the irregular baffle.

Another interesting feature is the consistent repetition of minor irregularities in the curves below 200 and above 1,500 c/s. These are all ascribable to the loud speaker itself, and most of the baffle effects are confined to the lower middle register.

The curves were taken in the open air with the baffle inclined to eliminate ground reflections, and the microphone distance was 5ft. The speaker used for the tests was the Celestion Senior Auditorium.

"Morse in Half an Hour"

THE system described in "How to Learn the Morse Alphabet in Half an Hour" (E. Marlborough and Co., Ltd., 51-53, Old Bailey, London, E.C.4, 3d.; by post 4d.) has an advantage over most others of its kind in that it helps the learner to associate the letters with sounds rather than with symbols.

A mnemonic guide, as printed in this little booklet, links each letter with a word beginning with the same initial and having the same number and sequence of long and short syllables as the corresponding morse symbol; thus, A (·—) is represented by "a-against" and N (—·) by "nob-le."

Special Short-wave Tests

Reports Wanted from the East

A SERIES of short-wave tests has been arranged by Mr. Douglas Walters, experimental station G5CV, for the morning of June 19th, when a total eclipse of the sun will be visible in Siberia and Japan. A wavelength of 42.43 metres (7,070 kc/s) will be employed; the transmitter is crystal controlled, and the power 150 watts.

The tests commence at 4.15 a.m. and continue until 5.15 a.m. BST; a 1,000 c/s tuning note will be radiated, interrupted at frequent intervals for station identification; together with power, frequency, etc., these being given in speech.

Reports on reception are requested and all will be acknowledged. It is particularly desired to receive reports from the Eastern Hemisphere and exact times when any unusual variations are noticed should be included.

Reports should be addressed to Mr. Douglas Walters, Station G5CV, c/o The Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.

CURRENT TOPICS

Events of the Week in Brief Review

The Most Northerly Station

THE station of Tromsø, situated in latitude 70° N., was regarded as the most northerly until Norway and the U.S.S.R. installed two new ones situated nearer to the North Pole. These transmitters are intended to broadcast meteorological news and information to a widely scattered population concerning the movements of shoals of fish. Gramophone records are used for entertainment purposes, more especially during the long winter nights.

East African Wireless

EXPERTS of the Air Ministry have been visiting Mombasa recently discussing with officials the site for a powerful wireless station. This is to be installed in preparation for the commencement next year of the Imperial Airways Flying-Boat route down the East African coast. The station will be used for directional and position-finding work on medium and short wavelengths.

Yugoslavian Short-wave Station

IT is reported that, on the initiative of M. Kosta Loukovitch, director of the Central Press Bureau of Belgrade, a short-wave station intended for the transmission of news in foreign languages is on the point of being built. This station will probably employ a wavelength of 82 metres, and, to commence with, it will use a power of 0.25 kilowatt, but this will be gradually increased to 2.5 kilowatts. It is hoped that the station will be receivable in all European countries.

Telephony and Tugboats

THE latest use to which wireless telephony has been put in America is to keep tugboat owners in touch with their vessels. The Radiomarine Corporation of America has equipped one of the tugboats belonging to a New York towing and transportation company with a special receiver for the reception of messages sent from an 11-metre telephony transmitter located ashore in New York. Uniformly good reception has been reported at widely separated places, even the East River bridges failing to prevent reception. Great developments are expected as a result of these experiments.

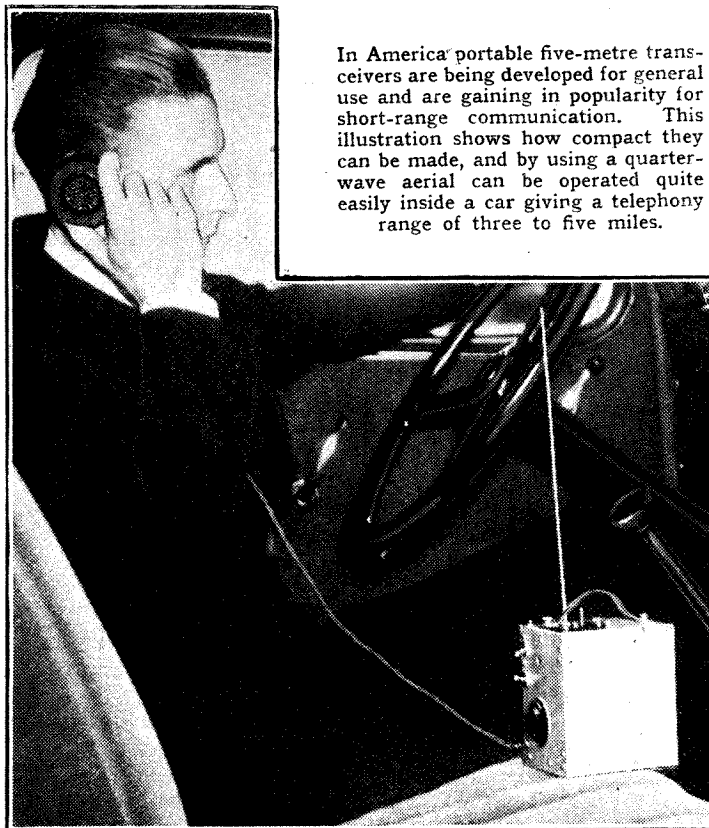
Television Coming ?

IT is possible that, after all, television from the Alexandra Palace will commence this year, in spite of what certain pessimists allege. In reply to a question in the House of Commons the P.M.G. has definitely stated that transmission of full programmes may be expected in the autumn, while skeleton test programmes may begin as

vice. The transmissions will, it is said, be sent from the station installed during the last few months at the top of the Empire State Building, the studios being in Radio City. Receiving stations will be established in various parts of New York to arouse public interest.

Five-metre Transmissions

THE experimental station G6SL, owned by Stratton & Co., Ltd., Birmingham, will be carrying out a series of telephony tests on 5 metres on



In America portable five-metre transmitters are being developed for general use and are gaining in popularity for short-range communication. This illustration shows how compact they can be made, and by using a quarter-wave aerial can be operated quite easily inside a car giving a telephony range of three to five miles.

early as July. In addition to this exciting news the Prime Minister promised that before long the House will be given an opportunity to debate Government proposals concerning the future of the B.B.C.

Russian Television

FURTHER television activities are reported from Russia, and an ultra-short-wave transmitter is proposed for Leningrad. In addition, communal "looking-in" stations will be established at suitable points in the city. This service will be operated independently of the one at Moscow,

Television in America

IT is reported from America that June 29th has been fixed as the opening day of the R.C.A. trial television ser-

Sundays, May 24th, 31st and June 7th, commencing at 10.30 a.m. and finishing at 12.30 p.m. (B.S.T.). An omni-directional aerial is to be used, and reports of reception will be appreciated. It is hoped to establish communication with other amateur experimental stations on the same wavelength if conditions permit. A further schedule may be arranged within a few weeks for the summer months.

Spain and Man-made Static

SPAIN is yet another country to make a determined onslaught on the annoying man-made static which is so disturbing to broadcast listeners. In future all makers of electrical apparatus of a type likely to cause interference are compelled to state the exact degree of in-

terference—expressed in scientific terms—caused by their wares. Heavy fines are to be imposed for non-compliance with the order. In cases where complaints are received and which on investigation reveal interference of less than 1 millivolt/metre no action will be taken.

Making it Snappy

THE other evening Messrs. Ross and Robinson, of East Acton, W.3, were packing up their gear at 8 p.m. after providing the sound amplification apparatus at the gliding demonstration by Clem Sohn, the famous "birdman." They were approached by the manager of a cinema asking them to install a public address system on the stage of his establishment in order to amplify the voice of Clem Sohn, who was appearing there at 8.56 p.m. that evening. Less than an hour after the order was given, and within a quarter of an hour of the van containing the gear arriving at the cinema, the apparatus was unloaded, installed and in use.

The Institute of Wireless Technology

THE annual report of the Institute of Wireless Technology, which was presented at the recent annual general meeting, revealed a further increase in membership. Television has been included as a special subject in examinations for several years past, and this is believed to be the only examination for television engineers to be held by any professional institution in this country. Half-yearly examinations are held for associateship and associate membership. Full particulars of the Institute can be obtained from the Secretary at 4, Vernon Place, Southampton Row, London, W.C.1.

N.R.E.A. Journal

THE current issue of *Radio-man*, official organ of the National Radio Engineers, contains much useful information for members of the Association among which it circulates. A list of subjects to be covered at the forthcoming Examination for Fellowships, to be held in London, probably during June, will be of interest to prospective entrants, who, incidentally, should make an early application to the Hon. Secretary.

Miscellaneous Advertisements

THE Whitsun holidays necessitate early press arrangements for the issue of *The Wireless World* of June 5th, and Miscellaneous Advertisements will close with those received by first post on Friday, May 29th.

Tracing Troubles in AC-DC Sets

SPECIAL PROBLEMS OF THE UNIVERSAL RECEIVER

By W. H. CAZALY

ALTHOUGH the modern "universal" mains receiver is a highly dependable instrument, it occasionally gives trouble, more especially when used on AC or positively earthed DC supplies. Reasons for such shortcomings are explained in this article, and cures are suggested.

IGNORING—no doubt very unfairly—all the care and erudition that have been employed in their special design, "universal" receivers may be regarded, when they are on the test bench, as merely DC instruments with rectifiers in the HT supply line. It is a common experience that receivers of this type usually work with less trouble on DC than on AC. Apart from breakdowns of the kind common to all mains receivers, one of the most frequently encountered phenomena is that their performance is quite passable on DC but unsatisfactory on AC supplies. As a matter of fact, such behaviour is due to a fault in the receiver, but the fault does not reveal itself audibly on DC until it becomes really bad.

This is not an article on general fault-tracing in mains receivers, so the testing procedure for the usual troubles will not be detailed. Tests for the grosser faults should preferably be made on DC supplies, and if current comes from a converter the machine must be in excellent condition. If, after it has been made to work well on DC, the receiver gives trouble on AC, the faults now to be discussed may be suspected.

These faults almost invariably give rise to the introduction of alternating voltages

circuit in Fig. 1 will help to show possible points of entry for these alternating voltages.

The most obvious path for AC to leak into the rest of the set is also the most common—through imperfect insulation between heaters and cathodes of valves. The reason why these faults have little effect on DC lies in the considerable difference between the mere ripple in the DC supply and the violent changes in AC supplies. Assuming, for instance, that a leak exists in the insulating material of the cathode of the IF valve in the circuit shown, there would be 39 volts across it. On DC this potential difference would be substantially steady, the only variation arising from the ripple superimposed on it. Unless the leak were bad enough for the DC to make an appreciable difference to the potential of the cathode it might not have an audible result in the loud speaker. But on AC, of course, the variations would amount to 100 per cent. of the potential across the leak and would, therefore, become audible much more readily. In a plain AC set the heater supply would come from a 4-volt winding, so that the cathode and heater would not have more than 4 volts, instead of 39

volts in Fig. 1 no more than 13 volts are applied, but if the insulation of the rectifier cathode broke down there would be 119 alternating volts waiting to take advantage of it. It is for this reason that the valve most frequently giving trouble turns out to be the rectifier. On DC, of course, this valve is almost a passenger, and a leak would make little difference until it became very serious indeed.

Test with Heating Current "On"

It should not be forgotten that the breakdown in the insulating material may only be in evidence while the valve is hot. It will probably disappear as soon as the valve cools down.

Another path for AC may be offered by a slight leak across the electrolytic smoothing condensers. On DC the negative line remains negative with only the superimposed ripple as a variation; on AC the variation is violent, of course. Hence one often finds that simply replacing the smoothing condensers with new ones or with paper-dielectric types will stop hum, although the discarded condensers may still be usable for other purposes.

Now, once alternating voltages find their way into the set by the above paths there is no knowing where they will wander. It is not often that the by-passing condensers are of such large capacity as to offer a negligible impedance to supply frequencies, and hence voltages due to them may make use of AVC lines to reach the grids of HF valves and detector circuits, where they will cause intolerable hum.

When the other circuits are in normal condition they do not pick up hum from the heater circuits except by conduction (as through a cathode-heater leak), since the mains frequencies are too low to be easily conveyed by stray inductive or capacity couplings. But if the other circuits are in an abnormally sensitive state they are liable to be affected. Thus a "free grid" or an unstable HF stage or the internal disconnections of some decoupling condenser may cause hum to occur.

The moral of all the above may now be plain; it amounts practically to this: that a "universal" receiver needs to be in better order when used on AC than on

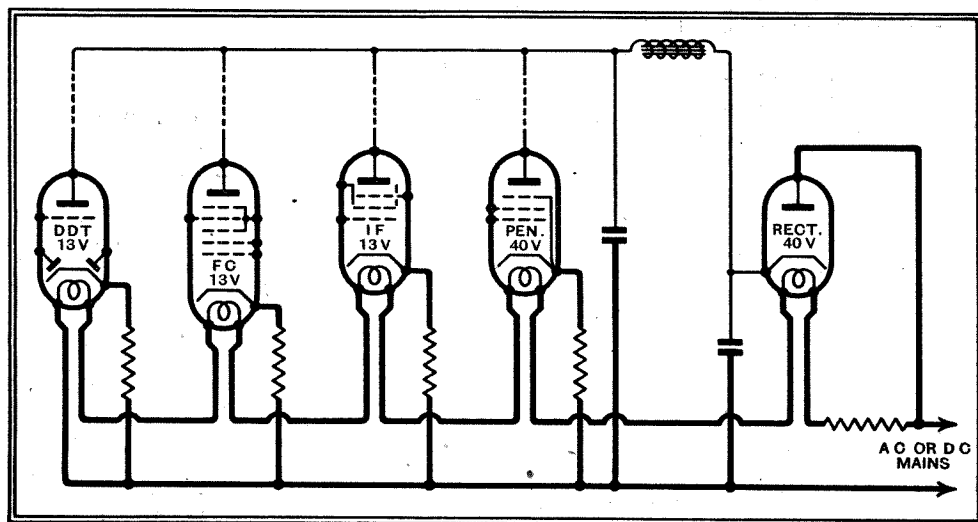


Fig. 1.—Power supply circuits of a typical AC-DC superhet. Wiring on which "raw" mains potentials exist is shown in heavy lines.

from the AC mains into sensitive parts of the receiver's circuits. With DC supplies there is only the usual ripple, which has much less effect—so little that performance on DC may seem satisfactory. A scrutiny of the "universal" supply

volts, between them, and the effect, with a small leak, might be inaudible.

Further consideration of the matter shows that much depends on the valve in which the leak occurs. Across the heater and cathode of the double-diode-triode

Tracing Troubles in AC-DC Sets—

DC mains. Connection to an AC supply is a severe test of the general goodness of the components in the receiver. This applies with especial force to the valves, and the quickest and best way of testing them is, of course, by substitution. But the valves used for test must themselves be above suspicion; preferably they should be taken from another "universal" set whose behaviour on AC is beyond reproach. Even new valves straight out of the carton have been known to show a difference between their AC and DC performances. The smoothing electrolytics also can only be conclusively tested by replacing them temporarily by others in unimpeachable condition.—If

possible by a bank of good paper-dielectric condensers of equal capacity. If neither of these experiments reveals the way to stop the trouble, rechecking of the rest of the receiver is indicated, with scrupulous care and the replacement of any components that show signs of abnormality.

There is, however, a final possibility that can be investigated—that of a positive earth. How the earth can be positive in DC mains is explained by the diagram in Fig. 2. In this diagram the generator at the power station is assumed to develop across its output terminals a total of 480 volts, which can be used for commercial purposes; for ordinary domestic use a lower voltage is desirable, and this is obtained by earthing the "neutral point" at the generator and taking domestic supplies alternately from each of the two other lines and the earthed "neutral." Thus, in one street there may be the three lines—neutral, positive, and negative—and one side of the street may be supplied from the positive and neutral (earthed) and the other side from the negative and the neutral, and in the latter case the neutral, or earth, would be of positive polarity.

Earth Line "In the Air"

How this can affect radio receivers used in that street is shown by the diagrams in Fig. 3. In A, where the negative is earthed, the function of the earthing condenser C2 is mainly to enable HF currents to reach the earth; it does not have to deal with the low frequencies of the mains, since the negative line is "held down" by its connection directly to the earth. This is just as well, because in "universal" sets that may be used on AC this earthing condenser is strictly limited in possible capacity, and cannot be made large enough to offer negligible reactance to very low frequencies. (R, of course, is the resistance of the valve heaters and

voltage-dropping or barretter resistance, while the rectifier and smoothing circuits are shown by the choke and C1.) In B the positive line is connected to the earth, and conditions become quite different; the negative line, to which are connected the negative sides of the smoothing condensers, is not held down and may offer

negative lead, or that he promptly blew his house fuses through the large earthing condenser as soon as he plugged in!

The most practicable method seems to be to make use of a large earthing condenser connected in an easily removable manner (screwed inside the cabinet, for instance, externally to the chassis), remembering that it will have to be removed if the receiver is taken to an AC district. If this has insufficient effect a choke may be tried. The trouble is, fortunately, not very common and should not be suspected until all other possibilities have been investigated; it is one of the few troubles largely due to imperfections in electricity supplies with which modern standard receivers cannot always deal.

"Television Journal"*An Official Organ*

WE have received a copy of the "first issue" of a monthly paper entitled "Television Journal." It is described as the official organ of the Institution of Television Engineers, Ltd., which appears to be a new body set up to issue diplomas of membership of various grades. Candidates who are considered eligible by a "Board of Directors" can obtain a diploma of Fellowship for £5 5s., one of Membership for £3 3s., or Associateship for £1 11s. 6d. The "Insignia of Membership" costs £1 5s.

Unfortunately, the Journal does not mention the name of a single individual either as an official or examiner of the Institution.

It is usual to have some information as to the status of an institution and the names of the examining board awarding diplomas before assessing the value of the qualifications which the awards carry.

Regarding itself, the Institution states: "Employers everywhere know from experi-

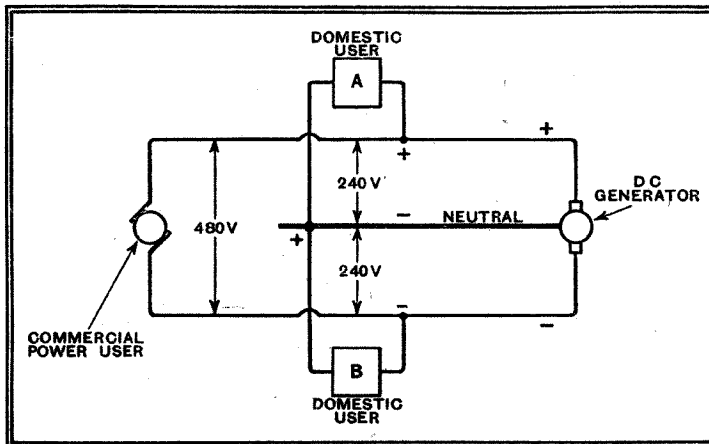


Fig. 2.—Explaining the three-wire system; the domestic consumers' mains may be either negatively or positively earthed.

quite appreciable impedance even to low frequencies, especially during daylight, when the electric lamps are not in use. And the earthing condenser C2 cannot effectively by-pass very low frequencies. Hence the smoothing condensers C1 may not be properly "earthed," and the ripple in the DC supply may make itself audible. A great deal depends on the quality of the supply and the use made of electricity in the district; low-frequency interference may become an annoying problem.

Several possible remedies suggest themselves, but, unfortunately, none are really permanent. Thus, putting a choke in the negative line would probably be very effective, but as it would have to carry the current of the valve heaters while maintaining at the same time a considerable inductance, it would be a bulky and heavy component. Again, earthing the set with a large condenser in place of C2 might do a lot of good, but it would have to be of the order of several microfarads.

It is further possible—though the author has never done it—to "earth" the smoothing condensers *via* the positive main, altering the receiver wiring to do so. In any case, it would be dangerous to carry out any of these alterations in such a way as to incorporate them permanently in the receiver; for if the owner moved unexpectedly to an AC district he would find either that the receiver refused to work at all on account of the heavy choke in the

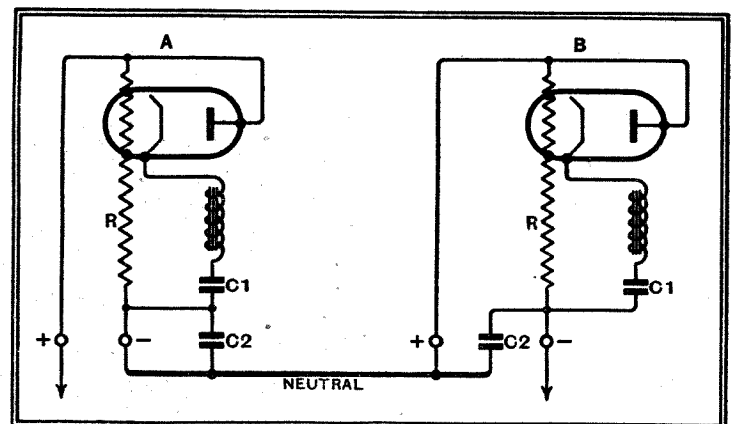


Fig. 3.—How universal receivers operated by consumers A and B (see Fig. 2) are affected.

ence that a man who possesses an I.T.E. qualification is capable and keen, and can be safely entrusted with important work."

Enquiry at Somerset House reveals that the Institution was registered there as recently as 7th February, 1936, with a nominal capital of £100 in £1 shares, one share having been taken up by Reginald Oswald, of Bristol, and one by Margery Schremer, also of Bristol, who is described as Secretary of the Company.

HINTS and TIPS

Practical Aids

to Better Reception

GENERALLY speaking, the modern HF choke is less than half the size of the old bulky type of component, and its external field is often restricted by the presence of an iron core, by special winding, or by metallic screening. This is all to the good, for experience seems to show that the "fieldless" type is preferable for practically every circuit position, apart from its obvious advantages in HF amplifiers.

"Fieldless" HF Chokes

Its usefulness extends also to the LF stages. In a case recently investigated, where the last trace of mains hum was still loud enough to be annoying, in spite of all efforts at removing it, a tentative short-circuit across the HF choke in the anode current of the leaky-grid second detector reduced the hum to inaudibility.

Apparently the coupling between this choke and the mains transformer was sufficient to cause an undesirable induction effect, and on substituting a small iron-cored screened component of reasonably similar inductance the trouble ended.

THERE are possibly quite a number of readers whose efforts towards higher fidelity of reproduction have reached a stage where further progress is impossible for the time being, simply because the loud speaker itself is not capable of doing

Useful Speaker Resonance

justice to any further improvement in the high-note response of the set. It is obviously a waste of time to extend the frequency range of the LF amplifier to, say, 10,000 c/s if the speaker itself reproduces little or nothing above 5,000 c/s.

In such a case there is little that can be done, short of replacing the present speaker by one of superior performance. However, an improvement can sometimes be effected by stiffening the cone, or replacing the diaphragm by one of a more suitable material. There is also another possible modification which, should it not prove entirely successful, is neither difficult nor expensive to try, and involves no structural alterations to the speaker.

It consists in tuning the speech-coil with a condenser of such a value that a resonance occurs at a high audio frequency and thus gives a useful "lift" to the top end of the scale. Unfortunately, the value of the required condenser cannot be calculated with any degree of accuracy, so it becomes necessary to resort to trial and error methods of selection; some form of constant-frequency input and output meter will be almost essential.

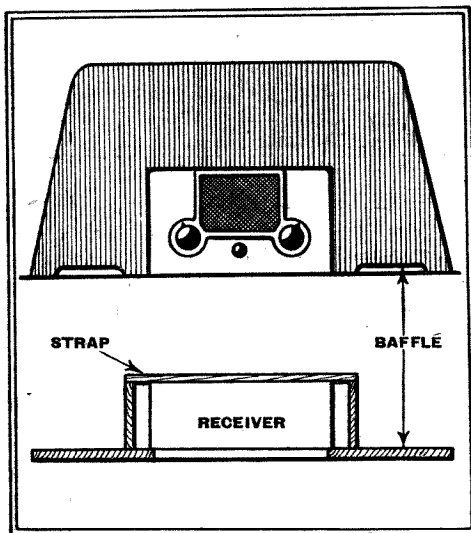
However, as a basis for further experiments, it has been found that, with a 16-ohm speech-coil, a condenser of 0.5 mfd.

brings the resonant frequency within the band of 5,000-6,000 c/s. At this frequency an increase in output of as much as 8 decibels was obtained—quite an appreciable improvement.

NOW that the novelty of the "midget" has worn off, there are probably several possessors of these miniature sets who find themselves dissatisfied with their rather thin tone and quite inadequate bass, and are wondering whether anything

Improving a "Midget"

can be done to improve the quality generally. One solution to this problem is, of course, to use a separate loud speaker. But one does not always wish to go to the expense of doing



Increasing the baffle area of a midget set; the lower sketch shows a suitable method of mounting a bakelite-cased receiver which cannot easily be screwed to the baffle.

so, and the following alternative scheme, which has possibly not been thought of before, may be preferred. It consists of mounting the complete receiver, exactly as it stands, behind a baffle. The latter, which should be as large as domestic considerations will permit, need not be at all unpleasing in appearance, if the proportions are chosen with care, and it can be made to stand on a table in the manner suggested in the sketch.

The baffle should be cut from a single sheet of wood, of reasonable thickness, and the receiver cabinet, if of wood, can be screwed to it from inside. The best method of mounting a bakelite cabinet is probably by means of a strap of wood. In either case it is advisable to ensure that the set fits snugly up against the baffle by interposing strips of felt at the edges of the opening.

TO those who take an interest in designing or constructing their own radio cabinet-work, it is suggested that, if narrow wooden bars are to be mounted by way of artistic relief in front of the speaker grille, these can be made to serve a useful

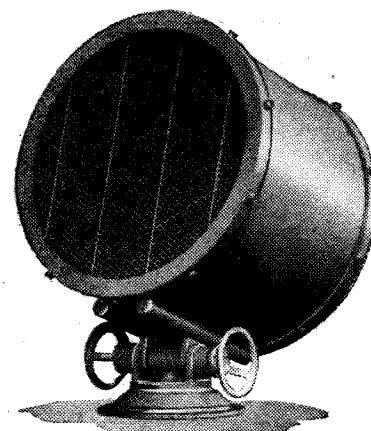
High-Note Diffusers

acoustic purpose as well as an ornamental one. By using bars of wedge-shaped cross-section, and placing them in such a way that they intercept the main beam of high frequencies radiated by the cone, they will act as a more or less effective diffuser, and tend to reduce "focusing" by distributing these frequencies over a wider area than is covered by normal loud speakers.

It is not possible to give figures regarding the size and shape of bar for best results, since the amount of correction necessary must largely depend on the individual speaker, and also because the effect of such a modification can hardly be measured, much less estimated, with any degree of accuracy; accordingly the reader is advised to suit his own tastes in this respect, guessing the dimensions to the best of his ability. At all events, no harm can be done to the reproduction, apart from a certain amount of high-note masking, if the bars are too wide or too close together. As a rough guide, the point of each wedge may have an angle between 20 and 50 degrees.

A diffuser of this kind is actually used in the H.M.V. "schools" loud speaker, but in this case it takes the form of a single large wedge-shaped bar which is mounted vertically on the front of the baffle, at a distance of about 5in. from the speaker aperture.

NEW PA SPEAKER



Reminiscent of searchlight practice; a 12-watt Castaphone sound projector, of the permanent-magnet type, produced by Castaphone Radio Service, of Culver Street, Colchester. In spite of the massive appearance, the instrument is quite light, as aluminium is largely used in its construction.

A Story of Public Address

Recollections of a "Standard" Sound Engineer

IN this article some account is given of the work of a Public Address engineer to show how the importance and applications of the service have grown even in the experiences of one firm alone.

WHEN one considers the excellence of the sound amplifying systems in use at the present time it is hardly credible that it is only fourteen years ago that the Western Electric Company (now Standard Telephones and Cables, Ltd.), the pioneers of the public address systems, conducted their first outstanding demonstration at the Radio Exhibition at the Horticultural Hall. The success which attended this occasion was so unmistakable that it was not long before enquiries were being received from all parts of the country. By 1924 PA systems were definitely known, and the Company was honoured with the then colossal task of equipping the Empire Exhibition with microphones and loud speakers, to be used for the opening ceremony by His Late Majesty King George V. His Majesty expressed great interest in the system installed, and visualised the vast possibilities open for it throughout the country. The first job of any real magnitude, however, was the Rodeo at Wembley, a happening still fresh in the minds of us all. His Majesty again appeared before the microphone at the opening of Lloyd's new building, and by that time PA systems were no longer looked on as an innovation, but actually expected by all orators addressing a large number of people.

From this time events moved apace, and the use to which PA systems have been put are not without interest. It is



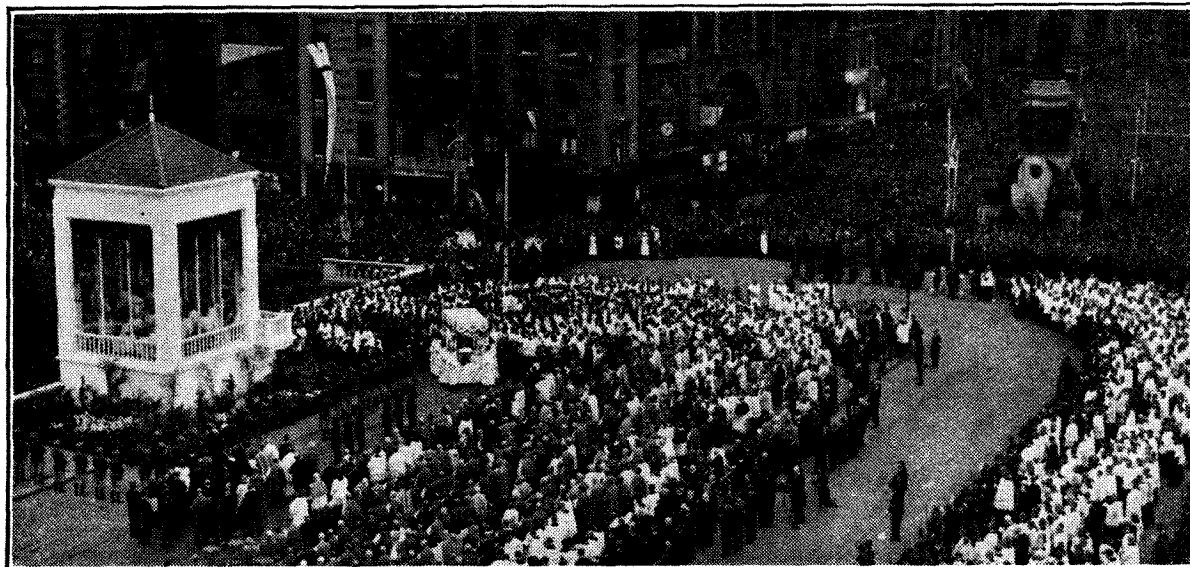
The laying of the Foundation Stone of Lloyd's new building by His Late Majesty King George was an occasion when Public Address Equipment was the means of making the ceremony audible to large crowds.

not only at vast gatherings that these systems are used, for although their application to crowds is more easily understood, small systems are now constantly in use for small dances and garden parties.

Crowds, however, always provide interest, and probably the Schneider Trophy of 1931, which was, incidentally, the largest of the Schneider Trophy series, and the Eucharist Congress in Dublin in 1932, are most noteworthy. At the Eucharist Congress, along fifteen miles of processional routes, no less than 400 loud

speakers were operated from ten different amplifying stations distributed at various strategic points. The congregational area was covered by a battery of thirty-four loud speakers, and more than 1,000,000 people were able to hear an address by the Pope, delivered *via* a telephone line from the Vatican in Rome, and to participate in the Papal blessing. At the conclusion of this, one of the largest divine services ever held in Great Britain, the PA system was again put into use for marshalling the enormous crowds into orderly procession. A special traffic control room had been arranged in the pavilion at the end of the colonnade, where the Chief Marshal was able to direct the traffic to and from the park.

So successful was this demonstration that the same equipment was requested for the Eucharist Congress in Buenos Aires in 1934. On this occasion the voice



The Dublin Eucharistic Conference was a wonderful opportunity for PA.

A Story of Public Address—

of His Holiness was relayed to an even vaster congregation.

Such demonstrations as these are extremely impressive, but there is another side to the PA system installer's job which borders on the incredible. Not very long ago the Standard Telephones and Cables Company was approached by the Irish Amateur Swimming Club to provide a system which, in addition to catering for the normal speech and music requirements of their gala, would also enable members of the club to dive under water holding a microphone, and remain under for ten minutes, talking to the crowd from the briny depths! This was, frankly, a bit of a poser, and the Company had visions of spoiling many moving coil microphones in the attempt—and these are, to say the least, expensive. The matter was, however, satisfactorily arranged, and specially prepared microphones were available for the occasion. The assembled spectators were very considerably mystified when the first diver took the microphone in his hands, dived under water with it, and then read written messages given to him by members of the public just prior to his plunge.

PA at Races

Another phase of PA system development is in catering for running commentaries at the many large motor races held each year. A new equipment is in course of preparation for Donington Park, and last year in Ireland the meetings at Cork, Limerick, Bray and Phoenix Park were all undertaken by the same operator, who was thus able to instil into his commentaries a certain intimacy with the motor racing world, in two cases his comments being broadcast from Athlone.

The railway companies are awakening to the importance of PA systems from the point of view of advising the travelling public of the various movements of the trains. An installation was recently put into commission at Liverpool Street, and temporary installations have been made for other railway companies during rush periods.

Again, PA systems are used on ships and in hotels for relaying band music, and maintaining communication between the various units, thus assuring the smooth running of the organisation.

Staff calling is another application of some interest. Not many years ago a staff-calling system was installed at the premises of the Alaska Fur Co. (Messrs. C. W. Martin and Sons, Ltd.). It is probable that we are not divulging any secret when we say that the management was a little nervous at this innovation. They thought that this aural method might interfere with the work of their employees, as they would probably look up each time any person was announced, and so waste valuable time. Admittedly this was so for the first two days, but after that the installation became an accepted fact, disturbed no one, and the Alaska Fur Co. placed an order for no less than forty loud speakers to be distributed over their

works. Thus, anyone from the managing director to the office boy could be located without delay, and customers and people from outside brought to the telephone should they be required. Sound equipment is also being used for broadcasting important announcements to the staff, and has potential uses in the case of fire.

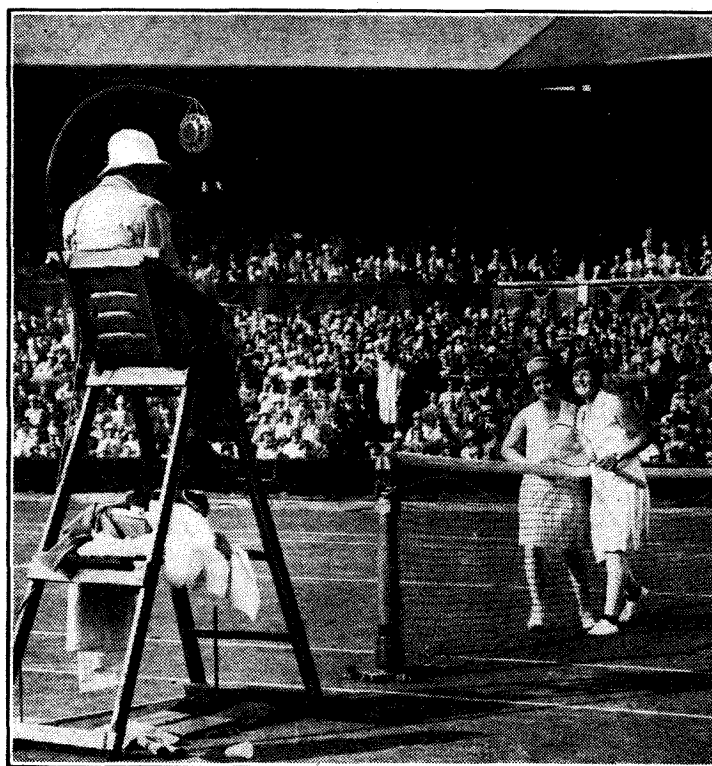
This indicates a new avenue of PA systems, several of which have been installed and are of enormous assistance in various fire stations up and down the country. A typical installation easily accessible to London can be found at Enfield. The apparatus in this case is such that, no matter how much noise is made by the engines and large numbers of people moving about, the crew can be efficiently informed of all the details necessary for their prompt appearance on the scene of the outbreak.

General Evangeline Booth had much to say about the efficiency of the PA system at the conclusion of a 1,000-mile

. On the occasion of the meeting of the Bible Tract Society, when Judge Rutherford's broadcast from Los Angeles had a world-wide audience, we had the pleasure of equipping no less than twenty-two different halls in England and Wales. His speech was taken by land lines over the American continent, broadcast over the Trans-Atlantic Radio Link to this country, and then conducted by Post Office lines to the various points. Sound systems were then put into operation, and each congregation heard every word that was spoken without the slightest trace of distortion.

Uses for Propaganda

Public Address is fulfilling a very useful part in preventing warfare and internal squabbles in at least one country. In 1930 the Air Ministry, who are always ready to appreciate the importance of new developments, equipped an aeroplane for use in Iraq. In August, 1935, it was decided to renovate the equipment, and the old Class A amplifiers, which required a very heavy high-tension supply, were replaced by more efficient Class B amplifiers, the equipment being installed in a new Vickers Valentia troop carrier specially fitted for the purpose. A considerable improvement in intelligibility was obtained.



Wimbledon Tennis audiences will always be grateful for the installation of Public Address Equipment.

tour of the British Isles in eight days. She averaged four meetings a day, and so intensive was the work on this tour that on one occasion the operators were able to erect the apparatus and get it into operation in $1\frac{1}{2}$ minutes from the time of arriving at the meeting place.

The Wimbledon lawn tennis tournaments have been very effectively catered for for many years, and the organisers of that vast spectacle, the Aldershot Tattoo, are very firm adherents to the Standard PA system. For this occasion two 250/350-watt amplifiers are necessary by reason of the fact that the audience is sometimes at a distance of $\frac{1}{4}$ -mile from the loud speakers, and also that an adverse wind may often arise. The power of these amplifiers is so great that under normal conditions, music and speech can be clearly and intelligibly heard at a distance of five miles.

The plane, with its equipment, was immediately shipped to the Middle East. The dissemination of propaganda amongst primitive peoples by means of such equipment undoubtedly has a great future, but an even greater future exists for similar equipment used on the ground to control the landing and taking off of aircraft at busy aerodromes. Such equipment has been tried, and is of the greatest use in preventing collisions.

Thus it will be seen that applications for PA systems in all parts of the world are interminable. New ideas crop up from day to day, and it can be confidently predicted that the systems that have been so useful for major functions during the past fourteen years will steadily become more essential as time goes on, and we can foresee a future where no gathering of any kind will be complete unless some form of sound amplifying system is available.

IN a recent broadcast in the Empire programmes Mr. David Kirkwood, M.P., said of the launching of the *Queen Mary*: "As she crept down the narrow channel of the Clyde, hundreds of thousands saluted her in gratitude—the *Queen Mary*, the emblem of Britain's resurrection."

Many thousands of people who no doubt wish that they could be among the passengers on the maiden voyage of the R.M.S. *Queen Mary* will have to content themselves with listening to the commentary from the Ocean Dock, Southampton, and join in the rejoicings in their own homes. On both the National and Regional wavelengths on Wednesday at 3.15 a description of the preparations for the departure will be given from the ship and embarkation shed. This will be followed at 3.45 by a relay of light music from the deck, and at 4.15 the actual departure of Britain's largest liner will be described from the ship and dockside. The commentator on board will be Mr. George Blake, who, it will be remembered, was at the launching, and Lt.-Commander T. Woodrooffe, R.N., will be on the quay.

In the evening at 9.15 a sound picture will be given from recordings edited by Laurence Gilliam.

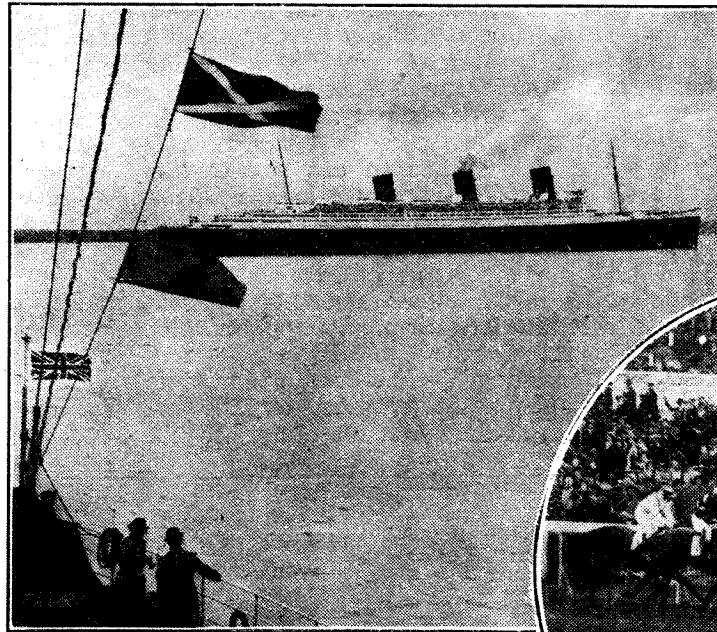
◆ ◆ ◆ "TRANSATLANTIC RHAPSODY"

THE programme, "Romance in Rhythm," which will be given on the National wavelengths at 8 on Tuesday, promises to be of great interest. Geraldo and his Orchestra will be supported by Olive Groves, Webster Booth, the Carlyle Cousins, and others. The



PAT HYDE, who appears in the variety programme from the Regional transmitter at 6.30 on Monday. She is a crooner and can play almost any instrument.

Listeners' Guide for



TWO OUTSTANDING O.Bs. are included in Wednesday's programmes. The "Queen Mary," seen above, from the deck of another liner, lying offshore, will provide one, whilst the Derby—that great annual event to which many people go only to see the cosmopolitan crowd—will be the subject of the other.

orchestra will play George Posford's "Transatlantic Rhapsody," which he has composed in the modern idiom at the request of the B.B.C. Variety Director. This descriptive symphonic rhapsody first portrays the departure of the *Queen Mary* with a kaleidoscope of cheering crowds, bands playing, and sirens blowing, and then through four themes to a finale providing a glimpse of the mighty liner ploughing her way through the seas on a moonlit night.

During the programme the two recently appointed television hostess-announcers, Miss Jasmine Bligh and Miss Elizabeth Cowell, will make their first appearance before the microphone.

◆ ◆ ◆ DERBY DAY

THE "O.B." department will be busy on May 27th, for just prior to the broadcast from the *Queen Mary* comes the running commentary, at 2.45, on the 153rd renewal of the Derby Stakes. It is hoped this year to give even a greater idea of the excitement and noise, and it is proposed to place a microphone at turf level at Tattenham Corner to

pick up the thunder of hoofs and, in the distance, the excited cries of the crowd.

At 9.15 in the Regional programme on Monday, Philip Allingham will give his experiences of working as a huckster on Epsom Downs. His knowledge of gipsies, horse copers, and "gentlemen of the road" is unlimited, and he should bring to listeners who have never been to Epsom Downs the atmosphere of Derby Day.

◆ ◆ ◆ EMPIRE DAY

IN co-operation with the African Broadcasting Company the B.B.C. will broadcast on May 24th a special Empire Day programme at 4 o'clock (Nat.), which will come to this country by the beam telephone service of the G.P.O. from Cape Town. It will consist of impressions of the development of South Africa in a series of broadcasts from points of historical interest. The places to be visited were given in detail in "Broadcast Brevities" last week. The programme will be introduced by the chimes from the Union Buildings at Pretoria, and will end with the

National Song, "Die Stem van Suid Afrika," and "God Save the King."

◆ ◆ ◆ RUDYARD KIPLING

BORN in India and brought up in England almost as an exile, Rudyard Kipling adopted the whole Empire as his province, and by virtue of



his genius as a story-teller compelled the interest of all parts of the Empire. In the National programme at 9.30 on Sunday the first programme broadcast of Rudyard Kipling's works will be given, selected by R. Ellis Roberts and Val Gielgud. Well-known actors will read the appropriate extracts from his works.

◆ ◆ ◆ BASEBALL

FOR those with a knowledge of America's national game, even though it may have been gained only last week during the sports talk by Mr. Carpendale, the running commentary on Saturday at 4.55 (Nat.) will be of real interest. This is the first occasion on which a commentary on a baseball match has been given to British listeners, and will be carried out by "Bob" Bowman from the White City Stadium during the match between White City and Harringay.

◆ ◆ ◆ DARTS CHAMPIONSHIP

A LESS serious contest is scheduled for Thursday, when the final of the Darts Championship in the London Area

the Week

Outstanding Broadcasts

at Home and Abroad

HIGHLIGHTS OF THE WEEK

FRIDAY, MAY 22nd.

Nat., 7.30, Fred Hartley and his Novelty Quintet. 8.25, Royal Opera House Relay. 11.15, Bram Martin and his Dance Orchestra.

Reg., 7.30, Music from the Scottish Past. 9.45 The Alfredo Campanoli Trio.

Abroad.

Berlin (Deutschlandsender) 8.10, Glazounov-Respighi Commemoration Concert.

SATURDAY, MAY 23rd.

Nat., 4.55, Baseball Commentary. 6.30, Sports Talk: Pol. 7, Saturday Magazine. 8.30, Variety. Reg., 7.15, Joe Loss and his Band. 8.30, Concert of British works. 9.45, Matovani and his Tipica Orchestra.

Abroad.

Madrid (EAJ7), 7.40, Madrid Philharmonic Orchestra.

SUNDAY, MAY 24th.

Nat., 4, Empire Day Programme. 7.55, Service from Chelmsford Cathedral. 9.30, Rugby Kipling's works.

Reg., B.B.C. Orchestra (B). 9, The Gershwin Parkington Quintet. ¶The B.B.C. Theatre Orchestra with Lance Fairfax.

Abroad.

Konigsberg, 7.45, "Bajazo" Opera.

MONDAY, MAY 25th.

Nat., Music from the Movies. 8.30, "Liebelel," a play by Schnitzler.

Reg., Variety, ¶Marches, by the B.B.C. Military Band. 9.15, The Huckster's Derby Day.

Abroad.

Frankfurt, 8.10, Liszt Concert.

TUESDAY, MAY 26th.

Nat., Dorothy Hogben's Singers and Players. 8, "Romance in Rhythm." 10.30, Jack McCormick and his Ambassadors Band. Reg., Nicholas Tschaikoff (clarinet) with B.B.C. Orchestra (C). 8, "Liebelel." 10, "Louise"; from Covent Garden.

Abroad.

Kalundborg, 7.30-11.40, Danish Music Society's Festival.

WEDNESDAY, MAY 27th.

Nat., The Derby and *Queen Mary* Relays. 6.50, Julian S. Huxley, talk: At the Zoo—I. 8, Symphony Concert: Isobel Bailie, Harold Williams, B.B.C. Choral Society and Orchestra (B). Reg., 7, "Scrapbook for 1924." ¶Al Collins and his Dance Orchestra. 9.30, Music of Alfred Reynolds.

Abroad.

Strasbourg, 8.45, Symphony Concert from the Salle de l'Orangerie.

THURSDAY, May 28th.

Nat., Public Opinion and Politics—I, talk by Lord Elton. 8.30, "Scrapbook for 1924."

Reg., 7.10, From the London Theatre. ¶B.B.C., Dance Orchestra. 9.30, B.B.C. Military Band.

Abroad.

Paris PTT, 8.55, "Tout va très bien" (Willemetz). Revue from the Théâtre des Nouveautés.

takes place at a well-known South London hostelry, "The Horns," Kennington. A descriptive commentary will be given at 8.15 in the Regional programme.

ANOTHER "SCRAPBOOK"

PAST "Scrapbooks" have been concerned with events within the memory of middle-aged folk; now it is the turn of the younger listener, who will no doubt be surprised to find how many of the major events of 1924 he has temporarily forgotten, for it is this year which is being recalled. "Scrapbook for 1924" is being presented by Leslie Baily and Charles Brewer, assisted either in person or from recordings of notabilities of the year, in the Regional

indeed a praiseworthy and outstanding feat.

"THIS MONTH OF MAY"

THE cast of the May Revue, which comes in the National programme on Wednesday at 10, includes Hermione Baddeley, Richard Ainley, Adèle Dixon, Doris Hare, Jean Sablon and the Radio Three. It will be noticed that this cast is a youthful one, and in addition all the material has been contributed by the young brigade. The *Queen Mary* again comes into the programmes when Adèle Dixon and Richard Ainley sing a number specially written to commemorate the maiden voyage, called "I'm Sailing with You." It is interesting to note that Hyam Greenbaum

preceded by a five-minute introduction.

The fare of the opera lover is very varied in the programmes from abroad during the next seven days. To-night (Friday) Brasov relays "Adriana Lecouvreur," by Ciléa, at 7.35. This opera was first produced at Covent Garden in 1904. Puccini's "La Bohème" will be relayed from the Royal Hungarian Opera by Budapest at 7.30 on the same evening. On Saturday, Stuttgart gives "Don Giovanni" (Mozart) at 12 midnight. Sunday is a very promising day for, among others, Leipzig gives a programme entitled "Lovers from Opera and Operetta," arranged by Delling, at 8 o'clock, with the Leipzig Symphony Orchestra under Theodor Blumer and first-class soloists. Breslau relays "The Mastersingers" (Wagner) at 6.30. On Tuesday Weber's three-act opera "Euryanthe" is being relayed from the Paris Conservatoire by Paris PTT at 8.30. "Cavalleria Rusticana" (Mascagni) from the Royal Theatre, Copenhagen, is being relayed by Kalundborg at 8.

BAND CONCERTS

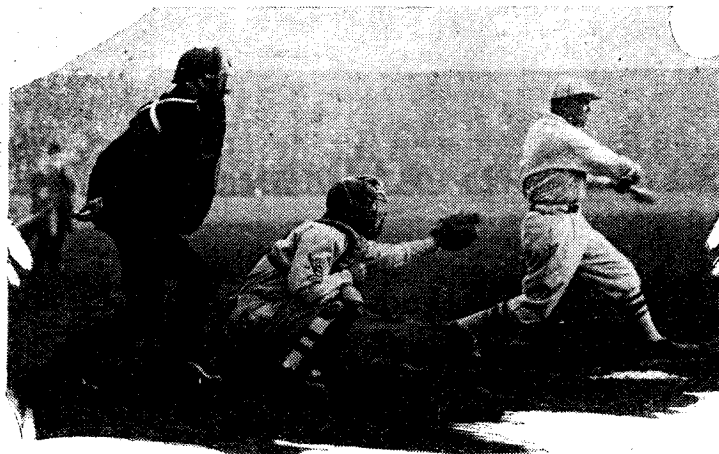
MILITARY bands feature in a number of the programmes during the week. From Strasbourg at 9 on Saturday will be heard a military band from Nancy, and on Sunday from the same station at 4 the Strasbourg 1846 Military Band. At 6.20 on Monday Leipzig gives "The Regiment Marches Away"—a soldier's life in song and chorus.

MISCELLANEOUS

CZECHOSLOVAKIAN folk songs are featured in the Strasbourg programme at 6.30 on Monday.

The second of a series of reports on the world's preparations for the Olympic Games will be relayed from the White City Stadium, London, by the German stations at 6.30 on Tuesday. The programme, which will last thirty minutes, will describe for German listeners the preparations of British candidates for Olympic Games honours.

THE AUDITOR.



AMERICA'S NATIONAL GAME is featured in the National programme on Saturday, when the first running commentary on a baseball match will be broadcast at 4.55. Note the well-padded umpire standing behind the catcher and the batsman.

programme at 7 on Wednesday, and again, Nationally, at 8.30 on Thursday.

It was in 1924 that the British Empire Exhibition was opened at Wembley, King Tutankhamen's tomb was discovered, and the tragic attempt to climb Mount Everest took place which resulted in the death of Mallory and Irving; these memorable events and others will be featured in the programme. One of the items is entitled "Broadcasting's Infancy," during which Captain A. G. D. West will give reminiscences of his experiences during those early days of broadcasting, when such "O.B.s" as the broadcasting of the nightingale's song was

will conduct for the Variety Department for the last time before taking up his new duties as Television Music Director.

OPERA

FROM the Royal Opera House, Covent Garden, to-night (Friday) at 8.25 will be relayed Nationally the second act of Wagner's "Tristan and Isolde." The conductor will be Fritz Reiner.

At 10 o'clock on Tuesday (Reg.) Act III of Charpentier's "Louise" will be relayed. The Orchestral Prelude "Towards the Distant City" precedes this act. The conductor on this occasion will be Malcolm Sargent. Both of these relays will be

Home Recording

HISTORICAL NOTES AND OBSERVATIONS*

EDISON, during his initial experiments in recording in 1876, used a revolving cylinder covered with tinfoil, and it was on this type of instrument that his famous "Mary Had a Little Lamb" was recorded. The tinfoil was discarded in favour of a wax cylinder, which proved more durable and faithful as a reproducer, and this, in turn, was superseded on account of its bulk by the wax disc.

Very soon the need was felt for a record which could be mass produced, and which could stand up to much wear and tear. It was then that the present system of electroplating the wax disc was evolved, and the process is briefly as follows: The record is cut on a highly polished wax disc, the composition of which is still a trade secret. A coating of superfine graphite is blown on to the surface of the wax in order to render it conductive, and the disc is then immersed in a copper-plating bath for about sixteen hours until a fairly robust coating of copper has been formed. From this positive "master," as it is called, several negative masters are made. These are used in the final process of pressing the black composition into the familiar discs which are then put in a lathe to render their edges smooth and true.

Originally the hill-and-dale method of cutting was used, a system which although theoretically superior to the lateral system, which has replaced it, is viewed with disfavour as there is a danger of the needle riding over the hill without entering the dale. The wear on the needle, and also on the record, is considerable (see Fig. 1). In theory the frequency response can be increased without increasing the width of the grooves. The lateral system makes it necessary to attenuate the bass somewhat in order to allow for 100 grooves per inch.

The commercial system, which the writer has described, although wholly satisfactory from the point of view of the large-scale manufacturer, is ruled out for the average amateur, and a simpler method must be sought. Hitherto a metal disc, usually aluminium, and sometimes pewter, has been used, and from the point of view of quality this method is very satisfactory. A sapphire "cutter" should be used, and the standard tracking device, which may be obtained for a few shillings, is quite satisfactory. Contrary to popular belief, aluminium is not cut in recording but indented (see Fig. 2).

The Wear of Fibre Needles

It is in reproducing from aluminium discs that the snag is met in that a fibre needle must be used. Steel trailer needles can be used, but these have the effect of reducing the life of the record to about six playings. Fibre needles wear very rapidly, and the pressure on the needle, which is at first some twenty tons to the sq. in., rapidly decreases towards the centre of the record to some two or less tons. Again, there is the very real risk of the needle settling on two grooves at the same time, introducing obvious complications. Using fibre needles an aluminium disc lasts for about fifty playings.

* This report compiled by Mr. M. E. Arnold embodies the salient points of a lecture given by Dr. R. G. Lemon at a recent meeting of the Radio, Physical and Television Society in London.

In an endeavour to overcome the needle problem a German firm introduced a home-recording system which uses a metal disc coated with bakelite which contains a plasticiser which is expelled after cutting by baking in an oven. Satisfactory recording is possible with this system, and for both cutting and reproducing a steel needle may be used. What might be regarded a disadvantage is that a special oven has to be used for baking, which for satisfactory results must be continued for twenty-four hours.

Bakelite is a substance which, owing to its comparative coarseness, is not ideally suited to recording. Owing to this, and to the fact that the baking process is inclined to melt the minute high-frequency cuts, the HF response on these discs is not very pronounced.

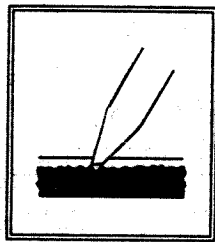


Fig. 1.—With the hill-and-dale method of recording wear on the playing needle is considerable, and a flattened point may ride over the hills and fail to enter the dales.

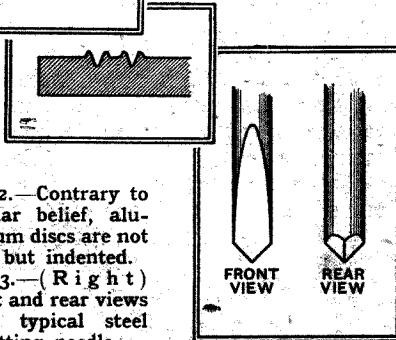


Fig. 2.—Contrary to popular belief, aluminium discs are not cut but indented.
Fig. 3.—(Right) Front and rear views of a typical steel cutting needle.

Recently a further Continental firm placed on the market a recording disc which, after cutting, is hardened by a simple chemical process enabling a steel needle to be used. The disc consists of a dead base of sheet glass which is coated with pure gelatine $\frac{1}{1000}$ in. in thickness. Several advantages are possessed by this disc. It may be cut and played with a steel needle and will stand up to some 200 playings. After cutting it is hardened with a solution of formalin and polished with acetone. During recording a lubricant consisting of wax dissolved in carbon tetrachloride should be used, although this is not essential. The cost of these discs is at present rather high, as with all the other coated types of discs, but with increased production it will no doubt become more reasonable.

The latest recording system with the greatest possibilities and which perhaps evoked most interest in Dr. Lemon's lecture is one evolved by the lecturer himself, and which has not yet been marketed. Dr. Lemon uses a very thin flexible transparent disc about twice the thickness of this paper. The material is a chemical product of paper and is of a laminated structure. The recording process is slightly different from the preceding one, in that the disc is first of all softened with a special solution. The record is then cut, after which it is hardened and polished with two further solutions. The

processing is done in a fraction of a minute while the disc is running on the turntable, and the record may be played back almost immediately. A glass plate is placed on the turntable to act as a "dead" base.

The chief advantage of these discs is in their low price as they can be produced for a few pence, and, of course, several may be stored in the space now taken by one standard disc. Reproduction from them is of high order, as the response at high frequencies is good. Surface noise is almost absent, and they may be played a few hundred times, using a steel needle.

The Cutter

In the last-mentioned system and all the others a standard pick-up is quite suitable for cutting, while the tracking device should be capable of producing about 85 grooves per inch. It is inadvisable to increase this to the commercial standard of 100 grooves per sec., as there is a danger of the grooves interfering with one another at the lower frequencies. A steel cutter ground to the shape illustrated in Fig. 3 may be used, although a sapphire is more durable.

For the purpose of matching and in order to isolate the pick-up from DC, speech should be fed to the pick-up via a transformer or choke filter circuit. In view of the fact that from 1-2½ watts should be used a considerable amount of DC will be present, which if allowed to pass through the pick-up might harm its magnetic system. Aluminium will probably require the full 2½ watts, and with this material the most effective lubricant is ordinary furniture polish.

It may be found necessary to place a weight on the cutting head in order to steady it and to ensure sufficient depth of groove. A powerful motor is necessary, and this may be either a spring motor or an induction type, which must have a steady running speed in order to preserve the pitch. A synchronous type motor will not prove sufficiently powerful in most cases.

There is no reason why, with reasonable care and a good quality amplifier, the amateur should not obtain results at least comparable with commercial recording, and in some cases slightly superior. He has the

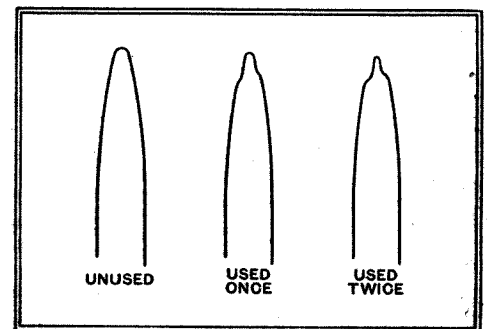


Fig. 4.—Fibre needles wear rapidly on aluminium discs, these sketches show the extent of this with but three playings.

great advantage in that his records do not have to undergo any intermediate process for the sake of mass production, and therefore he is able to minimise, if not entirely eliminate, surface noise and other undesirable features.

BROADCAST BREVITIES

News from
Portland
Place

Testing in the "South Region"

SINCE its hurried visit to the Isle of Wight, the B.B.C.'s mobile transmitter seems to have taken root at Milton, Hants. I understand that it may remain there for another week or two before vanishing to some other quarter to carry out further field strength tests in the new "South Region."

A Compromise?

Up to the moment of writing, experiences have not been too encouraging, and it looks as if the engineers will have to effect a good old British compromise in the final choice of a transmitting site.

If the altitude and general appearance of a site have seemed good, then the geological conditions have proved to be bad, and vice versa. Where the above requirements have all been satisfactorily met, the polar diagram has been too elongated or otherwise misshapen to provide a comprehensive service area.

B.B.C. Field Days

Testing is carried out very thoroughly, more than one transmitting van being in use at certain times. As many as 200 readings may be taken from one site, depending upon the amount of variation in signal strength.

The question of a wavelength for the proposed new station is causing the B.B.C. some concern. The station will not come within the high-power class, but it will have to give a good signal throughout the populous districts of Bournemouth, Southampton, and Portsmouth, while covering as much territory as possible on both sides of this area.

Interval Signals

WHAT has happened to the provincial interval signals?

Not many months ago all the Regions were busy concocting interval signals of their own, each "typical" of the locality. The North Region actually put its own signal on the air (one of the ingredients was York Minster bells). Then it was discontinued, and the much-discussed schemes of the other Regions came to nought.

The B.B.C., I find, are reluctant to discuss this matter. It would be interesting to know the secret history. But my enquiries leave little doubt that the whole idea has been deliberately dropped and is unlikely to be revived.

"Strange to Relate"

ONE of the biggest appreciative postbags for a long time was received after the Charles Brewer miscellany "Strange to Relate." This programme was put on definitely as an experiment, but was such a winner that the B.B.C. has decided on a series. But they are unlikely to start until August.

A Film Musician

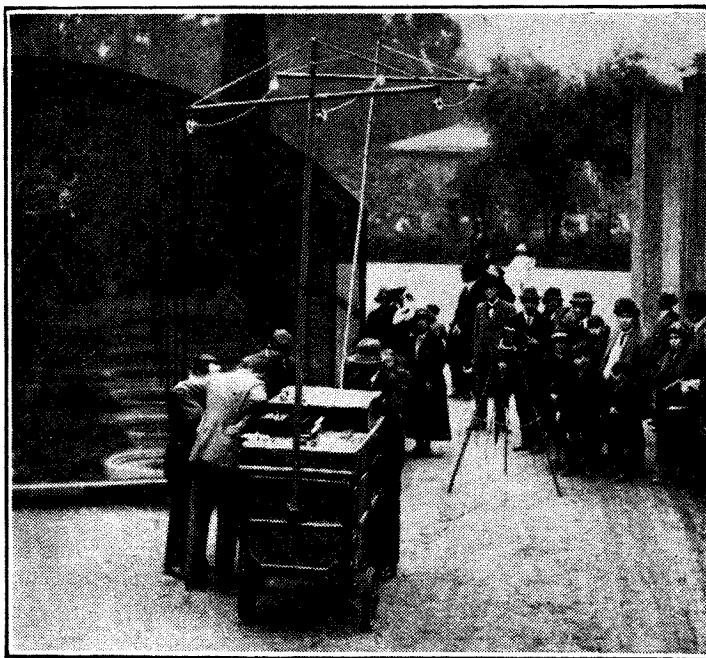
"MUSIC from the Movies" is becoming one of the most popular light orchestral features on the air, probably because the conductor, Louis Levy, as musical director of the Gaumont British Film Corporation, knows all there is to know about the subtleties of ensemble work at the microphone.

In this he differs from many

signed primarily for the Military Band, has a liveliness which is lacking in most of the other studios. Its reverberation period is just over a second.

The Hostess-Announcers

GOOD as they are, the published portraits of Miss Elizabeth Cowell and Miss Jasmine Bligh scarcely do justice to the hostess-announcers who are to charm the lucky owners of television receivers this summer. When I met the ladies in the Green Room at Broadcasting House last week, it was obvious that congratulations should be showered less on them than on the B.B.C. for having secured such a well-matched pair of "good-lookers." Miss Cowell is the brunette, Miss Bligh the blonde.



"THE PERAMULATOR." The unwieldiness of this apparatus used in 1924 for the broadcast from the London Zoo will no doubt be recalled by Captain A. G. D. West in his reminiscences of broadcasting's infancy in "Scrapbook for 1924." Further details of this broadcast will be found in "Listeners' Guide for the week."

eminent musicians who lack "microphone sense." Although they do not actually sport an "L" sign in the studio, they have an anxious time learning the rudiments of studio technique before they can be entrusted with a broadcasting orchestra.

A Lively Studio

Louis Levy and his Symphony give their eleventh broadcast in the National programme on May 25th. Their performances always take place in Studio 8a—on the top floor of Broadcasting House. This is the third largest studio in the building, and, having been de-

Tested by Television

One who witnessed their final high definition test at Hayes tells me that they were complete contrasts on the television screen, yet each "made a perfect picture." When I tell you that their voices are sweet and low, what else is there to be said?

Problems at the Palace

THE B.B.C.'s squad of television engineers are wondering how that august, late-Victorian structure—Alexandra Palace—will react to the emanations of the ultra-short-wave transmitters. It is one thing to tickle the ether in the broad

open spaces with a mobile test transmitter, and quite another to radiate from the confines of an untried building.

"Ultra-Short" Mysteries

Funny stories have already come across from America anent the effects of ultra-short-wave transmissions on coils of wire and steel railings in the vicinity of ultra-short-wave stations, and some strange things have happened at Daventry.

Not long ago miniature ultra-short-wave sets were being used by engineers there for communication between ground squads and men adjusting the aerial arrays of the Empire station. One day workmen in the neighbourhood downed tools hurriedly when they heard a musical programme "coming out of the grass." A piece of wire netting had become radio-active.

Hot-water radiators and cisterns seem to be peculiarly susceptible to the ultra-high-frequencies. If their natural wavelength is anywhere near that of the radiated signal they have been known to perform all the processes of rectification and amplification, and burst into song.

This phenomenon has already caused confusion, not to say alarm, among unsuspecting members of the B.B.C. staff.

The Television Mast

To get back to realities, it is worth noting that work at Alexandra Palace is proceeding steadily, if not rapidly. The mast is now over 100ft. high, the tapering portion having been completed. When finished it will stand 220ft. above the S.E. tower, which is itself about 80ft. in height.

If the "ultra-shorts" were only "optical" in range, the Palace would still have a splendid service area. On top of the tower, i.e., at the base of the mast, it is possible on a really clear day to see the mouth of the Thames.

Yiddish on the Ether

AN all-Jewish broadcast revue is coming shortly. It is to feature Jewish singing of the highest available standard, with sketches of Hebrew life and humour.

I understand that the entire programme will be in Yiddish, but in order that English listeners can follow it there will be explanatory announcements in English.

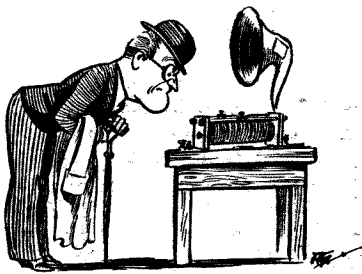
UNBIASED

A Painful Anachronism

WE are all accustomed to the various methods adopted by our large departmental stores to get rid of their merchandise, such for instance as the employment of well-known celebrities, more especially actresses, to sit and simper all the afternoon at our women-folk in the shop and so shamelessly induce them to squander more of our hard-earned money than their ordinary habits of extravagance would lead them to do. I myself, have, in fact, not escaped being pestered and importuned for this purpose by the publicity manager of one of the large stores.

Of all the various artifices adopted, however, I have seen none to exceed in interest one which was originated I believe, by the wireless manager of a well-known shop some months ago. This consisted of an exhibition of receivers of bygone years, people being invited to send in apparatus, and a prize consisting of a modern set being awarded for the most ancient entry. This idea has been successfully imitated in many parts of the country since then, not only in the case of wireless sets but also in the realm of motor cars and other "necessities" of this effete generation.

Finding myself in a large northern town a little while ago, I heard that one of the local shops was advertising one of these wireless shows, and so I duly trotted along and was soon deeply interested in the wealth of magnetic detectors and coherers displayed, to say nothing of various other relics of a bygone age. I was specially interested in a fine example of a coherer-receiver dating back to 1899 which had deservedly been awarded the first prize.



Relics of a bygone age.

I was, however, puzzled that set constructors at that period should have bothered to mark all the terminals so clearly with neat brass tabs bearing the appropriate wording engraved on them. These were naturally somewhat tarnished with age but still readable, and I was marvelling at the elaborate care with which each terminal was marked, when I chanced to observe a pair which were labelled "L.S." For some moments I racked my brains to think what the letters "L.S." must have stood for in the year 1899, when suddenly the truth dawned upon me and I immediately submitted the exhibit to a much closer inspection.

Several trivial little details of construction soon revealed to me that the set was constructed in 1936 rather than in 1899. It was quite obvious that the receiver had been carefully put together and then suitably "aged," like a faked oil painting, to give an appearance of genuineness. Had it not been for the terrible anachronism of fitting it with loud speaker terminals it would have passed muster even under my eagle eye. I am sorry to say that examination of the other exhibits revealed further examples of this duplicity, although, to the untrained eye, they would appear genuine enough.

It grieves me, however, that there should be wireless enthusiasts so lost to all sense of decency, and so lacking in the knowledge of how to obtain a new wireless set without paying for it, that they should stoop to such doubtful measures. I think also that the people who run these exhibitions are somewhat to blame for the obvious carelessness with which the exhibits are apparently judged, and, in order to teach them a lesson, I intend to send in an entry when the next exhibition comes along. My exhibit will be a receiver of 1884 vintage consisting of a simple Hertz resonator-ring fashioned out of a child's iron hoop. I am bound to obtain first prize as there cannot very well be a set of earlier date, and I shall then, of course, make a public exposure of the whole affair, as it is my intention to fit the Hertzian ring with A.V.C.

Scottish Listeners' Mecca

ALTHOUGH I sometimes despair of the younger generation which falls so far below my own in the matter of deportment and general conduct, to say nothing of parental respect and other Spartan virtues, I am compelled grudgingly to admit that some of them, at any rate, possess germs of initiative and intelligence.

An instance of what I mean occurred to me the other day while I was meandering through the Caledonian Market in search of wireless parts with which to build a new radiogramophone which I have in mind. As many of my readers will know, this ancient market, although founded long before the days of wireless, and having nothing to do with Scotland, is known nowadays as the Scottish listeners' Mecca, or, more correctly, as the Mecca of the London Scottish listener. The reason for this, I am told, is that in almost every one of the rows of stalls in the market, there are to be found one or more wireless sets bellowing forth the various European programmes at full volume, and it is possible to hear any item by dashing up and down the market to the vicinity of the appropriate set, thus saving yourself money.

I was trudging laboriously up and down long lanes of merchandise with my pockets bulging with the several bargains

I had already secured, when I was startled to hear the various programmes from each of the loud speakers in my vicinity drowned by overpowering morse. Some powerful transmitter was apparently calling a station, the call sign of which was the same as my own initials. I was

By FREE GRID

amazed, however, when I heard the station giving as its own call sign the initials of one of the little Grid Leaks whom I had left prowling round another part of the market.



An improvised transmitter.

My curiosity aroused, I commenced to read the message which was being slowly and haltingly spelt out amid a torrent of expletives pouring from the lips of the various stallholders who were trying frantically to tune it out. I was astonished to find that the message concerned myself and requested me to go immediately to the south-east entrance to the market.

Arriving at the rendezvous I found the little Grid Leak churning out the message by tapping two pieces of copper wire together. These were attached to the primary circuit of an ancient ignition coil which he had borrowed from a stallholder who specialised in motor parts. For aerial he had used the neighbouring iron railings, while the chassis of a well-used 1904 Benz was employed as a counterpoise.

It appeared that Mrs. Free Grid, who was in the millinery department of the market, had exhausted her supply of cash in acquiring the latest creations in head-gear and being refused credit in rather forceful terms, had by a fortunate chance, seen her offspring in the distance. Naturally she had pounced upon him and bidden him find me at once.

The unfortunate characteristics of deceit and slothfulness which he had inherited from his mother, caused him to retire out of sight and make a pretence of searching for me, an admittedly laborious task which he was reluctant to undertake. Fortunately the qualities of initiative and scientific-mindedness which I have contributed to his psychological make-up resulted in his hitting upon the idea of summoning me by wireless in the manner described. As he had quite correctly assumed, the signals of the untuned spark transmitter which he had temporarily erected were picked up by all the sets in the market irrespective of the wavelength to which they might be tuned.

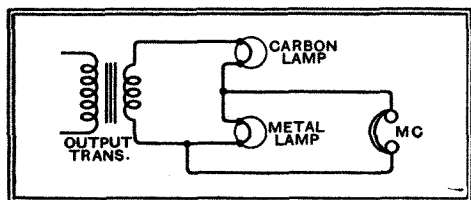
Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

"Simplified Volume Expansion"

FOR loud-speaker reproduction it is doubtful if the waste of power in the Crosley "Auto-Expressionator" is justified, while the conception of a "bridge" circuit which never approaches balance seems strange.

From a purely experimental point of view—for nothing would reconcile me to expansion without rule-of-thumb compression at the transmitter—a simple potentiometer across the output transformer consisting of one carbon filament lamp and one metal lamp, with moving-coil earphone across the latter, seems to work quite well, while the noise-signal ratio is excellent. It is not easy to find suitable carbon lamps, and, having broken my selected specimen, I am disappointed in not being able to send the quantitative measurements I had intended.



Still simpler volume expansion: circuit arrangement described by Mr. Gerald Sayers.

Some old Christmas-tree lamps are carbon. When looking for carbon filaments in a batch of old lamps I find the quickest check is (1) to measure the cold resistance of lamp; (2) substitute an equivalent wire resistance R ; (3) pass a measured current sufficient to cause a glow; (4) again substitute R . If the current falls at 4 compared with 3 we have the requisite characteristic. Ware, Herts. GERALD SAYERS.

Recording

YOUR Editorial (*Wireless World*, March 6th, 1936), discussing the limitations of the present system of lateral recording, and also indicating the advantages of the "hill-and-dale" method, together with the correspondence on the same subject, have induced me to write this belated letter.

Through the courtesy of your columns I have already given some particulars of "hill-and-dale" recording (*Wireless World*, July 12th, 1935), and, therefore, I will not reiterate those remarks here; nevertheless, I would like to add some further comments later, but I will deal now with several of the other outstanding points that occur to me.

First, I agree with Mr. Wright (*Wireless World*, April 3rd, 1936), that many of the old Blue Amberol phonograph cylinders are capable of excellent sound-quality when electrically reproduced; indeed, ardent devotees of the Edison phonograph maintain that in certain solo vocal recordings the "phono-cut" (hill-and-dale) cylinder is still unsurpassed to-day. I am sure it will interest these enthusiasts to learn that a pick-up has been specially designed for reproducing such cylinders. The inventor and patentee is my friend Mr. A. F. Sykes, and the number is B.P.439,800, but the device is not yet marketed. It can be adapted to reproduce the *Pathé* "hill-and-dale" cut disc, which,

by the way, no readers appear to have mentioned in correspondence. I understand that these discs are still manufactured and sold in France.

Secondly, I wish to remind the critics of the lateral recording system of certain difficulties that prevent this present method from giving of its best, which can be better than is usually supposed possible. Is it generally known that 90 per cent. of the records purchased are played on mechanical (acoustic) gramophones, mostly portable models? This figure has been given to me and I cannot guarantee its accuracy, and, to be frank, I think the estimate is somewhat exaggerated, but whilst the gramophone companies have to cater for any large percentage of mechanical instruments the quality will remain unstabilised. Also, the reason for not obtaining the optimum quality with electrical reproduction is the lack of co-ordination in the frequency response curves of recording and reproducing apparatus. The general trend of the recording response curve is well known, but empirical adjustments in the reproducer by tone-control devices are inadequate, and should be superseded by a definite tone-correction. However, the problem is that there is no standardisation; different companies vary their recording response curves slightly, and with such other variable factors as alteration of stylus cutting angle and shape, etc., the need for a stated policy is apparent.

But I have given above the main reason for the non-publication of such data, namely, the mechanical gramophone for which the aim must be high efficiency, as the amplification available is limited, and there is no appreciable control of either volume or frequency response.

Thirdly, there are several other recording systems that are often suggested for the improvement of sound-quality, e.g., constant amplitude and variable groove-pitch recording, but they are all hindered by the necessity of designing for mechanical reproducers.

In passing, it may be worth while to mention that an unbreakable and almost unwearable gramophone record was invented some time ago by Capt. R. J. Craig, which is still unexploited commercially. It is a lateral-cut, cellulose acetate disc, reinforced with aluminium and plays with a steel needle.

This leads me to my last point, i.e., the current topic of, shall we revert to "hill-and-dale" recording? From a purely technical and theoretical aspect the system has immense advantages, but it must be realised that records are intended for universal use, which again brings in the snag of the mechanical reproducer. This, unfortunately, is not the only adverse consideration, as the moving-coil pick-up for reproducing these discs is a much more delicate instrument than the sturdy moving-iron type, and will not stand rough handling by members of the lay public. It can be seen that under these unfavourable reproducing conditions to expect a complete change-over to the system is premature, as it would mean the scrapping of much plant and established technique.

Thus, financial considerations influence the march of progress, and the best we can hope and clamour for is the gradual issue of these "fidelity" discs.

Iford, Essex. DONALD W. ALDOUS.

The Service Engineer

WITH reference to letters from "Fair Play" and others regarding status of pay of service engineers, whilst the state of affairs complained of is undoubtedly true to a great extent, it is the natural result of a new and fascinating subject attracting many men to it who were already trained in some other trade or profession and absorbing large numbers of others who had no specific training.

How many of these can really claim to be qualified in radio engineering, or have taken the trouble to educate themselves in order to maintain the status in question? I venture to suggest that the claims of 90 per cent. would not bear investigation. The remedy lies with radio engineers themselves; there is no fairy godmother to wave a magic wand and give their calling the dignity of a profession with wages to correspond.

The National Radio Engineers' Association was formed a year ago by radio engineers who realised the danger of "dabbling" being allowed to continue unchecked, and would doubtless be able to achieve much for radio engineers if adequately supported.

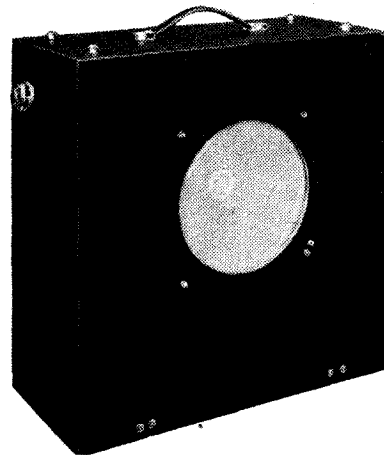
The hon. secretary of this Association, 34, Bush Elm Road, Romford, Essex, would, I know, be very glad to forward full particulars to anyone interested.

London, S.E.13.

S. HILLS.

HEYBERD PORTABLE AMPLIFIER

THE carrying case of this complete PA equipment measures $19 \times 19 \times 8\frac{1}{2}$ in., and divides diagonally into two self-supporting stands, one for the loud speaker and the other for the amplifier. The latter is designed for operation from AC or DC mains, and consists of an input triode, resistance-coupled to two output pentodes delivering 6 watts to the 10in. PM loud speaker.



Heyberd Model 136-P portable PA equipment.

There is provision for gramophone and microphone reproduction with a single centre-tapped fader volume control. A tone control is also included.

The price complete with microphone and twenty yards of cable is fifteen guineas, and instruments are also available for hire.

RANDOM RADIATIONS

Standard Sets?

THE wireless industry in general seems to have set its face resolutely against having anything to do with standard sets. From some reports, by the way, one might gather that the Ullswater Committee had recommended that standard sets should be marketed. Actually it did nothing of the kind; it remarked mildly that standardised receivers were sold at a low fixed price in Germany, and that a similar policy in this country might be of benefit to the poorer classes. "We suggest that its adoption should be seriously considered by the B.B.C. and the wireless trade." Glancing again at the report we find that the Committee regards the standardised set as being probably something on the lines of those recommended by it for use in schools. Of these latter they say, "All that is wanted is good reception of the National and the local Regional stations." Well, if the Committee seriously believes that there is any big market awaiting a low-priced set of the comparatively insensitive and unselective type that will suffice for purely local reception, I am afraid that they are a long way from understanding the attitude of those who buy receivers in this country.

They All Want Foreign Stations

I have no hesitation in saying—and I think that anyone who deals in wireless sets will confirm my view—that the vast majority of purchasers judge a wireless set by its ability to receive foreign stations. This doesn't mean once the set has been bought it is going to be used for long-distance work most of the time. On the contrary, the odds are that its owner will make use of the local Regional and National stations for the bulk of his listening. But even though he may seldom reach out for foreign stations, he does insist upon being able to do so when inclined that way. Partly for that reason, and partly because the prices of efficient small sets are probably nearly as low as they could be if standardisation were adopted, I honestly do not see any future for a "People's Receiver" in this country.

I am speaking, of course, of low-priced sets when I say that there is no demand for purely local receivers here. The high-priced set designed for reception of the local stations with the best possible quality is a different business altogether. There are plenty of people who want something of that kind and generally they can afford to have as well a set capable of receiving foreign stations.

The Relay Position

The radio industry is also opposing the Ullswater recommendation—this time it really was a recommendation—that the wired relay services should be taken over by the Post Office. Here I do not think that their arguments are quite so good. What they come to in a nutshell is that relay subscribers are already paying 1s. 6d. a week for the service that they obtain, and that if and when they are able to pay another 1s. they can become owners or hirers of receiving sets which will enable them to take their choice of dozens of different programmes. That is quite true so far as it goes, but it leaves out one aspect which I do regard as of particular importance. So long as the

wired relay services are conducted on a commercial basis by companies it is only natural that they will be found in thickly populated areas where they are likely to pay, and nowhere else. As I have mentioned before, one of the possible benefits of such a service is that it may enable people living in parts of the country where direct reception is poor to hear the home programmes. Since most of these areas are thinly populated wired relay services are unlikely to come their way unless the General Post Office is in control.

Car Radio Means Better Drivers

IN the United States car radio is very much more popular than it is in this country, the reason possibly being that over there full programmes of entertainment are receivable from a variety of stations on summer afternoons when people take to their cars and the open road. Whether that is so or not, the wireless set has become almost a standard fitting on every new car now sold in the United States. The American traffic authorities have found that so far from increasing the danger of driving by distracting the motorist's attention, the car wireless sets appear to have increased the safety of the roads. I think that most of those who have done long lonely drives will agree that the greatest danger is that one may become, if not exactly drowsy, at any rate less than normally alert in mind owing to the semi-hypnotic effect of the ribbon of road that incessantly rushes to meet one's eyes. I have found myself that the use of a wireless set does definitely prevent this, and also that it considerably decreases the fatigue of a long journey by oneself. I quite agree, though, with the proposal that it should be illegal to use car radio sets in built-up areas. For traffic driving these days one does want the fullest aid of one's ears as well as one's eyes.

A Thought on Television

WHEN television comes along those who have facilities for looking-in or tele-viewing, or whatever you like to call it, will have an experience which is the direct opposite of that which happened to most of us when the silent film was replaced by the talkie. If you remember, glamorous creatures who had captured our hearts by their beauty and their graceful movements in the pre-talkie days were apt to give us horrible shocks when their lips were unsealed by the advent of the sound-track. I recall reading a critique of the first talking film made by one lady whose admirers in her silent days were legion. "From those lovely lips," said the writer, "there came sounds reminiscent of the harsh metallic clash of grinding gears." And now we are going to see some of those who hitherto have won their way into our affections by their glorious singing or their delightful diction, though they themselves have remained invisible. Shall we get shocks such as those which accompanied the revolution in the cinema? Or shall we find our entertainers as easy to look at as to listen to?

"Diallist" Has His Doubts

Some will come with flying colours through the ordeal; others will benefit enormously from the fact that they can make themselves

By "DIALLIST"

seen; comic artists, for instance, will be able to make the fullest use of gestures, facial expressions and other "business" dear to them. But I am not at all sure that I want to see on the viewing screen many of those who are now voices and nothing more. Great singers, for instance, are often a sore disappointment when you see them in the flesh—and by flesh I mean flesh. When the tenor who always sounds as if he must be a handsome young stripling turns out to be a fat little man with a bald head and knock-knees; when the soprano whose lovely voice has always been a joy to you goes through the most agonised facial contortions in her efforts to reach a top note, won't you wish that you had stuck to gramophone records or the radio set.

It Does Seem a Pity

I RECENTLY heard from two young relatives of mine who are serving in India that each of them has purchased a brand-new wireless set. Naturally, I was delighted to hear of this, but my pleasure was considerably damped when I read further and found that both had been obliged to purchase American sets "because there is nothing of British make obtainable out here that will do what is necessary." Doesn't it seem too ridiculous for words? India is part of the British Empire. She has already got her own broadcasting system under way. And what our own people who are serving in the country want is a completely reliable short-wave and medium-wave set sensitive enough to bring in not only the Indian programmes sent out by medium-powered transmitters but also the Empire transmissions on the short waves. There is a huge potential market in India, but our manufacturers appear to be paying small regard to it. Possibly they don't realise that in some provinces—the Punjab, for instance—electrification is proceeding rapidly owing to the construction of dams and power plants, and that the market for mains receiving sets is pretty large now, and will become rapidly greater. The Americans have jumped in whilst our manufacturers are still hesitating, and unless the latter can act quickly they are likely to find that they have lost what should have been a wonderful market for their wares. I wonder how many of our radio sales managers know that the population of India is very nearly as great as that of the whole of Europe?

LISSEN MODEL 8130

SIMILAR in appearance to the Model 8113, this new "straight" receiver includes a short waverange covering 18.5 to 54 metres. It is designed for AC/DC mains, and the circuit consists of an HF pentode, triode detector, and output pentode. A moving-coil loud speaker is used, and the price of the receiver is nine guineas.

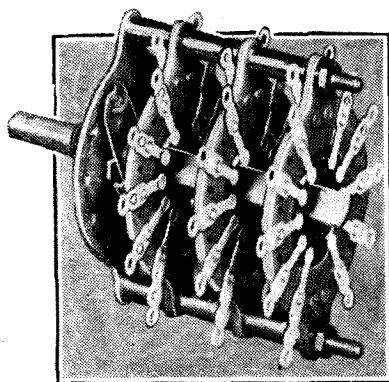
New Apparatus Reviewed

Recent Products of the Manufacturers

B.T.S. SWITCHES

A NEW series of wave-change switches designed especially for use in HF circuits, has been introduced by British Television Supplies, Ltd., Faraday House, Charing Cross Road, London, W.C.2. They are made as separate units, and any number can be ganged together and operated by a flat rod passing through their centres. This rod is insulated from all switches.

A thin plate, approximately zin. in diameter, made of the best quality Paxoline, carries the fixed contacts, while the moving, or selector, contact is attached to a rotatable centre disc measuring rin. in diameter.



B.T.S. wave-change switches arranged as a three-bank assembly.

Specially selected phosphor-bronze is employed for the contact springs, which have a heavy coating of silver, but the lug on the selector part is solid silver. The head of the springs, against which the silver lug presses, is dished inwards so that the spring is forced outward by the lug.

The movement is small but quite adequate to ensure a good electrical connection and the spring is not unduly strained, so that the switches should prove quite reliable.

The switch units are made in three standard types, viz., two-pole five-way, three-pole four-way, and four-pole three-way. In addition, any unit can be fitted with a centre metal disc for short-circuiting the coils not in use. Other styles will, it is understood, become available as occasion demands.

All switch assemblies are fitted with a front plate on which is a special locating arrangement, so that no ambiguity arises regarding the various positions.

The switches are exceptionally well made, and they can be confidently recommended.

Prices are quite reasonable considering that these new switches are unquestionably of a very high grade. For example, a two-pole five-way type costs 5s. 9d., while the locator plate fitted with a flat spindle up to 18in. long costs about 3s.

RAYMART MICRO-VARIABLE CONDENSERS

THIS new range of small variable condensers includes receiving types for short- and ultra-short-wave use, also some built to meet the special requirements of low-power transmitters.

They are assembled on a ceramic insulat-

Selection of Raymart new short- and ultra-short-wave condensers.

ing material described as R.M.X., whose dielectric properties appear to be particularly good at the very high frequencies. Brass is used throughout in their construction save for the steel balls in the bearing, but these are electrically short-circuited and so do not give rise to noise in operation.

In the receiving types normal spacing of vanes is employed, but those models intended for transmitting use have triple spacing.

The specimens tested and examined include one each of 15, 40, and 100 m-mfds. for receiver use, and one transmitting model of 40 m-mfds., nominal capacities. All have relatively low minimum capacities, the VC15X and the VC40X having but 2.5 m-mfds. each at minimum and 11.5 and 35 m-mfds. respectively at maximum. The VC100X measures 4.5 m-mfds. at minimum and 87 m-mfds. with the vanes fully meshed.

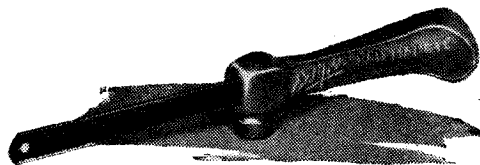
The transmitting model, TC40, had the relatively high minimum of 7 m-mfds., but this is inevitable, as it is considerably longer than the others, while its maximum capacity was 35 m-mfds.

These condensers are surprisingly cheap, yet they are very well made, and all the receiving models are fitted with an extension spindle for ganging.

The VC15X costs 1s. 4d., the VC40X 1s. 7d., and the VC100X 1s. 10d., while the price of the TC40 transmitting model is 3s. 6d., and they are obtainable from the Raymart Manufacturing Co., 44, Holloway Head, Birmingham, 1.

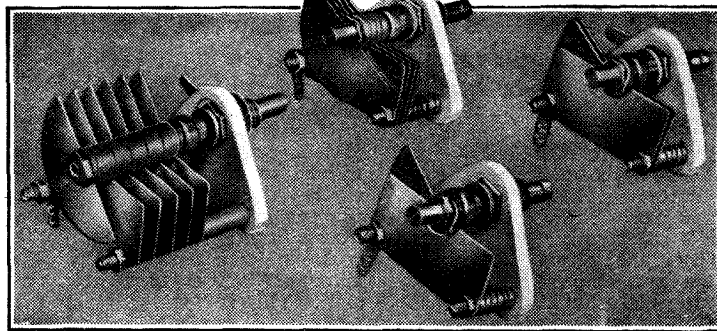
ECLIPSE HACKSAW BLADE HOLDER

EVERY user of a hacksaw has occasionally been confronted with the problem of cutting panels from a sheet of ebonite or metal and finding it necessary to remove the blade and improvise a handle by wrapping a rag round one end. Usually the inevitable happens and a slight twist results in a broken blade and sometimes a cut finger into the bargain.



Eclipse Pad Handle for hacksaw blades.

To meet such occasions as these, James Neill and Co. (Sheffield), Ltd., Composite Steel Works, Napier Street, Sheffield, 11, have evolved the Eclipse Pad Handle. Its construction is very simple yet quite ingenious and it provides adequate control of



the blade when cutting, with, of course, comfort in handling.

The handle is made of durable aluminium alloy and is hollow, so allowing the blade to be inserted, if required, to a depth of 4½ inches.

Another advantage is that broken hacksaw blades can be utilised to good purpose where otherwise they would most likely be scrapped.

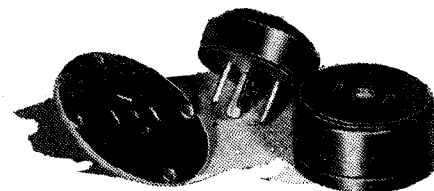
The Eclipse handle will hold also special pad saw blades, warding files, and several other tools, so that it forms a most useful addition to the tool kit.

The price, including one Eclipse 8in. blade, is 1s. 3d.

BULGIN LOUD SPEAKER EXTENSION SOCKETS

IN order to avoid confusion between mains power points and loud speaker extension wall sockets, A. F. Bulgin and Co., Ltd., Abbey Road, Barking, Essex, have introduced a new moulded bakelite wall socket that takes a plug fitted with flat pins.

This is, of course, intended for the loud speaker extension, or for any other purpose



New Bulgin flat-pin loud speaker extension sockets and plug.

in connection with the wireless apparatus, other than its power supply.

They are made in two- and four-pin types, the latter being for use where a field supply is required for energising the loud speaker.

All contacts are fully protected as the springs are well below the narrow slits in the bakelite cover which enclose also the connecting terminals. Provision is made to bring the wires out through the side of the socket.

The fitting is neat, unobtrusive, and measures only 1½ inches in diameter. A perfectly sound electrical contact is made with all pins on the plug and the price is 1s. for the two-pin socket and 1s. 6d. for the four-pin model. Plugs to match cost 9d. and 1s. 3d. each for two- and four-pin styles respectively.

This new fitting is made also for chassis mounting, in which form it somewhat resembles a valveholder, only the sockets are of the flat spring type. It costs 9d. in the two-pin and 1s. in the four-pin type.

Recent Inventions

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

MOTOR CAR SETS

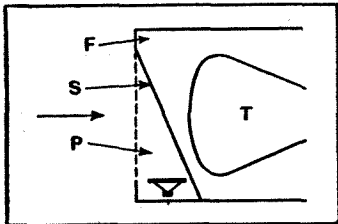
TO provide for wave-band switching in a motor-car set, a number of different "strip" aeriels are coupled to a common tuning-inductance through a switch-arm, which is controlled by a foot pedal from the front of the car. The number of the aerial "strips," and the value of the primary inductance in circuit, are both regulated by the position of the remote-control pedal.

C. W. Renz. No. 2020656. (U.S.A.)

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TELEVISION CABINETS

USUALLY the cathode-ray tube is set back some distance from the front of the cabinet and is viewed through a protecting sheet of glass. The loud speaker cannot then be mounted close to the tube because the sounds would be obstructed by the glass shield. So it is placed on one side, and the cabinet becomes more bulky than it otherwise need be.



Space-saving arrangement for mounting of a cathode-ray tube and loud speaker.

To overcome this difficulty, an opening P is formed in the frame F, surrounding the cathode-ray tube T, and a sheet of glass S is set at an inclination so as to leave space to accommodate the loud speaker L. The sound reproduction is in this way given free access to the open air. Alternatively the cathode-ray tube may be mounted vertically, and viewed through a reflecting mirror, the upper screen then being similarly inclined to provide the space required for the loud speaker.

General Electric Co., Ltd., and L. C. Jesty. Application date February 1st, 1935. No. 442323.

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"AUTOMATIC" TUNING

WHEN a superhet receiver is slightly mis-tuned, a "false" intermediate frequency is produced owing to the fact that the incoming carrier is sufficiently strong to force its way through the preselector circuits and "beat" with the local oscillations. But since all the tuning-condensers are ganged together, the local oscillator circuit will obviously not then be set to produce the true intermediate frequency.

According to the invention the

false frequency thus produced is utilised to bring the set automatically into tune. In operation, the tuning knob is first given a "searching" rotation, in the course of which the circuits pass through the true point of resonance. This is "marked" by the charging of a condenser, and on the return swing of the controls, which is effected automatically, by a ratchet movement, the movement is arrested so that the circuits are set and maintained at the resonant point.

E. K. Cole, Ltd., and G. Bradfield. Application date September 14th, 1934. No. 442897.

o o o o

RECEIVING SETS

A SYSTEM of "selective admission" is used which depends upon the receiver being tuned, not to the centre of the carrier-wave, but to one side of it, so that only one of the two usual side-bands is accepted. This narrows the tuning and so sharpens the selectivity of the set, any slight falling-off in signal strength being offset by subsequent amplification.

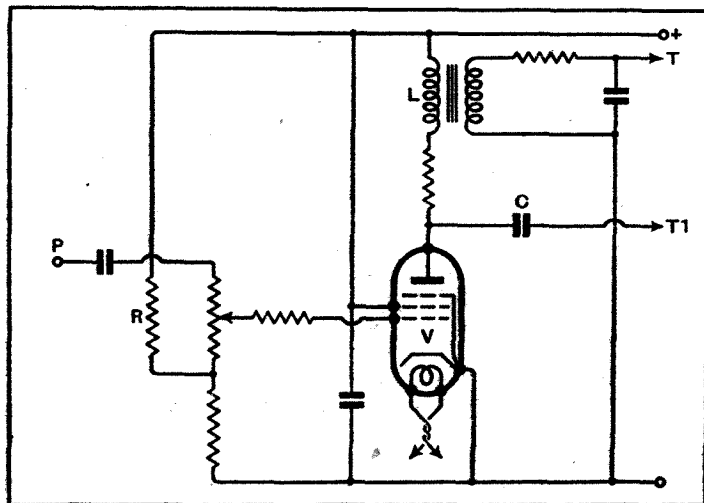
The invention is directed to special methods of tuning, and particularly to the way in which reliable automatic volume control is ensured in a receiver of this type.

Hazeltine Corporation (Assignees of H. A. Wheeler). Convention date (U.S.A.) October 3rd, 1933. No. 443270.

o o o o

TELEVISION RECEIVERS

PICTURE signals, and the usual synchronising impulses, are applied at P to the control grid of a pentode valve V, so that the picture voltage is positive and the synchronising voltage negative. Since the grid is already positively charged, through the resistance R, only the synchronising signals



Circuit for separating synchronising and picture voltages in television receiver.

produce any change in anode current. The comparatively low-frequency "framing" impulses are separated out across the inductance L, and are fed at T to the appropriate pair of scanning-electrodes in a cathode ray tube. The higher-frequency "line" impulses similarly pass by way of the condenser C to the terminal T1, which feeds the second pair of scanning electrodes. Both sets of impulses are substantially free from any admixture of the picture signals.

T. M. C. Lance, D. W. Pugh and Baird Television, Ltd. Application date August 24th, 1934. No. 443031.

o o o o

WIRED WIRELESS

RELATES to high-frequency systems in which several programmes are distributed simultaneously on different carrier-waves over the same wires, each subscriber being able to select the particular item he requires. When the electric power supply-mains are used as the distributing network, it is necessary to keep the "carrier" frequencies fairly low, say, between 25 and 45 kilocycles, with a minimum separation of 10 kc/s between each to allow for the required side-band width. It is then found that fluctuations in signal strength occur, due to interaction between the outgoing or direct currents and those reflected back from the end of the supply lines.

According to the invention this is avoided by terminating the feed-lines by a resistance equal to the surge impedance of the line, in series with a condenser having a smaller impedance at the carrier-wave frequency.

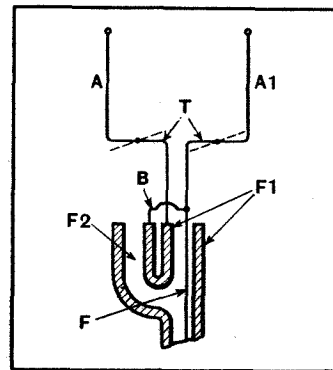
P. P. Eckersley and R. E. H. Carpenter. Application date July 26th, 1934. No. 443366.

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SHORT-WAVE AERIALS

TWO short-wave aeriels, A, A1, spaced half a wavelength apart in order to give a directional effect, are coupled to a tubular

transmission or feed-line F, F1, in the manner shown in the figure. The aerial A1 is connected to the centre wire F of the feed-line, and is also tapped at B to a bifurcated part F2 of the main sheath F1, which, in effect, forms a matched



Short-wave directional aeriels with matched impedance feeder.

impedance coupling. The aerial A is connected directly to the outer sheath F1. The transverse leads T between the feed-line and the two aeriels are arranged to oscillate with a current node halfway along their length, so as to reduce any radiation likely to distort or interfere with the desired directional effects of the main aeriels.

W. S. Percival. Application date July 19th, 1934. No. 443018.

o o o o

AIRCRAFT NAVIGATING BY WIRELESS

SIGNALS from a radio beacon (a) by a frame aerial, and (b) by a trailing wire or other non-directional aerial. The pick-up from the frame aerial is combined with that from the second aerial, first in phase and then in phase-opposition, and the resulting currents are fed through a commutator to a pair of Neon lamps. These indicate any deviation of the aircraft from the straight course by a dimming of the port or starboard light.

F. E. Nickel (Assignor in part to R. A. Keirle and W. E. Phillips). No. 2007477. (U.S.A.)

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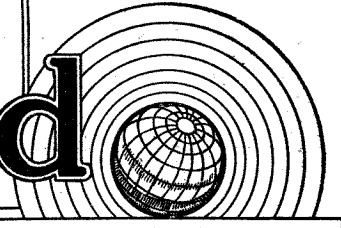
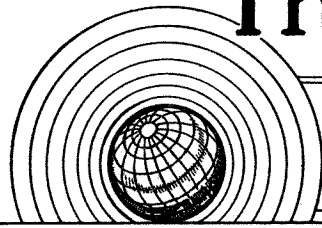
RELATES to a radio-navigation system of the overlapping beam type, in which the pilot of an aeroplane is kept to a given course by flying along the centre line where he hears a continuous note, or gets a zero-centre indication on his instrument.

The invention consists in the use of piezo-electric crystals to distinguish between the two note frequencies which predominate if the pilot deviates to port or starboard of his proper course. The crystals may be arranged in a Wheatstone-bridge circuit, which only remains balanced so long as the craft keeps on the proper track.

B. J. Chromy. No. 2022459. (U.S.A.)

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As many of the circuits and apparatus described in these
pages are covered by patents, readers are advised, before
making use of them, to satisfy themselves that they would
not be infringing patents.

CONTENTS

	Page
Editorial Comment	525
The "Queen Mary's" Wireless Equipment	526
Microphone Transformer Design and Construction	529
Current Topics	531
Training the Aircraft Operator	532
Unbiased	535
Screening	536
Listeners' Guide for the Week	538
Rothermel-Hammarlund "Super Pro."	540
On the Short Wave	543
Random Radiations	544
The New Ferranti Sets	545
Readers' Problems	546
Broadcast Brevities	547
Recent Inventions	548

EDITORIAL COMMENT

Standardisation

Have Transmissions Reached Finality ?

IN an editorial comment last week we put forward reasons why it was undesirable that the B.B.C. should be called upon to sponsor a standard receiving set. We explained that one outstanding argument why those responsible for the transmitting side should never attempt to standardise receivers was that transmission and reception are closely associated and, unless you are prepared to standardise transmission, you cannot contemplate standardising the receiver.

We have already been taken to task for this statement, for we are told that it is absurd to suggest that a change could now take place in the organisation of broadcast transmission which would render any standardised set designed to-day obsolete at a later date. Our critic is evidently convinced that the transmission side is already standardised.

It would be possible to discuss this subject at very great length, but this is not necessary for the purpose of justifying our objections to a standard set sponsored by the B.B.C. We need only draw attention to some circumstances which might contribute to bringing about a change in transmission conditions.

The first consideration affecting the design of receivers is the wavelength of the transmitters, and although to all appearances the wavelength bands of our broadcasting stations are standardised for the present, we cannot see that there is justification for the assumption that these wavebands are permanent. We know that, for the television transmissions, wavelengths of the order of 7 metres are to be utilised and that the sound transmission to accompany vision will be on an ad-

jacent wavelength. It is also well known that from the point of view of quality broadcasting the use of these very short wavelengths has advantages, and it has already been suggested that when the sound accompanying television is put out, the quality may prove to be so good as to make the public dissatisfied with the quality on the normal wavebands.

Television, it is at present considered, will be broadcast for limited periods only, but the wavelengths having once been allotted for television and its accompanying sound, these channels will not be utilisable for other services and, therefore, there will be no objection from the point of view of other users of the ether if transmissions in these channels are as continuous as the present broadcasting service.

Shortage of Channels

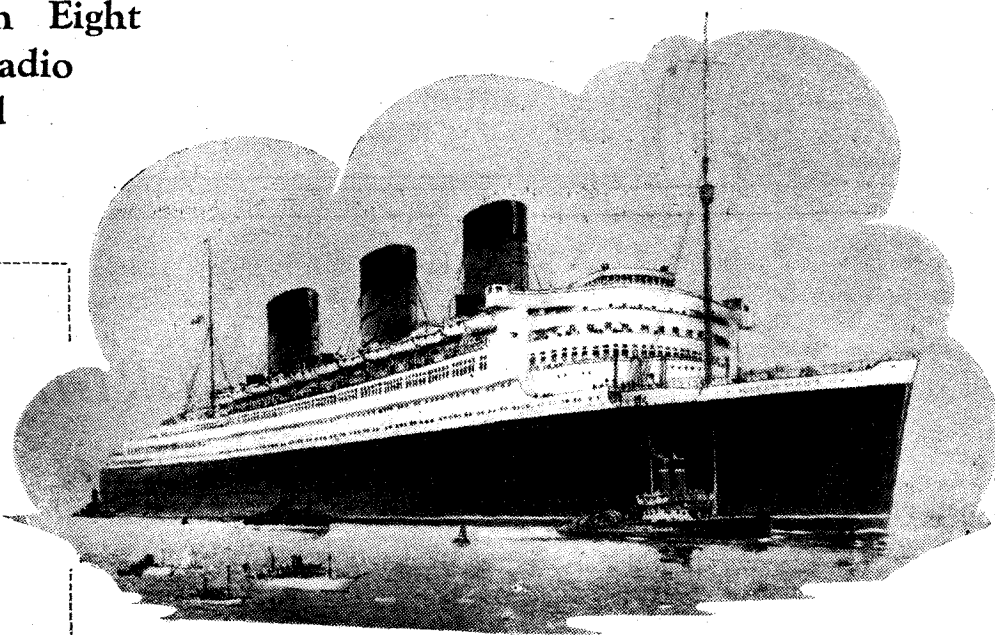
Is it not conceivable, perhaps even probable, that by the time the whole country is served with television transmitters the idea of transferring regular broadcasting mainly to wavelengths of this order will be a matter of general discussion, both amongst technicians and those who are responsible for allotting channels in the ether? If receivers of the future must be designed to receive television and sound on wavelengths of the order of 7 metres, it will become increasingly difficult to justify monopolising other wavebands, as at present, for general broadcasting requirements. As the importance of wireless for all kinds of purposes increases, the present greed of broadcasting services for more and more channels will quite likely have to be curbed.

These comments serve to show that broadcast transmission has by no means reached a state of standardisation and will justify our contention that the B.B.C. must not commit itself to sponsoring a standard type of receiver.

The Queen Mary's Wireless

Simultaneous Working on Eight Channels—Ship-to-Shore Radio Telephone—Broadcast and Direction-Finding Equipment

THE "Queen Mary," the finest and most stately liner ever put into service is equipped with the most elaborate wireless installation to be fitted in a passenger liner. The powerful short wave transmitters will have a world-wide range while at all times her passengers will be able to speak to nearly every continent by wireless telephone without leaving their cabins. In this article we give a brief description of the apparatus and its scope.



The majesty of the vessel is well conveyed by this impression from the artistic pen of Frank Mason.

PARTICULAR interest attaches to the wireless equipment on the new Cunard-White Star liner *Queen Mary*, as it is one of the largest and most elaborate ever installed in an ocean-going vessel. The ship is equipped for short-, medium-, and long-wave communication, and for manual and high-speed automatic handling of messages. A wireless telephone service linked up with the European and American telephone systems, is provided for passengers' use and facilities are available for transmitting and receiving broadcast programmes, and relaying them to all parts of the ship.

Owing to the heavy wireless traffic that

tively easy of solution since the transmitters and receivers can be separated by many miles and all messages handled from a central control station.

When the transmitters and receivers are installed on a ship, and most important of all, their respective aerials are so very close to each other, very special precautions are required to avoid mutual interference. And added to this, transmitters of very high power are installed.

A successful solution has, however, been found in the case of the *Queen Mary's* equipment, and it is possible to work eight separate channels of communication, *i.e.*, four transmitting and four receiving, simultaneously and en-

about 400 feet away from the receiving and central control room. Contrary to what one would expect in a high-power transmitting station, there is an entire absence of noise. In fact, there is no running machinery whatever, the generators being accommodated in a special compartment adjoining the engine room of the ship.

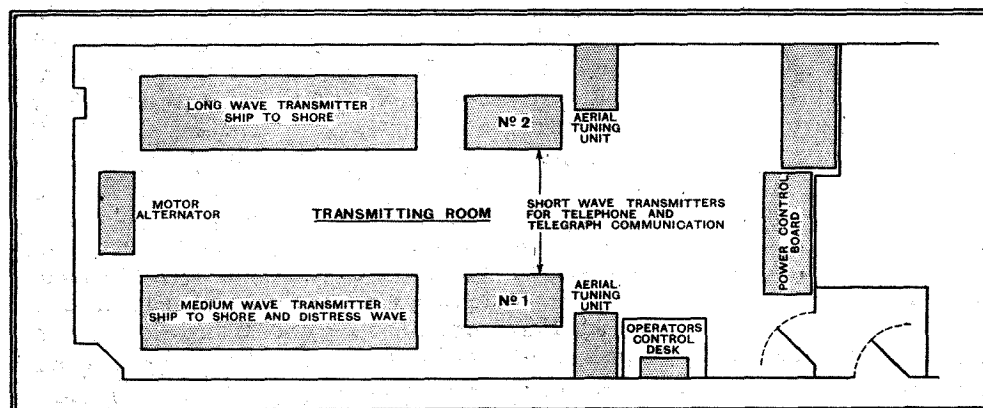
Power is generated as alternating current and the necessary DC for the transmitters is obtained from large gas-filled rectifiers.

There are four transmitters in all: one for the long waves covering a band of 1,875 to 2,727 metres, a medium-wave transmitter for the 600- to 800-metre band and two for the short waves. These can be employed on all the wavelengths allotted for ships' use between 17 and 96 metres and for telephony or telegraphy.

"Spot" Waves

Normally the *Queen Mary* will work on 32 "spot" wavelengths which have been selected after consultation with land stations and other authorities. There will be nine for telephony and eleven for telegraphy on the short-wave band, five for medium-wave telegraphy and seven for long-wave telegraphy. The call sign is GBTT.

As previously mentioned, the receiving and control room, where all incoming and outgoing messages are handled, is situated some 400 feet away from the transmitters, and adjoining it is the main accepting office where radio-telegrams are handed in and passengers can make their arrangements for radio-telephone calls.



The four transmitters are housed in a separate room and disposed as shown here.

will have to be handled by the *Queen Mary's* operating staff it is most desirable that independent communication with several land stations should be possible at the same time, and this is an exceedingly difficult problem in the restricted space of a ship. On shore it is compara-

tirely independent of each other. Each transmitter has a number of "spot" waves, and any of these can be employed at a moment's notice by an ingenious system of wavechange not hitherto incorporated in marine wireless installations.

The transmitters are housed in a room

As will be seen from the plan showing the layout of this room, running almost the full length are the operators' desks, each equipped with headphones, telegraph key and typewriter. In front of each is a control panel for two receivers covering between them all the wavelengths in use. From these desks the operators can start up or stop the transmitter, or can instantly change from one of the allotted "spot" waves to another. During busy hours four operators will be employed, while, when traffic is particularly heavy, high-speed automatic transmitting and receiving equipment can be brought into use.

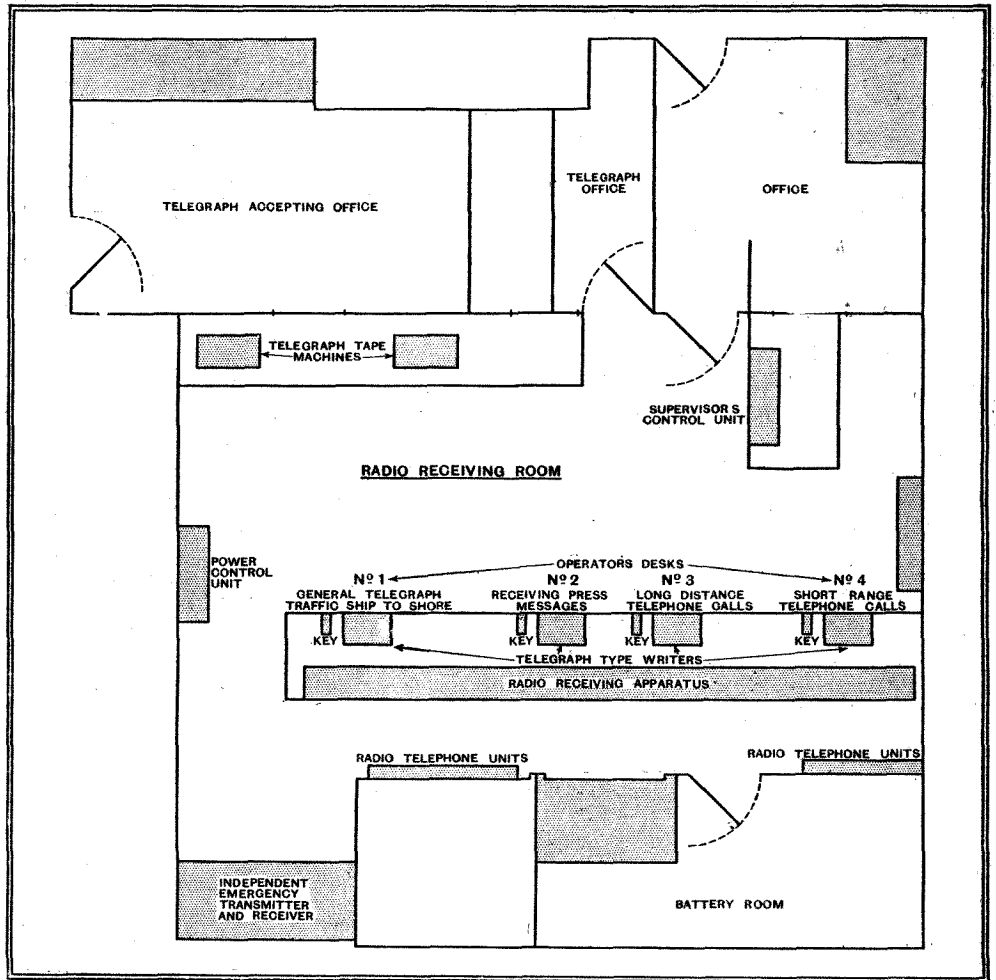
Radio Telephone Service

The various receivers are located behind the control panels that face each operator's desk, and access is obtained to them from the rear. Receivers of very high selectivity are fitted, which is a very necessary feature in view of the provision for multiplex working.

The ship-to-shore wireless telephone is also controlled from this room and is constantly under the attention of an operator whose principal work is to maintain a satisfactory volume and give the users the best possible service.

Secrecy on the ship's wireless telephone for passengers' use is ensured by adopting a system of "speech scrambling" so that private conversations are quite unintelligible to anyone listening on these wavelengths.

At the far end is an emergency transmitter and receiver built as a self-contained unit and worked by a large accumulator battery. It has a range of at least 500 miles, and is, in fact, of the same power and type usually installed as



Plan of the receiving room from where the transmitters, some 400 feet away, are operated by remote control.

the main wireless equipment of the average ship.

It is not possible to give any figures regarding the maximum range of the

Queen Mary's transmitters since all long-distance work will most likely be carried out on the short waves, and under favourable conditions her signals should be



Occupying the centre of the receiving room are the operators desks and each has two receivers covering the full band of wavelengths in use.

The "Queen Mary's" Wireless—heard in all parts of the world. The power of these is amply sufficient to ensure constant communication with Europe and America at all times.

An interesting feature of the receiving room, though it is not apparent to the visitor, is that walls, ceiling and floor are lined throughout with copper sheet so as to reduce to a minimum any interference with reception that might arise from the large number of electric motors and other electrical apparatus in the ship.

essentially a wireless unit, it is not operated or controlled from the wireless room but, being a navigation instrument, is under the charge of the ship's navigating officers; it employs a loop aerial. Bearings can be taken on any fixed shore station up to distances of 300 to 400 miles.

Another interesting feature is that while two of the ship's motor lifeboats are fitted with wireless sets of the type required by the Board of Trade, they are equipped also with small wireless telephone sets such as are employed by trawlers. As

aerial, say 20 feet, the milliammeter is observed to show an appreciably lower reading on a certain station which has previously been found to provide a steady non-fading signal, one has fairly conclusive evidence that a definite improvement has taken place.

As the indications given by the meter for each aerial or each alteration can be recorded, there is no need to hurry in the fear of forgetting the previous conditions, and so ample time is available for re-trimming the input circuit if this course seems likely to be necessary.

WHILST working a superhet converter in conjunction with a normal broadcast receiver, there are one or two points which should receive attention if really first-class performance is to be obtained from the combination.

Short-wave Converters

The first of these is that the receiver should be properly trimmed and adjusted for use with the converter. The fact that it was properly "in gang" when receiving the medium waves is no guarantee that it is properly ganged for use with the converter, since the removal of the aerial from the receiver may throw the aerial circuit out of tune.

Trimming can best be done with an actual signal received via the converter. Only the aerial trimmers need be touched, and an increase of capacity will always be required.

Having obtained the best signal strength in this way, further amplification can be had by using the reaction control of the set. For very weak signals the reaction control can be increased until the receiver is almost oscillating. To pick up a carrier-wave the receiver may even be allowed to oscillate momentarily.

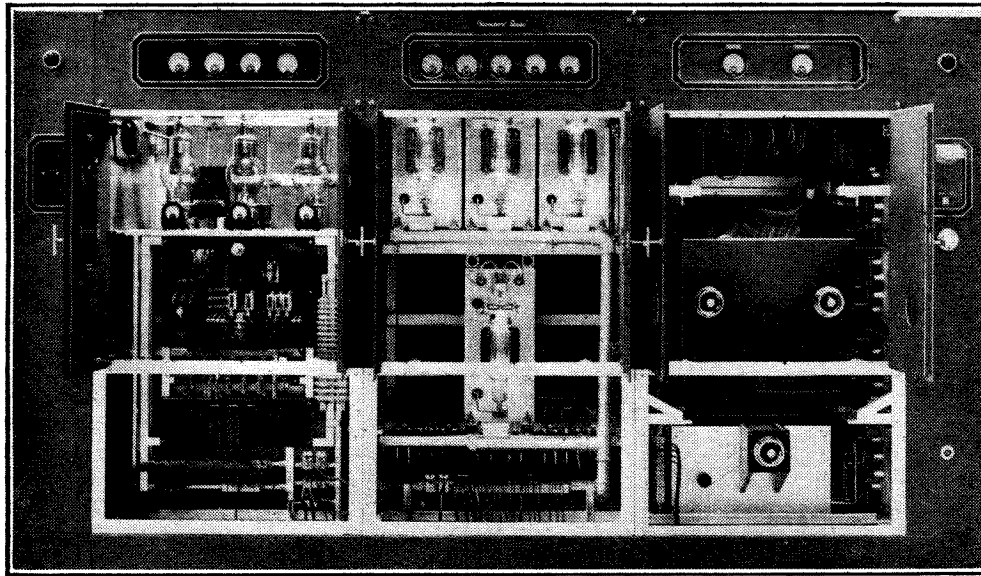
ATTENTION to input circuit design of short-wave receivers has virtually cured medium- and long-wave interference on the short waves through shock excitation of the receiving aerial, even in those districts where field strength from

Vice Becomes Virtue

the local station is considerable. But when a short-wave set is in use there are times when one wishes to hear a broadcast (perhaps a weather report) from the local station, without going to the trouble of changing over to a medium-wave set or plugging in the requisite medium-wave coil.

By connecting the aerial direct to the grid of the detector valve—that is, ignoring all intermediate couplings such as condensers, etc.—the local station should be heard with sufficient power and clarity to enable the weather forecast or other item to be received; in effect, one depends for reception on shock-excitation, and turns what is normally a vice into a virtue.

In the case of a short-wave superheterodyne it is sometimes possible to pick up the local station programme by the simple expedient of touching certain parts of the grid circuits with the finger.



One of the high-power transmitters installed in the "Queen Mary," showing, left to right, rectifier unit, valve unit and coil unit.

A very elaborate aerial system is installed consisting of no fewer than ten separate aerials, five for receiving and four for transmitting, while there is an emergency transmitting and receiving aerial for 600 metres. Some idea of the spans possible on a boat of this size can be gauged from the fact that the main transmitting aerial for long-wave use is some 500 feet long.

Although the radio direction-finder is

their operation is very simple communication could be maintained in the absence of a skilled operator. This is believed to be the first occasion on which ship's lifeboats have been fitted with wireless telephony as well as the customary telegraph sets.

The whole of the ship's wireless equipment, main, emergency and lifeboat sets have been supplied and will be operated by the International Marine Radio Company. H. B. D.

HINTS AND TIPS

Practical Aids to Better Reception

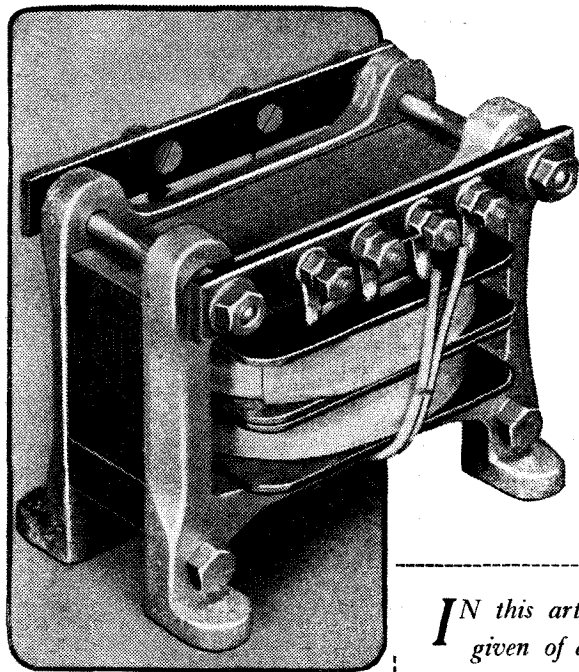
IN the past the task of comparing the relative efficiencies of different aerials has usually been, to the average amateur unprovided with measuring equipment, a very unsatisfactory and often fruitless one. The usual method is to tune in a weak station while using one aerial and then, as quickly as possible, to change over to another, but, unfortunately, by the time the change-over has been made, one often becomes rather hazy as to just how weak the station was before. Coupled to this uncertainty was the difficulty, in pre-superhet days, that any change in the aerial system was liable to upset the reaction adjustment, besides almost invariably necessitating retuning.

Comparing Aerials

With present-day receivers, however,

the aerial has little effect on tuning and still less on regeneration. Moreover, AVC, although making aural methods of comparison impossible, provides us instead with the means of actually measuring visually the relative "goodness" of different aerial systems. Any form of tuning indicator, provided it has some form of arbitrary scale, will serve the purpose, but a milliammeter is best.

Now, it is a well-known property of AVC that any increase in the overall efficiency of a receiver, such as may be brought about by improving the aerial system, will result in the same output being produced from the speaker on a given signal with less amplification from the variable- μ controlled valves, so that their anode current will fall. If, therefore, after increasing the height of an



Microphone Transformer

Design and Construction of a Model Suitable for Use with Transverse Current Carbon Microphones

By H. B. DENT

IN this article constructional details are given of a microphone transformer having a good frequency response and designed especially to enable the best results to be obtained from high-grade carbon microphones.

THE design of a microphone transformer can be treated very much in the same manner as for an output transformer, for it is customary to operate it with an artificial load across both the primary and the secondary windings; the former being the microphone, which may be regarded as a resistance, while for the latter we have a volume control usually taking the form of a potentiometer. Thus it can be regarded as coming within the category of a loaded transformer and the design work resolves itself mainly into choosing the correct ratio for matching the primary and secondary loads.

In order that the transformer shall give a satisfactory bass response, the reactance of the primary ought to be at least twice the impedance of the microphone at the lowest frequency it is required to reproduce. For a practical design it is not economical to choose a frequency much lower than about 50 c/s as the primary winding would have to be of relatively high inductance to suit a microphone of the transverse current type, such as that described in *The Wireless World of January 11th, 1935*.

Frequency Response

Incidentally it was for use with this, and carbon microphones of similar type, that the transformer described here is primarily intended.

In preparing the design of the transformer it was not only necessary to take into account its frequency response, but consideration had to be given to the fact that only the simplest of tools will be available for its construction. A design that entailed access to complicated coil-winding machines was obviously out of the question, but the possession of a simple hand-operated winder is considered a justifiable assumption, for if one is not already available there should be no difficulty in constructing a simple winding machine

from odds and ends in the spare parts box.

A good bass response will be assured if the primary inductance is adequately large, but in order to obtain a satisfactory treble output it is essential to divide the windings into several sections and interleave the primary and secondary sections so as to obtain the tightest possible coupling between them. Unless this practice is adopted only those turns on the primary and secondary that are adjacent couple really well, the others become progressively less effective as the spacing increases and this gives rise to what is termed *leakage inductance*. It must suffice here to say that as a rule the effect of an appreciable leakage inductance is to lower the general level of the output at the higher audio frequencies. This is usually most marked in loaded transformers.

For obvious reasons there is a limit to the amount of sectionalisation that can be employed in a home-constructed transformer, as, if this policy is carried too far, the work becomes exceedingly tedious and provides many more points where mistakes can be made in the interconnection of the separate coils.

Experience has shown that dividing the windings into six sections and cross connecting them as shown in Fig 1 results in a very satisfactory transformer, and with a response at 10,000 c/s only about 25 decibels below that at 100 c/s. Expressed

as a voltage ratio this amounts to 1 to 1.33 only. It is about the smallest change in sound level that can be determined by the average individual. A transformer with a characteristic as flat as that signifies may reasonably be regarded as good. It is indeed far better than the response characteristic of the style of microphone with which it will be used, and there is no point in aiming for anything better.

Having considered all the factors entailed in the design of this transformer, we might now turn our attention to the question of how to convert them into practical form in the easiest and most economical manner.

A ratio of one to ten has been chosen as being most suitable and best for the purpose for use with a microphone having an impedance of about 500 ohms. It allows a 50,000 ohms volume control to be employed between the secondary and the first amplifying valve and gives the correct matching. The primary inductance is fixed at about twice the impedance of the microphone at 50 c/s.

It now only remains to choose a suitable core size, determine the winding details and the manner of assembling the various sections. The working out of all these factors is a tedious business and will

not be gone into here in detail, but there are many short cuts, based on previous experience, that can be adopted with the assurance that the finished product will give the desired performance.

In the present case we employed Sankey No. 30 stampings for the core, which, when built-up to a thickness of one inch, give approximately 4.8 cubic inches of iron and an iron path $5\frac{1}{2}$ inches long. The abacs in the Radio Data Charts will enable the number of turns to be de-

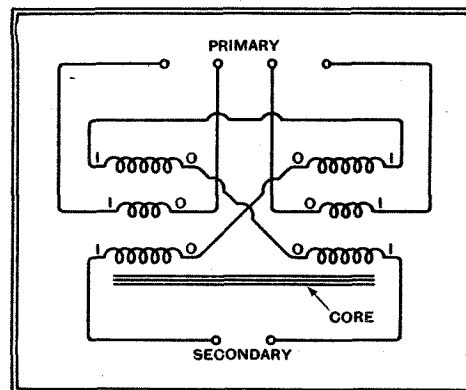


Fig. 1.—Primary and secondary windings are divided in sections and cross connected as shown here.

Microphone Transformer—

terminated to give an inductance of 3 henrys on a core of this size, but it should also be taken into account that some 20 mA or so of DC, representing the current from the polarising battery, will be flowing through the winding.

With a primary of 1,100 turns and a small air gap in the core its inductance will not be far short of the required value, and from this we can ascertain by simple arithmetic that the secondary will need 11,000 turns when the ratio is 1 to 10.

Winding Details

Accommodating these turns in the winding space available is also determined by calculation and, after making allowance for insulation, bobbins, etc., it has been found that No. 36 SWG enamel covered wire can be employed for the primary and No. 40 En for the secondary, which is probably the smallest gauge that can be handled conveniently when using a hand-operated coil winder.

Two bobbins are employed and each has two secondary sections and one primary, the latter being sandwiched between the other two. The bobbins each measure $2\frac{3}{8} \times 2\frac{5}{8} \times 9/16$ in. with a 1×1 in. hole in the centre for the core. The thickness of the end-checks must not exceed $\frac{1}{8}$ in. at the most, leaving an inside width of not less than $\frac{7}{16}$ in.

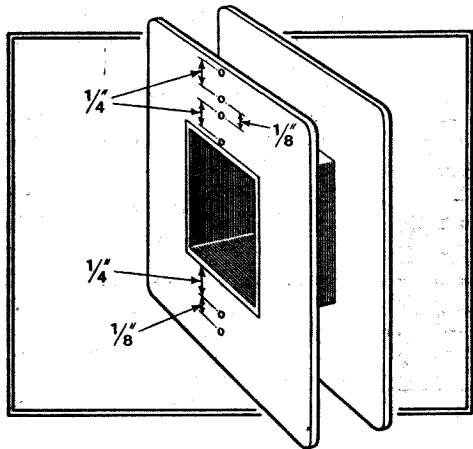


Fig. 2.—Position of the wire holes in one of the two bobbins. Both are drilled in the same manner.

Holes for the end of the various coils are drilled before windings, one is at the bottom, the next $\frac{1}{4}$ in. up, then one more $\frac{1}{8}$ in. from this, and another $\frac{1}{4}$ in. from the previous one. These are all on one side, while in the same check but on the opposite side of the large square centre hole, two more wire holes are drilled, the first $\frac{1}{4}$ in. from the bottom, and the other $\frac{1}{8}$ in. up from it. The sketch in Fig 2 should make this quite clear. The holes should be at least $\frac{1}{8}$ in. in diameter. Where the spacing is $\frac{1}{8}$ in. only, the holes should be staggered slightly.

The side with four holes is to pass in and out the ends of the two secondary sections, while the two on the other side of the core lead out the primary section's ends. The other bobbin is prepared in the same way.

A block of wood is now cut to fit the

centre of the bobbin and a hole drilled to pass the shaft of the coil winder. Two end-pieces to stiffen and support the bobbins during the winding must now be prepared, and long slots, about $\frac{1}{4}$ in. wide, cut to expose the small wire holes on each side. Having reached this stage the winding can be commenced.

The first section has 2,750 turns of No. 40 SWG En wire. Two layers of thin paper cut exactly the width of the bobbins (inside), are then put on, and following it comes 550 turns of No. 36 SWG En wire, and with the inner and outer ends brought out through the holes on the opposite side of the core tunnel. Two more layers of paper are now required for insulation and the next secondary section, also of 2,750 turns of the No. 40 gauge wire, wound on.

The other bobbin is wound in exactly the same manner and in the same direction. The lead-in and lead-out wires ought to be of heavier gauge than the primary and secondary wires, as this fine wire may break where it passes through the holes in the bobbin. Short lengths of No. 38 SWG enamel, or DSC, soldered to the fine wire and with two or three turns on the bobbins will answer quite well.

The core, which contains 72 pairs of Sankey No. 30 Stalloy stampings, is assembled with all T pieces on one side, the U's being on the other with the joints butting together. There is no intentional gap in the core, but the butt joints do in practice give a small gap that is adequate for our purpose. When assembling the stampings it is a good plan to reverse the order of two pairs in the centre of the core to rigidly position the stampings and lock the core together.

Bobbin Connections

The diagrammatic drawing of the windings in Fig. 1 shows the outer ends of the windings on the two bobbins adjacent, and they have been marked in this way to indicate that the bobbins are assembled with the winding direction opposite in the two cases, and this has been done to bring all leads on the outside, or exposed, faces of the bobbins so that the various sections can be more readily identified when the time arrives to interconnect them. As the order of connecting them is shown so clearly in the aforementioned sketch it is quite unnecessary to give a written description.

It only remains now to fit end-plates to clamp the core and also two terminal strips, one with two and other with four terminals. They can be fitted as shown in the illustrations of the finished transformer.

The primary sections are brought out to separate terminals so as to enable them to be joined either in parallel or in series. The series connection is required for microphones of the order of 500 ohms imped-

ance, and the parallel arrangement can be used with low resistance models, say of 125 ohms or less. Connected in this manner the primary inductance is approximately 1.0 henry.

In order to confirm that the inductance and response characteristics of the transformer are as envisaged, a series of measurements have been made on the model illustrated. The primary inductance, when measured with 3.5 volts AC

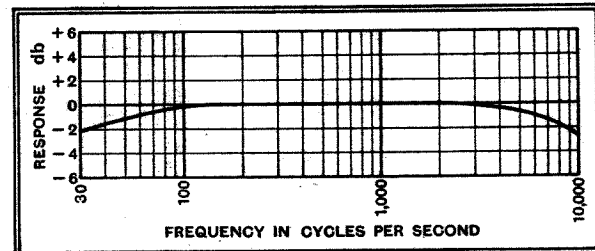


Fig. 3.—Response curve of the transformer with artificial loads of 500 ohms and 50,000 ohms across primary and secondary respectively to simulate working conditions.

across the winding, is 4 henrys. Under working conditions much smaller RMS volts will be developed across it so that it might be reasonably safe to assume that the requisite value of 3 henrys for the primary will be available in practice.

The frequency response curve of the transformer is given in Fig. 3 from which it will be seen that it is but one decibel down at 50 c/s. It may therefore be regarded as quite satisfactory for all normal requirements. The primary resistance is 110 ohms, and that of the secondary 2,650 ohms. These values may vary slightly with different models.

Finally, a word about materials. Stalloy stampings are made by Jos. Sankey and Sons, Ltd., and the bobbins, or material for making them, can be obtained from Sound Sales, Ltd., which firm will supply also cast aluminium end-plate for clamping the core. They supply stampings also.

About 10 oz. of No. 40 SWG enamel and just over 2 oz. of No. 36 SWG enamel wire is required for the windings.

Radio Amateur Call Book. Published by Radio Amateur Call Book, Inc., 608, South Dearborn Street, Chicago, Ill., U.S.A. Price \$1.25. Foreign \$1.35.

This very useful reference book is published quarterly, and the March, 1936, edition is No. 1 of Volume 17, the call book being first introduced in 1921.

It contains the call signs of almost every amateur wireless transmitting station in the world with name and address of the licensed operator. A list is given of the international prefixes for identifying the country in which the station is located, also the international "Q" code signals.

A useful section is that relating to commercial stations working on the short waves. Wavelengths are not given, but only the station's call sign and country are included. In all there are just over 300 pages.

Copies of the Radio Amateur Call Book magazine can be obtained from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex, and the price is 6s. post free.

Current Topics

EVENTS OF THE WEEK IN BRIEF REVIEW

French Wireless Developments

THE new French Government is said to be distinctly favourable to wireless as a means of disseminating news and views, and people of all political creeds are hoping for great developments, both in sonic and visual broadcasting. It is hoped that the present P.M.G. will be permitted to carry on with the good work which he has begun and that he will not have to vacate his office on account of his political views on less important matters.

Bulgaria Wakes Up

UP to the present Bulgaria has been far from prominent among the nations of Europe so far as broadcasting is concerned. All this is to be changed as a result of the building of two new stations at Stara-Zagora and Varna. The Postal authorities are reported to be behind the erection of these two stations. It is hoped that in the course of the year the projected 100 kilowatt station near Sofia will be heard on the air.

Empire Broadcasting

IT seems that in future greater use is to be made of the shorter of the short waves employed by the Daventry Empire transmitters. G.S.H. on 21.47 megacycles (13.97 metres) will be on the air for 6 hours daily from 12 noon to 6 p.m. B.S.T., while G.S.G., 17.79 megacycles (16.86 metres), is to have an 8-hour daily schedule commencing at 12 noon and continuing until 6 p.m. B.S.T., and again from 9.40 p.m. to 11.45 p.m. B.S.T. These schedules commenced on Sunday, May 24th.

Burmese Radio Service

IT is reported that the new beam wireless telephone station at Mingaladon in Burma is completed. It links Rangoon with Madras, and then the world via the latter station. The equipment is of the latest design, and is capable of working on a wave-range of from 15-100 metres. Seven aerial masts have been erected. There are two entirely separate aerials for the purpose of minimising fading by switching from one to the other.

Cruising "Hams"

AMATEUR transmitters have always been noted for the way they foster the social spirit. Their latest plan is to organise a British radio amateur's cruise to Holland and Belgium. It is

hoped to hold it during the August Bank Holiday week-end. It will probably be attended by enthusiasts from all parts of the country who, on reaching the other side, will make personal contacts with their Dutch and Belgian amateur confreres.

Five-metre Field Day

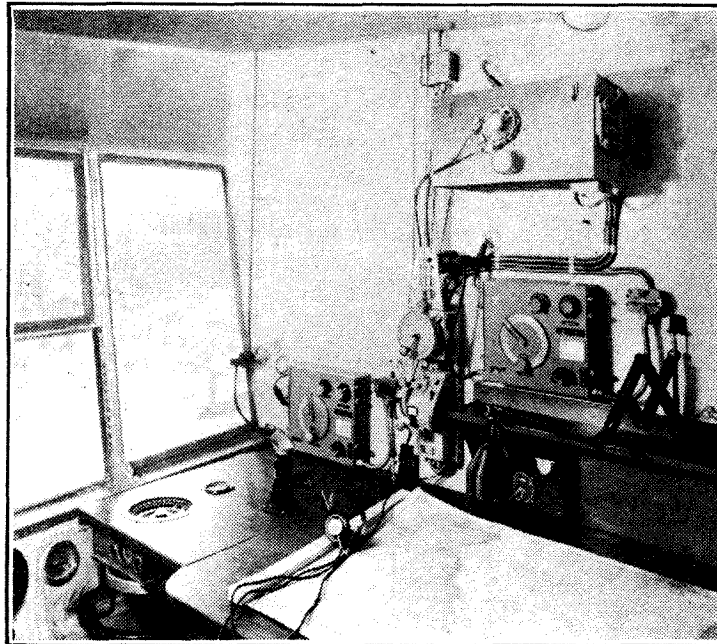
A FIVE-METRE field day is to be held on the river on Sunday, June 14th, by the West London Radio Society. A transmitter will be in operation throughout the day. All persons, either with or without a receiver, will be welcome. The expenses, including punts and tea, will be 3s. 10d. a head. Full particulars can be obtained from the secretary at 22, Camborne Avenue, Ealing, W.13.

The Loyal Relay

AMONG the birthday greetings to be received by H.M. the King on June 23rd will be messages transmitted by amateur radio from all parts of the Empire by members of the British Empire Radio Union. For many years past the B.E.R.U. have handed His Majesty a radio birthday message when he was Prince of Wales, and now, for the first time, they will be able to do so to him as King.

Germany Forges Ahead

THE German Postal authorities are busily engaged in laying the new "wide-frequency" cable between Hamburg and Munich. Not only will it be employed for ordinary tele-



Wireless navigation cabin of the airship "Hindenburg." The equipment includes installations for blind-landing and direction-finding, each being fitted with distant control to enable the receivers to be operated from the pilot's cabin.

Esthonia's Amateurs

AFTER years of operation "under cover," amateur transmitters in Esthonia are now reported to have received official recognition, and up to date fourteen licences have been issued. Applicants have to undergo a stiff technical test before obtaining a licence.

Dowsing Discouraged

IT is reported from Paris that the ecclesiastical authorities have officially frowned upon the activities of certain French priests in the science or art of water and ore divining, it being considered that this is unsuitable for a doctor of divinity.

phone work, but it will be pressed into use for television transmissions. It can handle frequency bands up to 4 megacycles in width, and, apart from linking together ordinary television stations for simultaneous broadcasting, it can deal with simultaneous two-way television-telephone calls using a definition of 180 lines. One thousand ordinary calls can be handled.

The Pope's Birthday

IT is reported that a special broadcast speech will be given from the Vatican station on the occasion of the Pope's birthday on May 30th.

Broadcasting the Olympic Games

TWO hundred and eighty microphones, 5,000 miles of twin cable, 1,500 miles of wire, 10,000 plug sockets and 580 engineers will be some of the material and men required for broadcasting commentaries and eye-witness accounts from the Olympic Games in Berlin, which will be held there from August 1st to August 16th.

Radio Olympiads

SIMULTANEOUSLY with the Olympic games in Berlin, it is reported that German amateur transmitters are to hold a DX contest with awards for entrants who work the greatest number of long-distance stations.

Ayr Frowns on Police Radio

A YR TOWN COUNCIL has decided to oppose the request of the Scottish Office for the installation of radio apparatus in the police station. "Certain people," said one councillor, "seem to be impressed with American methods of crime detection, but there are no circumstances at all in the annals of crime in Scotland that would justify this expenditure."

Wireless Shorthand Competition

A NOVEL wireless shorthand competition will, it is hoped, be held shortly in Czechoslovakia. A passage will be dictated from the Czechoslovakian broadcasting stations and the writer of the most accurate transcription sent to headquarters will be awarded a prize. In order to minimise the possibility of a tie, it is said that the passage dictated will be an exceptionally difficult one.

Polytechnic Wireless Lectures

THREE important lectures are to be given at the Polytechnic on Thursdays, June 11th, 18th, and 25th, from 6.30 until 7.30 p.m. The lecturer is Professor E. V. Appleton, M.A., D.Sc., F.R.S., who will deal, on June 11th, with the thermionic valve and its uses. The remaining two dates will be taken up by lectures on the propagation of wireless waves over the earth and through the atmosphere. The fee for the course is 5s.

Training the Aircraft Operator

THE young man who wants to act as wireless operator on board a commercial aircraft has first to obtain the Postmaster-General's W/T Air Operator's Licence. The standard of the examination, which is held at Croydon Airport, has recently been thoroughly revised, and is now a fairly high one, which means that the candidate must be up to the standard of a professional operator. The time required to reach this standard varies with individuals, but as a general average, six months' whole-time work at one of the specialised wireless schools is a reasonable estimate.

One of the most important parts of the examination is naturally Morse signalling, and the candidate must be able to read and send twenty words per minute with practically 100 per cent. accuracy. In the wireless school where the author is responsible for the organisation, two-thirds of the instructional period is devoted to signalling, and it is usually found that students have more difficulty in sending good Morse at the requisite speed than in

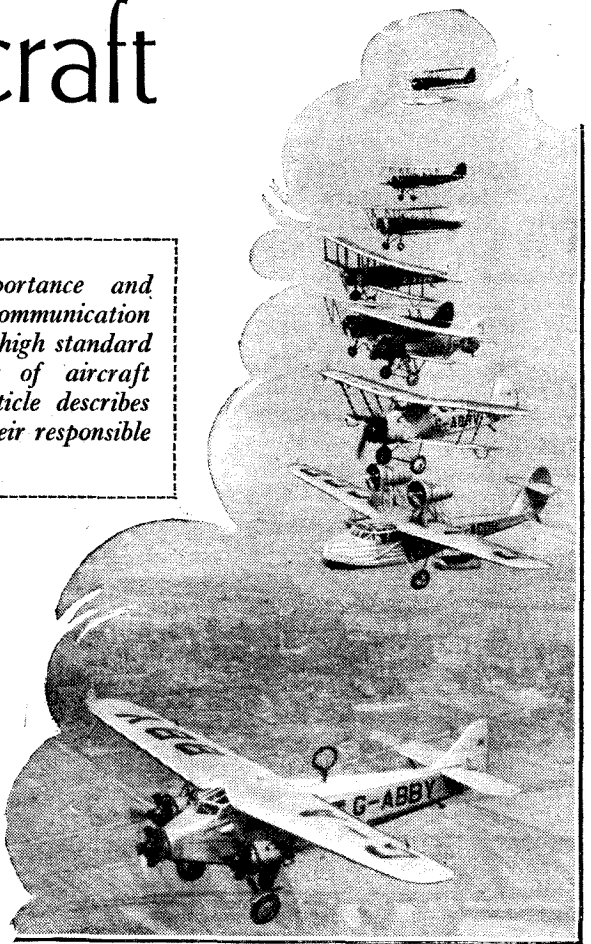
THE ever-growing importance and complexity of wireless communication on civil air routes calls for a high standard of competency on the part of aircraft wireless operators. This article describes how they are trained for their responsible duties

How the Wireless Personnel of Civil Aeroplanes Qualify for Their Jobs

By W. E. CROOK, Grad.I.E.E.

(Chief Wireless Instructor, Air Service Training Ltd.)

imagination and no nerves will make much quicker progress than the more highly strung type. The musical individual is often supposed to be good

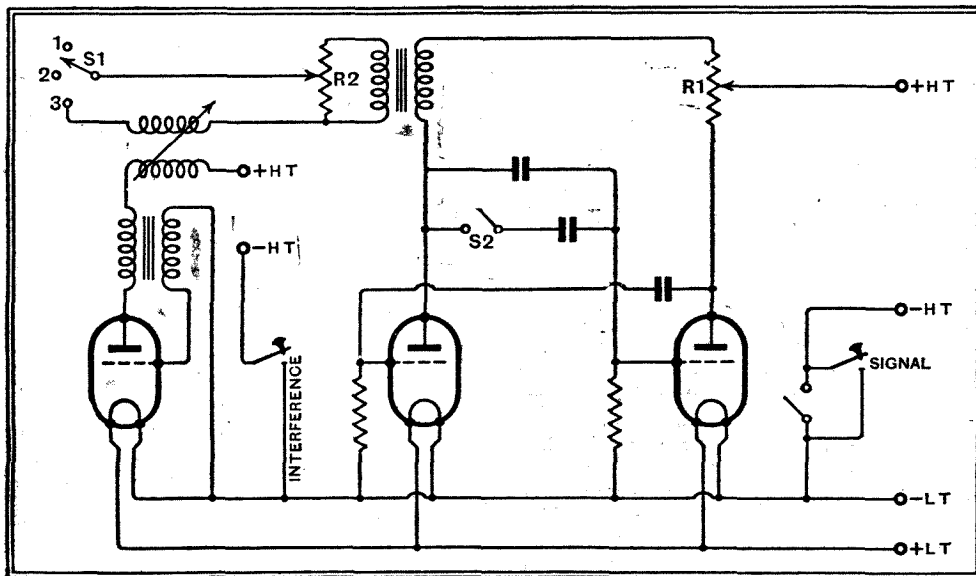


Training machines in formation. Note the DF loop on the aircraft in the foreground.

The features aimed at were: A note of variable pitch; variable volume; and facilities for introducing variable interference.

Versatile Practice Unit

The accompanying drawing shows the circuit arrangement of a valve buzzer for producing these effects. It will be seen that a multi-vibrator circuit is used for the signal note, and an ordinary self-oscillator for the "jamming." The reason for this is that the multi-vibrator lends itself much more readily to note control. The note control is the variable resistance R₁, the volume control being R₂. The switch S₂ brings in a parallel condenser which gives the lower note range. The values chosen are such that the signal note-frequency can be varied from about 20 cycles per second to above audibility. Note or volume variation can be introduced by the instructor whilst sending, and the interference can be either continuous or operated by a separate key. Each desk in the Morse instruction room is equipped with a suitable bracket on which is mounted a Morse key, a telephone jack and a tumbler switch. In one position of the switch the pupil can send to himself without interfering with other desks, and in the other position his transmission is audible in all the other headphones, including the instructor's. The master switch S₁ on the signal buzzer cuts



Valve "buzzer" for Morse practice. Artificial interference can be introduced to simulate actual working conditions.

receiving it. The reason for this is probably that as Morse sending is purely a matter of manual dexterity and the co-ordination of mind and muscle very little can be done in the way of teaching it. The student has to teach himself.

It is interesting to find that in general the best Morse readers are those of the phlegmatic type. The man with little

material as a signaller, but this is so only if he or she has a good natural sense of time and rhythm. Musical taste in harmony, etc., has little or no connection with the matter. The jazz drummer should be the signaller *par excellence!*

It may be of interest here to describe the apparatus for Morse signalling instruction which the author has developed.

Training the Aircraft Operator—

off all desks for transmission during periods when the instructor is sending.

A further development of the signalling instruction is the provision of a number of small cabins. Each of these contains a separate valve buzzer of the self-oscillator type, a switch in the filament circuit of the valve, a Morse key, two telephone jacks, a hand-microphone and ear-piece combined, and a small wall-map of some of the chief European air routes. The cabin buzzers are supplied from a common battery, and are wired through to the main buzzer for working with an instructor. At a fairly early stage of his course, the pupil goes into these cabins and acts as if he were in an aeroplane flying on one of the routes shown, carrying out all the appropriate wireless traffic by telegraphy and also by telephony, using the hand microphone. The purpose of the second telephone jack is to enable the cabins to be used for private practice at other times without interfering with each other. Each cabin buzzer has a different note, which lends further realism to the effects given.

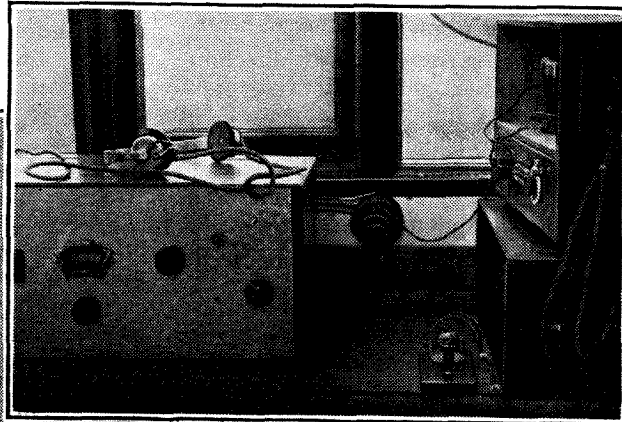
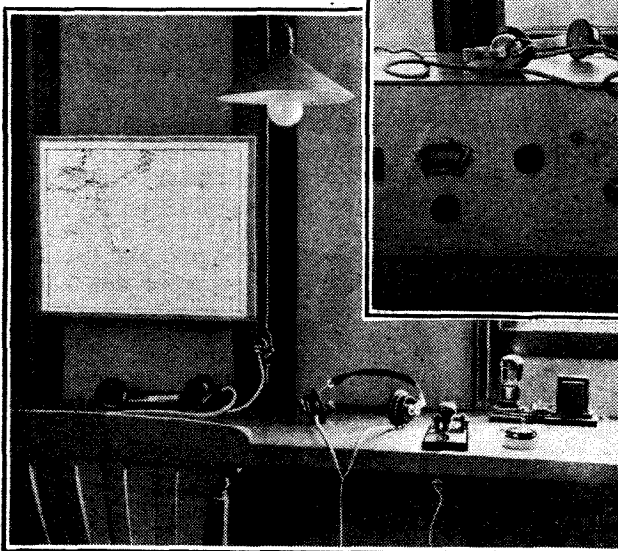
Official Procedure

In addition to sending and reading Morse as "second nature," the wireless operator must also learn the language of commercial radio-telegraphy. This is known by the forbidding title of "Procedure and Regulations governing the International Aeronautical Radio Electric Service," and includes the "Abbreviations" or "Q" signals. To the uninitiated, the messages which pass between an aeroplane and a ground station would appear to be a meaningless jumble of letters and figures,

but this form of telegraphic shorthand represents an enormous saving of time. For example, a ground station might ask an aeroplane whether he was flying above clouds, and the aeroplane might reply no, he was flying below clouds. Omitting call-signs, the appropriate signals would be:—

Ground station: QBG?
Aeroplane: N QBH.

Imitating service conditions: below is seen a cabin for buzzer traffic practice . . .



. . . the next step is towards something more closely approaching the real thing; work in one of the small out-stations (above) from which actual radio communication is carried out.

Similarly, to tell the ground station at his destination that he was winding in his aerial and landing, the following is sufficient:—

Aeroplane: QAL QBE.

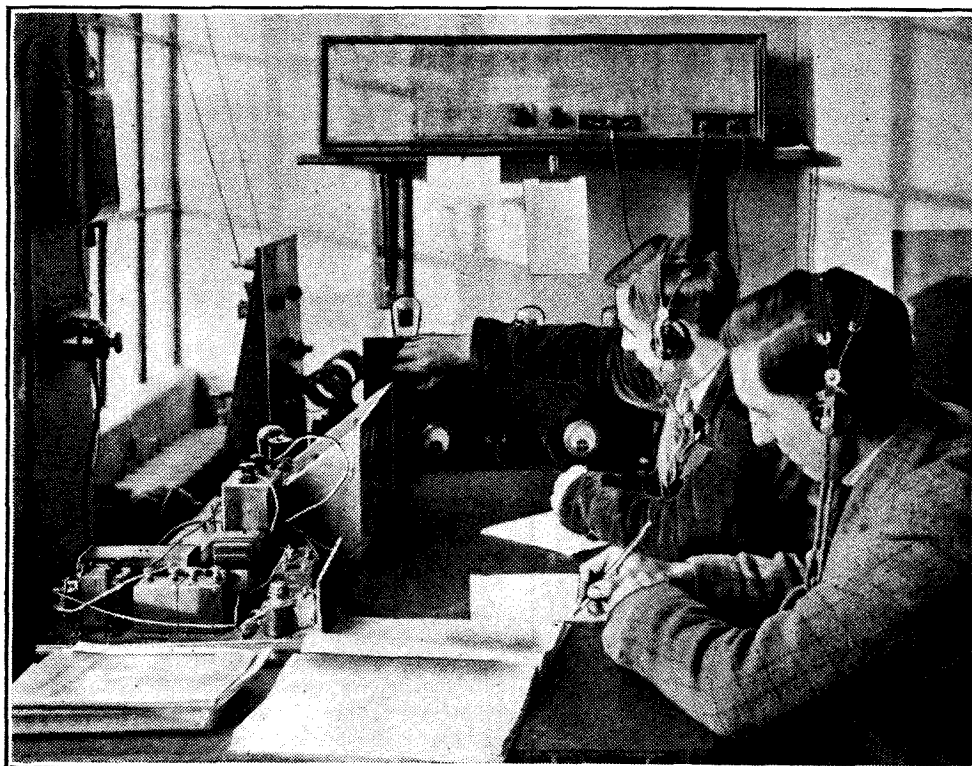
No amount of juggling with ordinary words could reduce the messages to this

ledge of the correct procedure, the cabins are used for traffic practice as previously described. As greater proficiency is reached, students carry out actual wireless communication over short distances by means of two small "out-stations."

One of these transmitters embodies a simple series-feed circuit using a single PM256 valve with about 250 volts HT maximum. Although intended for communicating over about 400 yards only, it gives good signal strength at 10 miles and is therefore run on reduced power. Separate aerials are used for transmitting and receiving so that the operator can "listen through," i.e., his receiver is always operative, and he can be interrupted during a transmission. At the other out-station there is an actual aircraft transmitter and receiver run entirely from batteries. To reduce the range and avoid interference with other stations, only a very small "sausage" aerial is used both for transmitting and receiving, this being done deliberately so that the student becomes accustomed to the use of either separate aerials or a single aerial.

Gaining Confidence

A third low-power transmitter is installed in the main ground station and is worked by an instructor, so that a small wireless "group" of three stations is formed. The value of this out-station work in training can scarcely be over-estimated. The pupils are left alone as much as possible, an instructor visiting the stations only occasionally in order to



Valuable and interesting practice in transmission and reception is obtained on the short-wave amateur bands.

Training the Aircraft Operator—

point out faults or to assist if necessary.

When the student has become a reasonably competent operator on out-stations, he then makes his first flight. Both cabin and open-cockpit aeroplanes are used, and the student carries out a number of flights, including cross-country journeys, maintaining constant touch with the ground station and passing imaginary public correspondence as well as the routine signals called for during the flight. The ground station is equipped with direction-finding apparatus, and plenty of attention is given to this important branch of the work. The aeroplane is actually brought back to the aerodrome on D/F bearings, speed and accuracy in obtaining the bearings being the points chiefly aimed at. The student also carries out D/F himself as part of his ground training.

Finally, in order to provide further means of operating practice with added interest, a complete short-wave station working on the amateur wavebands has been installed. The crystal-controlled transmitter is worked entirely from the electric mains by metal rectifier voltage-doubler circuits, the rectifying unit being mounted on the shelf just above the transmitter.

When sufficiently competent in signalling, students use this station under the supervision of an instructor, and work with any amateur stations which can be picked up. No special attempts at long-distance work are normally made, the object of the station being purely to provide practice in actual operating, but there is naturally a certain amount of healthy competition to establish DX contacts.

A Theoretical Background

To pass the examination, a fairly comprehensive theoretical knowledge is necessary, and it is the author's policy to spend a considerable time on the fundamental principles of electricity and magnetism, because it is only by equipping the student with a sound foundation that a superstructure of more advanced knowledge can be built. The principles and phenomena of alternating current are dealt with fairly thoroughly in so far as they apply to wireless work. Electrical instruments, dynamos and motors, and the conversion of AC to DC and *vice versa*, form the leading sections of what may be termed the purely "electrical" side of the work. Valves and valve apparatus naturally constitute an important part of the "wireless" side, and the student takes various valve curves during his practical work as well as carrying out a number of exercises with transmitters, receivers, and heterodyne wavemeters. Direction-finding in all its aspects is covered quite thoroughly.

The student is finally examined on one of several specified aircraft wireless installations, and three different equipments by different manufacturers are available at the wireless school with which the author

is connected. Thus, although the student must select one, and concentrate on all the details of that one for examination purposes, he actually acquires a much more extended knowledge of aircraft wireless gear, and is trained and does practical work on all three.

Fault-tracing forms an important part of the practical work on these installations, and by means of graded exercises the student becomes familiar with the symptoms and curing of any fault likely to arise on the set.

Many of these faults could not, of course, be rectified in the air, but the diagnosis of faults is of great value both from the theoretical and practical point of view.

As regards the qualifications necessary for a wireless course of this kind, any young man with an ordinary education should be able to negotiate it without serious difficulty. Cases do occur where a person is unable to read Morse and has to give it up, but these are very rare and can usually be traced to some medical

factor such as tone-deafness. At present there is no medical examination for a licence-holder, and no age limit—upper or lower.

With the increasing size of commercial air liners and the increasing volume of air traffic, the handling of the machine's wireless tends more and more to become a full-time job for a professional operator. The greatest obstacle to the universal employment of operators in commercial aeroplanes of all sizes is, of course, the question of pay-load. On an aeroplane one has to think in lbs. when considering extra load, whereas on a ship an extra ton or two is of little importance. However, all the larger aeroplanes and flying boats now being built have provision for carrying a full-time wireless operator, and as the door to a career in civil aviation this profession should offer great attractions to young men who have a taste for such work and who want to fly. It is, moreover, the cheapest way, so far as the cost of training is concerned, of engaging in civil flying in a technical capacity.

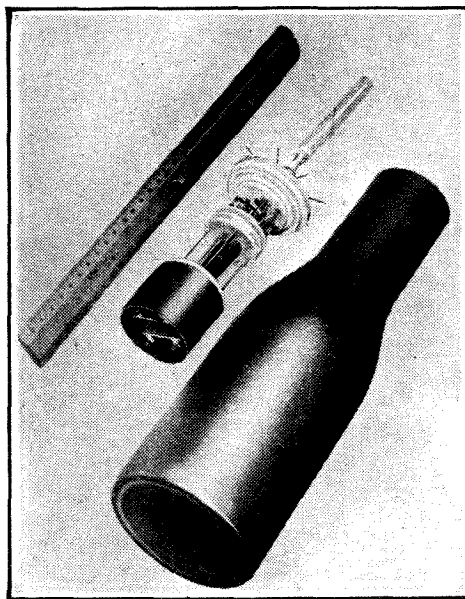
New Cathode-Ray Tube

Designed for Projecting
Television Images

ONE of the latest developments in television apparatus hails from Italy and consists of a new cathode-ray tube designed especially for projecting the received images on to an external screen.

In order to produce an image approximately 8in. x 10in. with a normal cathode-ray tube, it is usually necessary that the screen be some 15in. in diameter, but with the new Safar model a projected image 14in. x 14in. can be obtained with a tube screen of only 3in. diameter.

In the experimental tubes various materials have been used in place of the customary glass container, and in all probability the final models will have an outside envelope of ferro-nickel alloy with a screen of special glass welded to it. This will be



New Safar cathode-ray tube for projecting television images.

constructed to be optically correct and so introduce the minimum of image distortion.

The working voltage of these tubes will, it is understood, be of the order of 6,000 volts.

The Radio Handbook. By Frank C. Jones. 1936 Edition, 328 pages, with approximately 540 illustrations and drawings. Published by Pacific Radio Publishing Co., Pacific Buildings, San Francisco, California, U.S.A. Price \$1.

THIS is the second edition of The Radio Handbook, which deals exclusively with amateur short-wave receiving and transmitting practice. Being an American publication the design and operation of transmitters is a prominent feature, though adequate space is nevertheless given to the receiving side.

The first twenty-five pages are devoted to an introduction to amateur radio, and this chapter contains a wealth of useful facts in concise form on the fundamental principles of wireless.

The design and construction of transmitters is fully up-to-date, while many sound practical circuits are given. Receiving practice is dealt with in the same straightforward manner.

There is a chapter devoted to 10-metre equipment and a lengthy one on ultra-short wave practice. Many useful circuits of 5-metre transceivers are included in this section.

Design, types and methods of energising aerials occupy no fewer than twenty-six pages. This information can also be put to good use in reception.

Following a chapter on power supply units is a section devoted to the design and use of test apparatus in which the various applications of cathode-ray tubes is discussed.

Finally there is an appendix of useful data on matters of special interest to amateur short-wave experimenters.

On the whole a valuable addition to the bookshelf. Copies can be obtained in this country from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex, the price being 5s. 3d. post free.—H. B. D

UNBIASED

By
FREE
GRID



Lingua Franca of the Levantine
Bumboatmen

Teletopics

IN spite of their much vaunted "edification" the great white chiefs up at Broadcasting House seem to have been singularly inattentive at school, irrespective of whether they were brought up on the classical or the modern side. At one time the B.B.C. laboured under the impression that French and German were the only foreign languages that were "done" by the best people, and that is why at one time we got such ghastly attempts at Italian pronunciation.

Later, however, when the newspapers announced that certain very august personages were studying Italian, this language was hastily admitted to the fold, but not so modern Greek, and when it crops up in the course of an announcement, as it did recently, we find the B.B.C. either adopting a pseudo-classical pronunciation or talking the delightful lingua franca beloved of the Levantine bumboatmen.

Turning to the classical side of the business I must confess that I am surprised at the learned pedants of Broadcasting House allowing the Oxonian atmosphere of the place to be defiled by such hybrid words as "television." I should have thought that they would at least have insisted on some such Cacophonous monstrosity as telescopic; then we could gleefully have called our receivers by the simple name of telescope.

Not only are the B.B.C. pundits encouraging the use of such hybrids as television, however, but I learn that they are actually intending to originate some new ones themselves. They have, I hear, been searching round for some compact and descriptive word to describe that part of the transmitter which corresponds to the microphone in ordinary sonic broadcasting; the electric eye as it is often called.

They have, I learn, finally arrived at a suitable word which they intend to spring on us when television or telescopic finally commences. To obtain this word they have apparently sullied the Grecian purity of the word microphone by using it as the basis of a new and horrible hybrid—to wit, "micro-

visor," which will, I suppose, soon be on every tongue. It is my firm intention to visit the B.B.C.'s television department, as soon as my other engagements permit me, in order to make a last desperate effort to avert this etymological catastrophe.

I think, however, that the word televisor beats the lot. This miserable Greek and Latin sandwich is being used to describe the new system of adapting television to the ordinary telephone which is now the subject of experiment in the U.S.A. and elsewhere.

Married Women as Set Designers

I HAVE from time to time in this journal mentioned the crying need for a vest-pocket portable for use by persons who attend sporting events, such as the Derby, which are the subject of a running commentary by the B.B.C. As anybody who has been to one of these events is aware, a very large number of people, especially those of small stature, see nothing but the broad backs of the people in front of them.



Temporarily increasing your height.

Even if they adopt the practice which I myself have sometimes used, of temporarily increasing their height by resting their heels on the toes of the man behind, they may be chagrined to find that several people in the ranks ahead of them have adopted a similar expedient. To these people a vest-pocket portable complete with headphones is invaluable in order to enable them to understand what is going on. Even those in a good position for seeing the event will have their enjoyment

greatly enhanced if they are able to hear the commentary. This more especially applies to female observers of sporting events whose remarks and questions only too frequently reveal to the people around them their abysmal ignorance of the sport they are watching. More often than I care to mention I have found myself covered with confusion and the cynosure of all eyes owing to the artless chatter of my companion.

Several manufacturers have, at various times, tried their hand at turning out one of these devices, and their failure to make a fortune out of it has usually been due to the fact that they have failed to appreciate the size of the vest worn by the ordinary man. I can only think, therefore, that the set designers employed by the manufacturers who have turned out these things have been spinsters whose sense of delicacy has forbidden them to enquire too closely into the size of a man's vest. May I respectfully suggest, therefore, that in future these manufacturers, if they don't like male designers, employ only married women on the job? We shall then possibly get sets which will slip into the average vest pocket. At the moment my tailor is busy making me a special outsize in vests to accommodate one of the latest of these homely little portables.

Short Waves for Cars

I HAVE been busily engaged during the last few days ransacking the establishments of various vendors of radio in a vain effort to find a really modern and up-to-date car radio set. Not a single maker of these sets, so far as I have been able to discover, makes the slightest attempt to cover the short-wavelengths. The result of this is that the person most in need of car radio, namely, the lonely driver returning home in the small hours of the morning from a roadhouse, is left with absolutely nothing to listen to since the ordinary medium and long wave European stations have, of course, long since closed down when he commences his nightly trek towards home.

The usual excuse which I have been offered is that it is impossible to cover the short-waveband since the ignition system of the car would cause interference. This excuse simply won't hold water, because a year or so hence car radio will not only have to cater for short waves, but for ultra-short waves also, for surely the radio manufacturers don't suppose that car passengers are to be deprived of television? If only the set designers would tackle the question of eliminating interference in the case of ordinary short waves now, they would be in a better position to deal with the question of ultra-short waves next year. Will nobody act or shall I be compelled to do the job myself?

Screening

THE APPROPRIATE PRECAUTIONS DEPEND ON THE NATURE OF THE FIELD

By "CATHODE RAY"

THE stage scientist displays his learning in the form of long and unfamiliar words. He may be true to life so far as the biological sciences are concerned, but it is surprising how few totally unfamiliar terms are employed in other technical subjects. It is only the special meaning attached to them that is unfamiliar.

"Screening," for example. In everyday parlance a screen is understood to be a sheet of material suitable for protecting one against undesirable contact with wind, draughts, heat, X-rays, etc. The screens in a radio set (*shields* in America) are not for the protection of any person. Up to a point they might more appropriately be described as *partitions*. The different departments of a receiver can carry on their respective duties only if they are free from mutual disturbance.

The various studios and other departments of Broadcasting House are very thoroughly separated or screened from one another, because they are obliged to work in a compact group, yet without interference one with another. If it were not for the separating walls, the unprotected studio programmes would have to be spaced at very considerable distances from one another—and from the rest of the world's activities—to ensure a complete absence of disturbing sounds. They would then be so far apart that all communications between them would be absurdly long.

In a minor degree the identical problem arises in a receiver in which the valves—and sometimes the variable condenser—have to be protected from too much exposure to the sound from the loud speaker. But that is not what I am illus-

trating just now. Screening is necessary to separate the departments of a receiver from less obvious but more pervasive influences than sound—the electric and magnetic disturbances set up by neighbouring departments of the receiver and by many external sources.

In Broadcasting House there might be a ghost hunt going on in one studio—no, perhaps it is not quite fair to say that; but a very quiet programme anyway—at the same time as a full military band in another. Each of these studios must be well "padded"; the first chiefly to keep sounds from coming in, and the second to keep them from going out. Now the differences in strength of the electric (and magnetic) influences in a long-range receiver are incomparably greater than that between the quietest and noisiest items on the B.B.C. programmes. So screening is very important, and becomes more so as the range (or sensitivity) of the receiver is increased. A local-station re-

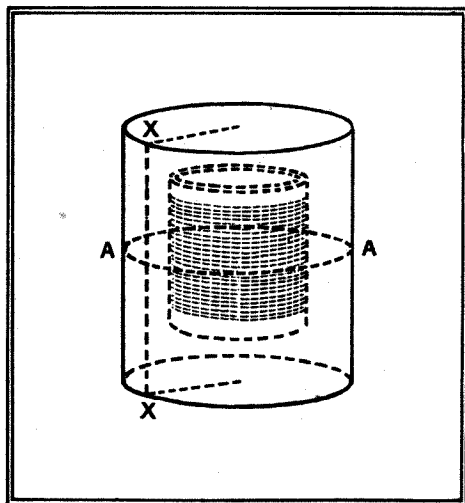


Fig. 1.—A magnetic screen for a coil must have continuous low resistance parallel to the direction of the winding (e.g., around AA). A seam along XX might easily render this ineffective. Closed ends to the cylinder improve the screening. If it is earthed, it serves as an electric screen also.

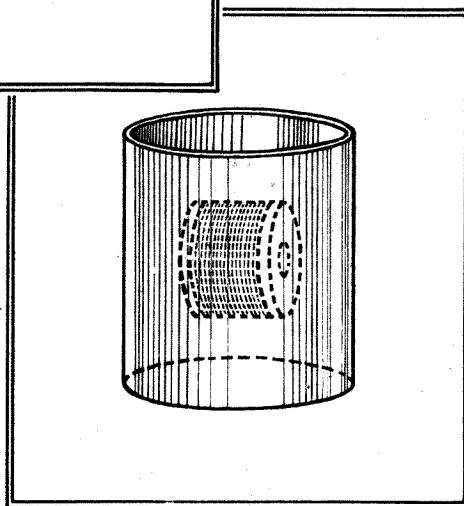
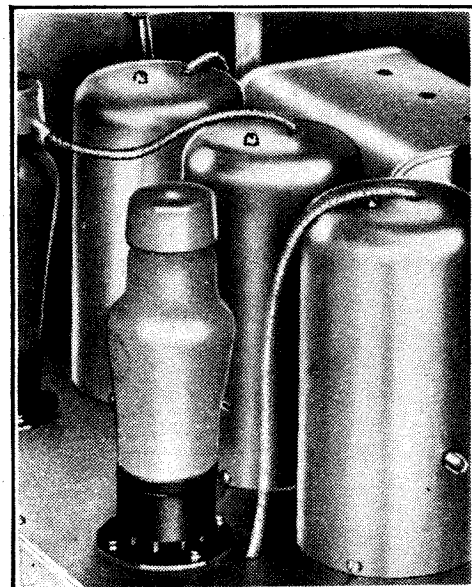


Fig. 2.—An open-ended cylinder is not very effective if its axis is at right angles to that of the coil.

ceiver can get along with very little; an all-wave all-station all-everything set has yards and yards of screening.

In some parts of a receiver, what happens—or what might happen were it not



for screening—resembles very closely the studio illustration. There are possibilities of actual disturbance breaking through, which is undesirable for the reason that it is *different* from what is meant to be going on. For instance, the programme reproduced from the loud speaker, described for the sake of argument as the desirable sound, might be mixed with undesirable hum from the supply mains, just because the more sensitive parts are not adequately screened from the connections carrying 50-cycle mains current. But the commoner and more serious effects are due to disturbances of the same nature.

Acoustic Reaction Analogy

This in itself would not be very disconcerting, any more than is the sound drifting in from an extension receiver repeating the same programme in another room. But if such an addition of sound to the first room caused the volume of sound in the second room to become louder, so that more leaked through, and made the sound louder still, it would keep on getting louder and louder until something broke. That can happen only when there is amplification between one and the other, as is the case in a public-address system for reinforcing the voice of a speaker in a large hall, where it sometimes does happen and results in a fearful howl unless the control man is still awake. The essence of a sensitive receiver is amplification, so unless the more weakly working parts are protected by ample screening from the highly amplified currents this cumulative effect will take place and result in instability, oscillation, howling (audible or otherwise).

So far I have been a trifle vague about what it is that has to be screened off. Sound can best be screened by thick wads of felt, flock, and similar materials. The screening effect of these is absolutely nil where magnetic influences are concerned, and practically nil with electric influences. This remark serves to call attention to the fact that there are two different influences to be dealt with; their distinctions are actually much more vital than it suggests. To explain them fully would mean going through the entire theory of electricity and

Screening—

magnetism, which I have not the space (nor the ability) to do, but you can get some idea of them by remembering that *electric* influences (*fields*, they are usually called) are associated with *voltage* and *condensers*, and *magnetic* fields are associated with *current* (milliamps.) and *coils*.

Where Circuit Diagrams Fail

It is just this sort of rough memory-aid that lands you in trouble unless you realise its limitations. Two parts of a circuit are soldered firmly to opposite ends of a stout metal chassis. Both appear, therefore, to be safely anchored to earth, and on a diagram they might be shown as being joined together. Certainly one would not show a condenser or coil interposed between them. But it must be remembered, that the shortest bit of straight wire or sheet has some inductance, and therefore acts as a very small coil, while two parts of a circuit some distance apart have some capacity between, and therefore act as a condenser not appearing on the diagram. And whenever current flows through an inductance, or voltage is set up across a capacity, a magnetic or electric field is produced, which is liable to influence any other circuit parts in the neighbourhood unless suitably partitioned off by effective screening.

Now the proper sort of screening to adopt is not the same for both sorts of field. You can have a good magnetic screen that is not connected to anything. So long as it has either very good electrical or magnetic conductivity, and forms a continuous low-resistance ring or cylin-

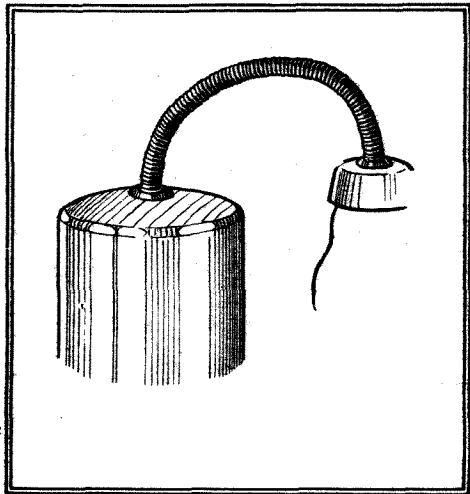


Fig. 4. . . . but a spiral is not at all good at the higher frequencies, because it puts an inductance between part of the screening and earth.

der round the coils of wire, it is capable of doing its job (Figs. 1 and 2). An electric screen, on the other hand, need not form closed rings, but it must be con-

nected to earth or some equivalent point, either directly, or, what amounts to the same thing, through a large capacity.

There is one other consideration that is important enough to take into account even in this hasty survey. It is frequency or wavelength. The higher the frequency (shorter the wavelength) the more pronounced are the phenomena we are talking about. The field set up, due to small currents having to flow across a few inches of chassis, would not in the ordinary way cause any concern at low (audible) frequencies, probably not at the higher "intermediate" frequencies, possibly not at the still higher-frequency "long waves." But at the very highest frequencies, the ultra-short waves, there would almost certainly be trouble.

Fortunately, while these fields become more noticeable with frequency, the problem of screening becomes correspondingly lighter. To obtain effective magnetic screening at the very low frequency of 50 cycles per second, it is necessary to enclose a coil in a thick and expensive case of mumetal or other extremely magnetic substance. Somewhere around the intermediate frequency of 100 kilocycles per second it becomes no

longer advantageous to use magnetic materials, and copper is better. At the highest radio frequencies even a thin shell of copper is quite enough.

Electric screening can be done with netting or expanded metal, or even a wire structure like a man's backbone with ribs attached, so long as it has a direct run to the earthing point (Figs. 3 and 5). That is where the trouble occurs, because, although the question of frequency is not so important as with magnetic screening, at very high frequencies even an inch or two of wire prevents the earthing from being perfect (Fig. 4). Much more, then, must a long, meandering connection of

quite appreciable inductance be avoided.

The conclusions are that any screen or shroud that is fitted to any low-frequency transformer or choke that you can afford is no earthly good as a magnetic screen, though it may have some slight utility as an electric screen (*if it is earthed*) or to prevent one from accidentally pushing a screwdriver through the windings. That at radio frequencies the ordinary can is quite a good magnetic screen, provided that there is not a seam down the side to make a bad circuit around the coil. That the same serves as an electric screen *if it is*

earthed. But that if you happen to want an electric screen that is definitely *not* a magnetic screen (e.g., between the windings of a transformer) you must cut a gap down the side. And that it is untrue to say you have earthed a screen if the earthing path is not negligible at the frequency concerned.

Radio. By Rudolph Arnheim. Translated by Margaret Ludwig and Herbert Read. Pp. 296 and 32 photographs. Faber and Faber, Ltd., 24, Russell Square, London, W.C.1. Price 12s. 6d.

MANY volumes have appeared on what may be called the vehicle of radio—its mechanism, propulsion, steering, control, upholstery, traffic regulation, etc.—and few on the passengers to be conveyed. But if the end is more important than the means, then Herr Arnheim's book surely commands attention. What is more, it deserves attention, for it is the most comprehensive and reasoned exposition of radio art that we have seen.

While of primary interest to those concerned in making programmes—producers, playwrights, artistes and speakers—the intelligent listener will find much to stimulate thought and sharpen his discrimination.

Herr Arnheim, whose corresponding volume on films has been an outstanding contribution to the subject of the visual art, is enthusiastic about "blind drama," and apparently accepts, in a spirit of sad resignation, its probable supersession by television. Incidentally, he places a touching faith in the capabilities of technicians.

Illustrations as well as text appear to have been translated, for most relate to the B.B.C.; few to German broadcasting. One has a feeling, often, that most of the methods held forth as desirable have already been put into practice by our own authorities—"transmissions from different rooms, too, may be united to give a single sound effect, a device which deserves to be used more than hitherto," for example. Other views, however, are more novel and provocative. This is a book to read, and to read carefully.—M. G. S.

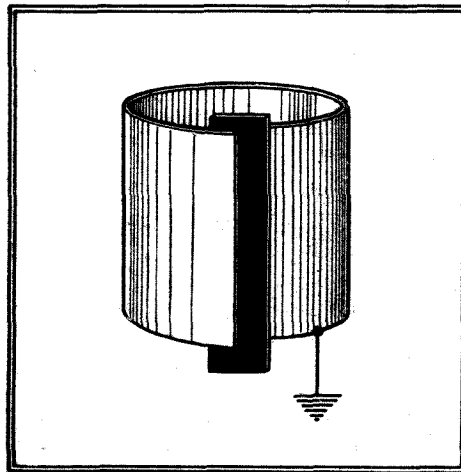


Fig. 5.—When the inner and outer windings of a transformer have to be screened from one another without impairing the transformer coupling, an overlapping sheet of metal foil with a thin strip of insulation preventing complete contact is the correct arrangement. It *must* be earthed.

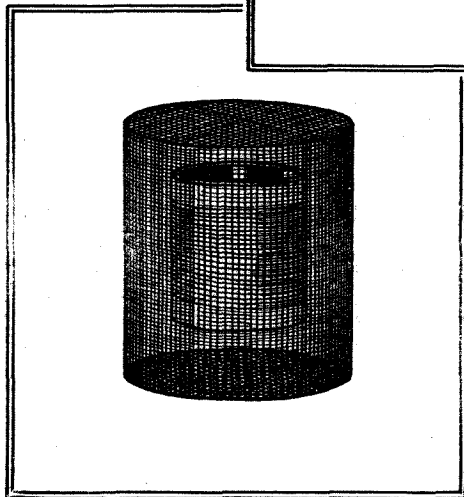


Fig. 3.—Although gauze or netting is not very effective against the magnetic field it is quite a good electric screen. . . .

der round the coils of wire, it is capable of doing its job (Figs. 1 and 2). An electric screen, on the other hand, need not form closed rings, but it must be con-

Listeners' Guide for the

MANY of the younger generation think of Lord Kitchener mainly in connection with the World War and his untimely death in the sinking of H.M.S. *Hampshire* on June 5th, 1916, but their elders will remember him also for his campaigns in the Sudan, which made his name, and the South African war, in which he showed he had even more outstanding abilities as a peacemaker than as a soldier. Of the Great War, Lord Kitchener said: "I have no fear about winning the war. I fear very much we may not make a good peace," which was indeed significant in the light of future events. In a special feature programme on Tuesday at 8.30 (Nat.), which will take the form of the now well-known dramatic narrative, listeners will hear the story of Lord Kitchener's life, work and struggles compiled from biographies, memoirs, despatches and letters.

THE "QUEEN MARY"

TO-NIGHT (Friday) at 8.15 from the National transmitter will be heard a microphone tour of R.M.S. *Queen Mary* while she is in mid-Atlantic on her maiden voyage. The programme is devised by John Watt, and the microphone will be taken to all the main points of the ship so that listeners will hear of her progress and the life on board.

On Monday she again comes into the National programme when her first entry into American waters will be celebrated. At 8 the last stages of her journey from Ambrose Lightship to Quarantine will be described, and at 8.15 the scenes in New York Harbour of America's welcome will be portrayed by British and American commentators from ship, shore and air. Any change in these times, due to unforeseen delay, will, it is hoped, be announced during the 6 o'clock News Bulletin.

RUSSIAN CHOIR

THE famous choir of the Russian Orthodox Theological Academy, Paris, will give a recital of music taken from the Russian Easter and Pentecost services in the National programme at 5 on Sunday. The

choir is a body of somewhat unusual musical interest, as it consists of only seven voices. Despite its limited personnel

oboe, viol da gamba, and harpsichord accompaniment by Purcell and instrumental music by Handel.



LORD KITCHENER is here seen at Port Said in 1911 with His Late Majesty King George V, who was on his way to India.

it has not only extraordinary purity of tone, but a typically Russian resonance and volume which can fill a cathedral.

SMALL COALMAN'S MUSIC CLUB

A CONCERT reminiscent of the type that used to be given in Thomas Britton's room over his little shop in Clerkenwell between 1678 and 1714 is arranged for 10.20 on Thursday (Nat.). Britton was by trade a humble coal merchant, and founded a music club which held weekly concerts, and included amongst its performers and audiences many distinguished people; Handel at times presiding at the harpsichord. The programme, selected from Britton's library, will include madrigals by William Byrd; songs with

FOREIGN RELAY

IN the National programme on Sunday at 10 is to be included a relay of popular Alsatian music from Strasbourg, which will consist of marches, dances, and melodies given by the Radio Strasbourg Orchestra, Cercle des Amis de l'Accordéon and Société de Mandolines Torino.

"BIG BUSINESS"

BOBBIE COMBER has gone into "Big Business" as a company promoter and Claude Hulbert is the unfortunate client to whom he tries to sell his doubtful stocks and shares. This is the theme of a series of sketches by H. E. Kavanagh, the first of which, "Changing Dials," will be given in the Regional programme at 9.30 on Tuesday.

HIGHLIGHTS OF THE WEEK

FRIDAY, MAY 29th.

Nat., 8.15, The *Queen Mary* in mid-Atlantic. 10, "Down River," Talk, G. M. Boumphrey. 10.20, Parry Jones with B.B.C. Chorus (A) and Orchestra (E).
Reg., 6.50, Covent Garden Relay. 9, "Limejuice Nights," farce by John Dighton.

Abroad.

Vienna, 8.30, Vienna Symphony Orchestra.

SATURDAY, MAY 30th.

Nat., 7, Saturday Magazine. 8.30, Variety. 10.20, Rawicz and Landauer (two pianos) with B.B.C. Theatre Orchestra.
Reg., 7.15, Morris Motors' Band. 8.30, Sibelius Concert. 9.30, The Karl Caylus Players.

Abroad.

Berlin (Funkstunde), 8.10, "A Sparkling Whitsun Bowl."

SUNDAY, MAY 31st.

Nat., 5, Russian Choir Recital. 7.55, Winchester Cathedral Service. 10, Relay from Strasbourg.
Reg., B.B.C. Theatre Orchestra with Tessa Deane and Arnold Matters. 9, "Love of Country," a mosaic of words and music.

Abroad.

Hamburg, 8, Massed Military Bands from Kiel.

MONDAY, JUNE 1st.

Nat., 5, "White Coons," 8, The *Queen Mary* at New York.
Reg., B.B.C. Military Band with Tudor Davies (tenor). 7.45, Act I of "Rosenkavalier." Recital: Peter Dawson.

Abroad.

Kalundborg, 8.15, "Summer Revue, 1936"—relay from the Phoenix Theatre, Copenhagen.

TUESDAY, JUNE 2nd.

Nat., 5.15, Frank Biffo's Brass Quintet. Carrol Gibbons and the Savoy Hotel Orpheans. 8.30, Kitchener programme.
Reg., 7, "White Coons." B.B.C. Orchestra (C) with Kathleen Long (piano). 9.30, "Big Business." 10.5, "Tristan and Isolde," Act III.

Abroad.

Cologne, 8.10, Orchestral Concert.

WEDNESDAY, JUNE 3rd.

Nat., Fred Hartley and his Novelty Quintet with Webster Booth. Symphony Concert. "The Little Show." 10.30, "Round Europe in 45 Minutes," B.B.C. Theatre Orchestra.
Reg., Anona Winn and her Winners. 8.15, Jay Wilbur and his Band. B.B.C. Orchestra (C) and Garda Hall.

Abroad.

Leipzig, 10.30, "Music of the Bach Family," Symphony Orchestra.

THURSDAY, JUNE 4th.

Nat., Pianoforte Recital, Hilda Dederich. 8.15, "Monsieur Beaucaire." 10.20, "At the Small Coalman's Music Club."
Reg., Crystal Palace Band. 7.5, Two Plays. B.B.C. Dance Orchestra.

Abroad.

Frankfurt, 8.10, Concert of marches.

Week

Outstanding Broadcasts at Home and Abroad

LESLIE HENSON

THE first of a series of four broadcasts of Will C. Pepper's "White Coons" Concert Party, revived and produced by Harry S. Pepper, will be given in the National programme on Monday at 5 and again on Tuesday, Regionally, at 7. Each of these four broadcasts will have a star guest artiste, these, if possible, having some historic connection with the concert party world. On Monday and Tuesday Leslie Henson, now one of London's most famous actor-manager's, who started his theatrical career in a concert party, will be the guest.

PLAYS

Two short plays form part of Thursday evening's Regional programme from 7.5 to 8. The first, "The Stolen General," by Francis Beeding, is an episode in the Napoleonic wars and will be produced by Owen Reed. The second is an adaptation for broadcasting by Cecil Lewis of D. H. Lawrence's "Rocking Horse Winner," to be produced by Robin Whitworth.

ROMANCE AND ADVENTURE

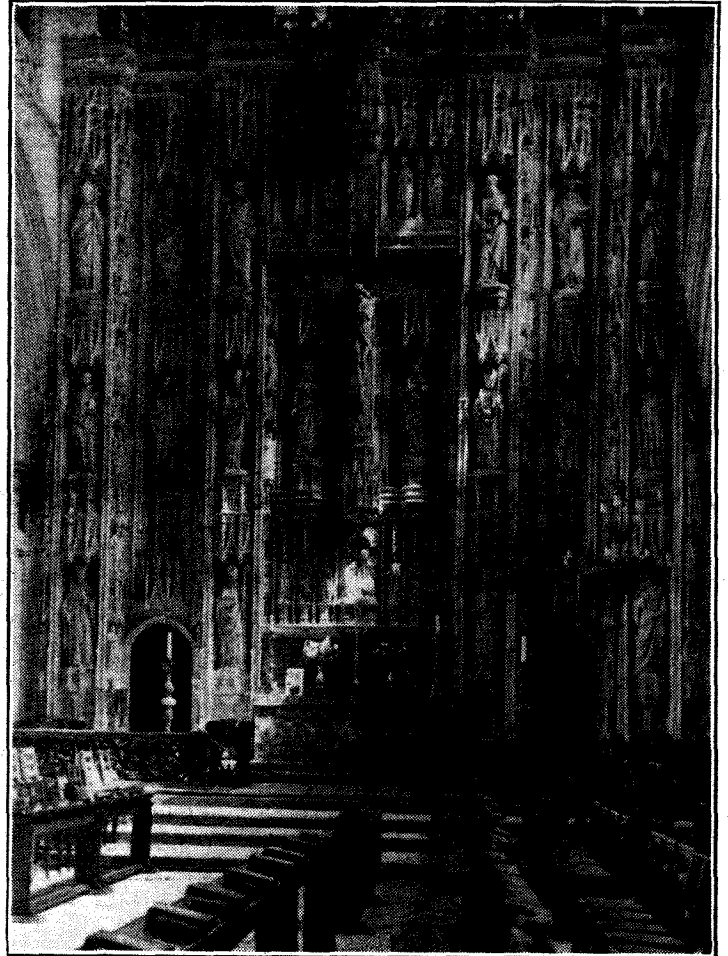
BOOTH TARKINGTON'S novel "Monsieur Beaucaire" was first produced as a play in London in 1902. The musical version, composed by André Messager, with lyrics by Adrian Ross, was performed at the Prince's Theatre, London, in 1919, with Maggie Teyte as Lady Mary Carlisle. The broadcasting version, which was first given in 1934, is drawn partly from the libretto by Frederick Lonsdale and partly from the novel, and will again be heard Nationally on

Thursday at 8.15, and repeated on the following night. The story takes place in the gay days of Beau Nash, in 1734. In the first broadcast of this, Margaret Lauder stepped out of the ranks of the Revue Chorus to play the heroine, Lady Mary Carlisle, in which rôle she will again appear. Richard Ainley plays the name part, and the cast also includes Stuart Robertson and Jan van der Gucht.

FOR OPERA LOVERS

FROM the Royal Opera House, Covent Garden, will be relayed Regionally acts from the following operas, the usual five-minute introduction being given before each broadcast. On Friday at 6.50 will be given Act I of "Don Giovanni." On Monday at 7.45 will be heard Act I of "Rosenkavalier," and on Tuesday at 10.5 the 3rd Act from "Tristan and Isolde." From the Continent to-night (Friday) comes Mascagni's short opera, "Cavaliere Rusticana" from Budapest I. On Saturday Smetana's opera, "The Bartered Bride," will be given by Prague and Strasbourg at 7.30. From Milan and Turin comes "Fedora" by Giordano, conducted by the composer, on Saturday at 8.45. Frankfurt gives a full dress performance of Flotow's "Martha" at 8 on Sunday, from the Municipal Opera. This full-blooded English comedy, with its scene laid in the Richmond and Hampton Court of Queen Anne's day,

THE ASSEMBLY ROOMS, BATH. A scene from the production of "Monsieur Beaucaire" at the Prince's Theatre, London, in 1919. This light opera is included in the National programme on Thursday at 8.15.



A SUNBEAM, entering through a plain glass panel in the stained glass window at 2 o'clock each afternoon, illuminates the redos in Winchester Cathedral. The Very Rev. E. G. Selwyn, D.D., Dean of Winchester, will give the address in the service from the Cathedral at 7.55 on Sunday.

should be of special interest to English listeners even in its German dress. Monday's best opera broadcast would seem to be Donizetti's "Daughter of the Regiment," from the State Opera, Dresden, by Leipzig, at 8.

FOLK MUSIC

ON Sunday, from Cologne and Hamburg, at 10.30, will be given an eye-witness account of the procession, interspersed with music, of a

century-old custom, "Neighbour's Feast," from the old Hanse town of Einbeck. Whitsuntide legends and folk lore are contained in "Under the Bridegroom's Oak," which will be given by Berlin (Funkstunde) on Sunday at 7.

CONCERTS

FROM Cologne, on Sunday, from 8 to 10, will be given a Whitsuntide concert, when the large Cologne Radio Orchestra and the Radio Chamber Choir will be conducted by Leo Eysoldt and Josef Breuer. A festival concert of Iberian and South American music will be relayed by Bordeaux-Lafayette at 8.30 on Tuesday. A symphony concert by the National Orchestra, conducted by Inghelbrecht, with Tibor Harsanyi playing his own concert piece for pianoforte, will be given by Radio-Paris at 8.45 on Thursday.

THE AUDITOR.



Rothermel-Hammarlund

"Super Pro"



A Versatile
Receiver Designed
Originally for Professional
Communication Services

THE radio industry in this country caters extraordinarily well for what may be termed the average requirements of the listening public. Range, selectivity and quality have been adjusted to a nicety to satisfy the present demands of the majority, and as a result the sets which fill our shop windows are undeniably good value for money.

The minority who can afford to indulge their taste for something better, whether in quality of reproduction or range of reception, are not so fortunate, and it is difficult to understand why in this country there are not more sets of the calibre of the Rothermel-Hammarlund "Super Pro" to meet a demand which undoubtedly exists.

This receiver was designed primarily for professional communication services, and is used by the U.S. Army Signal Corps. The standard model for general use differs in a few minor details, such as the impedance of the input and output circuits, but in general specification and performance is the same as the original design.

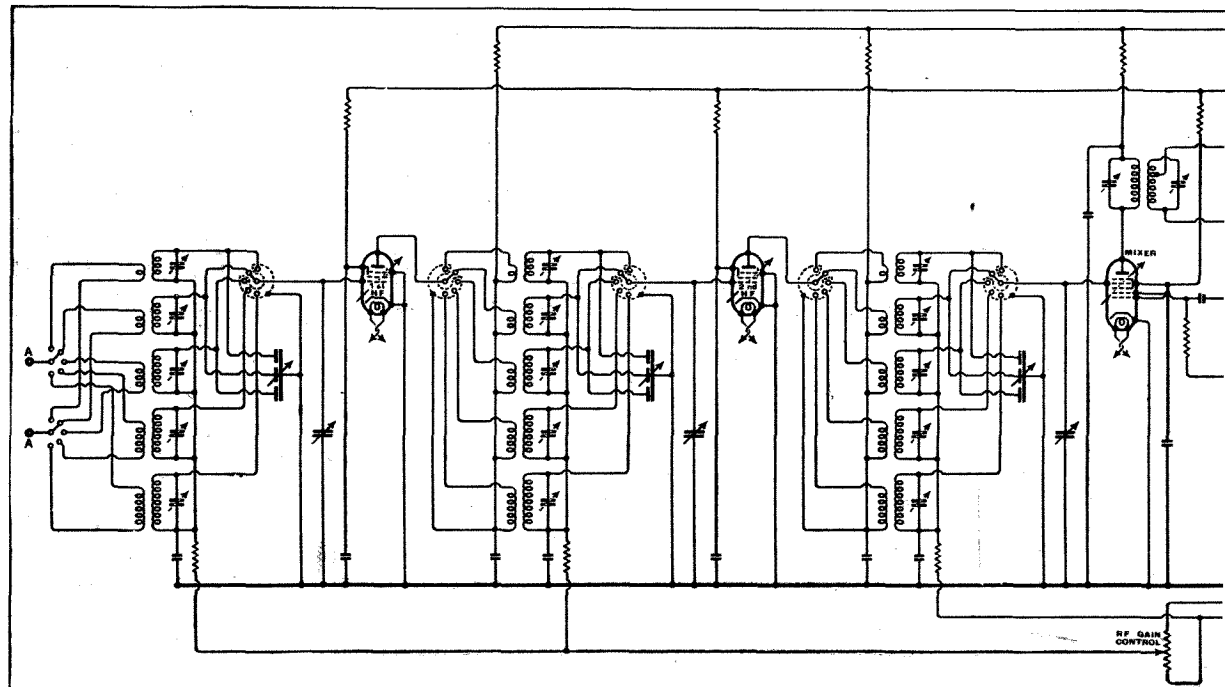
There are fourteen valves in the circuit and two separate rectifiers, making sixteen in all. The aerial input is designed for a 115-ohm transmission line, but will work satisfactorily on an ordinary open aerial system. There are two stages of HF amplification tuned on all five waveranges. In addition to the main tuning condenser there is a ganged band spread condenser, the capacity of which is adjusted by the waverange switch to suit the particular waverange to which the set is tuned. The band spread is operative only on the three lower waveranges as the slow motion ratio on the main tuning control gives a

sufficiently close adjustment on the two remaining ranges.

The AVC bias for the HF stages is tapped off a potentiometer across the main AVC line which provides the "RF gain" control. The frequency-changer, or mixer valve, is a heptode, and the separate oscillator is so connected that it is virtually a triode working with Hartley circuit connections. A send-receive switch is con-

nected in the HT line between the mixer and oscillator stages to de-sensitise the earlier stages of the set when the receiver is installed in close proximity to transmitting gear.

There are three valves whose sole function is IF amplification, but if we include the pentode section of the second detector and the AVC valve there are really five stages dealing with IF currents. The meter-type tuning indicator is common to



Complete circuit diagram. The power supply unit in the right-hand bottom corner includes a separate rectifier for supplying standing bias and is connected to the receiver unit through a multiple cable. The wave-range switching is shown by the conventional rotary symbol, but in the receiver itself a new type of parallel-action knife switch is employed.

the anode circuits of the three IF valves.

The AVC stage consists of a pentode IF amplifier coupled to the third IF valve through a link circuit. Parallel diodes in the same envelope rectify the output and apply it to the main AVC line in series with a variable bias derived from the separate rectifier in the power unit. The setting of this potentiometer determines the IF gain, and when the set is switched over from AVC to manual control this is the master control for the pre-detector amplification in the circuit.

The other subsidiary valve below the main line of the circuit is a beat oscillator for CW reception. The oscillator is of the electron-coupled type and its output is injected into the IF amplifier through the link circuit previously mentioned.

The second detector connections follow established practice and the output is passed to a triode first LF amplifier through a volume control potentiometer (AF gain control). Tone control is applied in the anode circuit of this valve before the amplifying audio-frequency output is passed to the driver valve of the output stage. Although the driver and the two push-pull output valves

are all of the pentode type, their connections are such that they function as triodes with slightly modified characteristics. The circuit conditions are arranged so that the output stage functions in the normal manner for small inputs, and under Class B conditions for powers approaching the maximum.

taining a firm rein on the reserve amplifying power which is at their disposal. The AVC system is not lacking in efficiency, but it is at times hard pressed to maintain control over the range of signal strengths which the receiver provides. A strict watch must, therefore, be kept on the IF gain control and in certain circumstances, when

receiving the local station, for instance, it may be advisable to switch over from AVC to manual control to avoid distortion.

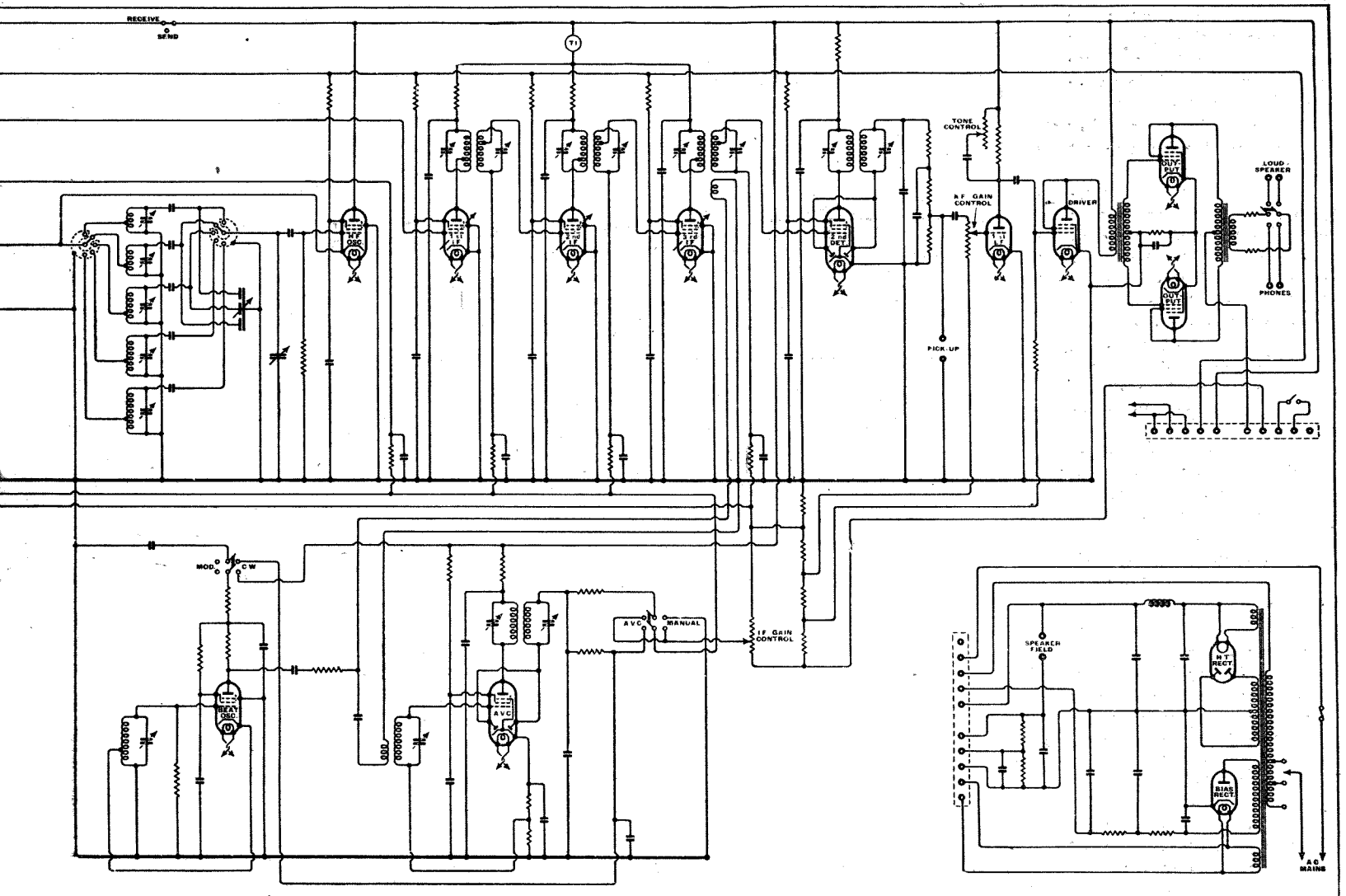
On all but the two shortest wavebands it is easy to overload the frequency changer by turning up the RF control too far, the overload point being indicated by a fall in volume as the control is advanced. It is, however, advisable to use as much "RF gain" as possible in the interest of quiet background, and with HF and IF amplification both variable it

is possible to demonstrate in convincing fashion the advantage of HF amplification before the frequency-changer in obtaining a good signal-to-noise ratio.

From the foregoing it will be gathered that the set is capable of receiving anything which can be picked up on the simple aerial systems at the disposal of

FEATURES.—Type.—Superheterodyne receiver for AC mains. **Wave-ranges.—**(1) 20-10 Mc/s (15-30 metres). (2) 10-5 Mc/s (30-60 metres). (3) 5-2.5 Mc/s (60-120 metres). (4) 2,500-1,160 kc/s (120-259 metres). (5) 1,160-540 kc/s (259-555 metres). **Circuit.—**Two HF amplifiers—mixer—separate oscillator—three IF amplifiers—beat oscillator—AVC valve—2nd det.—1st IF amplifier—drive valve—push-pull output valves. Full-wave HT rectifier, half-wave bias rectifier. **Controls.—**(1) Main tuning. (2) Band spread. (3) Waverange. (4) RF gain. (5) IF gain. (6) AF gain. (7) Selectivity. (8) Tone. (9) AVC—manual volume control switch. (10) CW—modulation switch. (11) Beat frequency control. (12) Send-receive switch. (13) Phone-speaker switch. (14) Mains on-off switch. **Price.—**85 gns. **Agents.—**R. A. Rothermel Ltd., Canterbury Road, London, N.W.6

From the summarised specification it will be seen that there are as many controls as there are valves in the circuit, and the receiver may, therefore, prove something of a handful for a beginner, but those who are sufficiently far advanced to assimilate and keep in mind the main features of the circuit should have no difficulty in main-



Rothermel-Hammarlund "Super Pro"

the amateur, and one imagines that for further improvement it would be necessary to use a special aerial of the reflector type. At all events, the range will be sufficient to keep the most ardent long-distance enthusiast busy for many a long month. The American short-wave stations were always audible, even under the most unfavourable conditions, and one had only to move the RF and IF controls off the minimum positions slightly to obtain a performance in daylight on the medium waveband comparable with that of a good "broadcast" superhet after nightfall.

The variable selectivity control has a useful range, and as an indication of its performance it may be stated that the band width over which modulation from West Regional could be heard when listening in Central London, could be varied from 22 to 7 kc/s. The London Regional, however, could not be approached nearer than 10 kc/s on either side of its normal setting without sideband splash.

There is no long waveband, but from 555 metres down to 15 metres there is complete coverage—a feature for which there is an insistent demand among enthusiasts. Nowhere throughout the frequency range of the set is a single self-generated whistle to be found.

A small Jensen speaker was supplied with the set for test; it gave clean reproduction, free from blurring and was particularly good on transmissions calling for good transient response. For the type of service for which the receiver is intended, most users will be more than satisfied with the standard speaker, but a larger unit could no doubt be fitted for those who wish to make the fullest use of the 15 watts available.

The receiver is constructed to the high standards of specification associated with products which have been designed to fill Government contracts. The metal front panel is of the order of $\frac{1}{4}$ in. thick and the cadmium-plated steel chassis is exceptionally rigid. All vital components are totally enclosed, but inspection plates are numerous. The sides and top of the main tuning unit, for instance, are all detachable and reveal the five sets of tuning inductances, the main and band spread tuning condensers and a waverange switch of more than usual interest. By means of eccentrics in the waverange switch spindle, shorting bars are successively depressed into knife switch contacts fixed in an insulating base plate. The contacts are of silver-plated phosphor bronze, and as each

is split, there are virtually six wiping contacts for every connection.

A mechanical shutter operated by the waverange switch discloses the appropriate frequency scale on the main tuning dial, and it is worth noting that the hair line is

really close to the scale. This eliminates parallax errors in reading and is essential in any precision instrument.

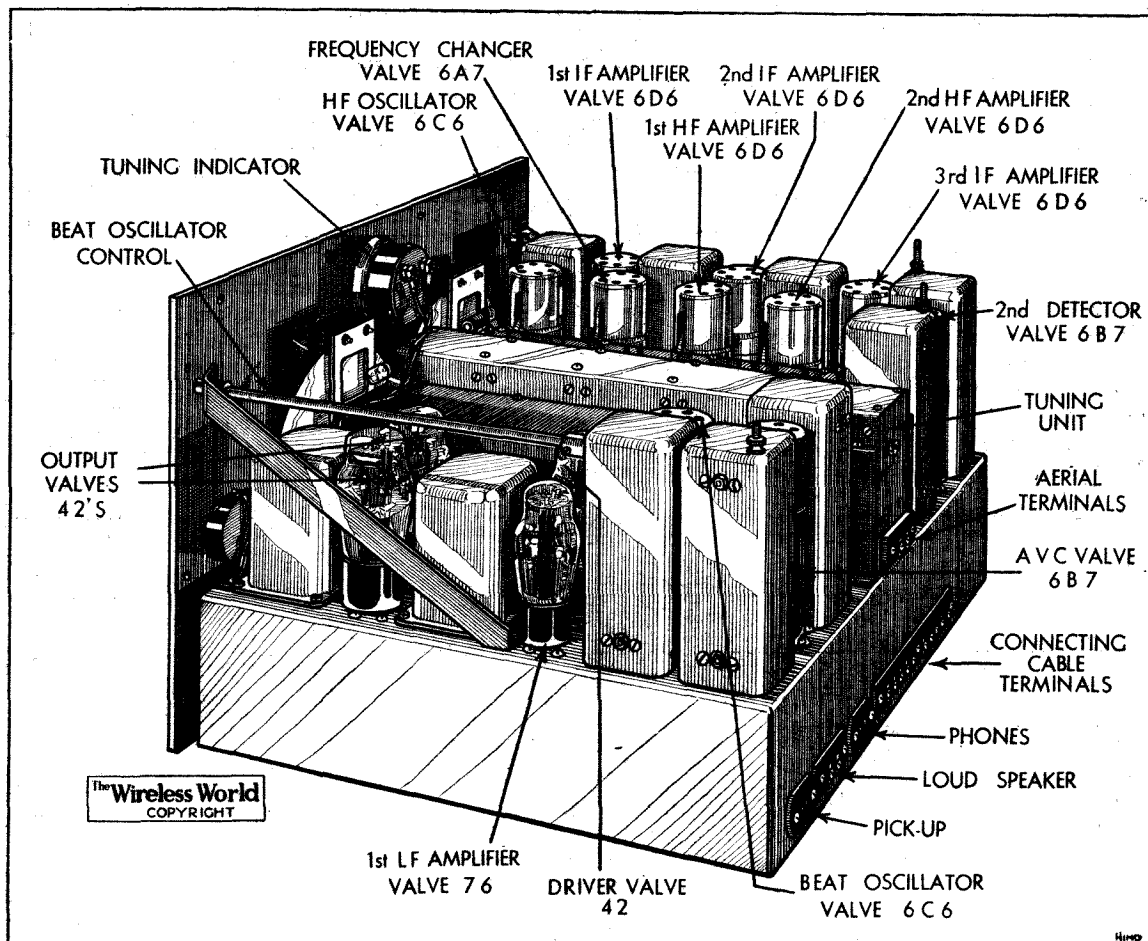
Here, indeed, is a receiver worthy of the skill of the "crack" wireless operator, whether professional or amateur.

NEWS FROM THE CLUBS**A New Amateur Association**

A NEW organisation, known as the Empire Amateur Radio League, has as its object the furtherance of the interests of amateur radio activities and technique. The provisional membership subscription is 5s. per annum and

and matters of special interest to short-wave listeners and amateur transmitters.

Copies, price 2½d. each, will be posted to anyone in the British Isles on application to the Secretary, A. E. Bear, 10, St. Mary's Place, London, S.E.16.



The chassis presents a workmanlike appearance, the coils, tuning condensers, and wave-range switches being enclosed in a central unit.

all who are interested in amateur radio are welcomed. Application for membership should be made to the Hon. Sec., Mr. E. N. Adcock, 206, Atlantic Road, Erdington, Birmingham.

Kensington Amateur Activities

Several interesting lectures have recently been held at the headquarters of the Radio, Physical and Television Society, West Kensington. The membership subscription to this society is 2s. per annum, but readers of *The Wireless World* are invited to attend meetings without incurring any obligation to become members. Those who would like further details are requested to write to the Hon. Sec., Mr. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

Short-wave News

The International Short Wave Club's *News Letter* is issued on the 14th of each month as a supplement to the Club's official organ, *International Short Wave Radio*. It makes its debut with the May issue as a printed booklet of eight pages. It deals with the forthcoming activities of the London Chapter of the Club,

Bideford Doings

The Bideford and District Short-Wave Society is continuing its meetings fortnightly throughout the summer, and a field-day is being planned. Two morse classes are held at each meeting in order to encourage members to qualify for a transmitting licence. The Secretary will be pleased to hear from anybody interested; his address is 5, Furzebeam Terrace, East-the-Water, Bideford, Devon.

New Television Society

A new radio society known as the North Wales Radio and Television Society has been formed and meetings are being held at the Wrexham Technical Institute. The Secretary will be pleased to furnish with particulars all who care to get in touch with him at 4, Kiln Bungalows, Hope, Wrexham.

Next Set Review:

**G.E.C. FIDELITY ALL-WAVE
SUPERHETERODYNE**

On the Short Waves

NOTES FROM A LISTENER'S LOG

FOR the past few months in this fortnightly column the stations mentioned have had their position in the high-frequency spectrum designated in wavelengths, and it is now felt that the time has come to drop this unscientific and old-fashioned system and to refer to stations by their frequency in megacycles per second. Since the beginning of this year the Daventry Empire stations have been announced exclusively in megacycles per second, partly for reasons of scientific accuracy and partly because the majority of receivers in use overseas are so calibrated on the high-frequency bands, only a small number—and those mainly British—being still calibrated in metres. There is also a personal reason; I have found it rather tiresome recently to change the frequencies mentioned in my rough notes into metres when writing in this column about new stations, etc., and I felt that "metres" should be kept to the one place where they really belong, which is, of course, aerial design and construction.

Henceforward, then, with the Editor's permission, stations will be referred to by their frequency in megacycles per second (Mc/s), but for the time being the corresponding wavelength in metres will also be given in brackets.

It may be interesting here to tabulate the broadcasting and amateur bands which have been internationally agreed:—

Broadcasting Bands.		Amateur Bands.	
Mc/s.	Metres.	Mc/s.	Metres.
6.00-6.15	49	1.720-1.995	160
9.50-9.60	31	3.505-3.730	80
11.70-11.90	25*	7.005-7.295	40
15.10-15.35	19	14.005-14.395	20
17.75-17.80	16	28.005-29.995	10
21.45-21.55	13	30.000-31.950	9
25.60-26.60	11		
		56.005-59.995	5

*This band is reserved for fixed services by the U.S.S.R.

It should be noted that a total band of 1.85 Mc/s has been allotted to broadcasting, while 2.7 Mc/s has been allotted to amateurs between 30 and 7 Mc/s internationally; the British amateur bands as shown above are 10 kc/s narrower than those internationally agreed.

While discussing the international allocation of frequencies, it may be interesting to note the new call-signs and frequencies of the German "Programme Addressed Material" transmitters; these transmitters are used in somewhat the same way as those of R.C.A. at Rocky Point such as WLL and WQP, and now all have calls beginning with DZ. Omni-directional aerials are generally at present used for these services:—

DZA	9.675 Mc/s	(31.01 metres, formerly DJI)
DZB	10.042 "	(29.87 " " DJJ)
DZC	10.290 "	(29.16 " " DIQ)
DZE	12.130 "	(24.73 " " DJS)
DZH	14.460 "	(20.75 " " none)
DZG	15.360 "	(19.53 " " DJT)

Note.—DJS is now the call of a new German station on 21.45 Mc/s (13.99 metres).

To conclude this section of our fortnightly notes, I will also give the fre-

quencies of the new Norwegian station, which is to be built at Jeløy:—

LKZ	21.50	Mc/s	(13.95 metres)
LKY	21.46	"	(13.98 ")
LKX	17.785	"	(16.87 ")
LKW	17.755	"	(16.90 ")
LKV	15.17	"	(19.78 ")
LKU	11.83	"	(25.36 ")
LKQ	11.735	"	(25.56 ")
LKE	9.572	"	(31.34 ")
LLD	9.55	"	(31.41 ")
LKJ	9.54	"	(31.45 ")
LKC	9.53	"	(31.48 ")
LKL	6.13	"	(48.94 ")

Before turning to a study of conditions and the fortnight's reception, I should like to refer to an interesting letter from "W. H." in the issue of May 15th.

In this letter astronomical numbers of sunspots were mentioned; for example, "March 19th—105 spots, March 20th—110," etc. I think I am right in stating the numbers given above do not refer to individual spots, but are actually *Wolf* sunspot numbers. The formula for finding the *Wolf* number—*n*—is as follows:

$$n = K(\log + f) \text{ where}$$

g = number of groups and single spots observed.

f = total number of spots counted in these groups.

K = multiplier depending on telescope used and observing conditions.

Sunspot activity has not been very great recently, and during the fortnight under review, May 6th-18th, was probably at a

maximum on May 10th-11th. At the time of writing, May 19th, there are only two spots visible, and these have completed about three-quarters of their transit of the sun's disc and have diminished in size day by day.

On Wednesday, May 6th, conditions were fairly good, W8XK being definitely good on 15.21 Mc/s (19.72 metres) in the evening, with W3XAL poor. The R.C.A. transmitter WLL on 17.90 Mc/s (16.76 metres), which is adjacent to W3XAL, was, however, an excellent signal when working with Berlin.

Fairly good results were obtained from W2XAF later in the evening, and at 11 p.m. W1XAL, Boston, was observed to be squegging badly, the main signal appearing as a badly distorted carrier on 12.05 Mc/s (24.9 metres).

Sofia, LZA, on 14.97 Mc/s (20.04 metres) was a good signal between 10.10 and 10.37 p.m. on Sunday evening, May 10th, but no call sign was given by the lady announcer, who used the French and, presumably, Bulgarian languages.

Beograd (Belgrade) has also been a good signal recently on 6.10 Mc/s (49.18 metres).

U.S. Amateurs to the Fore

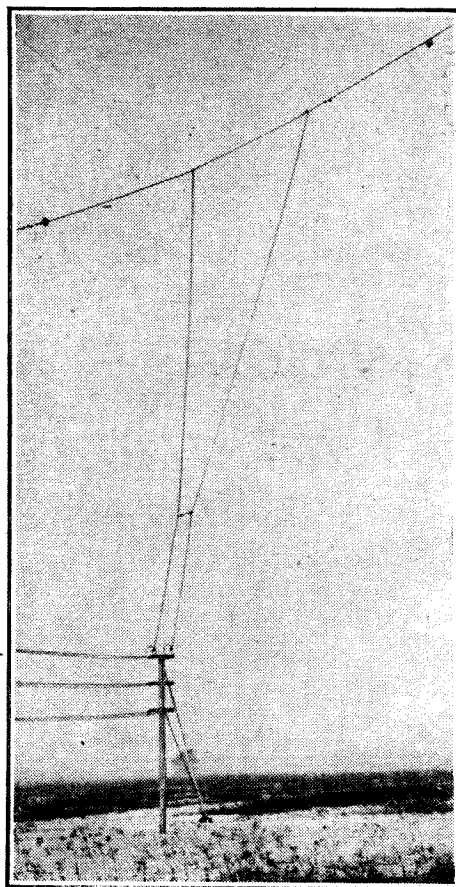
The U.S. amateurs were putting up quite a good performance on 14 Mc/s (20 metres) on Monday evening, May 11th, and W8XK on 15.21 Mc/s (19.72 metres) peaked to a really good signal of entertainment value by 11 p.m. Boston, W1XAL, was observed to be squegging still!

The next day, Tuesday, saw quite a change in conditions, and W2XAF was the best U.S. signal at 11 p.m., with W8XK very poor at this time on both 12 and 15 Mc/s.

Conditions, so far as the U.S. broadcasters were concerned, were still bad on Wednesday, May 13th, but the Bandoeng telegraph station PLF on 17.85 Mc/s (16.81 metres) was an enormous signal at 9 p.m. The best signal of the broadcasters this night at 11 p.m. was again W2XAF, but the commercial stations were performing excellently up to 15 Mc/s (20 metres).

At 8 p.m. on Thursday the best broadcaster was probably the Vatican HVJ on 5.968 Mc/s (50.27 metres), but the T.A.T. transmitters WKF on 19.22 Mc/s (15.61 metres) and WLA on 18.34 Mc/s (16.36 metres) were putting in really excellent signals from the States, with W3XAL quite poor. Both WKF and WLA were still excellent at 11 p.m.!

At this time, W8XK had risen to a



The half-wave horizontal doublet aerial system of W2XAF, one of the best-known American short-wave stations.

good signal on 15.21 Mc/s (19.72 metres), and a little earlier even W2XE had been fairly good on 15.27 Mc/s (19.64 metres). W2XAF was, however, only just audible.

Rather better signals were obtained from PRF5, on 9.50 Mc/s (31.58 metres), than from W2XAF, at 11.40 p.m., Sunday, May 17th, and the U.S. amateurs on 14 Mc/s were giving better results than any of the broadcasters on this occasion.

Although reception from the U.S.A. was again poor on Monday evening, WKF was R10 on 19.22 Mc/s at 10 p.m., and about this time HBJ on 14.535 Mc/s

(20.64 metres) and HBF on 18.95 Mc/s (15.83 metres) were heard at excellent strength, particularly the latter, broadcasting to America.

The half-wave of PPH on 24 Mc/s (12.5 metres) was also quite strong at 10 p.m.

One concludes with a list of a few of the better South American stations heard recently after midnight:

Cartagena ...	HJ1ABD	9.61	Mc/s
Panama ...	HP5J	9.605	"
Havana ...	COCH	9.432	"
Buenaventura ...	HJU	9.499	"

ETHACOMBER.

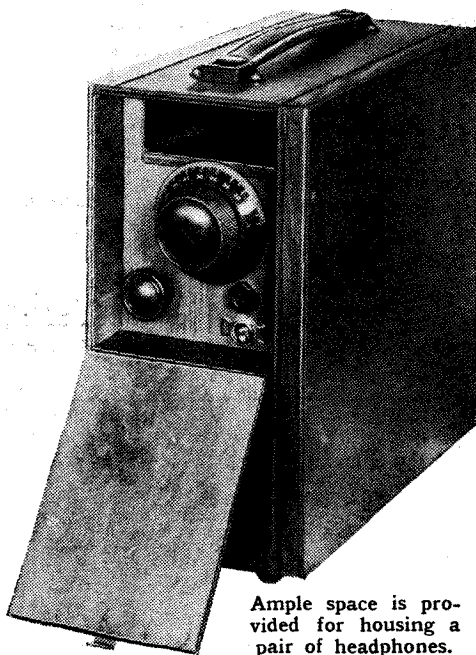
In Next Week's Issue

The Wireless World Holiday Portable

Sensitive and Compact Self-contained Equipment

THERE are many occasions upon which a portable receiver of light weight and small dimensions can be a great source of pleasure. The set to be described in next week's issue is designed for headphone operation, and is run entirely from dry batteries of types which are both inexpensive and readily obtainable.

Four valves are used and the frame aerial is included in the case, which has also a compartment to hold the phones so that the equipment is completely self-contained. Tuning is simple and the sensitivity adequate to permit several stations to be received even in poor locations, while under normal conditions many of the more powerful Continental transmissions are good signals.



Ample space is provided for housing a pair of headphones.

LIST OF PARTS

- 1 Variable condenser, 0.0005 mfd. slow motion drive **Polar 2SM**
- 1 Reaction condenser, 0.0003 mfd. with knob **Polar "Compax"**

Condensers

- 2 0.1 mfd. tubular **Dubilier 4513**
- 1 0.5 mfd. tubular **Dubilier 4517**
- 1 0.01 mfd. **Dubilier 670**
- 1 0.001 mfd. **Dubilier 670**
- 1 0.0005 mfd. **Dubilier 665**
- 1 0.0002 mfd. **Dubilier 665**

Resistances

- 1 10,000 ohms 1/2 watt **Erie**
- 2 50,000 ohms 1/2 watt **Erie**
- 2 250,000 ohms 1/2 watt **Erie**
- 1 2 ohms 10 watts **Bulgin AR2**

2 HF Chokes

- Bulgin HF8**

1 LF Transformer

- Bulgin LF33**

4 Valve holders, 4-pin

- Clix "Midget" B.T.S.**

1 3-spring automatic jack

- B.T.S.**

1 Telephone plug

- B.T.S.**

1 Toggle switch, on/off

- Bulgin S80T**

3 Wander plugs

- Eelex**

2 Spade ends

- Eelex**

1 Plug-top connector

- Belling-Lee 1175**

1 H.T. battery, 60 volts

- Ever Ready "Winner"**

1 LT battery, 4 1/2-volts

- Ever Ready 3-Cell 126**

1 Pair headphones

- B.T.S.**

Chassis and Cabinet

- B.T.S.**

Miscellaneous:—

- Scientific Supply Stores**

- 1 oz. No. 36 DSC and 2 1/2 ozs. No. 22 DSC wire for frame aerial; 2 lengths systofex; wood, wire, screws, etc.

Valves, 1 XSG, 1 XL, 2 XD

- Hivac**

Random Radiations

By "DIALLIST"

A Difficult Case

NOT very far from my home, though luckily far enough for me to be outside what may be termed its sphere of influence, interference with broadcast reception of a particularly poisonous kind cropped up some little time ago. The Post Office authorities responded at once to an appeal for help and soon tracked down the origin of the nasty noises to the premises of a small firm which specialises in certain kinds of electrical work. Those who had sent out the SOS were delighted to hear that the trouble had been located so quickly. Their joy became less when they heard that the proprietor of the concern flatly refused to fit the necessary radiation-suppressing appliances to his appa-

ratus. The Post Office engineers reasoned gently with him. They fixed up a temporary arrangement of suppressors which proved conclusively, (a) that interference could be stopped completely, and (b) that the suppressors in no way affected the working of the machinery. Still the offender was obdurate; he wouldn't spend a penny. His victims put their heads and their purses together and offered to defray the entire expense. They were met by yet another blank refusal. The position is, then, that the Post Office people have done their best; that the machinery is still causing interference so severe that in some homes reception of even the local programmes is impossible for a large part of the day; and that, though he knows this, the person responsible will do nothing despite the fact that all expenses would be met by others. Is not this a very clear proof of the necessity for strong Government action in the matter of radiated interference, action which is now long overdue?

Driving it Home

It may be argued that the best way of dealing with a selfish and inconsiderate offender of that kind is for listeners to withdraw their custom from him. There is a lot in that, and I have known cases where pressure of this kind has worked fairly well. It is, however, at the best of times rather a long business for a man who is innately pig-headed to climb down even when he knows that he is in the wrong. He may let his pocket suffer for a considerable time before he will give way. Nothing short of a severe penalty is going to make him see the error of his ways. I am no lawyer, but I have often wondered whether a case of this kind couldn't be dealt with under the present Act by bringing against the offender a charge of transmitting without a licence. So far as I know no case on these lines has ever come before a court, and if one were brought the result might possibly be interesting.

Empire Broadcasts Inwards

FOR a long time the commentaries on current events in the United States have proved very popular with listeners. From the technical point of view they have proved that it is possible normally to maintain a regular short-wave service at a given time between the two countries. In view of this success it is intended shortly to establish what may be termed two-way broadcasting between this country and the rest of the Empire. At present the Empire is kept closely in touch with the doings of the Home Country by means of the Daventry short-wave service, but the Mother Country hears very little at first hand from the Empire. The intention is to inaugurate regular relays from B.B.C. medium- and long-wave stations of broadcasts from Canada, Australia, New Zealand, South Africa and other parts of the Empire at a not-far-distant date. These will at first be rather in the nature of an experiment, but as time goes on I expect to see them becoming regular and permanent features of the home programmes.

Radio Physical Jerks

AMERICA, I believe, set the fashion of broadcasting instructions for physical training exercises in the cold grey dawn. Several other countries followed suit, and should you care to tune in, say, Turin at 7.45 in the morning you will see how they do it in Italy. So far the B.B.C. has not provided us with wireless physical jerks, but a beginning is to be made shortly on a small

Random Radiations—

scale. I understand that the first P.T. broadcasts will be intended for schools, but that if they evoke sufficient enthusiasm amongst listeners in general they may achieve a wider scope. For me, the only kind of broadcast P.T. that I have ever enjoyed was that magnificent burlesque of war-time physical jerks given by the "Roosters."

**Finding Listeners' Tastes**

FOR some while certain of the relay stations have kept graphs showing the rise and fall of the load on their amplifiers during programme hours. These graphs show the approximate number of their subscribers who are using their loud speakers at any given moment. Since it is easy to superimpose upon the graphs a scale showing the items in progress at any time, it has been held that this provides an ideal method of gauging the tastes of listeners. But does it? First of all, relay subscribers form only about three per cent. of the total of listeners, and, secondly, they are drawn largely from a class which would naturally be expected to show appreciation of "popular" items and a distaste for those of a more intellectual kind.

**What Ended the Squeal ?**

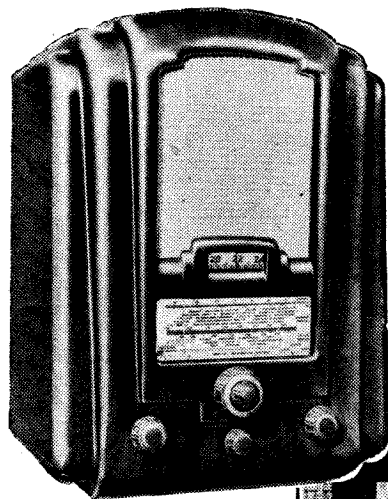
THE other day, when several of us were discussing the nuisance of interference from electrical machinery and so on, I couldn't help recalling what conditions were like in the early days of broadcasting. It is true that the flashing sign, the electric sausage machine, the milk separator, and the like, were not then very much in evidence with their unwelcome broadcasts of crackles and fizzes; but there was another sort of interference, which has virtually ceased to exist now. At that far-away time few B.B.C. stations, if any, were rated at more than 1.5 kilowatt, and the most usual receiver was a 2-valve or a 3-valve set operating a loud speaker of the horn or cone type. The ambition of the newcomer to wireless was to obtain the greatest possible volume of sound from his loud speaker. Those skilled in the art of tuning operated their sets just a little short of the point of oscillation, but the others (and they were many) screwed up the reaction coupling until the set was oscillating and then tuned to what was known as "the silent point between squeals." The result was that during the evening there was nearly always somebody fiddling with his tuning knobs and causing the loud speakers of his neighbours to give vent to horrid howls. That kind of thing is very rare nowadays, on the local stations at any rate. Freedom from squeal interference is one of the benefits that high-powered transmissions have conferred upon us.

**East, West, . . .**

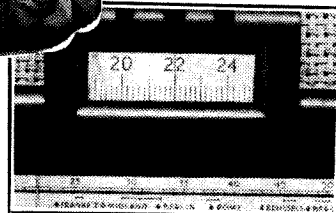
IT'S rather the fashion nowadays for people to say how dull the B.B.C. programmes are and how much they suffer by comparison with those from Continental stations. But my experience is that some of the fiercest detractors of the home programmes spend a large part of their time in listening to them and comparatively seldom make those radio trips abroad of which they talk so much! I do, I suppose, as much listening to foreign stations as most people, since it is part of my job in life to keep in touch with their doings; but if I had to make a choice between a receiving

set that would bring in the home programmes only (supposing that there were such a thing) and one which would give me all European stations but no British (again supposing that such a thing existed) I have not the faintest shadow of a doubt that I should immediately choose the former. This is not to say that there's not a great deal of entertainment—and very fine entertainment—to be received from the Continent. There is. But consider for a moment the enormous choice that is at your command. On any evening there are probably twenty

or thirty such stations whose transmissions can be received with something approaching perfection by means of the modern set. How many stations do you visit before you find something that seems really worth listening to? And do you listen to one and the same station's programme for several hours on end? I don't think that you do very often. In order to maintain a flow of sparkling entertainment from the Continent you have got to pick an item here, an item there. In other words, you take the cream and let the skimmed milk go.



"Nova" all-wave superhet in the newly designed moulded cabinet. The "Magnascopic" scale (right) assists accuracy of tuning on the short-wave range.



The New Ferranti Sets

All Models Now Include a
Short-wave Range

matically to the condition of highest selectivity when the tuning knob is turned to receive another station.

Finally, there is the "Gloria" superhet, which in the earlier stages is the same as the "Arcadia," which has an intermediate LF amplifier and push-pull output triodes following the second detector. The undistorted output is $6\frac{1}{2}$ watts, and a specially large cabinet has been designed to ensure the best possible reproduction.

THE 1936 programme of Ferranti, Ltd., is of more than usual interest, for every receiver is equipped with a short-wave range in addition to the usual medium- and long-wave broadcast bands. The increasing importance of short-wave listening has induced most of the leading firms to include an all-wave receiver in their lists, but we believe that this is the first instance of a complete "all-wave" set programme in the country.

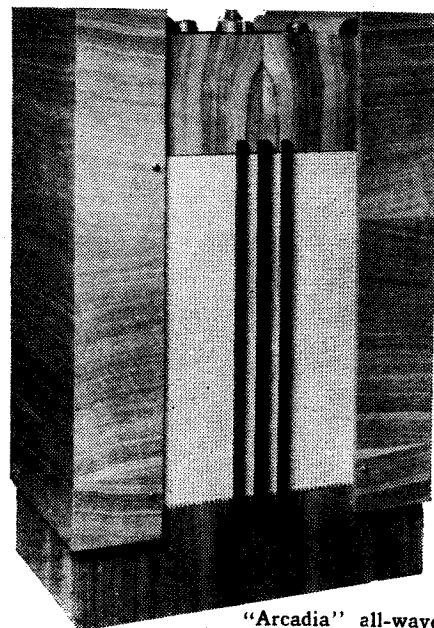
The smallest model in the series is the "Parva," which is a "straight" receiver similar in specification to the "All-Wave Straight Three" recently reviewed.

Next comes the "Nova" superhet, with a heptode frequency-changer, variable- μ IF amplifier and combined detector and output valve. For this receiver a new style of moulded cabinet has been introduced, and the large indicating dial is supplemented by a degree scale which enables the settings of short-wave stations to be logged with great accuracy. The new "Magnascopic" scale, as it has been named, is based on the principle of the optical lever and a system of right-angled mirrors projects an enlarged image of the scale on the rectangular screen immediately above the main tuning dial. It is stated that the new indicator gives the equivalent of a scale over 6ft. in length.

Both the foregoing models are available in AC/DC form, and the "Nova" is also supplied as a battery receiver with QPP output.

In the "Arcadia" model a separate $2\frac{1}{2}$ -watt triode output valve follows the double-diode-triode detector and variable selectivity is included. By an ingenious mechanical device the set is returned auto-

The "Parva" and "Arcadia" receivers are available as full-length consoles as well as table models, the "Arcadia" console being of particular interest on account of the recessing of the controls horizontally in the top of the cabinet. The series is completed by radio-gramophones incorporating the "Parva," "Arcadia," and "Gloria" chassis. The latter instrument is a fine example of the cabinet maker's art, and includes an automatic record-changer.



"Arcadia" all-wave variable selectivity console with controls recessed in top of cabinet.

Readers' Problems

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Measuring Dynamic Resistance

WE are asked by a reader who has not access to elaborate laboratory equipment to suggest a simple method of measuring the dynamic resistance of a tuned circuit.

We suggest the scheme shown in Fig. 1, which calls for no instrument other than a valve voltmeter; even this need not be accurately calibrated from the absolute point of view, so long as relative voltages are correctly shown.

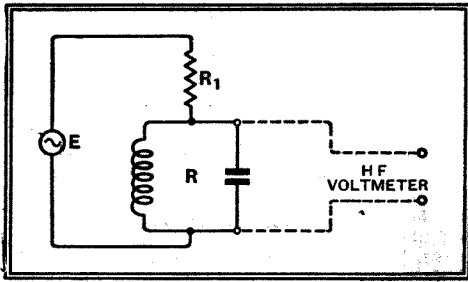


Fig. 1. A simple way of measuring the dynamic resistance of a tuned circuit

The procedure is to apply to the circuit an oscillatory voltage, at the frequency to which it is tuned, from a source E, a resistance R_1 being interposed. The next step is to adjust the value of this resistance until the voltage indicated by the voltmeter is equal to half that existing across the source E. Under these conditions we know that the dynamic resistance R of the tuned circuit is equal to the resistance of R_1 , which can be measured by ordinary "DC" methods.

The PA Amplifier

WE are asked to suggest a method of introducing optional bass cut-off into the PA amplifier as described in our issue of April 3rd.

This can easily be arranged by connecting the unused section of the bass control switch in such a way as to replace C_{17} by other condensers of lower value. In most cases capacities of 0.01 mfd. and 0.1 mfd. would be about right, but it is a good plan to determine the values experimentally in order to suit personal requirements.

Without Foundation

OLD traditions die hard, and so it is, perhaps, not surprising that in many quarters the belief is held that for real quality reception the superheterodyne circuit is quite out of place.

Informed opinion has, however, swung over to a diametrically opposite point of view, at any rate so far as long-range and medium-range reception is concerned. The amount of selectivity that is necessary for such reception can, it is admitted, be obtained in a straight set, but by ordinary means it is almost impossible to prevent a radical change of selectivity taking place

over the normal broadcast wavebands. It will therefore be obvious that any system of fixed tone correction is bound to fail.

In a superheterodyne, on the other hand, selectivity can be much more nearly constant, and when controllable selectivity is required it can be much more easily arranged than in the straight set. All this is in reply to one of the doubters, whom we would assure that there is no reason at all why unexceptionable quality should not be obtainable from a superheterodyne.

Valve-assisted Wave-trap

A READER who wishes to set up a wave-trap (or absorbing circuit) of exceptionally high efficiency has apparently overlooked the possibility of obtaining the extreme circuit "goodness" that he requires with the assistance of a valve.

The proposed coil that he asks us to criticise would probably be of the right inductance value and of sufficiently low HF resistance for his purpose, but it would be bulky and expensive. It seems that an ordinary coil, plus a reacting valve fed from the same source as the receiver, would be more satisfactory; a wave-trap on these lines has the advantage that its dynamic resistance may be varied within wide limits by adjusting reaction. Some useful information on valve-assisted wave-traps appeared in our issue of March 22nd, 1935.

Superheterodyne Coils and Condensers

IT should be emphasised that, by the act of obtaining a special superheterodyne tuning condenser with a shaped-plate section for the oscillator circuit, one is not relieved of the necessity of obtaining special signal-frequency coils. In order to obtain accurate ganging, it is necessary that the oscillator coils should have a different (and always a lower) inductance value than that of the signal-frequency coils. Moreover, the oscillator frequency and intermediate frequency are inter-dependent, and it is necessary that the coil and condenser should be designed for working at the desired IF.

Piezo-Electric Pick-ups

A CORRESPONDENT who writes about his piezo-electric pick-up seems to have overlooked the fact that this device behaves in some respects in a markedly different manner from the earlier moving-iron type. In particular, the effect of a shunt resistance is quite different; by reducing the value of the resistance connected across the piezo-electric device the high frequency response is accentuated; with a moving-iron pick-up it would be attenuated by the same alteration.

LF Amplifier Interaction

A READER who has recently reinstalled his gramophone amplifier in another room complains of an annoying resonance in the middle register which was not previously noticeable.

This may be due to stray reaction between the output and input ends of the set; very probably it has been brought about by rearranging the various external connecting leads. Although it is well known that accidental reaction introduced in this way can cause howling, it is not so widely

appreciated that it may seriously impair the frequency characteristics of the amplifier long before it becomes acute enough to cause actual self-oscillation.

Turning Down the Wick

A WOULD-BE constructor of the PA Amplifier hesitates before adopting this design because he fears that the quality of reproduction will fall off if the instrument is normally operated at an output much below its maximum rating—say, at 3 or 4 watts.

There are no real grounds for such fears, as, with the PA amplifier, there is no loss of quality when volume is reduced.

Without a Power Transformer

ASKING us to provide him with the circuit of an HT rectifier to work from AC mains without a power transformer, a querist "supposes that such an arrangement is safe to work."

It is possible by taking suitable precautions to dispense with the transformer, and at the same time to satisfy the existing safety regulations. However, these precautions are somewhat extensive, and perhaps in most cases it is best to use a transformer after all.

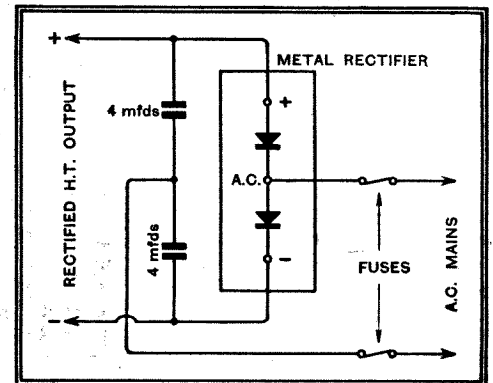


Fig. 2. A transformer-less HT rectifying circuit.

We assume that our correspondent wishes to use a metal rectifier, and on this assumption the circuit arrangement shown in Fig. 2 is suggested. This will provide a voltage about double that of the mains supply. As an alternative, a high-voltage rectifying valve could be employed in the type of circuit recommended by the makers.

The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

BROADCAST

News from Portland Place

BREVITIES

No Sunday Dance Music

CURIOUS how hard it is to kill that lying jade, Rumour. From time to time unauthorised statements have been made that the B.B.C. intends to introduce dance band music into the Sunday programmes; and always a denial has come from Broadcasting House. But the B.B.C. post-bag still contains a lot of protests from indignant listeners at the contemplated "desecration of the Sabbath." No hint has been given that there will be any dance music broadcasts by the B.B.C. on Sundays, excepting, of course, transmissions of special arrangements of the rather classical type of dance music which bears no resemblance to syncopation.

Television Colours

ALREADY the B.B.C. has printed a colour code for the use of artists who will appear in the programmes at Alexandra Palace.

There are three shades or tones available: light, medium and dark, and into these all the colours of the rainbow must be accommodated. Colours registering as white, or nearly so, include all pale shades, orange, red and the lighter browns. The dark browns, greens and purples come out grey, while nearly all blues, except light, appear black or nearly so, on the television screen.

Dress Rehearsals

Artists will be impressed with the necessity of wearing "contrasting" clothes, with bold patterns.

All television rehearsals, it is understood, will be regarded as dress rehearsals, as the appearance of the artists and their reaction to the special lighting effects is perhaps the primary consideration in television transmission.

Profit-makers of Broadcasting

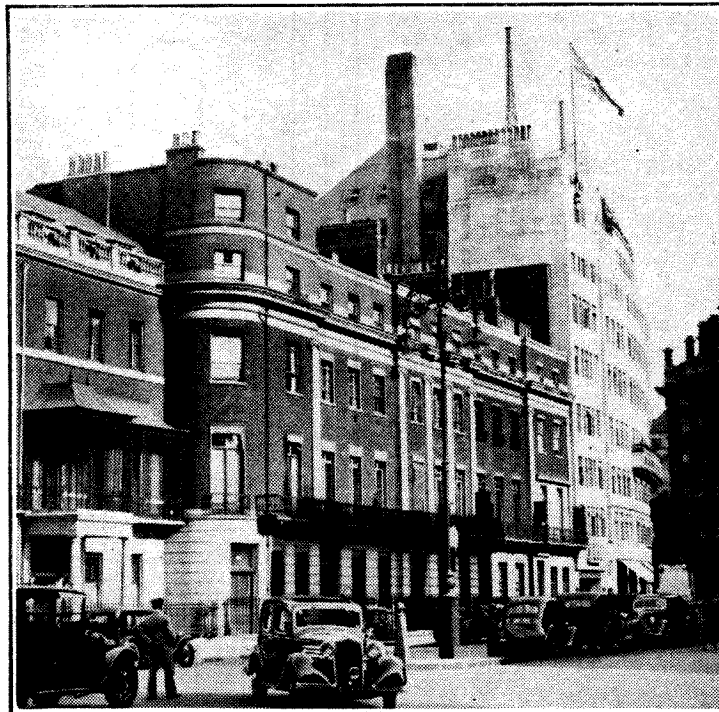
WHO gets the big money in broadcasting? Not the organisers of programmes, not the artists, nor the station and engineering staffs; but the electric light undertakings, which draw the chief profits out of entertainment on the air. According to Dr. Orestes Caldwell, one of the original members of the United States Federal Radio Commission, the electric light companies collect two dollars for every dollar earned by artists, broadcasting stations and networks combined.

The more considerable part of this revenue is in respect of lighting current used by listeners who sit up very late at night. The vast increase in the use of mains receivers is also bringing a constantly growing revenue to the coffers of electric light companies. The consumption of electrical energy by listeners'

announcer and dance band company, was the very important Algernon Sprigge.

All Pulling Together

The impression one takes away from these jolly—and to a large extent, informal—occasions, is that B.B.C. talent is not confined to the broadcast



THE B.B.C. having acquired No. 10, Portland Place, now own the whole of the property between Broadcasting House and Duchess Street. Most of the houses are already in use as offices, so that it might well be expected that an additional Broadcasting House will eventually arise.

receiving sets in Europe alone is computed to be of the nature of 1,997 million kilowatt hours, representing an average annual consumption per receiving set of 35.73 kilowatt hours. On the whole, it is more profitable to be a shareholder in an electricity corporation than in the most flourishing wireless business.

Behind the Scenes

MODESTY is the only apparent fault in the B.B.C.'s Amateur Dramatic Society, which has never yet been persuaded to come "on the air," despite the excellence of its productions. Sir John Reith has been appearing this week as Bates the butler in Ian Hay's "The Sport of Kings," with which the Society has amused large audiences at the Fortune Theatre. Leslie Mitchell, former

studios. Full many a flower might be born to blush unseen in the General Office or the stokeholes of Portland Place if it were not for the Amateur Dramatic Society.

Another impressive feature is that these amateur theatricals level all ranks in the common desire to produce a worthwhile performance.

Standard Receivers

YOU can take a horse to the water but you cannot make him drink," and just as the Ullswater Committee can make recommendations, it is another matter whether the B.B.C. will carry them out, even if pressure is brought to bear.

Officials of the B.B.C. seem quite satisfied that the Corporation should not be induced to indulge in the manufacture of

standard receivers in conjunction with the wireless industry, nor even to give their blessing to any one type of cheap receiver which may be produced jointly by the manufacturers.

It seems that the B.B.C. is fully aware of the risks that would be run if they sponsored such a set and so induced the public to think that it was the last word in receivers and ideally suited to the reception of B.B.C. programmes.

Television Sets

In the case of television the B.B.C. has no choice in the matter of transmissions but must undertake to put out programmes with the transmitting apparatus supplied by the two concerns, Baird and E.M.I. Receivers will have to be standardised for the time being for the reception of these two transmissions. The B.B.C. have not committed themselves to these systems alone for all time.

Why Not a Museum?

NO one can wander for long through the corridors and studios of Broadcasting House without coming across excellent material for a broadcasting museum.

The Effects Department could furnish many show cases on its own account because, probably for sentimental reasons, no one takes it upon himself to destroy the dear old superannated gadgets which were used to make "noises" at Savoy Hill.

Mobile Recording Era

Old wind machines, horses hooves, roller skates (pushed to and fro in a turned-up zinc bath to simulate train sounds) are still preserved. Many of them were superseded when the mobile recording department set about bottling genuine noises all over the country.

The First Talk

But there are other departments, besides Effects, which could contribute handsomely towards the formation of a museum. The engineers must surely possess some of those original transmitting valves which "went phut" about every other evening, and these sacred relics would sit well beside those early chimes on which "Uncle Arthur" (Mr. Arthur Burrows) used to broadcast "Greenwich Time."

The most sacrosanct object of all—it would be preserved from prolonged exposure to light under a flap of red velvet—would be the MS. of the very first talk.

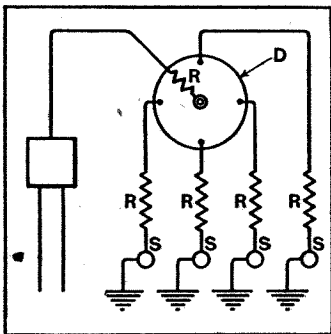
Recent Inventions

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

INTERFERENCE SUPPRESSORS

IN order to reduce "static" interference, particularly that due to the ignition system of a motor car, suppressor resistances R are inserted in series with the leads from the distributor D to each of the sparking plugs S, as well as in the connection to the ignition coil.



Arrangement of suppressors in car ignition system.

In addition, a choke coil consisting of about twelve turns of insulated wire on a half-inch spool is inserted in the aerial input circuit. This is found to have a comparatively low impedance to the sustained signal-waves, but serves effectively to reject the highly damped "static" impulses.

Philadelphia Storage Battery Co. Convention date (U.S.A.) September 20th, 1934. No. 443001.

SHORT-WAVE SIGNALLING

VERY short waves, of the order of 10 centimetres, are focused on to a reflecting or refracting surface comprising a number of tubes containing an easily ionised gas. Each tube is fitted with an outer band-electrode, to which a biasing voltage is applied, to control the degree of ionisation of the contained gas.

The tubes may be arranged as a flat reflecting surface, or as a prism or lens. The short-wave radiation can thus be focused into a beam, or made to converge or diverge, in accordance with the density of ionisation existing inside the tubes. The assembly, in fact, forms a quasi-optical lens, the refractive index of which is controlled by the biasing voltage applied to the ionising electrodes of the tubes.

Marconi's Wireless Telegraph Co., Ltd. (Assignees of V. K. Zworykin). Convention date (U.S.A.) August 31st, 1933. No. 443426.

"BLIND" LANDING BY RADIO

FOR guiding an aeroplane safely to ground, at night or during fog, two rotating beam beacons are installed on the aerodrome, to-

gether with a non-directive aerial. The latter is modulated with a note equal to the frequency of rotation of the two beams.

The aeroplane carries a synchroscope meter with two indicator needles, which work over a chart of the aerodrome. This is mounted on the dashboard of the machine so that the point of intersection of the two needles shows the pilot his actual position at all times during his approach to the aerodrome and his subsequent descent.

L. V. R. Philpott (Assignor to Westinghouse Electric and Manufacturing Co.). No. 2008401. (U.S.A.)

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DISTRIBUTING TELEVISION

THE range of television and similar ultra-short-wave signals is limited to the so-called pseudo-optical distance. To increase the service area it has already been proposed to radiate such signals from a "master" transmitter to outlying districts, where they are received and re-radiated from local transmitters. In practice, however, this involves the use of extensive re-amplification, and the presence of an operating staff at each of the re-radiating centres.

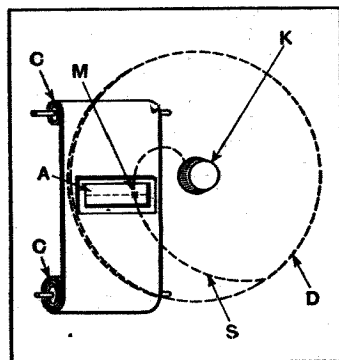
According to the invention, a higher level of field-strength at the distant point of re-radiation is ensured by transmitting the original signals in the form of a directed beam from the "master" station. The beam has a sufficient "spread" to energise a group of distant non-directional aerials, each of which then re-radiates the signals over the local service area.

V. K. Zworykin (Assignor to Radio Corporation of America). No. 2028857. (U.S.A.)

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TUNING DIALS

TO facilitate accurate tuning to a large number of stations, the name of each station is marked on



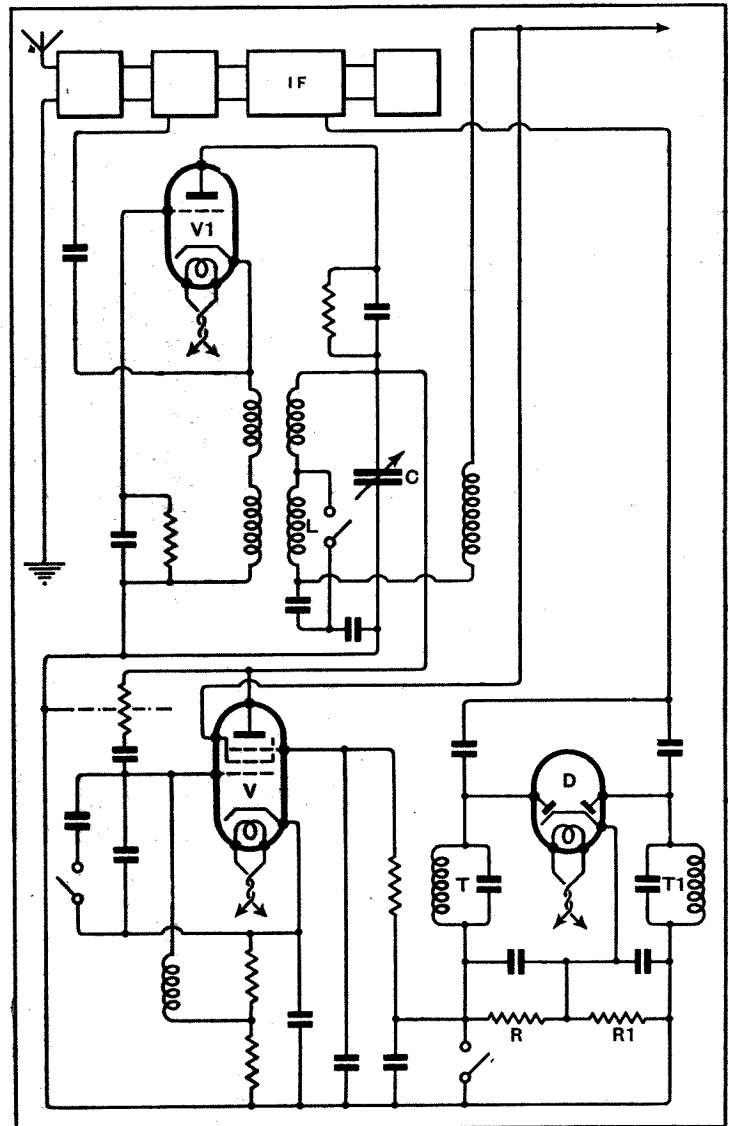
Tuning dial designed to accommodate a large number of station names.

a chart C which is gradually unrolled so as to present them one

by one through an illuminated aperture A. Associated with each station name is an individual calibration mark, shown at M. In operation a transparent disc D is rotated by the tuning knob K, until a "scanning" curve S registers with the calibration mark M to indicate the correct tuning. Alternatively the station names

duces a correcting factor which serves to bring the circuits dead into tune.

As shown in the drawing, the pentode V is shunted across the tuned circuit LC of the local oscillator valve V1. A double diode D is fed with intermediate-frequency currents from the amplifier I F. The diode is connected



Details of the circuit employed for automatic correction of mistuning.

may be printed on a second disc mounted on a sleeve behind the one carrying the "scanning" or cursor line.

R. J. Pickard. Application date October 11th, 1934. No. 443121.

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AUTOMATIC TUNING

THE initial mistuning of a super-het set is automatically corrected by the action of a pentode which is shunted across the local oscillator circuit. The effective impedance of the pentode is increased or diminished according as the initial setting of the tuning control is above or below the correct point of resonance. This intro-

to two circuits T, T1, one of which is tuned above and the other below the correct intermediate frequency. The corresponding load resistances R, R1, are arranged in opposition in the suppressor-grid circuit of the pentode V, and vary the effective "slope" of that valve in one direction or the other according to whether the initial tuning is above or below the correct point of resonance. This in turn reacts upon the tuning condenser C of the local oscillator until the initial error has been corrected.

Murphy Radio, Ltd. G. B. Baker, and G. F. Hawkins. Application dates July 25th and December 4th, 1934. No. 443423.