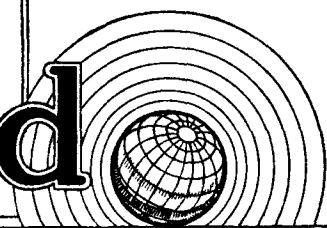
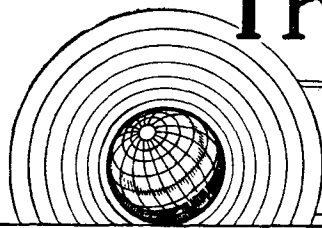


The Wireless World

THE
PRACTICAL RADIO
JOURNAL
23rd Year of Publication



No. 749.

FRIDAY, JANUARY 5TH, 1934.

VOL. XXXIV. No. 1.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.

Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.

Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:

Home, £1 rs. 8d.; Canada, £1 rs. 8d.; other
countries abroad, £1 3s. 10d. per annum.

*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.*

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EDITORIAL COMMENT

The Wavelength Change Order Next Week's Issue Early

IN next week's issue the change-over of European broadcasting station wavelengths will form the chief topic of interest. The issue will carry with it as a free supplement a novel "key" to the new wavelengths, printed in colour on a large card which will provide a record of station tuning positions for the future, as well as a guide to the identification of the new wavelengths as the change-over takes place.

This special supplement can only be made available with copies of *The Wireless World* and cannot be obtained separately. As the issue is likely to prove very popular, it would be well for readers and their friends to make sure of obtaining next week's issue by ordering it in advance from their newsagents.

would do all in their power to rectify it. We are glad, therefore, to be able to report that investigations have been made by systematic listening by the B.B.C. engineers, as a result of which they have satisfied themselves that although background noise of one programme behind the other is present at times, it is no more prevalent now than has always been the case.

They find that there is not a continual background of one programme behind the other, but that it does occur very occasionally. It is extremely difficult to eliminate, arising as it does from cross-talk due to unusual line adjustments. We are assured that the investigations will continue, with the object of eliminating all suspicion of cross-talk in the future.

No doubt the B.B.C. engineers would be glad to receive further reports from readers who observe this trouble, and will be assisted in their task if such co-operation is forthcoming.

Background Mystery

The B.B.C. Investigates

WE drew attention in our issue of December 1st to letters which we had received from readers complaining of the frequent presence of a background of speech or music behind one or other of the Brookmans Park transmitters. These letters, for the most part, came from readers who obviously had a good technical knowledge and wide experience and were well aware of the effects produced by cross-modulation, so that we felt fairly confident that some other explanation had to be found for this irritating phenomenon.

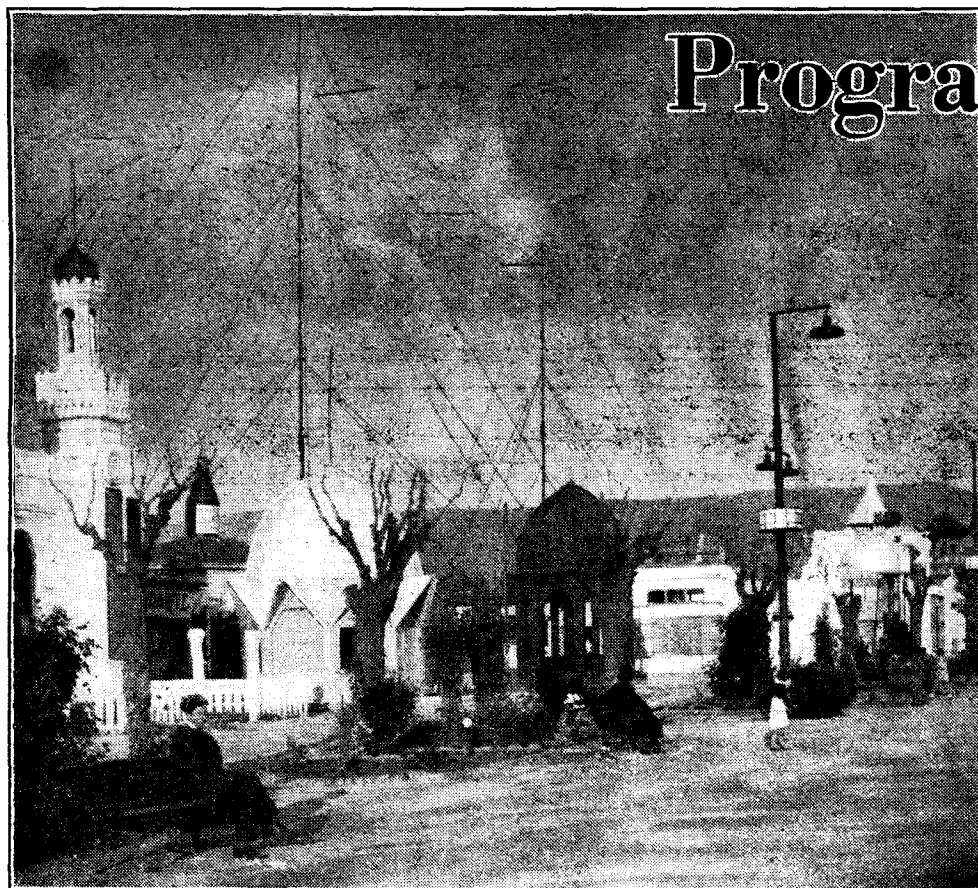
We suggested that the B.B.C. engineers should look into the matter, with a view to eliminating the trouble. We had little doubt that the engineering staff of the B.B.C., as soon as they appreciated that something was amiss,

News from the East

Big Increases of Power Expected

ALTHOUGH most of our readers are only too well aware of the "race for power" among European broadcasting stations, it will come as news that the epidemic is spreading to the Balkans, including Turkey. The discoveries made by our Special Correspondent, Mr. Cecil W. Lusty, during his recent tour to Constantinople, and related in this issue, show that the East is tardily awaking to the full possibilities of broadcasting.

Whether the new power urge will be welcomed by the already harassed International Broadcasting Union is debatable, but there can be little doubt that the British listener will welcome the new and unusual programme material which is promised for the near future.



Programmes from the Near East

By CECIL W. LUSTY



COMING SHORTLY

Angora (Turkey)	-	-	150 kW.
Brasov (Roumania)	-	-	150 kW.
Sofia (Bulgaria)	-	-	50 kW.
Belgrade (Yugoslavia)	-	-	50 kW.
Athens (Greece)	-	-	50 kW.

The company, I found, receives 65 per cent. of the licence revenue—of Yugoslavia's 55,000 licensed listeners about 11,000 are in and around Belgrade—and the Government the remaining 35 per cent. But as the company also conducts the technical side of the service it is asking for its proportion to be increased to 80 per cent. The desired increase would naturally result in a higher standard of programmes and probably extended broadcasting hours.

Untapped Talent

Radio Belgrade is usually active from 11 a.m. to 1.45 p.m., 4 p.m. to 5.20 p.m. and 7 p.m. to 11 p.m. or midnight (Central European Time). The musical director, M. Petar Krstic, kindly prepared for me an analysis of his programmes, and, on broad lines, the time is divided as follows: Music, 67.3 per cent.; literature, 2.7; talks, 6.2; criticism and news, 11.1; religion, 3.6; relays, 9.1. I



Radio Belgrade, in the Knez Mihailova, will soon be replaced by a 50-kW. station.

Giant Transmitter Plans in the Balkans

"GO East," said the News Editor, and I went. "Storm shirts" at German radio stations, barbed-wire entanglements in Switzerland, suspicious Austrian gendarmes at Bisamberg . . . these remained but a memory as I hastened to the Danube, storied river of song, where rises beautiful Budapest, pride of the Magyars, great capital of Hungary, and gateway between the Occident and my "Promised Land."

A pigmy-like figure clung precariously to the swaying Budapest radio tower that bestrides Central Europe like a Colossus, and gazed around. Westward lay the great cultural centres of Rome, Vienna, Prague and Berlin, whose programmes come at good strength to our British firesides, but ever eastward rolled on the majestic Danube beckoning to lands uncharted by most English loud speakers.

Gusts of wind made my descent difficult, but I reached the ground safely.

Budapest's fascinating illuminations

faded as the impudent little paddle-boat fussed down the misnamed "Blue" Danube to Belgrade, capital of Yugoslavia. The directions given me for the radio station, Knez Mihailova, were somewhat hazy. However, using my *vade mecum* *Wireless World* as a breast-plate, I was finally piloted to the station.

THE author of this vivacious and informative article has just returned after a radio pilgrimage from London to Constantinople. The trek was made in order that "The Wireless World" could confirm recent rumours concerning broadcasting developments in the Near East which bid fair to provide British listeners with new and unusual programme material. Mr. Lusty's disclosures of the new high-power plans are exclusive to this journal.

I rejoiced to find that the voice of Yugoslavia will later be well heard in the British Isles. M. Le General Kalafatovich, the courteous director of the service conducted by the Radio Belgrade A.D. Company, which is 98 per cent. British owned, told me that the concern had embarked on a £100,000 broadcasting scheme. The

present 1928 2.5-kW. station, which has received reception reports not only from English *Wireless World* readers, but also from Scandinavia, California, Africa and India, is being replaced by a modern 50-kW. plant on flat rural land about eight miles south-east of Belgrade. The two 100-metre masts were nearing completion when I visited the site, and I was informed that the station would be "on the air" towards the end of 1934. Mine Host also told me that 6-kW. relay transmitters would be established at Skoplje and Sarajevo. The existing Belgrade transmitter will be transferred elsewhere.

The title picture is of the amateur 1-kW. station in the fair grounds at Salonika, which is the precursor of a 50-kW. transmitter to be installed later by the Greek Government at Athens.

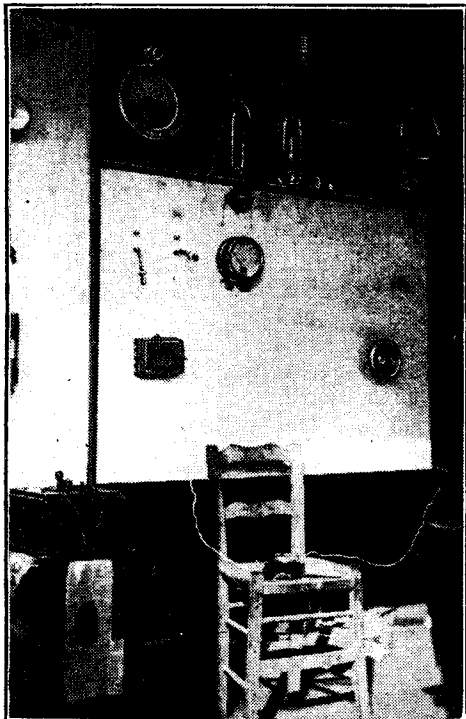
Programmes from the Near East—

discovered permanent relay lines to the cathedral, Opera House, University, Concert House, etc., while there is a radio orchestra of 16 players.

The present programmes are of a very encouraging nature, and with the new radio house put in order I can predict some interesting broadcasts for English enthusiasts, as there is vast musical talent in the land of the Slavs yet untapped by radio.

Bulgaria is Ambitious

The aeroplane unloaded me at the pleasant university city of Zagreb, and I found "Radio Zagreb" above the cable tram system connecting the old and the new town. I learned that the present 0.75-kW. station, built in 1926, would be superseded by a 20-kW. transmitter. This is being constructed near the river Sava, a few miles from Zagreb, and will be ready about the same time as Belgrade. The

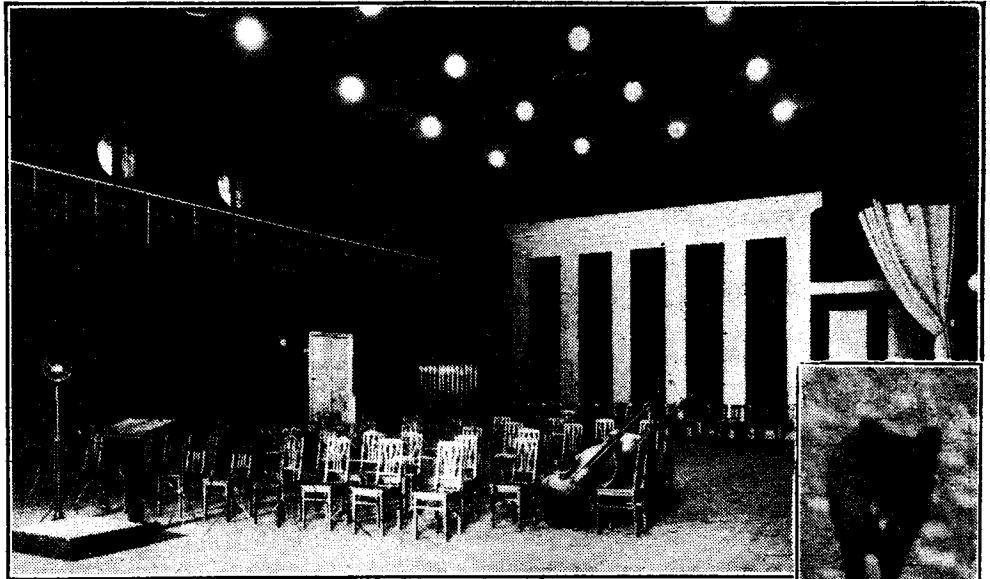


The little 1-kW station at Salonika with which Greek amateurs are "keeping the pot boiling" until the opening of the 50-kW transmitter at Athens. The station staff are seen on the right.



old plant will be given marching orders to Split, on the Dalmatian coast, to serve as a relay. The station at Ljubiana, the Yugoslavian Salzburg, was increased to 7 kW. last year.

The Simplon Orient express shunted me the following day into Sofia, the little capital of Bulgaria, and reputed to contain as many barber's shops as Birmingham. Eventually I was guided to Rodno Radio,



The Bucharest studio has the authentic Western European atmosphere. On the right is the station mascot.

in Benkovska Street, off the boulevard Dondoukoff.

Radio in Bulgaria can be described as "pale but interesting." The present existing transmitter, one of 350 watts, made its debut in 1930 and is maintained by the Bulgarian Society of Radio. This society, however, is now a house divided against itself, having split into two factions. One group, Bolgarsko Radio, a cultural co-operative society, wishes broadcasting to be independent of the State, but the principal Rodno Radio League is opposed to private monopoly. The former group advised me that they planned to erect a 4-kW. transmitter in a central position and subsequently to build relay stations in the east and north of Bulgaria and around Sofia.

At the Foreign Ministry I was officially informed of the Government's intention to install, in 1934, a 50-kW. transmitter to the east of Sofia.



I was pleased to hear from Rodno Radio—one of the most enthusiastic amateur corps I have met in my extensive travels—that, in order to foster radio-mindedness, they are not waiting for the State station, but are building a 3-kW. plant in the suburbs. My trip to this small station under the frowning heights of Mount Vitosha was highly interesting. The engineer, M. Hugel Tchoutchouloff,

told me that the two 65-metre masts, formerly used at the commercial transmitter behind the railway station, were presented by the Minister of Public Works, who also gave the bricks for the building and the machinery. An amateur working bee is in full swing and the cost to the society will be only 500,000 leva (about £735 at par). This plant will be testing early in 1934. The Government station, which will cost 40,000,000 leva (approximately £58,824 at par), will be devoted to national programmes, the 3-kW. plant to local programmes, and the pioneer 350-watt station, after conversion into a 500-watt transmitter, will be removed as a relay broadcaster to Varna, "Queen of the Black Sea."

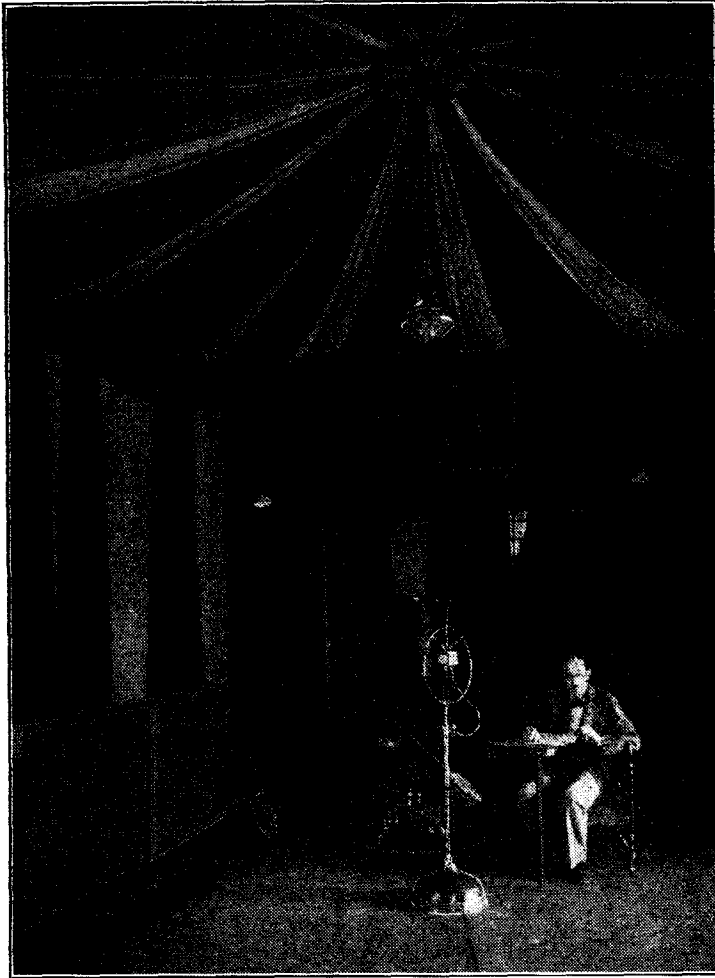
"Writtle" Days in Sofia

As the Government pockets the whole of the licence revenue and Rodno Radio is dependent financially upon minor advertising and members' subscriptions, the programme material at its command is restricted. (My mind travels back to our own Writtle days!) Relay lines, however, connect with the cathedral, Parliament, etc., while—unusual for this commercial age—artists give services gratis! Bulgaria, I learned, has about 4,000 licensed listeners, and there is a sliding scale of fees. With the arrival of the promised national station we should at least hear a new type of broadcast fare. Radio in Bulgaria being in its infancy, I expect it would be some time before the future State service could compete in programme building with the maturer organisations in other countries. Bulgarian national music, preserved in spite of black centuries under foreign yokes, is highly original and entertaining.

Through the rugged Balkan mountains, across the frontier Danube, and so to Bucharest, the modernistic city that has risen, Phoenix-like, on the war ashes of

Programmes from the Near East—

the old capital. By imitating the action of playing a violin I was sufficiently understood to be escorted to the palatial offices and studios in the Rue General Berthelot, and after presenting my credentials to the guardian and mascot—a



An exclusive photograph of the Stamboul studio, with the announcer, Dsemil Bey, reading the news bulletin. Turkey promises 150-kW. transmissions for Western Europe in the near future.

lively little fox—I was given the freedom of the station.

Roumania's 150-kW Station

Roumania, I discovered, has a "five-plans-in-a-year" scheme. Ing. G. Munteanu, the obliging chief of this most progressive company, the Societatea de Difuziune din Roumania, 60 per cent. of the shares of which are owned by the State, revealed to me the full details of the ambitious project. A giant 150-kW. transmitter will be constructed near Brasov (the contract has been given to a British company) and will join the ether kings next autumn; the present 12 kW. Bucharest station will be "pepped up" to 20 kW.; and 20-kW. plants will be erected at future dates at Chisinau, in Bessarabia, Cernauti, the Bucovina, Cluj, Transylvania, Timisoara, the Banat, and Tazi. The nearly completed 20-kW. experimental station at Brasov, which under the Lucerne Plan has the longest wavelength in Europe, will be transferred to one of the relay sites.

I am also able to disclose that the mammoth 150-kW. transmitter will radiate international programmes, which will be received by Roumanian nationals in other countries; the Brasov station (temporary site only) will be a national transmitter, and its musical programmes will be relayed by Bucharest and the other 20-kW. broadcasters, which will also "put out" their own regional talks.

Broadcasting in Roumania has been on an organised basis since 1928, and consequently, I was not surprised at the splendid standard of the service. The present transmission hours (Eastern Standard Time) are from 1 p.m. to 2.30 p.m., when gramophone recitals, news and market reports are given; 6 p.m. to 7 p.m., orchestral performances, news and lectures; 7 p.m. to 8 p.m., Radio University; and 8 p.m. to 11 p.m., records, vocal and instrumental, comedies, opera, concerts and cabaret relays. Bucharest has a radio orchestra of 36, and really has excellent talent to draw upon. Relays of sports, important functions, and of Vienna and Budapest figure in the broadcasts. The company, I learned,

receives 70 per cent. of the varying licence fees and the State 30 per cent. Advertising is conducted between items.

Before hitting the eastward trail again I went by taxi one night along the magnificent Chaussee Kissaloff to the Bucharest transmitter. Scarcely had I alighted at the station entrance when I was assailed by the Hounds of Bucharest, a troupe of savage watch dogs. The engineer explained: "Soldiers can be bribed or intoxicated, but our 12 dogs are MOST reliable guardians."

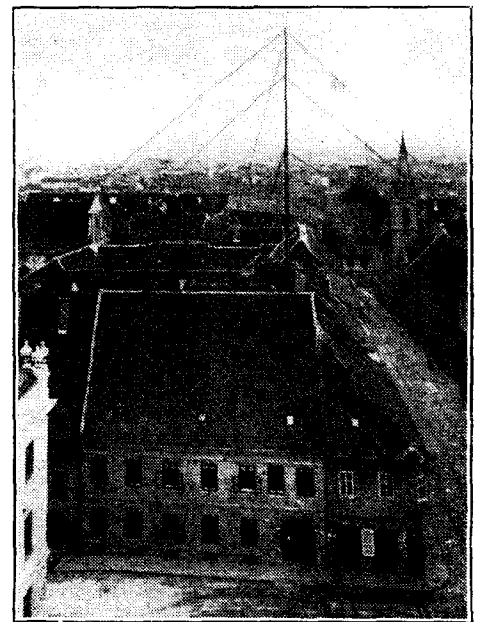
A ship took me through the Black Sea and the Bosphorus, to Stamboul, former capital of Turkey, and an incongruous spectacle of old and new. The game of "hide and seek" ended in my locating the studios of the Telefon Sirketi in the post office in the Rue Meydancik, Stamboul. The director, Hayrettin Bey, cordially welcomed me, and outlined the history of broadcasting in the Republic. The 5-kW. Stamboul station, I learned, came into being about 1925, and the 7-kW. plant at Angora about 1928. I was also informed that the Turkish Government had an-

nounced its decision to build a 150-kW. transmitter at Angora to serve as the mouthpiece of the Republic, and that the existing Angora broadcaster would be transferred to a relaying site. The contract for the new national station has not yet been signed. When completed, it should be well picked up in England, and listeners will hear more of the peculiar eastern music which, in spite of its wailing and somewhat monotonous strain, is always fascinating to the Western mind.

Programmes from Athens

From the minarets of Stamboul and the Golden Horn my Odyssey took me across the Aegean Sea, rich in mythological associations, to Salonika, principal centre of Thessalonica, Greece. Here I found a blank expression to be the best "lingo," and I was speedily in touch with the Association des Sans Filistes Saloniciens. As in Bulgaria, I found another band of ardent amateurs, who, in the absence of an organised service, conducted their own little station. The 1-kW. plant, which, I learned, has been heard in Central Europe and even England, is situated in the September Fair grounds, and I was shown over the station by the engineer and speaker, M. Tsingueridges. The station, I was informed by the president, M. Minas Orologas, broadcasts records and music every Saturday from 9 p.m. to 11 p.m. (Eastern time). The Greek Government, I found, intends to construct a high-power station of at least 50 kW. at Athens, and several relay stations. Upon investigating the position at the Ministry in Athens I learned that the foreign company given the concession had failed to carry out its obligations, and that the State is now negotiating with a British company.

The fairy lights of Le Piree, romantic port of Athens, the brooding cliffs of the Corinth Canal, sun-gleaming Adriatic waters, the gardens of Italy, gay and noisy Paris—and then back with my exclusive story to Dorset House.



Radio Zagreb uses a power of only 0.75 kilowatts, but will soon be superseded by a 20-kW transmitter.

The Piezo-Electric Loud Speaker

First Details of Production Models Now Available in This Country

MORE than one unit is required to cover the band of frequencies required for faithful reproduction of speech and music, and for domestic use a diaphragm type moving-coil loud speaker in conjunction with a special unit for the extreme top offers the best solution. The piezo-electric loud speaker is especially suitable for the latter purpose and in the near future is likely to be widely adopted.

IN the march of progress towards high quality of reproduction the improvements in loud speaker design have lagged behind those of amplifiers and other sections of the receiving equipment. The moving-coil principle has probably contributed more than any other to the standard which has so far been reached, but there is general agreement that no single loud speaker is capable of reproducing uniformly the range of frequencies from 30 to 10,000 or 15,000 cycles which is required for really faithful reproduction.

If a large diaphragm is used to give an adequate output in the bass it is generally accompanied by serious attenuation of the high frequencies above 5,000 or 6,000 cycles, and, conversely, if a small diaphragm is designed to do justice to the region between 5,000 and 15,000 cycles, the amplitude required to produce an equivalent sound pressure at lower frequencies is impracticably large.

High-frequency Reproducers

The general trend of design, therefore, has been to use a large diaphragm moving-coil in conjunction with an auxiliary unit designed specially for the upper register. Special moving-coil units with miniature exponential horns have been used successfully, and the electrostatic loud speaker is also capable of giving good results if the requisite attention is given to the conditions in the output circuit. It would now

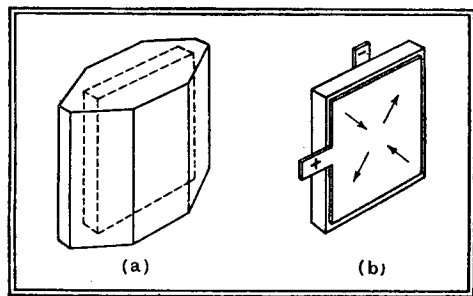


Fig. 1.—(a) A crystal of Rochelle salt showing the plane from which the active element is cut. (b) Under the influence of electric strain the crystal plate contracts along one diagonal and elongates along the other.

appear that the piezo-electric crystal loud speaker is destined to make an important contribution to the technique of high-frequency sound reproduction. The practical difficulties associated with the con-

struction of these units have been successfully overcome, and we understand that production models are now available in this country.

The piezo-electric effect was investigated in 1880 by F. and P. Curie, who discovered that certain crystal substances when subjected to mechanical strain developed electric charges on their surface. The converse effect was also observed, and it is the change of form due to the application of an electrostatic charge which is made use of in the crystal loud speaker. The effect is greatest in Rochelle salt (sodium potassium tartrate, $\text{NaKC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$).

The natural crystal is approximately of the form shown in Fig. 1 (a), and the active element is cut in the plane indicated by the dotted lines. When a difference of potential is established between opposite faces through the medium of foil electrodes, the crystal elongates across one diagonal and contracts across the other as shown by the arrows in Fig. 1 (b).

One method of utilising this deformation to drive a cone diaphragm is indicated in Fig. 2 (a). The lower edge of the crystal is fixed and the drive, which is parallel in direction to the lower edge, would be taken from either of the top two corners.

The amplitude obtainable in this way, however, is small, and better results are obtained by building up pairs of plates in the manner indicated in Fig. 2 (b). The polarity of the applied charge is opposite in each case, and if the two elements are cemented together the resultant strain causes the plates to bend in a direction at right angles to the plane of the foil electrodes, much in the same way as the bi-metallic strips used in recording thermometers and thermostats. When this type of unit is used three of the corners are clamped, and the resulting deformation is concentrated at one corner, to which the drive is attached.

Where it is desired to utilise the sound

energy radiated directly from the surface of the unit, as in the high-frequency horn type of loud speaker, four elements are cemented together with their active corners in the centre, as shown in Fig. 2 (c).

Preparing the Crystals

The production of Rochelle salt crystals of suitable size and the subsequent machining of the plates call for considerable knowledge and skill, and due credit

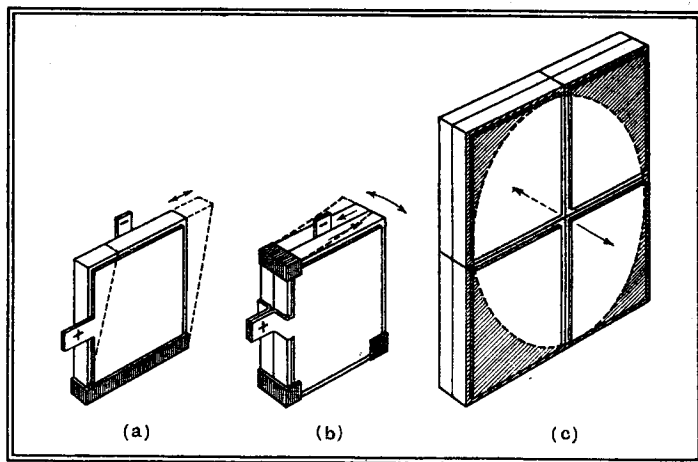


Fig. 2.—Methods of utilising the deformation of the crystal. (a) Direct lateral drive. (b) Bending of two elements cemented together with potential applied in opposite directions. (c) Composite diaphragm for horn type loud speakers.

must be given to the Brush Development Co., of America, for their success in overcoming the many obstacles to commercial production. Small and perfectly formed crystals are selected from a number obtained by evaporation, and are then "grown" in a saturated solution of the salt. The large crystals, which may be as much as 3in. or 4in. in diameter, are then treated to remove any excess of the "mother liquor," after which they are machined into plates of the order of $\frac{1}{16}$ in. thickness. The development of the right type of cutting tools is in itself no mean achievement, for the salt is not unlike washing soda in its mechanical properties, and in the early stages the only method of cutting available was to wear through the crystal with a wet string.

After the unit is finally assembled it must be completely sealed with a coating of waterproof varnish, but care must be taken to avoid scratches which might later permit the ingress of moisture.

The Piezo-electric Loud Speaker—

Through the courtesy of the Rothermel Corporation, Ltd., we have recently had the opportunity of testing one of the diaphragm type loud speakers. This is the model R95, and it is shown in combination with a Sonochorde permanent-magnet moving-coil loud speaker in Fig. 4. The driving element is built up of four laminations, approximately $2\frac{1}{2}$ in. square, the total thickness being $\frac{1}{4}$ in. A sketch of the assembly with the cover removed is shown in Fig. 3. The rubber pads at

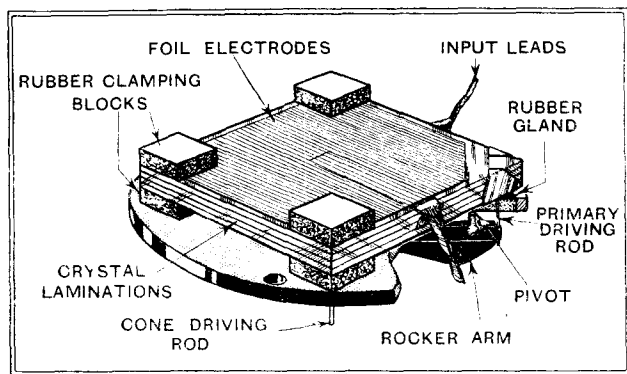


Fig. 3.—Constructional details of the Type R95 crystal unit in conjunction with a Sonochorde permanent-magnet moving coil.

three of the corners are clamped between the cover and the base plate, and a critical pressure is applied to obtain the maximum efficiency. The drive is transmitted from the free corner of the plate by means of a short rod, which passes through a rubber gland in the base plate to one end of a light and rigid lever, designed to increase the amplitude of vibration at the cone apex.

We were particularly impressed with the efficiency of the unit, which is comparable with that of some of the best moving-iron types which were in vogue at one time. The lower and middle register is quite good, but the unit excels in the region from 2,000 to 8,000 cycles. In combination with the moving coil, it gave better reproduction than we have previously heard from commercial dual moving-coil units, and even when used in conjunction with one of the larger and more expensive energised moving coils a very definite improvement in quality resulted. No

D.C. current in the primary winding does not appear to affect the functioning of the crystal, which has this advantage over the electrostatic loud speaker that it does not require any initial D.C. bias voltage. The electrical characteristics of the crystal loud speakers are similar to those of a condenser, and in the case of the R95 unit the equivalent capacity is of the order of 0.03 mfd.

In addition to the unit described, the makers also market a larger model incorporating four motor units linked together through a system of levers to drive a 12 in. cone, and it is claimed that good response is obtained from 7,500 down to 30 cycles. There is also a special horn loud speaker designed for the range from 3,000 to 15,000 cycles, and we hope to be in a position to report on the performance of this unit at an early date.

In conclusion, it is interesting to note that the application of the piezo-electric effect to loud speaker design was suggested in the pages of this journal as far back as 1923, when, in a report of a demonstration at the Institution of Civil Engineers, the following comment was made:—"The crystal also acts as a high-impedance telephone transmitter. On account of its high impedance it is particularly suitable for measuring sound waves in what may be called high-impedance media, such as water. . . . The crystal may also be used as a high-impedance telephone receiver.

"The phenomenon is extremely interesting, but probably a definite commercial application has yet to be found for it."

At the time these notes were written the piezo-electric effect was only of interest as a scientific novelty, but it has since proved an invaluable tool in any investigations requiring the measurement of rapidly varying pressures such as are to be found in internal-combustion engines and in the development of explosives. The applica-

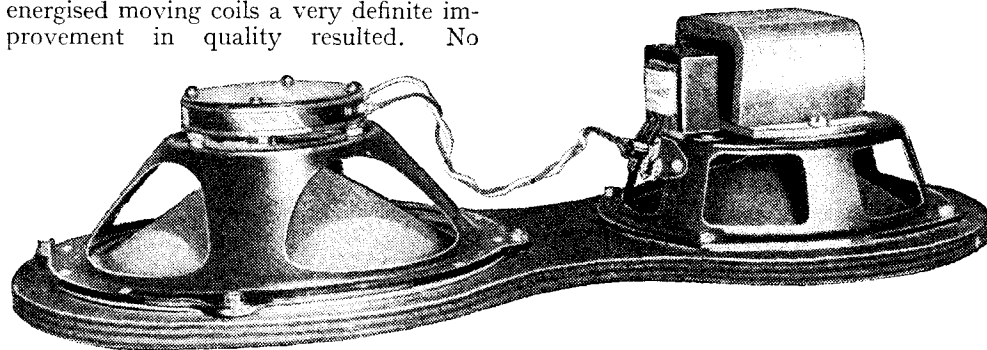


Fig. 4.—Dual loud speaker consisting of the R95 crystal unit in conjunction with a Sonochorde permanent-magnet moving-coil unit.

special precautions were taken to ensure correct matching, and the crystal unit was connected directly across the primary winding of the moving-coil output transformer. The polarising voltage due to the

tion of the effect to loud speakers and microphones has only been delayed by the difficulties, now happily removed, of producing homogeneous crystal plates of sufficient size.

SHORT-WAVE WORLD

THERE have been distinct indications of an improvement in the general level of short-wave reception conditions, and during the past fortnight some of the American stations have been particularly reliable. It seems, however, to be an unfortunate fact that reliability and good signal strength seldom go together.

Bound Brook, W3XL, on 46.69 metres, has been one of the best North American stations, and it has been possible to "hold" his programmes for three or four hours from 11 p.m. onwards. Fading curves plotted on this station between midnight and 2 a.m. on three occasions showed an average level of R7; during all three periods the transmission only sank below R5 for a total time of four or five minutes.

When this degree of consistency is reached, short-wave stations are really worth listening to. Unfortunately one can rarely maintain such results for more than seven or eight consecutive days, after which period the fading often becomes of the "R9 to R2" variety, the R9 periods failing to compensate for the much more lengthy spells of R2.

North American Reception

Anyone with a reasonably efficient short-wave receiver ought to be able to log six or seven of the North Americans between 45 and 50 metres. The best, in order of merit, as logged in South London during December, appear to be W3XL, W3XAL (49.18), W8XK (48.86), W4XB (49.64), W3XAU (49.5) and W2XE (49.02).

The 31-metre band seems to be devoid of anything interesting except on Sunday mornings, when Sydney (VK2ME) is usually very good. He has been held until as late as 11 a.m. at times, but his peak usually occurs at 7 or 7.30 a.m. The various Brazilian stations, many of whom work just above the actual 31-metre broadcast band, are quite interesting to listen to, but one often has to wait so long for identification that they are passed over unrecognised.

The Best South Americans

South America is certainly very well represented on the short waves, and it is possible to log stations in eight or nine different countries. Ecuador has two very reliable stations in HCJB (37.04 metres) and HC1DR (47 metres), both being located in Quito.

The best Colombian station at the moment is Bogota, HJ3ABF, on 47.97, and the Venezuelan stations are so numerous as to be quite confusing, especially as they appear to change call signs and wavelength with bewildering frequency. Maracay (YVQ) is at present on 44.96 metres, Caracas (YV1BC) on 49.08 metres, and a new station with the call YV14BC on 49.2 metres. The latter uses an input of 15 watts, and has already been logged in this country!

Very few owners of short-wave sets have ever heard Bolivia. They have a chance during January, when the La Paz station CP5 will be working daily on 49.3 metres, relaying the long-wave programmes from station CP4.

No times have been mentioned for the above stations, but they are all active between 6 p.m. and midnight, local time, which means that most of them should be heard between 11 p.m. and 5 a.m. in this country.

MEGACYCLE.

UNBIASED

BY FREE GRID

Daylight Law-breakers

IN the course of a somewhat busy life I have come across many instances where the law has been flagrantly flouted, but none, I think, so glaring as that which came to my notice the other day. Strangely enough, the offence was committed under the very noses of those who are supposed to enforce the law.

The instance to which I refer occurred some weeks ago on the occasion of a public procession in London. As the event is now stale news, it would be a breach of journalistic etiquette to state what it was.



Engrossed in my lesson.

In order to view the procession, I took up my position on the kerb and was soon encompassed about by garrulous females. Indeed, I was glad that I had brought along my vest-pocket portable, which served the treble purpose of shutting out the horrible cackle of tongues, of providing me with the wherewithal to wile away the time until the procession came along, and of giving me a certain amount of moral uplift, for I tuned in to the transmission for schools in order to be instructed in the proper use of King's English.

Just when getting engrossed in my lesson I became conscious of irritating morse interference steadily growing in intensity. It appeared to spread all over the tuning dial and was absolutely unescapable. As it became louder and louder it suddenly occurred to me that it must be emanating from the procession, and this I swiftly proved by using the frame in my portable as a direction finder, and then consulting the map of the procession-route printed in my morning paper, which also gave the times at which the cavalcade would pass certain spots.

Immediately I gained a certain amount of kudos among the crowd by announcing from time to time exactly where the procession was; indeed, it became somewhat embarrassing in the end, as several women among the crowd thought that I possessed powers of an occult nature, and eagerly pressed money upon me with the demand that I cast their horoscopes. Fortunately I was saved from an awkward predica-

ment by the arrival of the advance guard of the procession.

I very soon found out the source of the morse interference. In the procession was a large waggon carrying a 1934 wireless transmitter at one end and one of 1901 vintage at the other, the idea being to demonstrate radio progress since the beginning of the century. Naturally the 1901 instrument consisted of an old ten-inch spark coil and the usual accessories. Although the modern instrument was dumb, the ancient static-generator was actually being worked by an operator, who was got up to look as antique as the hook-up he was using.

Thousands of listeners must have had their enjoyment spoiled just for the sake of amusing the mob with a few pretty sparks. The crowning piece of insolence, however, was that this deliberate law-breaking was going on within a stone's throw of one of the famous Post Office radio vans. Needless to say, I am preparing a full and picturesque report to be sent to the proper quarter.

Thicker Paper, Please

MY correspondence bag has been unusually heavy lately, and while I do not want to appear to be of a complaining nature, I do wish that correspondents would make use of a better grade of notepaper.

In pursuance of my policy of having everything in my set home constructed I am at present engaged in making up the necessary fixed condensers for my latest receiver, but I find most of the letters in my post bag break down at an extremely low voltage, and, indeed, the dielectric properties of the correspondence as a whole are deplorably poor. I trust that those who write to me will see fit to remedy this defect. As it is the paper is too thin for high voltage condensers.

While on the subject I may mention that judging from the extraordinarily large number of my correspondents who have of late been seeking my advice on what sets they ought to build or buy, my readers are evidently under the delusion that I am in the habit of buying or building every set that appears, whether commercial or otherwise. Sometimes I can help, but more often I fear that the reverse is true.

It would help greatly if only my readers would all send me a full report giving their candid opinion of such sets as they may have been inveigled into building or buying. I could then at least get together a very comprehensive directory of unvarnished reports, and send copies out to any correspondent who happened to enquire about a set which I had in my collection.

Radio Course for Pinheads—II

I AM greatly indebted to one of my more advanced readers, who has kindly supplied Lesson II of my recently started Radio Course for Pinheads. This section for the tiny tots of radio bids fair to become very popular, and I am looking to other readers to emulate the example set them, and render me all the assistance in their power to make this educational course the thorough-going success which it deserves to become. This week we deal further with the aerial mast.

The function of the aerial mast may be summed up in the equation

$$N = \sqrt{\frac{(x-P)(xyz)}{(a+b+c)}} + \left(\frac{\sqrt{V-nbg}}{\text{Oh Y'eah?}}\right),$$

where N is the silly mutt trying to hold the pole up straight and the rest is bad language.

$$\text{Then } W = \sqrt{\frac{(x-P)(xyz)}{(a+b+c)}} + N = \sqrt{\frac{(x-P)(xyz)}{(a+b+c)}} + \left(\frac{\sqrt{V-nbg}}{\text{Oh Y'eah?}}\right),$$

where W is his missus falsettoing as she undoes the aerial wire, and gets it all muddled up and kinked. But as the co-efficient of N, Fig. 2 (and what a figure!) is capable of handling large outputs, the damping effect of N is largely counteracted by the reaction feedback which she lets him have good and



Fig. 2.—and what a figure!

proper, so that with the square root from W, $N = .0000000001$. It can therefore be seen from the above that the matter is a simple one which any reader can work out for himself to his own satisfaction.

If any reader desires further elucidation of the above points I shall be happy to put him in touch with the criminal who supplied the lesson, but I can accept no personal responsibility, and in any case I am feeling far from my usual self this week—not at all an unpleasant feeling.

Magnetic Recording and Reproducing

The Marconi-Stille Apparatus Described

ALTHOUGH the Blattnerphone or magnetic recorder has been known for many years it is only recently that it has been developed into a practical instrument suitable for general recording purposes, and particularly for the requirements of broadcasting. This article describes in detail the principle of the Marconi-Stille equipment.

FOR many years past investigation into problems associated with various methods of recording and reproducing sound waves for gramophone, talking film or broadcasting purposes have been taking place. The Marconi Company has contributed largely to this work, and their processes for electric recording on gramophone discs and the successes obtained with the "Visatone" film recording and reproducing equipment are now of world-wide renown.

A consideration of the various methods of sound recording and reproducing which might be applicable for broadcasting purposes shows clearly that the magnetic system possesses many important advantages, and it will, therefore, be useful to enumerate some of these.

Apart from the magnetic method, the other processes which can be adapted to the recording and reproduction of sound for broadcasting purposes may be divided into two main groups, viz. (1) optical or film methods, and (2) mechanical or gramophone methods. There are many

tion of modern methods of amplification and frequency response correction, that it has been possible to produce practical apparatus which would meet the stringent requirements of sound reproduction for broadcast purposes.

The magnetic recording system has a very important advantage over other

(2) The apparatus is very simple to handle, has no chemical developing, as in the film method, or any apparatus requiring delicate mechanical adjustments, as in the wax recording methods. As the process used is electrical throughout, no specialised knowledge is required apart from that which is already possessed by the general or electrical technical staff of a broadcast studio.

(3) It is a very simple process to piece together various programme items to make a continuous composite programme which can be reproduced without any break or interruption. It is also very easy to "wipe out" parts of a programme and replace with completely different matter.

(4) The record can be reproduced indefinitely without any loss of sensitivity or deterioration of quality.

(5) When a record is no longer required, the programme recorded on the strip can be "wiped out," ready for a new programme to be recorded.

(6) When required a special continuous record can be made which will repeat automatically.

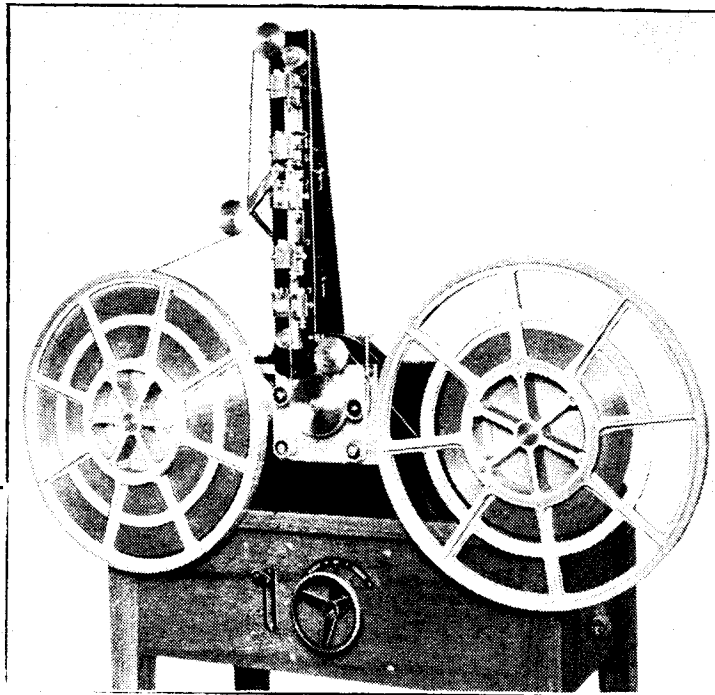
The equipment is designed to work with an input signal of a power level of one milliwatt, and

its normal output is the same, but considerable margin is allowable. It will be found, however, very convenient as a normal practice to work to an equal input-output basis as this greatly simplifies the problem of studio control.

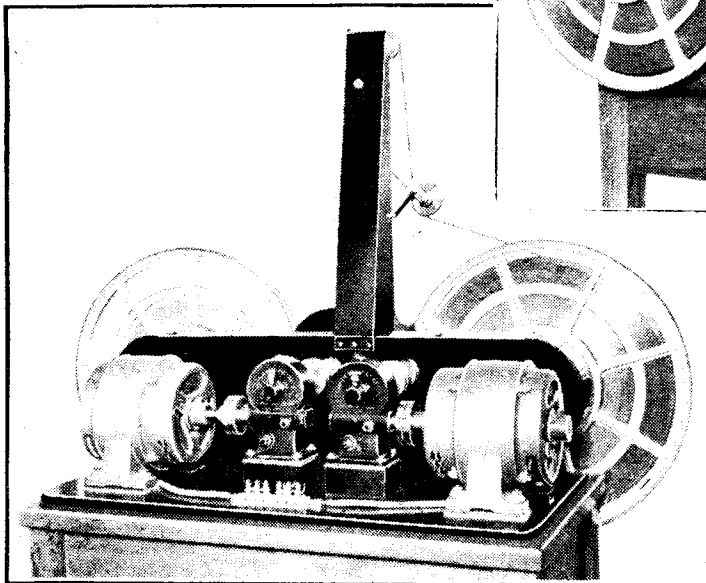
Details of Mechanism

The Marconi-Stille machine incorporates the necessary mechanism for driving the steel tape at a uniform speed through the electro-magnetic apparatus, which produces a varying magnetic flux in the tape in the case of recording, or translates the magnetic record into currents of varying amplitude for reproduction purposes.

In the amplifying and control panel are placed all the necessary amplifying, equalising and control equipment to enable the programme current from the microphone amplifier, which forms part of the normal studio equipment, to be recorded on the tape at the correct strength, and, when required, either at the



Front and back views of the Marconi-Stille equipment. For explanation of detail reference should be made to Fig. 1.



methods in that recording and reproduction can be effected simultaneously, and this affords a very simple method of

systems or processes which, although they differ in detail, can be classified under these groups, and possess the same general features.

The general principle of magnetic recording has been known for a long time, and was utilised by V. Poulsen in the Telegraphone, but it has only been comparatively recently, as the result of experiment and research into the magnetic phenomena involved and by the utilisation

checking any loss of sensitivity or deterioration of quality in the complete recording-reproducing process.

The Marconi-Stille equipment, which forms the subject of this article, possesses, amongst others, the following important advantages:—

(1) An uninterrupted record of thirty-five minutes' duration is provided, which is very much longer than that obtainable with the other methods.

Magnetic Recording and Reproducing—

instant of recording or at any subsequent time, to be reproduced at the same strength as was put into the equipment. The loud speaker unit enables instantaneous comparison to be made between the input signal to the equipment and the output therefrom. The power supply unit provides for the rectification and control of the high-tension and low-tension energy for actuating the amplifying equipment, which in a normal installation is designed for 50-cycle 220-volt three-phase supply.

The loud speaker contains its own amplifier and rectifier, the whole forming one unit. It is designed to give distortionless output of approximately 10 watts on an energy input of 1 milliwatt.

Considering each unit in more detail, Fig. 1 is a diagrammatic sketch of the machine itself which has been drawn to illustrate the tape driving mechanism. The power supply for the machine is three-phase, and there are two motors of the same power rating. The motors are of similar type although their functions and method of starting differ.

Driving Mechanism

The motor near the left of the machine actuates through gearing and a friction clutch the drum A and, by means of a special endless V-section belt drive and similar clutch, the drum B. The adjustment of the clutches is such that when the motor is running the tape is just in tension, so that when the main tape drive is applied the steel tape unwinds from one drum and winds up on the other, or vice versa, according as to whether, on the one hand, the steel tape is being wound for recording or reproducing, or, on the other hand, is being rewound on to its drum after the recording or reproduction has been finished. This motor is controlled by a quick break switch.

The other motor which is nearer the centre of the machine drives through a worm gearing and flexible coupling on to a flywheel, which is rigidly coupled to the "driving wheel." This motor can be run in either direction, and it is controlled by a double starter which starts up the motor in one direction by moving the handle to the right, whilst a movement from the centre to the left starts the motor in the reverse direction. The electrical arrangements are such that the motor starts as a non-synchronous type, but it runs as a synchronous motor when the starter is hard over either to the left or right. The function of the flexible coupling and flywheel are to ensure a uniform motion of

the tape-driving wheel, as it will be appreciated that the slightest irregularity of motion of this wheel would be transmitted to the steel tape and would cause irregularities in pitch of musical notes. The driving wheel motion is communicated to the tape by means of a special canvas fric-

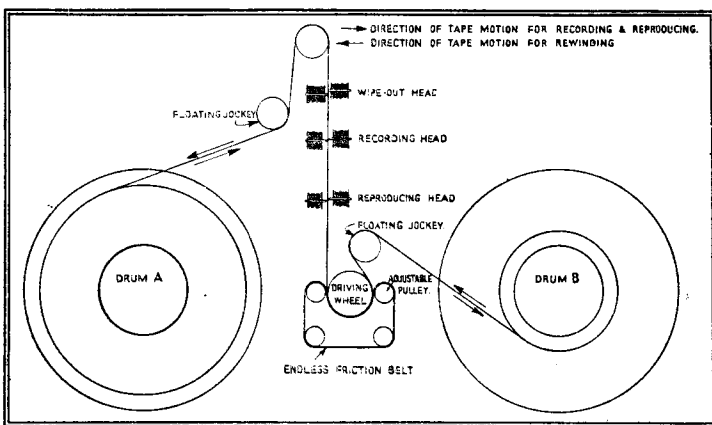


Fig. 1.—Theoretical design to illustrate the principle of the equipment. For the sake of simplicity the reproducing and recording heads are not shown here in duplicate, as they appear in the actual equipment shown in the photograph.

tion belt, which passes over four jockey pulleys (one of which is adjustable) and is held in tension by them against the driving wheel so that the steel tape, which passes under the driving wheel, is held up to that wheel by the endless belt. The driving wheel thus effectively communicates its motion to the steel tape without allowing any slip. The normal tape speed is 90 metres per minute. Fig. 1 shows the tape drive direction for recording or reproducing and that for rewinding. It will be seen that when recording or reproducing the tape is made to pass between the poles of special bi-polar electro-magnets, each of which has a separate function to fulfil. The first head encountered by the tape is called the "wipe out" head. Its function is electrically to eliminate any previous record on the tape, whilst the second head, for "recording," translates the currents from the microphone into bands of varying magnetic flux upon the tape. The last head encountered by the tape translates the varying flux bands into currents again, and is termed the "reproducing" head. The three heads are very similar in construction, but they are used with wholly different circuits. In the "wipe out" head the longitudinal separation of the pole pieces relative to the tape is fixed, as it is not at all critical in this head. The "recording" and "reproducing" heads are each provided with a micrometer adjustment for controlling the separation of the pole pieces, as this

adjustment considerably affects the response characteristics. All the heads have a special micrometer for adjusting the pressure of the pole pieces upon the tape.

The three heads of the recorder are connected by screened twin leads to their appropriate places on the amplifying and control rack.

The recording amplifier is specially designed to amplify the currents delivered by the microphone or "A" amplifier to a degree suitable for the electrical conditions as determined by the recording head. Use is made of a type D.P.T. pentode valve, which has, relatively to the recording head, a very high impedance at all working frequencies. On this panel are also provided adjustable potentiometers for controlling the current through the "wipe out" head and the auxiliary D.C. current, which magnetically sets the tape at the right part of the magnetisation characteristic for recording. A potentiometer and attenuator are provided to adjust the required levels for recording.

The "programme meter," which is a standard unit designed for broadcast studio work and which employs two type M.L.4 and a type V.M.S.4 valve, can be plugged into circuit at either the output or input circuits of either the recording or reproducing amplifiers. During the recording process it is normally connected across the input circuit of the recording amplifier for monitoring the recording level. It is calibrated directly in decibels, and by means of an auxiliary calibrated potentiometer the total measuring range of the instrument is from -20 to +20 db., with reference to 1 milliwatt.

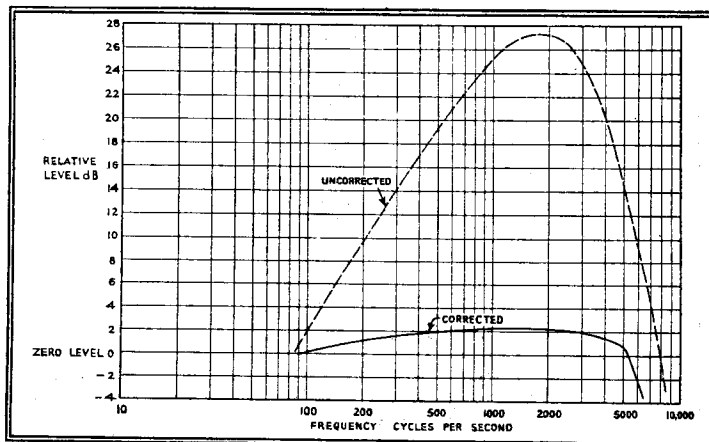


Fig. 2.—Diagram showing corrected and uncorrected response curves.

The reproducing amplifier amplifies the current from the reproducing head so that the output level is about 1 milliwatt. It is a standard "A" amplifier as used for broadcast studio purposes, and uses a type D.H. valve and two type D.D. valves. Provision is made for connecting the reproducing amplifier to an equaliser unit. The amplification of the unit (uncorrected) is about 60 db.

The equaliser unit, which is arranged to connect directly across the grid circuit of the second valve of the reproducing amplifier, is a simple series resonant cir-

Magnetic Recording and Reproducing— cuit with adjustable capacity, inductance and resistance to cover the range of correction required.

In Fig. 2 the broken line shows a typical uncorrected response curve connecting the output of the reproducing amplifier with constant input voltage to the recording amplifier as the frequency is varied, and using the normal tape speed of 90 metres per minute and normal settings of the pole pieces.

From this it will be seen that the response is approximately proportional to frequency up to 1,000 cycles (it will be remembered that a rise of 6 dbs. corresponds to twice the output): between 1,000 and 2,000 cycles the rate of change of the

response is less than linear and decreases until a maximum is reached at about 2,000 cycles, and above this frequency the response decreases with increasing rapidity as the frequency is raised.

The full line shows how the response curve is very much improved by the correct adjustment of the equaliser and the pole piece separation.

Provided that the maximum recording level of 10 dbs. below 1 milliwatt is not seriously exceeded when recording, the distortion due to non-linear magnetic effects is hardly noticeable aurally, and with adjustments made to the frequency characteristic shown it requires a trained ear to distinguish between the speech on the loud speaker compared with that on the input.

A NOVEL LOUD SPEAKER

AS a result of experiments which have been made in France by M. Edouard d'Alton, a new loud speaker has been produced which has distinct possibilities, though its principle is somewhat unorthodox.

The movement is of the normal moving-coil cone diaphragm type and it is enclosed in a sound box at the base of the instrument, and the coupling to the surrounding air is made through a series of resonators. The base is divided into two chambers, one communicating with the high-frequency pipes

and the other with the longer pipes for the middle and lower frequencies. The range covered is from 32 to 3,344 cycles and the frequencies of the resonators are chosen to overlap. It is claimed that peaks and troughs which would occur in the loud speaker in free air are levelled, and that the output at the extremes of frequency is strengthened.

The general principle is certainly intriguing, but it would be interesting to know what influence the sustaining effect of the resonators would have on the reproduction of transients.

COLLARO AUTOMATIC RECORD PLAYER

GRAMOPHONE enthusiasts in possession of complete works, recorded in the normal sequence on the back and front of a set of discs, have often wished that the distracting process of resetting the instrument at the end of each section could be eliminated. While record changers have successfully solved the problem for those in a position to buy new records specially pressed for the purpose, the man with an extensive library of the older recordings has justly complained of neglect. The new Collaro mechanism will go far to remove this reproach, for while it is not a record changer in the sense that it does not carry a magazine of records, it reduces the handling of the discs and turntable mechanism to an absolute minimum.

The record is inserted through a narrow slot in the side of the cabinet, and, from then until it reappears in the slot for turning over, is handled and played entirely by the mechanism. The motor is automatically switched off at the end of each playing, and a press-button at the front enables the record to be rejected at will. It is not even necessary to lift the lid for needle changing, which can be effected through a small door in the side of the cabinet. It goes without saying that one of the "permanent" types of needle will be used.

A geared induction motor is used, and the mechanism is strong and reliable. The records are carefully handled, and slide gently across the covered surface of the turntable.

In table-model form, for converting existing sets to radio-gramophones, the unit costs £8 17s. 6d., and a "Low-boy" model incorporating a record cabinet is available at

10 guineas. The chassis is also obtainable for incorporation in complete radio-gramophones, the price being £6 18s. 6d.



The Collaro record player incorporated in a radio-gramophone cabinet

BOOKS RECEIVED

Keramische Baustoffe für die Hochfrequenztechnik. (Ceramic Materials for High-frequency Work), by Erich Schwandt, Hachmeister and Thal, Leipzig, 1933.)

The use of ceramic insulating materials is finding increasing favour with designers of radio receivers and components. In this country there are already to be found many examples of its application to the construction of short-wave tuning condensers and trimmers, and there seems no reason why its scope should not be extended to include H.F. choke and coil formers and the insulation of waverrange switches, etc.

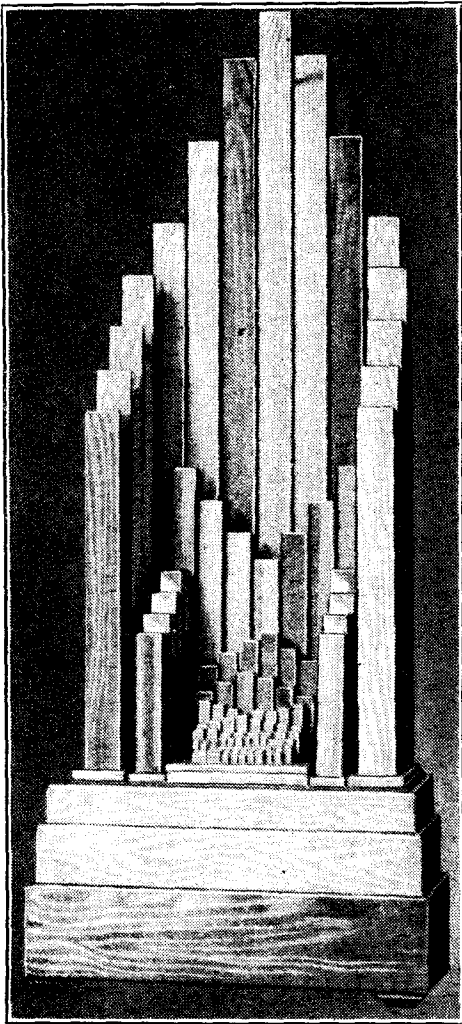
The designer in search of information regarding the electrical properties of this group of substances will find all the data he requires in this succinct handbook. It is shown that, next to quartz and mica, these ceramic types of insulators have the lowest power factor and show the least variation of this constant with frequency. From the constructional point of view their physical properties and the ease with which they can be made into any shape by die pressing or machining give them a definite advantage, while from the point of view of cost they are well able to hold their own with other materials when the question of power factor is taken into account.

The chemistry of the substances used in the manufacture of steatite compounds is adequately treated, and chapters are devoted to the milling and firing of the mixture and to the design of the insulators from the standpoint of obtaining the greatest mechanical strength.

A bibliography is included and the book is a model of what a monograph on a technical subject should be.

Note: The production of ceramic insulators for wireless work is already well established in this country, and Steatite and Porcelain Products, Ltd., of Stourport, Worcs, make a speciality of this type of material under the name "Frequentite."

Radio Upkeep and Repairs for Amateurs, by A. T. Witts, A.M.I.E.E.—A practical handbook on fault-clearing and set maintenance, describing the instruments required for simple tests and the method of tracing faults, with useful advice on the care and maintenance of receivers, batteries, accumulators, etc. Pp. 158, with 103 illustrations and diagrams. Published by Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2. Price 5s.



A system of acoustic resonators is used in this loud speaker to reinforce the sound output over a wide range of frequencies.

Adjusting Band-Pass Filters

An Accurate Method of Trimming Closely Coupled Coils

By W. T. COCKING

THE band-pass filter now finds one of its chief applications in the I.F. circuits of the superheterodyne, and, as its name implies, it involves two tuned circuits so coupled that the resonance curve is double-peaked. Two circuits coupled more loosely, so that the resonance curve has only a single peak, cease to be a band-pass filter in the true sense of the word, although the symbols used for their representation on the circuit diagram may be identical.

Where loosely coupled circuits are employed no difficulty whatever is found in their adjustment, for the tuning of one circuit affects that of the other to a negligible degree. This can hardly be said of the band-pass filter, however, and experience has shown that by ordinary methods it is not possible to tune the circuits accurately. In view of their common use and as their performance is adversely affected by inaccurate adjustment, some simple method of achieving accuracy in tuning is obviously an urgent requirement.

Closely Coupled Circuits

Let us consider the I.F. circuits of a superheterodyne as affording the most typical practical case. The connections of a single band-pass filter are shown in Fig. 1, and our problem is so to adjust the trimming condensers C that the two circuits are exactly in resonance. If the coupling between the two coils is sufficiently great to produce a double-humped resonance curve and an attempt be made to trim the circuits for maximum signal

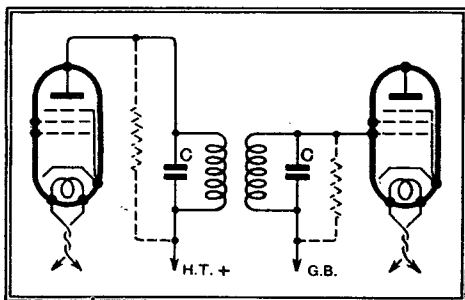
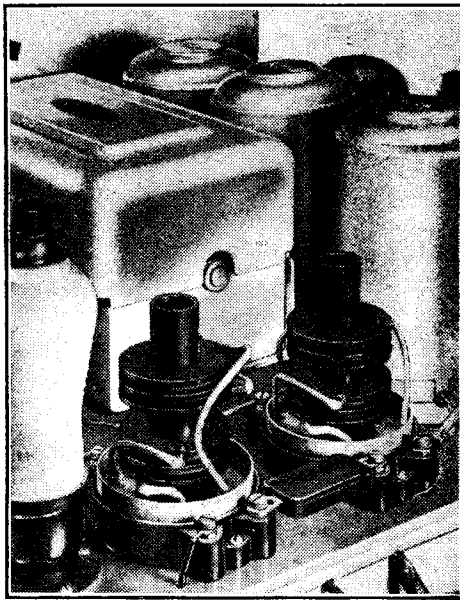


Fig. 1.—The connections of a typical band-pass filter are shown here, with the method of connecting damping resistances to flatten out the double-hump in the resonance curve while tuning

strength in the usual way, it will be found that the resonance curve assumes the shape shown at B of Fig. 2, whereas with accurately tuned circuits it would be nearly symmetrical as in curve A. Obviously, the correct band-pass effect is not obtained, and on account of the small

hump in the side of the resonance curve the circuits are inferior to ordinary cascade types giving the same degree of sideband cutting.

Now it is well known that the peak separation is dependent upon the coupling between the two coils and that in theory



The two coil units of a superheterodyne band-pass I.F. stage. The coils are screened by metal covers when in use.

this does not affect the trimming. It has been suggested in the past, therefore, that trimming must be carried out with the coils loosely coupled so that only a single-peaked curve is obtained and accurate tuning is easy. The coupling can then be tightened in order to produce the desired double-humped curve.

While this procedure is an improvement upon trimming with closely coupled circuits, it is by no means a complete cure, for it is found that the tuning is affected to an appreciable extent by variations in the coupling. This is partly due, of course, to the necessity for altering the physical positions of the coils when varying the coupling, since this leads to changes in the stray circuit capacities. It will be obvious, therefore, that what we require is a means of altering the effective circuit coupling which has no effect upon the trimming.

Now, the peak separation of a band-pass filter does not depend entirely upon the coupling, but is greatly influenced by the H.F. resistance of the tuned circuits—the greater the resistance the tighter must be the coupling for the maintenance of a given peak separation. It follows from this that if we have a filter in which the

THE band-pass filter is now so widely used that any method whereby a simplification of adjustment can be obtained is of importance. Hitherto, the accurate tuning of such filters has hardly been possible without elaborate laboratory apparatus, but a method is described in this article which enables very simple trimming to be obtained.

coils are so coupled that the desired peak separation is obtained under normal operating conditions, we can alter it to a coupled circuit of the single peaked variety by the simple procedure of increasing the circuit resistances. As regards the avoidance of a double-humped resonance curve, this has a similar effect to loosening the coupling.

Shunt Resistances

In practice, the simplest way of increasing the resistance is to shunt each transformer winding by a resistance, and the lower the value of the shunt resistances the greater is the damping imposed upon the tuned circuits. Provided that the resistances employed are non-inductive and of negligible self-capacity, their presence does not affect the tuning to any appreciable extent. The best method of trimming an I.F. band-pass filter, therefore, resolves itself into carrying out the operation with both primary and secondary shunted by resistances of such value that only a single peaked resonance curve is obtained. Upon the removal of the resistances the correct symmetrical curve with two peaks will be found.

The value of the shunt resistances, which are shown dotted in Fig. 1, will naturally depend upon the constants of

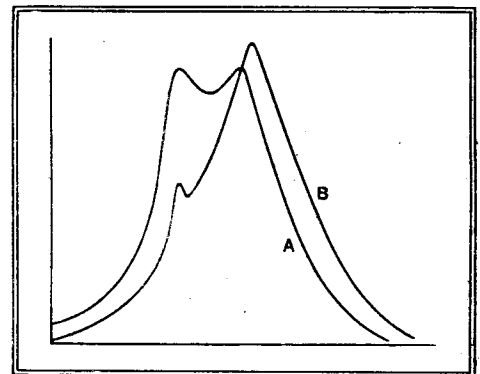


Fig. 2.—The resonance curve of a properly tuned band-pass filter is symmetrical and takes the form shown by curve A. The effect of inaccurate trimming makes the curve take an asymmetrical form as shown by curve B.

the I.F. transformer and upon the degree of coupling adopted—the lower the coil efficiency and the tighter the coupling, the lower must be the resistances. It has

Adjusting Band-pass Filters—

been the writer's experience that 50,000 ohms meets the majority of practical cases, and that the usual composition type resistances are the most suitable for the purpose. A word of warning should be given against the use of too low values of shunt resistance, however, for these exercise such a great damping effect that trimming becomes very flat, and it is difficult to find the true optimum point. Similarly, inaccurate ganging is likely to result from the shunting of only one winding of the transformer—both windings must be approximately equally loaded.

By adopting this trimming procedure it is possible greatly to improve the accuracy of tuning in the case of true band-pass filters, and so obtain the full measure of selectivity and quality of which the circuits are capable. It should be pointed out, however, that with receivers employing critically coupled circuits, such as the New Monodial Super¹, there is no necessity to make use of this artifice. It is only necessary when the coils are so tightly coupled that a double peaked resonance curve is obtained, and it then represents the only simple and practical method of trimming accurately.

¹ *The Wireless World*, July 21st and 28th, 1933.

CLUB NEWS**New Members Wanted**

The Radio, Physical and Television Society still has vacancies for new members. Recent features have included a television demonstration and a lecture on the "Modern Automatic Telephone," followed by a visit to the Fulham Automatic Telephone Exchange. Hon. Secretary: Mr. F. J. Bubar, 67, Nassau Road, Barnes, S.W.13.

Technical Advances of 1933

The recent revolutionary developments in modern radio research were the subject of a lecture given by Mr. P. W. S. Valentine, A.M.I.E.E., of the Mullard Wireless Service Co., Ltd., at a recent meeting of Slade Radio (Birmingham). Mr. Valentine dealt with A.V.C., Class "B" amplification, and multi-valves. All interested in the society's work should communicate with the Hon. Secretary at 110, Hillaries Road, Gravelly Hill, Birmingham.

Ladies' Radio Section

A special section for lady members has been formed by the London Chapter of the International Short Wave Club. Features of future meetings will include Morse instruction, followed by lectures and demonstrations. All interested are asked to communicate with Mr. Arthur E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

How the "Catkin" is Made

Lantern slides showing the construction of the Catkin valve were shown at a recent meeting of the Bec Radio Society. Interesting information was also given concerning the double diode triode, indirectly heated cathode rectifier and the D.A.100. Hon. Secretary: Mr. A. L. Odell, 9, Westway, Grand Drive, Raynes Park, S.W.20.

Radio of To-day, and Why

How modern conditions have necessitated the introduction of H.F. screened pentodes and the double diode triode valves was described by Mr. Carter, of the Mullard Wireless Service Co., Ltd., in a lecture on "Modern Radio Practice" before the Southall Radio Society. Communications should be addressed to the Hon. Secretary, Mr. A. J. Stephens, 98, Pole Hill Road, Hillingdon.

ON THE SPOT

Visits to Foreign Broadcast Stations

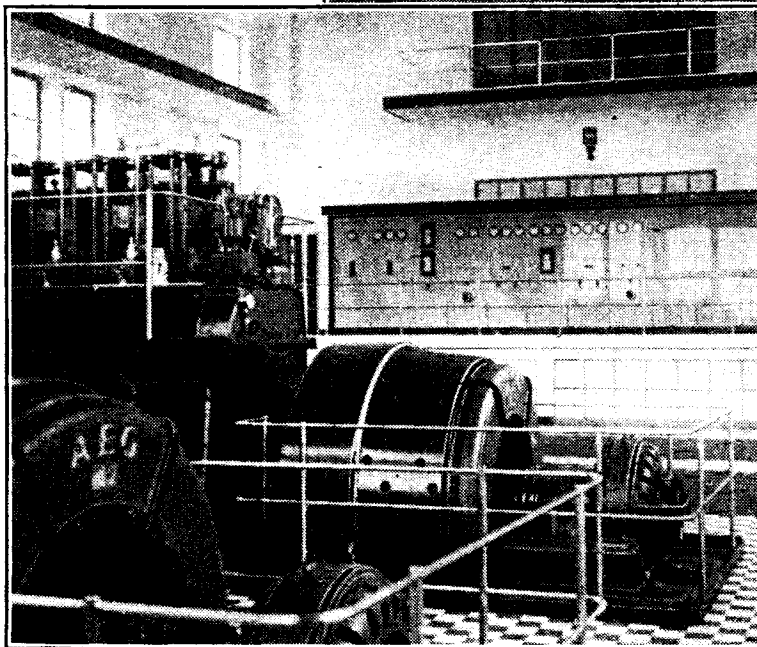
XII.—Luxembourg—252kc/s—1190 metres—200kW.

NEVER was the future of a station more fraught with mystery than that of Radio Luxembourg at the moment of writing. Luxembourg may work on the new medium wavelength assigned to it by the



Jean Bruck and Eva Siewert photographed with Jacques Clerget (on right), the station director.

The Luxembourg station is situated near the small village of Junglinster. Below is a photographic impression of the generator hall.



Lucerne Plan or resolve to flout the much-questioned authority of the International Broadcasting Union by remaining on its existing long wavelength.

It is pleasanter to turn one's thoughts to

the studios, situated in a lovely old-world villa in the centre of a private park. At the time of my visit a moat was just being reconstructed round part of the house, though whether or not this was in preparation for an attack by members of the International Broadcasting Union was uncertain! The new permanent orchestra was just in the middle of the midday concert, and while they played I talked with the announcers. There was Jean Bruck, who announces in French, and who introduced me to Eva Siewert, the much-travelled German girl who has held the position of announcer in German for more than a year. She is a typical "Berlinerin," in spite of her excellent English and French. I spoke also to Léon Moulin, who announces in the Luxembourg *patois*, a queer mixture of Dutch, French and German.

When I had toured the studios I left the jolly Luxembourg announcers and made for the transmitter building at Junglinster by the little steam tram which takes an hour and a half to do the journey. However, I abandoned this mode of travel and took a car, which did the 16 kilometres in under twenty minutes. The transmitter is very

beautifully situated, and as one catches sight of the three ponds, arranged on ascending terraces, one is reminded of Versailles. Actually, these ponds serve the practical purpose of cooling the big Diesel plant supplying the power to the station. Accommodation has been left for the installation of two more Diesel engines, as all power is produced at the station itself.

There is also room for the new high-power short-wave transmitter.

The aerial system is of the "umbrella" type, held by three steel masts 180 metres in height.

WANDERING WAVE.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Wavelength

Metres.	kc/s.	kW.	Station.	Tuning Positions.	Metres.	kc/s.	kW.	Station.	Tuning Positions.
1935	155	7	Kaunas (Kovno) (Lithuania)		360.5	832	100	Berlin, Funkstunde (Germany)	
1875	160	7	Huizen (Holland) (<i>Kootuyk</i> , 50kW., after 3.40 p.m.) (K.R.O. and N.C.R.V. programmes.)					(S.-W. Stn. DJI on 31.38 m., DJB on 19.73 m., DJC on 49.83 m., DJD on 25.51 m., DJE on 16.86 m.)	
1796	167	40	Lahti (Finland)		355.9	843	50	London Regional (Brookmans Park)	
1725	174	75	Radio Paris, CFR		352.1	852	7	Graz (Austria). (<i>Relays Vienna</i>)	
1635	183.5	60	Berlin (Deutschlandsender) (Germany).		349.6	858	7.6	Barcelona, EAJI (Spain)	
1554.4	193	30	Daventry National		348.8	860	10	Leningrad, RV70 (Russia)	
1546	194	7	Ankara (Angora) (Turkey)		345.2	869	11.5	Strasbourg, PTT (France)	
1481	202.5	500	Moscow, RV1 (Russia) (S.-W. Stn. on 25m.)		341.7	878	35	Brno (Brunn) (Czechoslovakia)	
1446	207.5	13	Eiffel Tower, FL, Paris		337.8	888	15	Brussels II Velthem (Belgium). (<i>In Flemish</i>)	
1412	212.5	120	Warsaw I (Poland)		335	896	5	Cadiz (Spain)	
1380	217.5	100	Novosibirsk, RV76 I (Russia)		334.4	897	1.9	Poznan (Poland)	
1348	222.5	30	Motala (Sweden). (<i>Relays Stockholm</i>)		332.2	903	50	Milan (Italy). (<i>Relays Turin</i>)	
1200	250	5	Stamboul (Turkey)		328.2	914	60	Poste Parisien (France)	
1200	250	21	Reykjavik (Iceland)		325	923	60	Breslau (Germany)	
1190	252	200	Luxembourg		321.9	932	10	Göteborg (Sweden). (<i>Relays Stockholm</i>)	
1170	256	25	Tashkent, RV11 (Russia)		318.8	941	0.25	Dresden (Germany). (<i>Relays Leipzig</i>)	
1154	260	30	Kalundborg (Denmark). (<i>Relays Copenhagen</i>)		318.8	941	1.5	Naples, INA (Italy). (<i>Relays Rome</i>)	
1132	265	15	Monte Ceneri (Switzerland)		315.8	950	1.6	Marseilles, PTT (France)	
1117	268.5	40	Moscow, Popoff RV58 (Russia)		312.8	959	1.7	Cracow (Poland)	
1083	277	60	Oslo (Norway)		312.8	959	10	Genoa, IGE (Italy). (<i>Relays Turin</i>)	
1071	280	35	Tiflis, RV7 (Russia)		309.9	968	50	West Regional (Washford Cross)	
1035	290	36	Kiev, RV9 (Russia)		307	977	0.7	Radio Vitus (Paris). (S.-W. Stn. on 43.75 m.)	
1000	300	100	Moscow RV49 (Russia). (S.-W. Stn. on 50 m.)		307	977	0.75	Zagreb (Yugoslavia)	
988	320	20	Kharkov, RV4 (Russia)		304	986	13	Bordeaux Lafayette, PTT (France)	
857	350	100	Leningrad (Russia)		301.5	995	50	North National (Manchester)	
840	357	3	Budapest (Hungary)		298.8	1004	11	Tallinn (Estonia)	
800	375	50	Sverdlovsk, RV5 (Russia)		296.1	1013	20	Hilversum (Holland). (7 kW. before 4.40 p.m.) (V.A.R.A., A.V.R.O. and V.P.R.O. programmes.)	
750	400	1.3	Geneva (Switzerland). (<i>Relays Sottens</i>)		293.5	1022	0.7	Limoges, PTT (France)	
720	416.6	20	Moscow, RV2 (Experimental) (Russia)		293.5	1022	2.6	Kosice (Czechoslovakia)	
689	436	1.5	Oulu (Uleaborg) (Finland)		291	1031	13.2	Viipuri (Viiborg) (Finland). (<i>Relays Helsinki</i>)	
574.7	522	0.7	Hamar (Norway) (<i>Relays Oslo</i>)		288.3	1040	50	Scottish National (Falkirk)	
574.7	522	7	Ljubljana (Yugoslavia)		288.3	1040	1	Bournemouth. (<i>Relay Station</i>)	
570	527	0.25	Freiburg (<i>Relays Muhlack</i>)		286	1049	0.8	Montpellier (France)	
569.3	527	2	Grenoble (France)		284.8	1053	0.7	Lyons (Radio-Lyon) (France)	
565	531	16	Wilno (Poland). (<i>Relay Station</i>)		283.6	1058	0.5	German Relays (Berlin, Magdeburg, Stettin)	
560	536	1.5	Kaiserslauten and Augsburg (<i>Relay Munich</i>)		283.6	1058	0.5	Innsbruck (Austria). (<i>Relays Vienna</i>)	
550	545	120	Budapest No. 1 Lakihegy (Hungary)		282.2	1063	2	Lisbon CT 1AA (Portugal). (<i>Short-wave Station on 31.25 m.</i>)	
542	554	10	Sundsvall (Sweden). (<i>Relays Stockholm</i>)		281.2	1067	0.75	Copenhagen (Denmark)	
539.6	556	3	Palermo (Italy)		279.3	1074	13.5	Bratislava (Czechoslovakia)	
533	563	100	Mühlacker (Stuttgart) (Germany)		276.5	1085	60	Heilsberg (Germany)	
525	571	15	Riga (Latvia)		273.7	1096	7	Turin (Italy)	
517.2	580	100	Vienna (Bisamberg) (Austria)		271.5	1105	1.3	Rennes, PTT (France)	
509	589	15	Brussels No. 1, Velthem (Belgium). (<i>In French</i>)		269.8	1112	20	Bari (Italy) (<i>Relays Rome</i>)	
501.6	598	20	Florence, IFI (Italy) (<i>Relays Turin</i>)		267.6	1121	0.75	Valencia (Spain)	
495.8	605	1.2	Tröndelag (Norway)		267.4	1122	6.25	Nyireghaza (Hungary). (<i>Relays Budapest</i>)	
488.6	614	120	Prague (Czechoslovakia)		265.8	1128.5	1.3	Lille, PTT (France)	
480	625	50	North Regional (Manchester)		263.8	1137	11.2	Moravska Ostrava (Czechoslovakia)	
472.4	635	60	Langenberg (Germany)		261.5	1147	50	London National and West National	
465.8	644	15	Lyons la Doua, PTT (France)		259.3	1157	17	Frankfurt-a.-M. (Germany)	
459.4	653	60	Beromünster (Schweizerischer Landessender) (Switzerland).		259.3	1157	2.3	Trier and Cassel. (<i>Relay Frankfurt</i>)	
453.2	662		San Sebastian, EAJ8 (0.6 kW.); Klagenfurt (0.5 kW.) (Austria) (<i>relays Vienna</i>).		257.1	1167	10	Hörby (Sweden). (<i>Relays Stockholm</i>)	
453.2	662	0.25	Agen (France)		255.1	1176	0.7	Toulouse, PTT (France)	
451.8	664	20	Milan (Vigentino) (Italy). (<i>Relays Rome</i>)		253.1	1185	5	Gleiwitz (Germany). (<i>Relays Breslau</i>)	
447.1	671	0.5	Madona (Latvia). (<i>Relays Riga</i>)		252	1193	5	Barcelona, EAJ15 (Assoc. Nat.) (Spain)	
447.1	671	7	Danzig (<i>Relays Heilsberg</i>)		249	1205	0.8	Juan-les-Pins, Nice (France)	
441.2	680	50	Paris, Ecole Supérieure, PTT		247.7	1211	10	Trieste (Italy). (<i>Relays Turin</i>)	
435.4	689	55	Rome, IRO. (S.-W. Station, 2RO on 25.4 m.)		245.9	1220		Berne (0.5kW.) (Switzerland) (<i>relays Beromünster</i>); Eskilstuna (0.2kW.), Sjöfle (0.4 kW.) (Sweden) (<i>relays Stockholm</i>); Linz (0.5 kW.) (Austria) (<i>relays Vienna</i>); Turku (Abo) (0.5 kW.) (Finland) (<i>relays Helsinki</i>).	
429.7	698	2.5	Stockholm, SASA (Sweden)		244.1	1229	0.5	Basle (Switzerland). (<i>Relays Beromünster</i>)	
424.3	707	2	Belgrade (Yugoslavia)		242.3	1238	1	Belfast (N. Ireland)	
424.3	707	100	Madrid, EAJ7 (Union Radio)		240.6	1247	0.5	Stavanger (Norway)	
419	716	100	Moscow, Imini Stalina (Russia)		238.9	1256	2	Nürnberg (Germany). (<i>Relays Munich</i>)	
416.4	720.5	5	Munich (Germany)		238	1260	1	Nimes (France)	
413	725	60	Rabat (Morocco)		237.2	1265	3	Bordeaux, Sud-Ouest (France)	
408.7	734	16	Athlone (Irish Free State)		235.5	1274	0.5	Kristiansand (Norway)	
403.8	743	25	Katowitz (Poland)		233.8	1283	1.65	Lodz (Poland). (<i>Relay Station</i>)	
398.9	752	25	Sottens (Radio Suisse Romande) (Switzerland)		232.2	1292	0.25	Kiel (Germany). (<i>Relays Hamburg</i>)	
394.2	761	12	Midland Regional (Daventry)		230.6	1301	—	Swedish Relay Stations	
389.6	770	120	Bucharest (Roumania)		227.4	1319		Flensburg, Bremen and Hanover. (<i>Relay Hamburg</i>)	
385.1	779	8	Leipzig (Germany)		225.9	1328	10	Fécamp, Radio-Normandie (France)	
385.1	779	10	Toulouse (Radiophonie du Midi) (France)		224.4	1337	1	Cork (Irish Free State) (<i>Relays Athlone</i>)	
381	788	16	Stalino, RV26 (Russia)		219.9	1365	1.5	Beziers (France)	
376.4	797	50	Lwow (Lemberg) (Poland)		218.5	1373	0.2	Plymouth	
372.2	806	1.5	Scotish Regional (Falkirk)		218.5	1373	0.5	Salzburg (Austria). (<i>Relays Vienna</i>)	
368.1	815		Hamburg (Germany)		217	1382	1.2	Dublin (<i>Relays Athlone</i>)	
			Seville, EAJ5 (Union Radio) (1.0 kW.); Galicia EAJ4 (0.2 kW.) (Spain); Bolzano (1.0 kW.) (Italy); Helsinki (10 kW.) (Finland) (<i>relays Lahti</i>); Kharkov, RV20 (10kW) (Russia).		217	1382	0.5	Königsberg (East Prussia). (<i>Relays Heilsberg</i>)	
368.1	815	0.7	Fredriksstad (Norway). (<i>Relays Oslo</i>)		214.3	1400	1	Aberdeen	
366.7	818	0.8	Radio, LL, Paris		211.3	1420	1	Newcastle	
364.1	824	1	Bergen (Norway)		209.8	1430	1.25	Magyarovar, Miskolc and Pecs (Hungary)	
363.6	825	13	Algiers (Algeria)						

SHORT-WAVE STATIONS OF THE WORLD

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

Table with columns: Metres., kc/s., Call Sign., Station., Tuning Positions., Metres., kc/s., Call Sign., Station., Tuning Positions. Lists various international radio stations and their frequencies.

DISTANT RECEPTION NOTES

Problems of Static, Artificial and Natural

THE Munich and Stuttgart high-power transmitters were at work again during the Christmas holiday and both were very well received.

The French law against man-made interference comes into force in the spring. As originally drawn up it might have been very effective, for its provisions compelled all appliances capable of radiating interference to be fitted with proper suppressor devices.

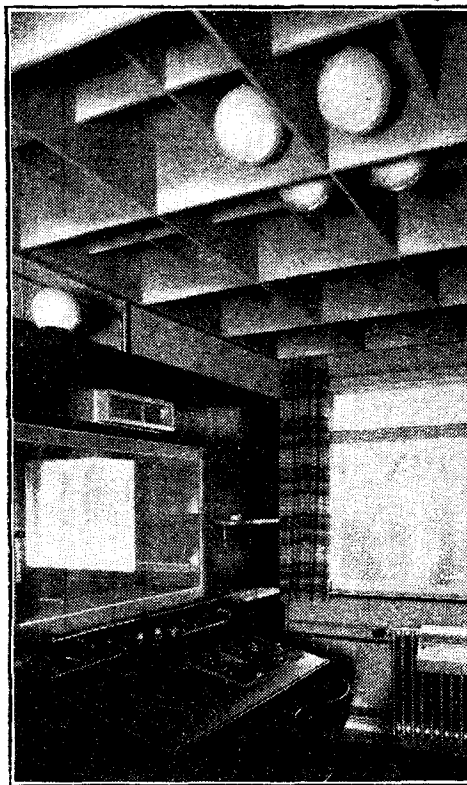
As the Act now stands the Minister of Posts and Telegraphs can make all kinds of exemptions and it will therefore be possible to drive the proverbial coach and four through the Act.

It is to be feared that something of the same kind will happen when the long overdue measures against man-made interference are taken in our own country.

Where Heterodynes Persist

The interference with Huizen, though less frequent than it was, still occurs at times and Luxembourg suffers on occasion from severe heterodynes. Heterodynes are also to be observed from time to time on Bernmünster, Poste-Parisien, Bari and a few other stations.

Kalundborg appeared to be using higher power over the Christmas season, for there was a great improvement in the signal



THE SILENCE CABINET between the two talks studios in Königsburg's new broadcasting building is notable for the peculiar acoustic treatment of the ceiling.

strength. Budapest on the other hand was curiously weak during the Christmas holidays.

On the long waves Radio-Paris is now regularly at work once more. The best selection of stations on this band is Huizen (when not interfered with), Radio-Paris, Zeesen, Warsaw, Luxembourg, Kalundborg and Oslo.

Best on the Medium Band

Of medium-wave stations an astonishing number can be received at good strength and clear of interference at present, provided that the set is reasonably selective. Budapest, Stuttgart, Vienna, Brussels No. 1, Florence, Langenberg and Lyons Doua rarely fail to provide good loud speaker reception. Rome is always to be relied upon and Munich is coming in splendidly. Katowice shows a distinct improvement. Toulouse, Leipzig, Strasbourg, Brussels No. 2, Milan and Breslau never fail to provide entertainment when required. Bordeaux Lafayette has returned to good strength and Hilversum is always well received. Bratislava is not at the moment very strong, but Heilsberg, Turin and Frankfurt are well heard. Toulouse PTT appears to be using somewhat higher power than it was. Trieste is always to be found at good strength and Lille PTT frequently comes in well. Nürnberg and Fécamp are both strongly received, but spark interference can be troublesome on both of these transmissions.

D. EXER.

NEWS of the WEEK

Current Events in Brief Review

Television in Italy

CATHODE-RAY television tests on ultra-short waves are shortly to begin at the Turin station.

Playing for Safety?

ALTHOUGH the Yugoslavian Government is now entitled to use Radio Belgrade for sixty minutes a day, political questions are almost entirely avoided. Most of the period is devoted to meteorological forecasts and reports on the level of the water in the Danube.

The Office Set

DEPRESSION or no depression, office workers of the future will be assured of entertainment to fill their leisure moments, for the Radio-Keith-Orpheum Building, New York, is setting a new fashion in having its 1,200 offices equipped with broadcast receivers fed from a single aerial on the "Antenaplex" system. The centre antenna, consisting of two 20ft. poles erected at the top of the thirty-one-storey building, feeds receiver points in each office mounted in a single wall plate with two plugs, one for antenna and earth, and the other for the power supply.

Broadcasting from the Antarctic

ALTHOUGH rather disappointing reception is reported of the signals from Admiral Byrd's Expedition in South Polar regions, engineers of the Columbia Broad-



A BROADCASTING SQUAD. This picture, taken during the recent Japanese manoeuvres, shows how broadcast listeners were provided with a running commentary. The microphone on the leading horse is connected to the ultra-short wave transmitter behind, which in turn communicated with the local broadcasting station. In the rear is an engineer with a wavemeter.

casting System, which is relaying the Expedition's messages, state that improved results may be soon expected. Better reception was achieved during the fourth broadcast, which took place when Admiral Byrd's ship, "SS. Jacob Ruppert," was moored at Wellington, New Zealand, just before the final departure for the ice pack.

When the vessel reaches the Antarctic a relaying station will be erected at Little America, and from here it is expected that the signals will be much better.

Unreliable

FROM a Vienna correspondent:—

Mr. Newly-Rich: "Yesterday our radio foretold sunshine and warm weather, yet we are having cold, rain, and wind."

Mrs. N.-R.: "Go and buy a better one with sixteen valves."

Radio Pays in Czecho-Slovakia

WHEREAS all other sources of Czecho-Slovakian postal receipts show a falling off during the past year, radio has revealed itself as the "milk cow" of the Post Office budget. Licence receipts this year have reached 67,200,000 crowns, or 13,200,000 in excess of last year. The net surplus to the State amounts to 38,500,000 crowns.

Canadian Broadcasting on its Feet

SIXTY-EIGHT broadcasting stations, all but five of them privately owned and operated, are listed in the new Log just issued by the Canadian Radio Broadcasting Commission. It appears that the Canadians have boldly widened the broadcast band to embrace not only the 540 k.c. frequency at the lower end, but the 1,510 k.c. frequency at the top.

The Commission itself owns and operates five stations, namely, CRCM, Montreal; CRCO, Ottawa; CRCT, Toronto; CRCS, Chicoutimi; and CRV, Vancouver.

Radio Curfew

THE 318 dwellings which the Sutton Trust is building in the City of Newcastle are each to be fitted with wireless sets free of charge. A condition of tenancy will be that all wireless sets be switched off at 11 p.m.

The Radio Amateur Call-Book

WE regret to learn of the death of Mr. F. T. Carter, who for many years has been agent in Great Britain for the "Radio Amateur Call-Book."

We understand that the agency is now being carried on by Mr. F. L. Postlethwaite at 41, Kinfauns Road, Goodmayes, Ilford, Essex, to whom notification should be made of new call-signs or changes of address.

Physical Society's Exhibition

MANY wireless enthusiasts, both amateur and professional, are attracted by the Annual Exhibition of the Physical Society at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London, S.W.7. The keynote of novelty at the 24th Annual Exhibition, to be held on January 9th, 10th, and 11th, appears to be the many and varied uses to which the photo-electric cell and the cathode-ray tube have been put since their commercial production a few years ago.

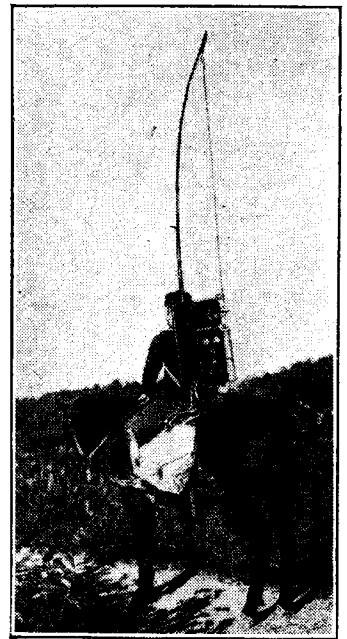
The cathode-ray tube in use as a relay will be seen accurately picking out points on a current or voltage wave near the zero value. In the trade section will be seen many examples of recent developments in electrical indicating instruments, radio-frequency apparatus, relays, recorders, and similar apparatus.

Admission to the Exhibition is free without ticket on Thursday, January 11th next, from 3 p.m. to 6 p.m. and 7 p.m. to 10 p.m. Admission on the first two days is by ticket, obtainable from the Exhibition Secretary, the Physical Society, 1, Lowther Gardens, Exhibition Road, London, S.W.7.

Uncertainty in Manchester

WIRELESS dealers in Manchester are complaining of the attitude of the Manchester Corporation Electricity Department in declining to give the public definite information as to when various districts in the city are to change from D.C. to A.C. supply. It is declared that the position is being aggravated by the circulation of a leaflet by the Department advising consumers to consult the Authorities before buying any new electrical equipment.

The radio dealers declare that the work of changing over from one system to the other will take several years to accomplish, but the circular is having the effect of retarding the purchase of wireless sets, many prospective buyers being afraid to purchase a mains



STRAIGHT FROM THE HORSE'S BACK. A Japanese broadcasting engineer with the ultra-short wave 4-watt transmitter employed for running commentaries on the military manoeuvres.

set on account of the uncertainty of the position.

The Electricity Department states that the circular is sent out from time to time merely to remind subscribers that changes are in progress.

Amateurs Assist the Customs

FINNISH wireless amateurs recently picked up the transmissions of a secret station transmitting in Morse to smuggling parties. As a result of the information communicated to the Finnish Customs by the amateurs, torpedo boats and other armed vessels are now patrolling the coasts.

Wireless as a Career

AN interesting gramophone record which may seriously affect the choice of a career among visitors to the Schoolboys' Exhibition, Shepherd's Bush, has been prepared by Mr. H. de A. Donisthorpe, and is reproduced at the Exhibition.

"If you are inclined to wireless," says the speaker, "here are a few hints. The wireless operator on board ship in the Mercantile Service has a nice and useful life. . . . Perhaps the best prospects in wireless lie with H.M. Services, where there are special branches devoted to the signal or wireless side.

"The commercial side of wireless also offers opportunities. Engineers are required for the various broadcasting stations and for the designing of the various set makers' goods, and here boys with ingenuity and sound basic electric training will be required.

"Do not consider that wireless is purely confined to mere broadcasting or the exchange of messages over space. Very few people realise that talking pictures are achieved by the machinations of the wireless engineer who has designed all the apparatus."

The Exhibition remains open at the White City until January 13th.

The W.B.E. Certificate

IN referring to the recent achievement of Mr. Frank K. Neill (G15NJ) in winning a W.B.E. Telephony Certificate, we stated that the letters "W.B.E." after an amateur's name indicate he has communicated by telephony with a station situated in a British possession in each Continent of the world. The W.B.E. is normally awarded for two-way telegraphic communication, but Mr. Neill's telephonic feat was recognised by a special certificate.

BROADCAST BREVITIES

By Our Special Correspondent

Seven Years in One

DURING 1933 the B.B.C. transmitted for 59,966 hours 12 minutes, or nearly seven years, with a breakdown percentage of only 0.019. Surely we are beginning to get something in return for our ten-shilling licences. As an Aberdeen friend points out, however, it was not possible for any one listener to tune in for seven years during 1933 because so many of the stations transmitted simultaneously.

Heavy Correspondence Bag

The year revealed a growing tendency by correspondents to regard the B.B.C. as a public reference library for the solving of all musical, historical, literary or general knowledge posers. Quite naturally, the Corporation refuses to accept the rôle of general adviser, but enquiries relating to past programmes are always answered, and some 30,000 of these were actually dealt with during 1933.

Bethlehem which had to occupy two seconds, no more and no less. To prevent a hitch Mr. Hibbert practised this one announcement for half an hour, until it was literally right to the split second.

Cross-talk Between B.B.C. Stations

THE many readers who so kindly responded to my invitation for letters on the question of cross-talk between London Regional and London National enabled me to place a well-documented case before the B.B.C. engineers. As a result special tests were instituted at Brookmans Park, and by senior engineers at home.

The engineers' report makes interesting reading.

"Difficult to Eliminate"

It has been established, says the report, that the amount of background of one pro-

was proved conclusively that there was no pick-up on the tuning fork circuits, and it was only by abnormal adjustments that any cross talk became audible at all.

"We might mention that the investigations will continue, as it is the aim to eliminate all suspicion of cross-talk even on a known frequency of occurrence and level."

A Tribute to the Engineers

Once again it becomes clear that the B.B.C. engineers will stick at nothing to get the best results, and, what is more, are ready to take a hint from listeners themselves.

If all sections of the B.B.C. copied the Engineering Department in this respect things would go much more smoothly, and I should probably have considerably less to write about.

North National for Continental Listeners

CONTINENTAL listeners seem to have been mightily upset by the synchronisation of London and West Nationals. The London station was very popular abroad, but as a long-distance station it is hopeless under present conditions.

Mr. Ashbridge, the Chief Engineer, is now recommending that our friends on the Continent should tune in North National, which gives a good signal and, as reports show, is easily receivable over hundreds of miles away.

New Wireless Game

ANOTHER test of the listener's ear will be carried out on January 15th. In the previous week you may be intending to listen to the two little programmes entitled, "Who Was That?" in which listeners are invited to recognise the voices of unannounced broadcasters. On January 15th the game is carried into a new field, places being substituted for people. Within a quarter of an hour the Variety and Outside Broadcasting Departments will take listeners by microphone to a number of places in Great Britain, each of which will be given a number but no name. Listeners will be asked to decide upon the locality from its characteristic sounds.

Pronunciation Problem

THE name Joule, so bound up with our early studies in electricity and magnetism, is to be pronounced "Jool," according to the latest recommendation of the B.B.C. Advisory Committee on spoken English. I have never heard it pronounced otherwise, but the information may be useful to all who have hitherto rhymed the word with coolie or bath-towel.

An International Body

By the way, it appears as if this small committee may expand into a more international body, for it has been realised that the English language does not belong to these Islands alone. The Advisory Committee has decided to get into touch with authoritative opinion on language questions in the U.S.A. and in the Dominions.

Science knows no frontiers; American, Canadian, Australian and South African scientists visit this country for study and research, and if there is a standard pronunciation for technical terms, nothing is lost and something is possibly gained.



HIGH TENSION IN THE CONTROL ROOM. An animated scene on the eighth floor of Broadcasting House during the transmission of the King's message and Empire greetings on Christmas Day. A duplicate staff of engineers was present to handle the intricate exchanges.

Ideas are Scarce

Despite this flood of correspondence it is sad to hear that very few suggestions for new or original programmes are really practicable. Very occasionally something does emerge which can serve as the nucleus of an idea for a scheme which can possibly be considered to be worthy of discussion.

Hard Work at the Mike

MR. HIBBERT, the B.B.C.'s Chief Announcer, has received some well-deserved tributes on his own share in the success of the Christmas broadcasts. Announcing on occasions such as these is not simply a matter of good diction and a cool head. It also requires some hard work.

Practising an Announcement

There was one announcement during the Christmas Eve broadcast of the bells of

gramme behind the other is not much greater at present "than it was when, or has been since, the station first opened."

The engineers go on to say that there is not a continual background of one programme behind the other, but that it does occur very occasionally. As it is spasmodic in its appearance, and because of abnormal conditions of line levels, etc., which have to be employed to hear it when listening at Brookmans Park and on the wireless at Broadcasting House, the trouble is extremely difficult to eliminate.

Tests to Continue

"On the theory," continues the report, "that cross-talk in the direction of London Regional to London National might be more audible than in a reverse direction, due to pick up on the tuning fork (synchronising circuits) at Brookmans Park a special investigation was instituted, and it

Power-Grid Detection For Battery Sets

By H. JACKSON, B.Eng.

De-saturation of the L.F. Transformer by Reverse Secondary Current

IT is well known that the primary winding of an L.F. transformer, when directly connected in the normal way, carries the anode current of the preceding valve, while the secondary does not in general carry any direct current at all.

The effect of the current in the primary winding is partially to saturate the core of the transformer, so that it is necessary to keep this current within certain limits in order to avoid the deleterious effects which would result if the core were allowed to become saturated.

As an intermediate L.F. stage is now seldom used, we need hardly consider this matter except in relation to the detector, and especially in relation to the so-called power-grid detector, where steady anode current is comparatively large—so large as to render it undesirable to pass this current through the primary of an ordinary intervalve transformer.

One well-known method of overcoming the difficulty is to employ the resistance-capacity method of feeding the transformer so that the primary winding does not carry any direct current but only the audio-frequency currents rejected by the high-value anode resistance used in this method. As anode current must be relatively high, a considerable amount of voltage is necessarily lost in this resistance, and so extra H.T. pressure must be

applied to make good the loss. This explains why so little attempt has hitherto been made to apply the power-grid method of detection to battery sets.

It happens, however, that the parallel-feed system is not the only way of avoiding saturation of the core. If a direct current is made to flow in the secondary winding so that its magnetising effect is in opposition to the magnetising effect of the anode current flowing in the primary winding, it is then possible, by so adjusting the respective values of the two currents, to reduce the core saturation effect to substantially zero.

Figs. 1 and 2 illustrate two methods of carrying this scheme into effect. Referring to Fig. 1, which represents a conventional detector-output circuit, it will be seen that the detector anode current flows through the primary P of the transformer, the condenser C1 and resistance R1 serving merely for decoupling.

Direct current is also allowed to flow through the secondary windings of the transformer from the H.T. battery via resistance R2, which must be of such a value that the magnetising effect of this current is equal to that of the anode current passing through the primary winding, and, since these two effects are arranged to act in opposition, the resultant steady flux through the core of the transformer is substantially zero.

As there will now be a certain D.C. current, it will be seen that the detector anode current flows through the primary P of the transformer, the condenser C1 and resistance R1 serving merely for decoupling. Direct current is also allowed to flow through the secondary windings of the transformer from the H.T. battery via resistance R2, which must be of such a value that the magnetising effect of this current is equal to that of the anode current passing through the primary winding, and, since these two effects are arranged to act in opposition, the resultant steady flux through the core of the transformer is substantially zero.

voltage drop across the transformer secondary, a compensating adjustment of grid bias must be made. If desired, this disturbance of bias may be avoided by adopting the scheme shown in Fig. 2.

It will be seen that the introduction of

HERE is an alternative to the well-known "parallel-feed" method of connecting an L.F. transformer. It works best with high-ratio transformers, where the resistance through which balancing current is fed to the secondary has a very high value.

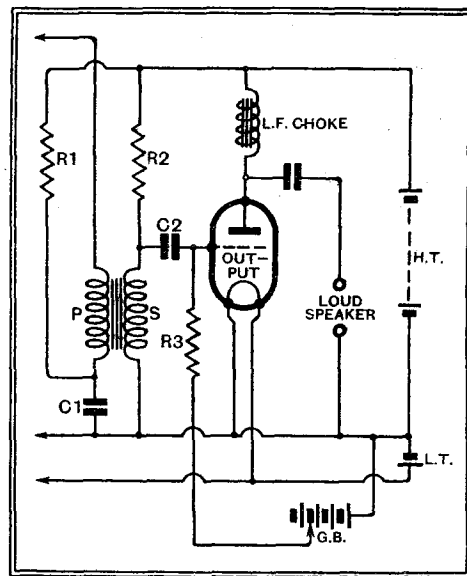


Fig. 2.—By interposing condenser C2, any disturbance of output valve bias is avoided.

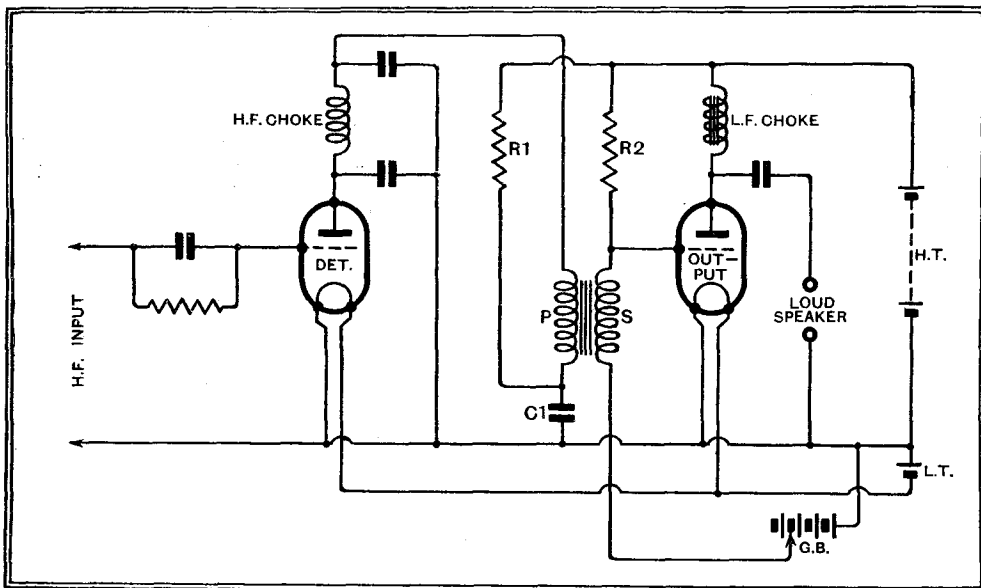


Fig. 1.—The simplest method of passing a balancing current through the transformer secondary.

condenser C2 will effectively isolate the output valve grid from any D.C. voltage developed across the transformer secondary. The valve will now obtain its grid bias voltage via a high-resistance grid-leak R3 in the usual manner.

It may be argued that since the resistance R2 is virtually connected in shunt with the transformer secondary, this method of connection would result in a reduction of the overall amplification of the circuit. Although there will inevitably be some reduction in gain, yet a little consideration will soon show that this will not be anything like as serious as might seem at first sight. In intervalve transformers of this type, the secondary has many more turns than the primary, and so the necessary current which must be made to flow in the secondary to give equal magnetising effects (or equal ampere-turns) in both windings will be correspondingly reduced in comparison with the anode current of the detector.

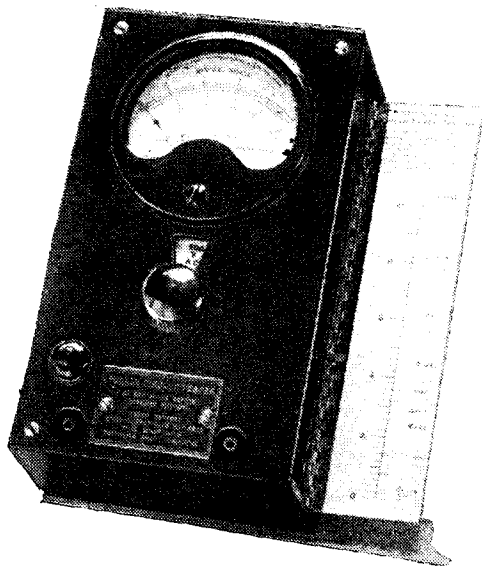
This will generally result in a very high value for the resistance R2—so high as to render its shunting effect on the secondary winding fairly small. Of course, if the resistance R2 were replaced by an audio-frequency choke of the requisite D.C. resistance (or a choke and resistance in series), the shunting effect would be reduced to something approaching zero.

NEW APPARATUS REVIEWED

PULLIN CIRCUIT TESTER

THE Pullin Circuit Tester is a high-grade multi-range instrument designed for making all the measurements and tests required on a modern wireless receiver. It is an instrument that will appeal to the radio service engineer, the set constructor, and the amateur electrician, for it has a particularly high degree of accuracy. Of the seven ranges available, two are for A.C. voltage measurements; one reads up to 10 volts, while the other has a range of 0-500 volts. A Westinghouse rectifier is incorporated, and these voltage ranges could be employed for power output measurements, using a known resistance, since the accuracy is well maintained at audio frequencies up to about 4,000 cycles.

For D.C. measurements the ranges provided are: 0-25 volts, 0-500 volts, 0-10 mA., and 0-100 mA. In addition, resistances up to 100,000 ohms can be tested. But to avoid confusion the resistance scale is not engraved on the meter dial, but on the inside of a hinged flap located on the right-hand side of the case.



Pullin A.C. and D.C. Circuit Tester.

The various ranges are selected by a switch, and, as a safeguard against accidental damage, a spring-loaded, press-button switch is fitted which isolates the meter, and which must be pressed down before a reading can be taken on any range.

This instrument was found to be very convenient to operate; it gives measurements with an accuracy adequate for all normal requirements, and has the useful feature of being fitted with a dead-beat movement. It is housed in a neat black bakelite case measuring 6 $\frac{3}{8}$ in. \times 3 $\frac{1}{2}$ in. \times 2 in., and weighs about 2 lb. The makers are R. B. Pullin and Co., Ltd., Phoenix Works, Seaford Road, West Ealing, London, W.13, and the price is £8 8s. A black leather carrying case is available at 8s. 6d.

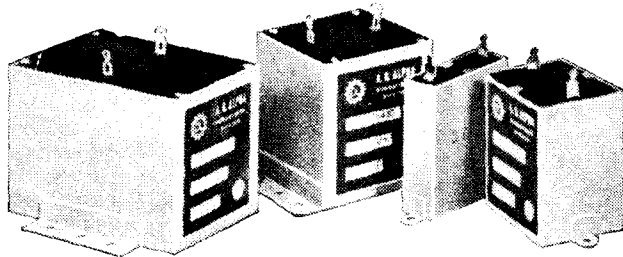
ALPHA CONDENSERS

ALPHA condensers are of Swedish manufacture and distributed in this country by Alpha Products, 86, Munningham Lane, Bradford. They are avail-

Latest Products of the Manufacturers

able tested at 500, 700, 1,000, and 1,500 volts D.C., in sizes ranging from 0.1 mfd. to 6 mfd., and in each case the working potential is about one-third the D.C. test voltage.

We have tested some specimens of the



Selection of Alpha 1,500-volt test condensers.

1,500-volt type, and their capacities, measured at 50 cycles A.C., were all within the maker's tolerance of plus or minus 10 per cent. The insulation resistance of the condenser, and also between condenser and case, was in every instance better than 1,000 megohms per mfd. on D.C.

The price of this and the 1,000-volt type is 2s. 3d. for 0.1 mfd., 3s. 2d. for 1 mfd., 5s. for 2 mfd., and 7s. 2d. for 4 mfd. The 500- and 700-volt models are slightly cheaper.

UTILITY MITE SUPERHET CONDENSER AND NEW DIALS

THE Mite series of gang condensers made by Wilkins and Wright, Ltd., Utility Works, Holyhead Road, Birmingham, 21, are available in two patterns, one embodying a die-cast frame, and the other a pressed-steel frame. And, although the former are slightly smaller than the latter, even the steel frame models are diminutive compared with their standard type, for a three-gang unit measures only 4 $\frac{1}{2}$ in. \times 3 $\frac{1}{2}$ in. \times 3 $\frac{1}{2}$ in. Yet, despite its small size, nothing has been sacrificed in accuracy of matching or tracking, and in this respect it compares very well indeed with any on the market.

Tests made with a three-gang 110 kc/s superhet. model show that at no part of the scale does the mis-matching between the preselector sections exceed 0.5 per cent., while the tracking of the oscillator section is entirely satisfactory using preselector and oscillator coils of 157 mH. and 126.5 mH. for the medium waves, and 1,900 mH. and 925 mH. coils for the long waves respectively. The long-wave padding condenser should be 0.002 mfd. semi-variable. The small trimmers are decisive in their action, and afford a variation of about 50 mmfds.

Constructionally, the condenser is very well made; the rotors are supported in ball bearings at each end, and earthing contact points are provided between each section. The plates in the rotor are semi-circular, and specially shaped stators give the required condenser law. Die-cast bonded rotor and stator units are employed, and the whole assembly is exceedingly rigid.

Using the coil values mentioned above

and one of the new wavelength-calibrated Utility disc drives, and keeping the stray capacities as low as possible, all circuits can be trimmed to give very close agreement with the dial readings.

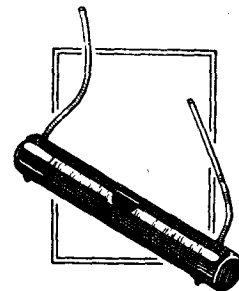
These dials are made in several different patterns; some have 0-180 division scales, but others are wavelength-calibrated. One model has a high-ratio reduction, 50 to 1, and is suitable for short-wave work.

The three-gang superhet. condenser tested costs 24s., or 19s. with three equal capacity sections. Disc drives cost 2s. 6d. each with a flat scale, and 3s. with a bevelled scale. The Micro Disc 50-to-1 reduction model costs 8s. 6d. in bevel type.

WATMEL HYWATT RESISTANCES

ALTHOUGH wire-wound and rated to dissipate three watts, the new Watmel Hywatt resistances are no larger than the average one-watt composition type, the overall size being 1 $\frac{1}{2}$ in. long and $\frac{3}{8}$ in. in diameter.

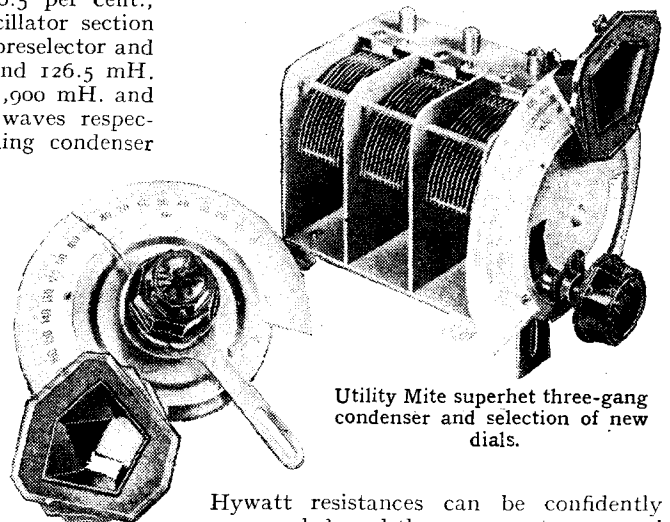
A specially prepared porcelain former is employed, and the fine resistance wire is spot-welded to the copper connecting leads. The resistor is then



Watmel Hywatt resistance.

coated with a hard heat-resisting enamel. The standard colour code is adopted, but to facilitate identification each resistor is enclosed in a transparent paper envelope marked with its value in ohms and the wattage rating. Resistors up to 50,000 ohms are made, priced 1s. each.

Some specimens tested showed very close agreement to marked values; the discrepancies in no case exceeded 5 per cent., while the majority were within 2 per cent. of the stated resistance. When dissipating three watts the resistor becomes hot, but the temperature rise is not abnormal and has negligible effect on the resistance value. The enamel is quite capable of withstanding much higher temperatures as it neither softens nor discolours.

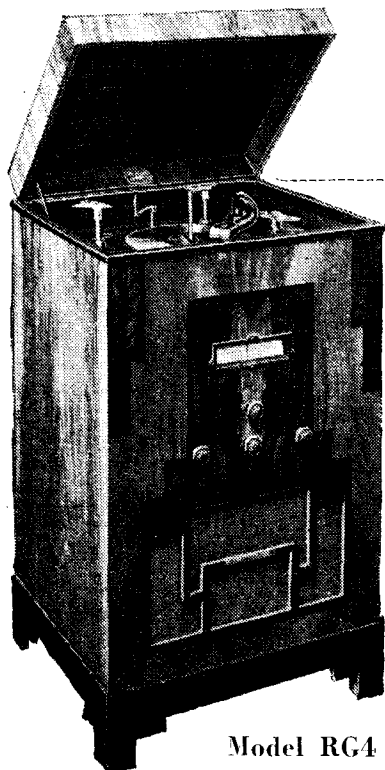


Utility Mite superhet three-gang condenser and selection of new dials.

Hywatt resistances can be confidently recommended, and they represent very good value for money. The makers are Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, Middlesex.

H.S.P. Auto Radiogram

An Inexpensive Instrument Incorporating a Record Changer



Model RG4

IN view of the fact that this 25-guinea model incorporates a Garrard automatic record changer, the impression might be created that some sacrifice of quality had been made in the cabinet or radio chassis in order to keep the price at this level. We found no justification for this speculation. An excellent performance was obtained from the three-stage receiver chassis, and the finish of the cabinet was of a very high order. The sound output given by the power pentode output valve and the energised Rola loud speaker are in keeping with the imposing appearance of the cabinet, and there can be no doubt that as a source of entertainment this combined instrument will fulfil most people's requirements at a very reasonable cost.

There are three stages in the radio receiver, comprising an H.F. amplifier, grid detector and power pentode output valve. The input to the H.F. stage is through a capacity-coupled band-pass filter, and both the aerial and secondary circuits are tapped down to provide the maximum selectivity. The radio volume control consists of a potentiometer controlling the grid potential

FEATURES. Type.—Cabinet model radio-gramophone for A.C. mains incorporating an automatic record changer. **Circuit.**—Screen-grid H.F. stage with band-pass input—H.F. pentode grid detector—power pentode output valve. Full-wave indirectly-heated valve rectifier. **Controls.**—(1) Tuning with illuminated scale calibrated in wavelengths. (2) Combined radio volume control and on-off switch. (3) Reaction control. (4) Waverange and gramo. switch. (5) Gramo. volume control. **Price.**—25 guineas. **Makers.**—H.S.P. Wireless Co., Langford Works, Weston-super-Mare.

of the H.F. valve. Tuned-grid coupling is used between the screen-grid H.F. stage and the detector, and reaction is applied to the tuned grid coil of the coupling circuit.

An H.F. pentode type of valve is used for detection and is followed by transformer coupling to the power valve. It is interesting to note that the coupling condenser is returned to H.T. instead of to earth, as is usual. The core of the L.F. transformer is earthed, and a condenser is connected across the secondary to by-pass residual H.F. currents and to prevent excessive high-note reproduction. An additional resistance-capacity filter is also connected for this purpose across the primary of the output transformer.

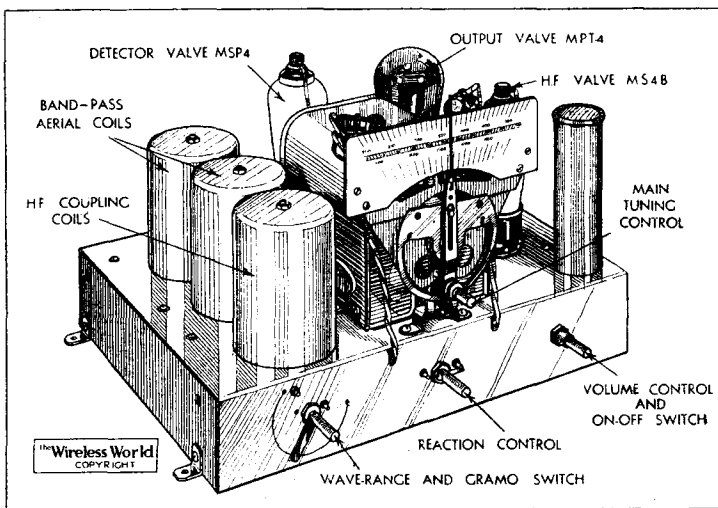
An extension loud speaker may be fitted, and a switch is included in series with the speech coil to cut off the main loud speaker if desired. The rectifier valve is of the indirectly heated type, and the initial voltage strain on the smoothing condenser is thereby relieved. A centre-tapped condenser is connected across the high-tension winding to reduce H.F. interference picked up on the mains.

The receiver chassis is well constructed, and high-grade components of well-known

make are used throughout. An auxiliary chassis below the loud speaker unit in the bottom of the cabinet carries the rectifier valve and one of the smoothing condensers, while the mains transformer is mounted separately on the floor of the cabinet.

The controls are well placed, and are fitted with plain knobs. The volume control is somewhat crowded towards the minimum end, but reaction is free from backlash.

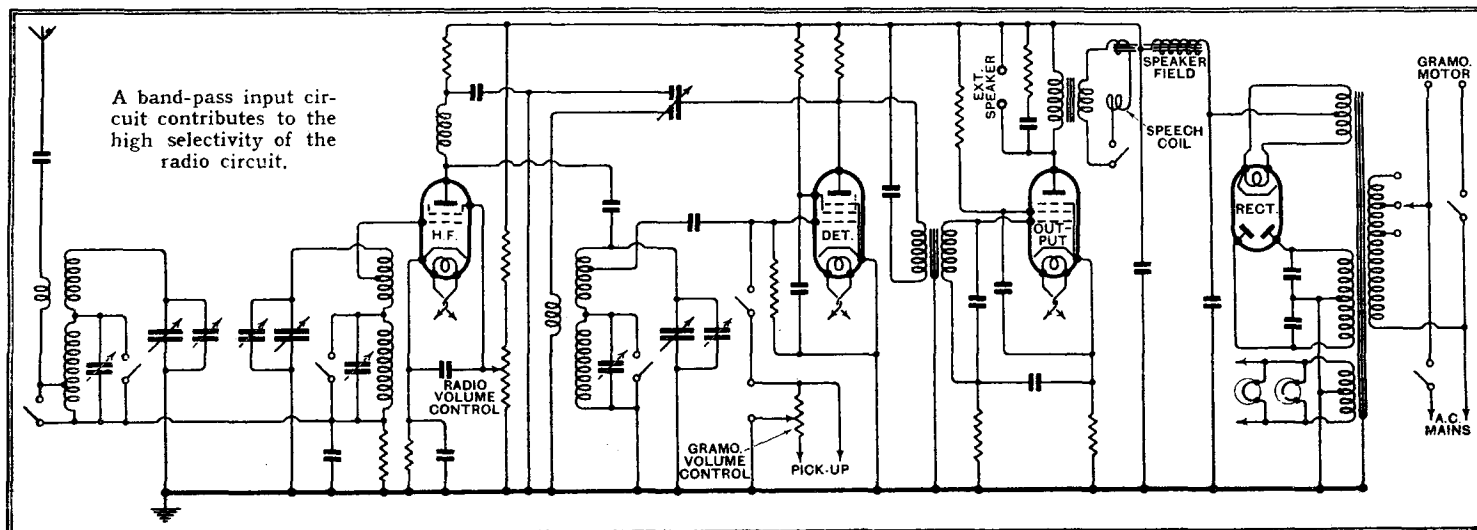
On test the receiver proved to be unusually sensitive for a three-stage circuit, and the intrinsic selectivity, without the assistance of reaction, was also very good. Interference from the London National transmitter in Central London was absent outside a band from 245 to 263 metres and from the Regional between 335 to 370



High-grade components are used throughout in the receiver chassis.

metres. The wavelength scale was accurate, and there could be no doubt of the set's capability of receiving all the European stations of good programme value.

The record changer is fitted with a Garrard pick-up which has an excellent characteristic, and a separate volume control for gramophone reproduction is incorporated in the motor board. There is ample reserve of amplification both on radio and gramophone, and it is possible to overload



U.S.P. Auto Radiogram—

the output stage, but not before over one watt of undistorted output is obtainable. The quality of reproduction is bright, and there is no lack of bass, though a certain proportion of this is contributed by a slight cabinet resonance. This is by no means objectionable, however, unless the

volume is increased to the point where overloading would in any case set a limit.

Hitherto, automatic record changers have been regarded as adjuncts of the very expensive radio-gramophones, and the makers are to be congratulated on bringing this feature within the range of a larger section of the public.

Readers' Problems

The Nature of Interference

THE user of a D.C. mains set tells us that intermittent interference from the mains (as distinct from a steady hum) is observed only when the receiver is tuned to an incoming carrier wave. In these circumstances, is it likely that the fitting of one of the various anti-interference mains filters that have been described from time to time in these pages would prove efficacious?

It seems safe to conclude that the particular form of interference of which our correspondent complains is of an "L.F." nature. Probably it is transferred by ordinary induction into the aerial-earth system. Interfering impulses of this nature cannot normally pass through the H.F. tuning circuits of the receiver unless helped on their way by a carrier wave, on which the interference is superimposed as modulation.

Accordingly, it seems certain that the interposition of an H.F. filter in the mains leads would not, in this rather unusual case, confer any benefit. We suggest an experimental rearrangement of the aerial and earth system.

Falling Current : Rising Voltage

A READER, who has very wisely kept a record of the original anode voltages of each of the valves in his receiver, has now noticed that the measured voltage between

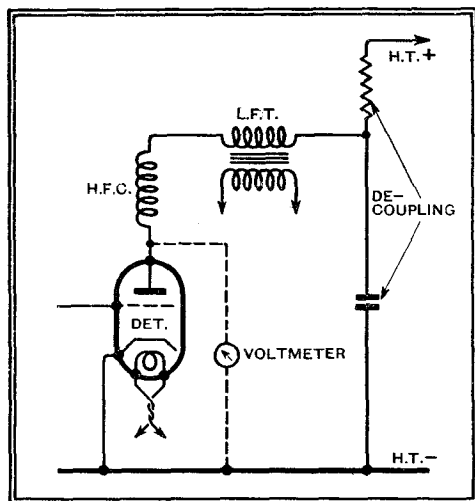


Fig. 1.—An increased voltmeter reading suggests that the detector valve has lost emission, and is consequently taking less anode current.

anode and cathode of the detector valve has risen appreciably—more than 20 per cent. Anode voltages elsewhere have undergone no appreciable change, and we are asked to say what may be deduced from these measurements.

There can be little doubt that the emission of the detector valve has fallen off, and as a consequence less current is passing in its anode circuit. This means that less

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.

voltage is absorbed in the decoupling resistance and other incidental resistances, and so the voltage on the anode has risen.

The circuit with which we are here concerned is reproduced in Fig. 1.

Whistles

IN asking our advice as to the suppression of whistle interference, several users of superheterodynes seem to be unaware of the fact that these whistles may be due to entirely different causes, and consequently will require entirely different cures.

First, we have the type of whistle of which the note does not vary with the tuning, and which is not in any way to be ascribed to the set or to its peculiarities, except that it may indicate an abnormally good high-note response. The cause is heterodyning between the carrier waves of transmitting stations occupying adjacent channels. By sacrificing temporarily a certain amount of brilliancy in reproduction, this type of interference may be avoided by fitting a whistle filter such as that described in *The Wireless World* of November 10th.

The other type of whistle is due to a peculiarity of the superheterodyne itself, and is known as second-channel interference. Pitch varies with tuning, just as in an unstable receiver, but even in the most unfavourable circumstances (near a high-powered twin transmitter) the whistling should only affect reception of four distant stations. Those readers who have experienced this form of interference will be interested to know that an effective "second-channel suppressor" will be described very shortly in the pages of this journal.

The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

Tone-corrected Volume Control

AT one time it was considered that the perfect volume control should not interfere in any way with the frequency characteristics of the L.F. amplifier. But lately it has been realised that, due to the peculiarities of the human ear, it is not only permissible, but actually desirable, that operation of the control should introduce what may be described as "distortion." When volume is reduced to a low level, it is all to the good if the middle register be reduced in strength proportionally to a greater extent than the bass or treble.

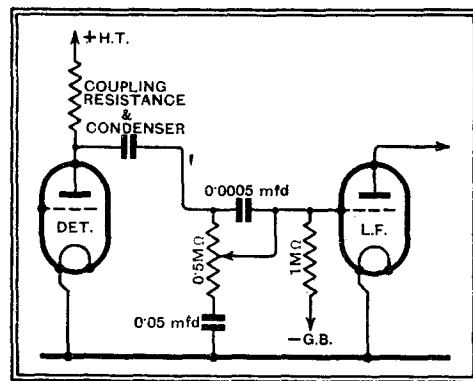


Fig. 2.—As volume is reduced by operation of the potentiometer, the middle register is attenuated to a proportionally greater extent than high or low notes.

Writing on this subject, a reader asks us to recommend a tone-corrected volume control circuit applicable to his own resistance-coupled L.F. amplifier.

The arrangement shown diagrammatically in Fig. 2 should meet the case fairly well, and has the advantage of simplicity. Values are suggested, but it would be worth while to try the effect of different capacities for the condensers marked 0.0005 mfd. and 0.05 mfd. The first controls high notes and the second low notes.

For further information on this subject our correspondent is referred to an article in *The Wireless World* of April 21st, 1933.

Inconstant Selectivity

THE user of a highly sensitive receiver of fairly modern design tells us that, although the set is generally satisfactory and very pleasing to operate, selectivity varies considerably "from day to day." A number of stations, of which a list is given, can sometimes be received quite clear of their neighbours, but on other occasions a background of intelligible interference becomes evident.

The most likely causes of such changes are intermittent and varying contact resistances in series with one or other of the tuned circuits, or similar leakages in parallel. But faults of this nature do not often manifest themselves in the way described by our correspondent, and we are much more inclined to think that varying selectivity is due to natural causes. If we may say so, should not "from night to night" have been substituted for "from day to day" in our correspondent's letter? After dark the signal strength of distant stations fluctuates enormously, and it is quite natural that a given transmission may be strong enough at one minute to cause interference, and at the next may fall below the level at which it is receivable.

We suggest that careful comparative tests should be carried out in daylight.

The Wireless World

THE
PRACTICAL RADIO
JOURNAL
23rd Year of Publication

No. 750.

FRIDAY, JANUARY 12TH, 1934.

VOL. XXXIV. No. 2.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.

Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.

Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:

Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other
countries abroad, £1 3s. 10d. per annum.

*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.*

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EDITORIAL COMMENT

The Wavelength Re-shuffle

Grounds for Optimism

EVERY wireless listener is by now aware that an important event in European broadcasting takes place next Sunday night, when a re-shuffle of wavelengths under the Lucerne Plan is staged to commence. A great deal has been written already on the subject, including some grossly exaggerated reports suggesting that the result of these changes of wavelength will be that the ether in Europe will be more than ever congested and that sets will have to be designed to give even greater selectivity than at present.

We see no reason for adopting so pessimistic a view on the effects of the Plan.

Theoretically, the new arrangement should make reception in Europe substantially better than it was before; there should be considerably less mutual interference and the need for extreme selectivity should certainly be no greater than it is at present. Why should we be pessimistic enough to anticipate failure of the Plan when it has been accepted by the vast majority of the broadcasting authorities in Europe? Those few transmitters who have not so far undertaken to accept the new arrangement will, in all probability, be forced to do so, if not in the common interest, at least in their own, since otherwise they are likely to find reception of their own transmitters is impaired.

We may be justified in expecting that the new scheme cannot settle down on ideal lines immediately. Although the signatories to the Plan have undertaken to make the change-over at once, it may be supposed that there will be slight adjustments to be made for a few

days after the main Plan comes into force, and until then it would be hasty to form any conclusions as to the success, or otherwise, of the scheme.

In this issue we have taken special steps to endeavour to be helpful to our readers in their effort to re-calibrate their receivers under the new arrangement. We include as a special supplement to the issue a chart which we believe will prove very helpful, as it indicates the approximate channels into which the wavelength bands have been divided for the purpose of allocating stations in such a way that they will not mutually interfere. The present positions of the stations in the wavelength scale are shown alongside the new allocations, so that those who have already calibrated their sets will be able to make a direct comparison.

Aids for the Listener

We anticipate that one or two stations shown on each chart may eventually differ slightly in their positions from those indicated, and we definitely know that there are certain transmitters which have not, at the time of going to press, yet indicated their intentions in regard to the positions they will eventually take up.

In addition to this supplement, we are describing in this issue a special station finder which will, we believe, prove of very great value to those who wish to calibrate their sets and are prepared to go to the extra trouble involved in making up this unit.

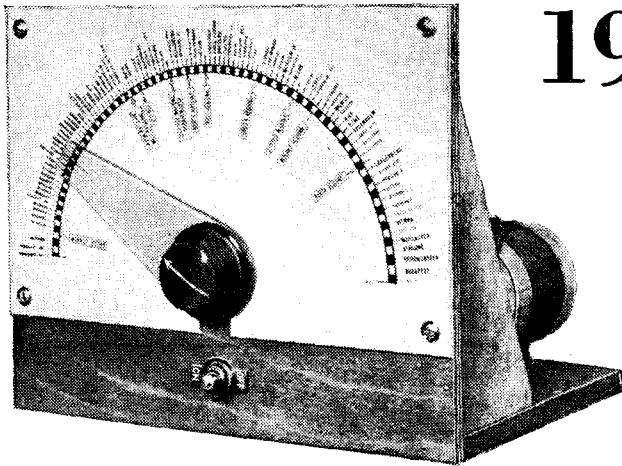
Other articles are included having a bearing on the change-over arrangements, which we hope will prove helpful, and in particular we would draw attention to the exclusive information published on the actual schedule to be followed in the change-over.

1934 Station Finder

An Easily-built Device Giving Positive Identification

HOW to build a simple buzzer-energised wavemeter, directly calibrated in the new station settings, which instantly identifies a transmission without reference to graphs or charts. It is virtually self-calibrating.

By H. F. SMITH



THE perfect receiver of the future will doubtless require no external aid to station identification—or, what amounts to very much the same thing, to the finding of any wanted transmission. Ultimately, a really satisfactory tuning scale, giving a direct, accurate, and easily read indication of the station to which the set is tuned will probably be devised, although it is arguable that a system of tuning by numbered channels, with a reference chart as a supplement to the user's memory, has points in its favour.

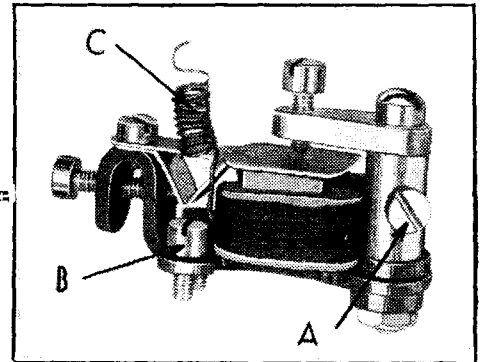
There are few, if any, existing receivers that are not open to criticism with regard to their tuning indicators, and until this particular problem has been solved, there can be no doubt that the use of a suitable type of wavemeter as an adjunct to the set provides the best means of finding or identifying stations. A station-calibrated meter, such as that to be described in this article, eliminates all the usual wearisome intermediate processes.

A direct-reading station finder, operating on the absorption principle, was described in *The Wireless World* some time ago. But, due to the general adoption of A.V.C., such a device is no longer suitable for the majority of modern sets; a radiating meter which acts as a miniature local transmitter has a distinctly wider field of usefulness. The present instrument consists merely of a tuned circuit, made to oscillate at the wavelength to

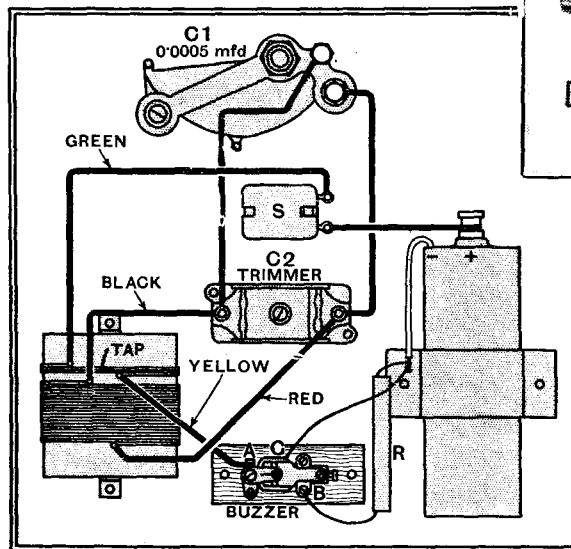
cover the medium wavelengths only, as there are relatively so few stations on the long waveband that it is considered unnecessary to introduce the complications necessary for covering that band.

There is no difficulty whatever in making a wavemeter, but certain precautions must be observed in designing an instrument that shall be virtually self-calibrating and with which a ready-made scale, such as that printed on the next page, may be used. Fortunately the necessary degree of "repeatable" accuracy may be ensured by using a modern type of jig-

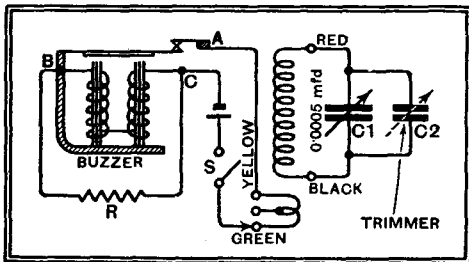
frame of the variable condenser is joined to the low-potential end of the tuned section of the coil (the end nearest to the small primary winding) and also to the top plate of the trimming condenser C2, in order that hand-capacity effects may be avoided when the time comes to make



A Townsend type of buzzer, with connecting points marked to correspond with other diagrams.



Practical wiring plan. Identifying colours on coil connecting leads are indicated.



Circuit arrangement of the station finder. A capacity of 0.00005 mfd. is suitable for the trimmer, while a shunt resistance R of 15 ohms is recommended for use with the usual 25-ohms buzzer.

which it is adjusted by means of a buzzer, which is in turn energised by a single dry cell. To avoid undue damping, the buzzer circuit is inductively coupled to the tuning coil.

The 1934 Station Finder is designed to

assemble tuning condenser, of which divergences in capacity between individual specimens is small, and by fitting a tuning coil closely matched in inductance value to the one with which the original calibration was carried out. It should be realised that there are no alternatives to these key components as specified in the "List of Parts."

With regard to construction, the builder has ample latitude. Layout is quite unimportant, and the apparatus may be mounted and housed in almost any way desired. The condenser pointer which traverses the station scale should be transparent, with a datum line scribed on its under-side.

In connecting up the apparatus, care should be taken to see that the uninsulated

initial adjustments. It should also be realised that the key components should be handled gently in order to avoid risk of bending the condenser plates or displacing the windings of the coil.

Even if a buzzer of a type differing from that illustrated be used, it will not be hard to make the connection to it correctly after

studying the various diagrams, in which the terminal points all bear the same lettering. It will be seen that the shunt resistance which is required for correct operation is joined across points B and C, and is thus in parallel with the magnet windings. The art of adjusting a buzzer is easily acquired, but some care should be taken in finding the best tension for the back-spring which tends to force the armature away from the magnet pole-pieces.

With the buzzer operating properly, the process of calibrating may be begun. The instrument is coupled to the receiver by placing it in proximity to the aerial lead-in wire, or even to the earth lead; the more sensitive the receiver, the greater may be the spacing. With unscreened sets, where radiation may be picked up directly by the coils, the wavemeter may often be placed on the top of the cabinet.

PRACTICAL HINTS AND TIPS



FROM many points of view it is unfortunate that the human ear is notoriously deficient in retaining impressions either with regard to volume or pitch. In comparing the merits of alternative components or circuit arrangements,

Comparative Tests

an observer is likely to go badly astray unless means are available for making a quick change-over from one to the other; if time must be spent in changing over a number of connections, the original impression is lost, and tests made in this way are almost always valueless.

This applies mainly to comparisons made by aural means, but even with the aid of measuring instruments, a quick change-over from one arrangement to the other is at least desirable, as conditions may have changed in the meantime.

Although it may seem to involve a great deal of trouble, it is a wise plan to cultivate the habit of using a switch, and not interchangeable connections, when making comparative tests. Admittedly, the wiring of the switch may take time, but once done, comparisons may be made in a fraction of a second—long before the ear has had time to lose its first impression.

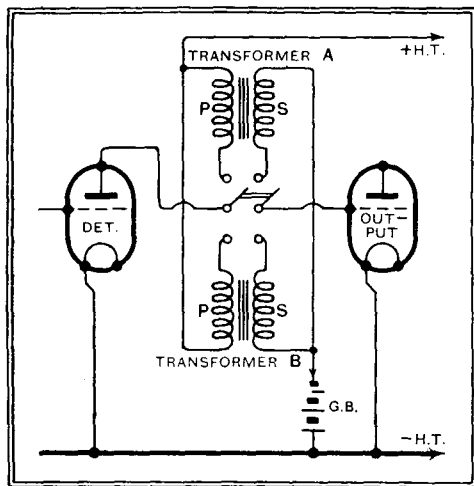


Fig. 1.—Illustrating the use of a change-over switch for rapidly comparing the characteristics of two L.F. transformers.

Of course there is always the possibility that complicating factors will be introduced by the inclusion of a change-over switch and the necessary additional wiring, and so common sense must be exercised and reasonable care taken to avoid instability and other untoward effects. In H.F. circuits in particular, the use of an unsuitable switch is likely to introduce

Simplified Aids to Better Reception

heavy losses, but fortunately it is easy to obtain good but inexpensive double-pole change-over switches of the type sold for earthing the aerial system; the best of these have porcelain insulation. Vulcanised fibre should never be used in cases where dielectric losses are likely to prejudice the results of the test.

It is impossible to enumerate all the various uses to which a change-over switch may be put as an aid to experimental work, but the method of application will be fairly obvious. For instance, it will be realised that it is seldom practicable to change over *all* the connections of a component; instead of doing this, the best plan is to join together the corresponding low-potential points, and to use the switch for changing over the high-potential connections. This practice is exemplified diagrammatically in Fig. 1, which shows the appropriate connections for comparing two L.F. transformers.

Failing a switch, or in circumstances where the use of such a device might be undesirable, it is worth while trying to arrange for a quick change-over by means of suitably arranged plugs and sockets with flexible leads.

THE opinion seems to have gained currency that automatic volume control tends to increase background noises. Actually, an A.V.C. system that is working properly can do nothing to increase these noises; for that matter, even if it is not functioning "according to plan," it is most unlikely to do so, although there is the remote possibility that

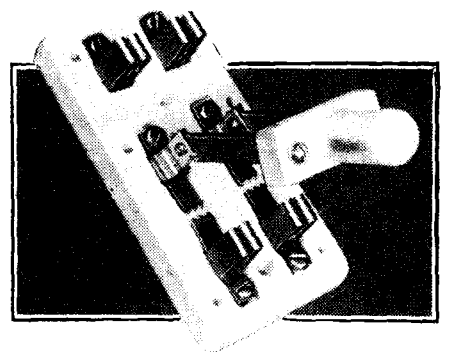
A.V.C. and Background Noise

hum may be increased by bad design. This misconception probably arose through the fact that A.V.C. is generally included only in highly sensitive sets, which are naturally more affected by various types of electrical interference. Again, it must be admitted that background noises, though actually no louder, tend to become more evident when A.V.C. is fitted.

When an A.V.C. set is tuned to a wavelength at which there is no incoming carrier wave to desensitise it, magnification will be at a maximum, and so the incidental voltages giving rise to noise will be amplified to the fullest extent. On tuning to a strong unmodulated carrier wave, the background will be automatically made

more quiet by the desensitising effect of the A.V.C. system.

In unfavourable circumstances, where background noises are troublesome, a strong case can be made out for the fitting of some sensitivity-limiting device, such as that included in the latest *Wireless World* receivers.



A cheap but satisfactory D.P.D.T. switch with porcelain insulation throughout.

IN order to avoid attenuation of the bass register, due to the well-known reversed-reaction effect, it is usual nowadays to shunt the bias resistor associated with L.F. amplifying valves with a low-voltage dry electrolytic condenser (in the order of 50 mfd.). A condenser of this capacity offers an almost negligible opposition to the flow of current at even the lowest audible frequencies, and so the proportional amplification of these frequencies is substantially unaffected.

Too-effective Decoupling

Many users of sets—and particularly of those with high-quality resistance-coupled L.F. amplifiers—which were designed before these particular condensers were introduced, have no doubt considered the possibility of substituting them for existing paper condensers of the almost-standardised capacity of 2 mfd. In nine cases out of ten it is safe to do this, but occasionally the result of improving low-note amplification will be the production of actual or incipient L.F. oscillation.

Those who are endeavouring to improve bass response in this way should therefore bear in mind the possibility of having to improve anode-circuit decoupling; as a rule the most practicable way of doing this is to fit extra decoupling condensers in parallel with the existing ones in both detector and L.F. anode circuits.

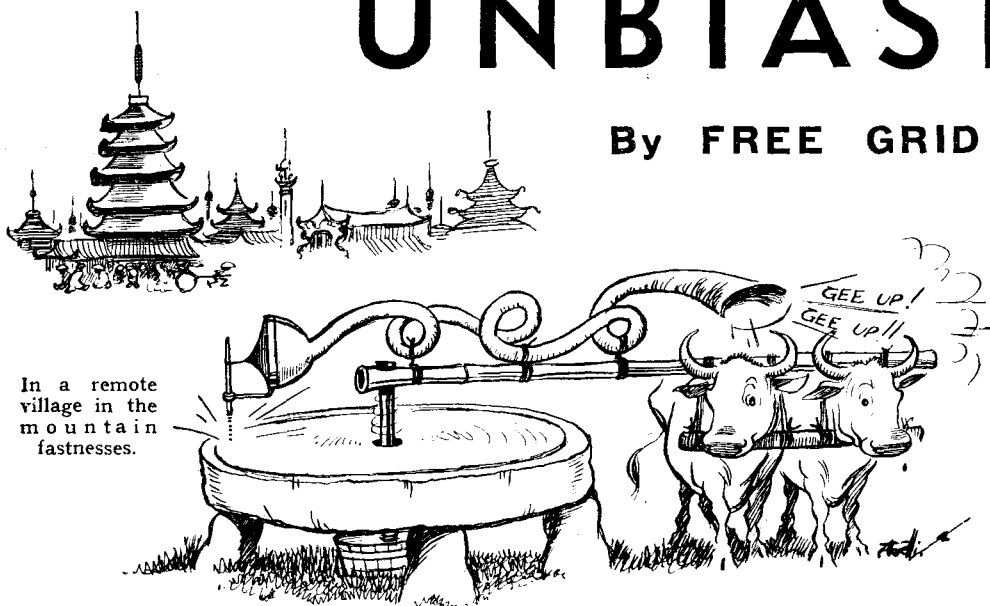
Why "Nine Kilocycles?"—

Plan every care has been taken to ensure that stations of high power working on adjacent channels shall be spaced as far apart as possible geographically, in order that they may make use of a greater band width than 9 kc/s without mutual interference.

We come to the conclusion, therefore, that no special significance attaches to the figure of 9 kc/s. It is really the result of a simple division sum, with the number of stations or groups of stations requiring separate channels as the divisor and the number of kilocycles in the waveband set aside for broadcasting as the dividend. At

the same time, in the event of mutual interference arising between stations of equal power at, say, a point equidistant between them, it would still be possible to cut out the interference and to receive excellent speech and very good reproduction of music by restricting the band width either at the transmitter or the receiver to 9 kc/s.

UNBIASED

By FREE GRID

In a remote village in the mountain fastnesses.

Manual Recording

AS the result of much radio listening I have long been a convert to the gramophone, and nobody is more appreciative than myself of the enormous strides which the art of recording has made during the past few years. In many cases, in fact, I have long since thought that the recording is better than the original, more especially in the case of certain soprano voices. In spite of this, however, nobody could have been more astonished than I was the other day to learn from an ardent gramophile, who spends a great deal of his time in various recording studios, that this is a solid fact and no mere fancy on my part.

I had been round to my friend's house the other evening to listen to certain forthcoming releases, and had heard a remarkably fine recording of a well-known soprano, whose chief claim to notoriety is an unusually pernicious high-note wobble. Indeed, the performance was so good and free from all traces of her characteristic wobble that I could not help remarking to my friend that it almost seemed as if the records she made were "touched up," like her photographs. To my astonishment my friend immediately retorted that this was just what did happen, and he expressed his astonishment at my ignorance. He went on to explain that not only were all soprano wobbles removed by craftsmen skilled in the manipulation of jewellers' chisels and similar tools, but that things like missing high notes and aspirates could actually be put in where needed.

At first I was inclined to think that he

had been misinformed, in spite of his very close association with the trade, until suddenly he opened the flood gates of memory by passing me over a microscope and bidding me see the faint but obvious markings of the craftsmen's tools.

The whole business took me back over a quarter of a century ago to an occasion when I was exploring in China, the chief object of my trip being to research into the ancient civilisation of that land of mystery. Coming one day upon a remote village in the mountain fastnesses I observed what at first appeared to be the customary team of oxen grinding out corn by means of a circular mill. Fastened to the yoke above the heads of the beasts, however, I noticed a curious contraption terminating in a ram's horn, from which was emanating strange sounds which proved to be exhortations in the local dialect to "Gee Up!"

How it Worked

Climbing to the top of the affair I was amazed to find a gigantic stone gramophone disc several feet in diameter. At one end of the yoke was an outside in sound boxes consisting of a tightly stretched missionary skin, to the centre of which was attached a bamboo "needle" which passed down to a single circular track around the outer edge of the stone record. The whole arrangement, in fact, was a crude form of gramophone in which the record was held still and the sound box and tone-arm revolved. Needless to say, I left no stone unturned to find out the origin of this remarkable arrangement and learnt through an interpreter that it had

been invented several centuries B.C. by a lazy but ingenious tiller of the soil who preferred this method

of urging on the oxen to further efforts to that of personal attention.

The most remarkable fact about the whole thing, however, was the method of making the record. Instead of the human voice itself being used to make the necessary indentations they were hewn out of the stone with hammer and chisel. Great delicacy of touch was not required, owing to the enormous size of the record.

No Comments

Truly there is nothing new under the sun, and so far as I can make out this method of what I may call manual recording was not used again until a year or so ago, when, as explained in an article in *The Wireless World* of February 3rd, 1933, Rudolf Pfenniger commenced to do a very similar thing for a Bavarian film company. Now, apparently, it has been resuscitated once again to make good certain deficiencies in the human voice. It is not my business to make comments on the morality of the whole affair, but merely to record the scientific facts, otherwise I could make a few trenchant remarks.

Twenty Years Ago

Extracts from *The Wireless World* of January, 1914

From Questions and Answers.—"P. B. (Brighton): Over what distance will it be possible to receive signals with the following apparatus: A single slide inductance, a variable condenser, a potentiometer, a single headgear of 1,000 ohms, an aerial of four line wires, height 75 feet, using 300 feet of aerial wire?"

The answer indicated that he should be able to receive "quite a number of English coast stations and large stations in Spain, France and Germany if they come within your range of wavelength, whatever that may be."

"EUROPE'S TIME SIGNALLER.—Little did M. Eiffel suspect the use to which his Tower was destined to be put. It has lately taken on itself some of the functions of a newsagent by despatching by wireless each morning and evening news to the French warships and the military posts in Morocco, and, as all know, it was chosen by an International Conference in 1912 to signal the hour to the rest of Europe. This is done at a number of fixed times."

"THE PHYSICAL SOCIETY.—The annual Exhibition of the Physical Society was held in London on December 16th. . . . In the crystal receiver shown by the Marconi Company the detector consists of two carborundum crystals which can be used either independently or put in opposition. . . . An adjustable air condenser was also shown at the Marconi stand. The maximum capacity is 0.01 mfd."

The Great Wave-change

Complete Time-table and Plan of Operations

THE WIRELESS WORLD is again able to provide exclusive information regarding the operation of the Lucerne Wavelength Plan. With the aid of the accompanying time-table and guide, British listeners can follow the extremely interesting operations on Sunday and Monday next, and, incidentally, calibrate their receivers by the Brussels wavemeter.

IN the theatre it is the custom to ring down the curtain before the stage-hands come on the boards, though, if the truth were known, scene-shifting could often provide a more entrancing entertainment than anything in the printed programme. But Europe's broadcasting stage has no curtain; the International Broadcasting Union cannot cloak the midnight deeds of Sunday and Monday next in a decent wrapping of Heavyside Layer, and so, from 11 p.m. onwards, listeners who are curious enough to switch on will hear as lively a running commentary as ever came to their ears through a normal "outside broadcast."

The main work will be accomplished on the night of the 14th, and *The Wireless World* is now able to give the exact plan of procedure.

The "battle plan," as it has been called, is divided into two sections: National checking and International

(gium), Berlin, Berne, Madrid, Mojaisk, Prague, Sesto Calende (Italy), Stockholm, Tatsfield and Warsaw will check those of their own countries.

At 2 a.m., G.M.T., the checking points will measure the wavelength of stations in the smaller countries which are not equipped with adequate wavemeter installations.

Measurements will conclude at 2.19 a.m. and then will follow the most interesting period for British listeners, when, at 2.20 a.m., the results of the wave checking are broadcast as follows:—

Brussels results from Radio Paris (in English and French).

Berlin results from Zeesen (in German).

Helsinki results from Lahti (in German).

Prague results from Prague (in German).

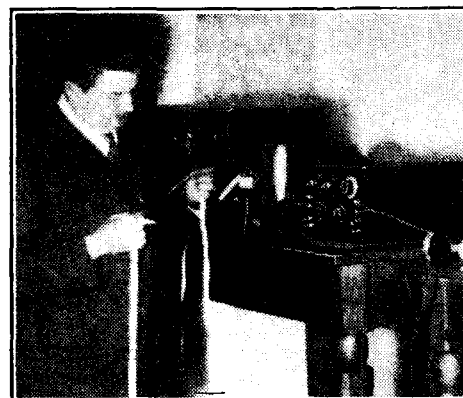
Sesto Calende results from Rome (in French).

Stockholm results from Stockholm (in Swedish and Norwegian).

Warsaw results from Warsaw (in French).

At 2.29 a.m. precisely these transmissions will cease, to be succeeded by the great international check, which begins at 2.30 a.m. and continues without intermission until 7 o'clock in the morning.

The brunt of the "battle" during this period will be borne by the international checking post at Brussels, which will attempt to measure the wavelengths of nearly all the European stations. The results of the measurements will



The busiest man in Europe on Sunday next will be M. Raymond Brailard, Chief of the Brussels Checking Station, who is here seen studying the tape disgorged by the automatic wavelength recorder

between the announcements will, in most cases, be filled by characteristic tunes or national melodies.

Brussels will be checking the stations at the rate of twenty-four an hour, and it is hoped to cover at least sixty transmitters on the first night. The time-table for this section will be as follows:—

G.M.T.	Stations
2.30 a.m.	Russian stations, two by two every five minutes.
3.0 a.m.	Ankara.
3.10 a.m.	Polish stations.
3.35 a.m.	Austrian and Hungarian stations.
3.50 a.m.	Norwegian stations.
4.5 a.m.	Swedish stations
4.15 a.m.	Danish stations
4.20 a.m.	German stations.
4.50 a.m.	Italian and Spanish stations.
5.50 a.m.	Reykjavik (Iceland).
5.55 a.m.	French stations.
6.25 a.m.	British stations
6.50 a.m.	Luxembourg.
6.55 a.m.	Swiss and Dutch stations.

The second night—January 15th-16th—will be less strenuous.

All stations will take their normal programmes until 11 p.m., and during the evening Brussels will be hard at work checking in order to get a good grasp of how the plan in general is working.

At 11 p.m. on Monday, the 15th, all European stations will close down, and Brussels will announce by Radio-Paris, Zeesen and Warsaw the results of this second series of checks. At the same time defaulters will be asked to "come on the air" at a given time and subject themselves to a third check.

This will conclude the greatest "field day" in the history of European wireless, and listeners who are prepared to sacrifice a little sleep will reap their reward by having their sets calibrated by no less an authority than the Brussels wave-meter itself. The English and French announcements from Radio-Paris will simplify the process for listeners in this country, and make it possible to be certain of at least a dozen or more exact frequencies. This knowledge will help towards the quick location of all the other transmitters.

THE SCHEME AT A GLANCE.

Period I.—11 p.m. (G.M.T.) Jan. 14th to 2 a.m. Jan. 15th.

National Wavelength Checking.

Period II.—2.30 a.m. to 7.0 a.m. Jan. 15th.

International Wavelength Checking.

Period III.—11.0 p.m. Jan. 15th and onwards.

Final Checking by Brussels Control Station.

Jan. 14th	11.0 p.m.	(G.M.T.)	Zero hour. Each country checks its own wavelengths.
"	15th	2.0 a.m.	Stations checked in countries not possessing wavemeters.
		2.20 a.m.	Radio-Paris and other high-power stations announce results.
		2.30 a.m.	Brussels control bureau checks stations in pairs at the rate of 24 per hour until
		6.25 a.m.	British stations are checked by Brussels.
		11.0 p.m.	All stations cease transmission. Brussels confirms wavelengths and broadcasts results via Radio-Paris, Zeesen and Warsaw.

checking. Zero hour for the first period begins at 11 p.m., G.M.T., on the 14th and closes three hours later. During this period the stations of the following countries will start transmission on their new waves:—

Belgium	Czechoslovakia
France	Italy
Germany	Sweden
Switzerland	Great Britain
Spain	Poland
Russia	

International checking stations (as tabulated in *The Wireless World* of November 17th) at Brussels (for France and Bel-

gium), Berlin, Berne, Madrid, Mojaisk, Prague, Sesto Calende (Italy), Stockholm, Tatsfield and Warsaw will check those of their own countries. In addition to these three high-power stations there will be only two other stations at any one time on the air, namely, those whose wavelengths are being checked. It should be noted that stations will be checked in pairs.

As each pair of transmitters comes on the air announcements will be made in the language of the country and repeated at least every thirty seconds. The intervals

BROADCAST BREVITIES

By Our Special Correspondent

B.B.C. Stations Working at 6.30 a.m.

SO far as sleep is concerned, the B.B.C. engineers will fare as badly as any on the night of Sunday-Monday next, for I understand that the British stations will not come up for their final check until the grey hour of 6.25 a.m., when the engineers in Poland, Spain, Czechoslovakia, and other more civilised countries are safely tucked in their beds.

Nightmare in Brussels

Yet even the B.B.C. will have an easy time compared with that of M. Braillard and his assistants at Brussels, who will be hard at it from 11 p.m. on Sunday till 7 a.m. on Monday without intermission. They hope to check wavelengths at the rate of some twenty-four an hour, and a more nerve-racking task, with all Europe standing by to time-table, it is difficult to imagine.

Tantalising Luxembourg

Luxembourg, by the way, intends to tantalise us until the very last moment, but I can confidently state that she will remain on the long waveband. Apparently, the International Broadcasting Union has abandoned the idea of inducing this—one of the smallest States in Europe—to come to heel, and is now trying to find room for her 200-kW. station a little higher in the wavelength scale than at present.

A Secret Revealed

I believe that Luxembourg may share a wave with Minsk on 1,442 metres, but we shall not know definitely until Monday morning at 10 minutes to 7 when the station will be officially checked on its new wave.



FILM BROADCASTS FROM THE STUDIO. Sound films, accompanied by running commentaries on the pictures, are a frequent feature in the Poste Parisien programmes. Note the silence cabinet from which the announcer views the picture and interpolates explanatory remarks.

An Ill Omen

[T always seems to bode ill for the B.B.C. when the British public ceases to criticise. And one cannot but notice that the public has been growing very indulgent of late.

Last year, at a time when the programmes appeared to be giving unusual satisfaction, the Corporation suddenly offended Poland and spent an unpleasant period in trying to make good.

Unhappy Choice

It was another ill-omened hour, just when the B.B.C. was flushed with a sense of increasing popularity, that it chose the Portland Place site for Broadcasting House, thereby condemning itself to years of cramped effort in a building too small by half.

Little Black Cloud

And now, following the excellent Christmas broadcasts, the B.B.C. is popular again. What is the trouble now?

This time the little black cloud is on the Empire horizon.

Empire Broadcasting in Trouble

It would be incorrect to say that Mr. Cecil Graves, the B.B.C.'s Empire Programme Chief, and his Department are really happy over immediate prospects.

Put bluntly, Empire broadcasting is making no headway. Trouble began at the outset with the choice of indifferent programme material on the assumption that the Dominions and Colonies would be so delighted to receive anything from the Mother Country during the experimental period that the programmes themselves would be of secondary importance. No greater mistake could have been made.

Why Not Relay Points ?

However, strangely enough, it is not of the programmes that Empire listeners are complaining but of the transmissions themselves, which are compared most unfavourably with those of Eindhoven, Holland, and the French *Poste Coloniale*.

practicable in our case where it might not be in the case of other countries—it should be possible to guarantee the Empire listeners a service which would be good enough, at least, to enable them to criticise the programmes.

This, surely, is every listener's birth-right.

Mismanagement

A REAL flaw in the B.B.C. transmission arrangements was emphasised the other evening when National listeners were kept waiting for the Paul Robeson recital until the Bach Oratorio from London Regional was finished nearly a quarter of an hour late.

Gale Warnings that Never Come

There seems no earthly reason why one transmitter should be kept waiting for another in this fashion.

The same thing occurs when an urgent gale warning is broadcast from Daventry National. Listeners to the London, West, North and Scottish Nationals hear the news of the impending announcement and have their normal programme cut off while the announcement is made. Yet the actual gale warning is confined to the Daventry long-wave transmitter and inexperienced listeners waiting in silence on the other National stations can be forgiven for wondering whether their receivers are at fault.

The Question of Continuity

There seems no reason why, in the case of an ordinary musical programme, any interruption should be necessary on the medium-wave Nationals. Continuity does not matter except in the case of radio plays and symphonic works, and the long-wave listener is, therefore, not seriously inconvenienced by the fact that the programme is continued on the medium wave during the gale warning.

Rhapsody : "Broadcasting House"

MANY have sung the praises of Broadcasting House, but Mr. George Posford is the first musician to compose a rhapsody about this Palace of Pleasure. It is to be broadcast in the London Regional programme on January 30th by the augmented Theatre Orchestra conducted by Constant Lambert.

Characteristic Sounds

I know nothing of the piece so cannot tell you whether Mr. Posford introduces such characteristic sounds as the "shush" of the disinfectant sprays, the clatter of the canteen, or the last round-up at closing time, but I do know that we may expect something very bright and scintillating from the pen of the composer of "Good Night, Vienna."

Famous Edifice

THE news that the B.B.C. is taking over the Maida Vale skating rink has filtered through to the Continent. I see it is announced in the German Press that the Corporation is going to make use of the "well-known Skatung Ring-Saal."

The Listener's Birthright

In this way—and the disposition of the British Empire enables such a system to be



Tuning Noises

Explaining the Sounds Heard While Tuning

By W. T. COCKING

DURING the process of tuning a receiver, various sounds are heard which bear little or no relation to the broadcast programmes. These sounds arise through heterodyning between stations and background noises and may assume a widely different character in a modern receiver from those in an old-type set. In this article, the types of noise commonly found are described and their cause explained.

THE sounds audible during the process of tuning a receiver of the older type are familiar to all but the newest comers to radio. Many of the latest designs of receiver, however, possess an extraordinarily high degree of selectivity, and this has led to a modification of the familiar tuning sounds, and made accurate tuning imperative if high-quality reproduction is to be secured. The greatest difference, however, has been brought about through the advent of automatic volume control, and many have failed to realise completely all that it entails.

When tuning an ordinary receiver, no particularly remarkable sounds are heard. If its selectivity is not of a high order, the local station will be audible when the tuning control is still some distance from its true setting, but the programme will be heard quite normally and with good quality. The only difference, in fact, between the "off-tune" and the correct settings is one of volume. Distant stations tune-in in the same manner, except that their apparent spread is less on account of their relative weakness. With such a receiver the only unwanted sounds heard will be due to atmospherics, man-made static, and interference from other broadcasting stations.

Interference

This interference may take two forms: the programme from an unwanted station may be heard as well as that from the wanted one, and there may be a steady high-pitched whistle due to heterodyning between the carrier waves of adjacent stations. The only way of avoiding this interference is by making the selectivity of the receiver higher. It might be thought that the only effect of this would be to remove the interference and so give quieter operation. This is not necessarily the case, however, for although the interference may be reduced or abolished when the set is tuned to the wanted station, during the process of tuning various peculiar sounds make themselves evident. Moreover, even when the set is accurately tuned, a new form of interference may appear.

This is the interference popularly known as sideband splash, and it is caused by the sidebands of an interfering station heterodyning the carrier of the wanted station to give an intermittent, high-pitched, twittering sound. It is not necessarily a defect of highly selective receivers, for it is actually present in unselective types, but is then rarely noticeable, for it is too weak to be heard through the background of wanted and unwanted programmes. Unfortunately, there is no known way of preventing sideband splash which does not appreciably affect the quality of reproduction, and at present the only remedy is to restrict the high frequency response of the receiver. It is usually only serious when receiving the weaker of two adjacent stations.

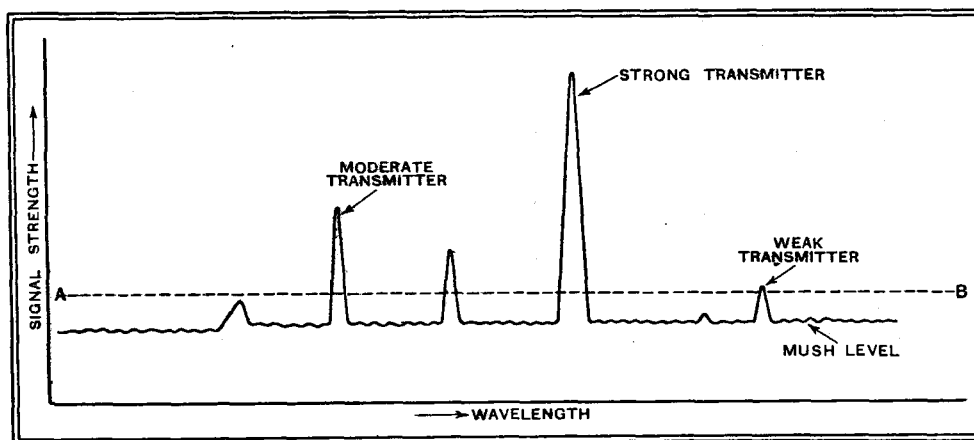
When first tuning a selective set, it will be found that the reproduction is very high pitched and distorted as the exact tuning point is approached, but that normal quality is obtained when the set is tuned accurately. This distortion is due to the selective action of the tuning circuits when they are tuned, not to the carrier wave, but to the sidebands. Under

distortion. It is for this reason that accurate tuning is so important in a selective receiver, whether it be a straight set or a superheterodyne, and the quality will be found to vary greatly with the precise setting of the tuning control.

Selectivity

The ear is a very unreliable indicator of volume, and the old process of tuning for maximum volume is rarely sufficient for a modern receiver. Almost invariably, therefore, the best procedure is to tune for the deepest toned reproduction, for the ear is far more critical of changes of tone than of volume. With a little practice, such tuning can be carried out as accurately as if a visual indicator were employed.

Selective receivers may be divided into two classes—those which are fitted with true band-pass filters, and those which have sharply peaked circuits and tone-correction for the maintenance of the high-frequency response. When using the former it will be found that tuning is quite flat over a small range, but that the



The effect of A.V.C. is well illustrated by this diagram, which shows the relative values of different stations and the mush level on a reduced scale. When tuning with a set not fitted with A.V.C., the sensitivity would normally be adjusted to a point represented by the line AB, and the mush would be only a gentle background in the absence of a signal. On tuning in a station, of course, the sensitivity would be altered appropriately to its strength by the volume control. With an A.V.C. set fitted with a "noise suppressor" the initial sensitivity is of the same order, but A.V.C. automatically reduces the amplification on tuning in a station. Without a "noise suppressor" the sensitivity between stations would rise to such a degree that full output would be obtained from the mush.

these circumstances the sidebands may actually assume a greater strength at the station suddenly disappears when the control is moved beyond this range. No peculiar results are to be expected in this

Tuning Noises—

case when tuning from one station to another on an adjacent channel, save that when the set is tuned mid-way between the two, the programmes from both stations will usually be heard simultaneously. With the other class of receiver, however, tuning is very sharp indeed, and when the set is tuned midway between two stations, it is probable that nothing will be audible. If the setting of the volume control be advanced, however, a weird background of unintelligible twitterings will probably appear and be due to a complex heterodyning action between the sidebands of the two stations.

This leads us quite naturally to automatic volume control (A.V.C.), for this fitting is one which automatically increases the sensitivity of the receiver when it is mis-tuned from a station, or rather, reduces the sensitivity when a station is tuned in. It is as if the volume control of an ordinary set were kept always at maximum in the absence of a signal, but reduced automatically when a station is tuned in.

It is obvious, therefore, that a set fitted with A.V.C. at first trial appears very noisy in operation. When actually tuned to a signal, it is in no way noisier than an ordinary set not fitted with such control, and there is then no difference in the performance. As the tuning is varied to pass from one station to the next, however, a vast difference appears, for as soon as the set is mis-tuned from a carrier the sensitivity rises to its maximum, and a tremendous racket composed of sideband splash, atmospheric, and valve hiss makes its appearance, just as it would in an uncontrolled receiver if the volume control were turned full on between stations.

Noise Suppression

Such a background is obviously unpleasant, and gives the impression that A.V.C. increases background noise. It is usual, therefore, to fit a "noise suppressor." This often consists of a form of manual volume control which can be thrown out of circuit at will by a switch. The control is so adjusted that when the set is not tuned to a station the sensitivity is insufficient to give any troublesome background. When the station has been tuned in, the suppressor is cut out of circuit by the switch, and the maximum sensitivity of the set is then available. A method of this nature is simple and inexpensive, and so it is widely used. It is open to the drawback, however, that one often forgets to throw the suppressor in circuit when tuning, with unpleasant results. Various schemes have been proposed from time to time by which noise suppression can be accomplished automatically, and there is no doubt that this arrangement is ideal. At the present time, however, the methods available are by no means simple, and many of them are not wholly free from technical objection. Moreover, they materially increase the cost of a receiver. There is no doubt that such a system will eventually be used,

but at present it is a question of waiting until a reasonably simple and satisfactory scheme is evolved.

When a set fitted with A.V.C. is tuned to a fading station the volume variations normally associated with fading become inappreciable, so that one of the chief uses of A.V.C. is as an anti-fading device. It is by no means a complete cure for fading, however, for it will sometimes be found that severe distortion occurs. This is due to no defect of A.V.C., but to the sidebands of the received station fading in a different manner from the carrier. In extreme cases it may actually happen that the volume increases, due to the carrier fading much more than the sidebands. This is a comparatively rare occurrence, however, and the usual audible effect of

fading is of a steady signal accompanied by a rising and falling background of hiss, and sometimes distortion. If fading be severe, it may happen that interference from a neighbouring station becomes noticeable when the wanted station becomes weak, and this is particularly likely to happen when the trough of a fade of the wanted station coincides with the peak of a fade of the adjacent station.

Enough has been said to show that the latest developments in receiver design have profoundly modified the sounds heard while tuning the receiver—sounds which, of course, are not present when the set is tuned to a station. It is hoped that these notes will serve the purpose of enabling listeners to identify the various sounds and to understand their causes.

DISTANT RECEPTION NOTES**Two Interesting Low-powered Stations**

GERMANY'S three new 100-kilowatt stations are now in full operation. Stuttgart (Mühlacker) is working on 533 metres, Munich on 419 metres, and Berlin (Tegel) on 360.5 metres. Strangely enough, the most strongly received of the three is Munich, though one would have expected the best reception from Stuttgart, with the highest wavelength of the three.

Owing to the almost uncanny way in which low-powered stations working near the bottom of the medium waveband sometimes come in, some readers may possibly have picked up the new Turin station which is now transmitting on 212.8 metres. The power used is at present only 0.2 kilowatt. At least two other new Italian transmitters will be opened this year at Milan and Rome.

the Yugo-Slavian, Norwegian and German stations have closed down Grenoble often continues to transmit, and then comes in with quite surprising volume. Grenoble will have a wavelength of its own under the Lucerne Plan, and it should then be well worth the attention of listeners.

The Best Transmissions

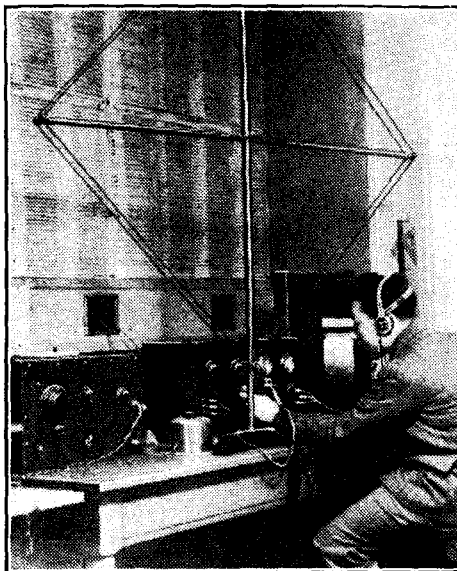
Huizen has been practically free for some days now from the interference of Russian origin which has for so long spoilt its broadcasts. On some days the interference is just audible during programme intervals, but it is not sufficiently strong to spoil reception. Radio-Paris, Zeesen, and Warsaw are all very well received at present, but Motala is going through one of those periods of weakness which are characteristic of this station. Luxembourg is badly heterodyned on almost every evening. Kalundborg now appears to be using its full power output. Oslo is also showing considerably increased strength.

In the upper part of the medium waveband some magnificent transmissions are now to be found. Budapest, Stuttgart, Vienna, Brussels No. 1, Prague and Langenberg never fail to provide good reception, but Florence is disappointing.

Lyons Doua is another excellent transmission, but both Beromünster and the Ecole Supérieure are heterodyned more often than not. Rome and Stockholm are both to be relied on. Belgrade is receivable on some evenings, though seldom with any great strength. Katowice is showing a return to form. Toulouse, Leipzig and Strasbourg are all first-rate stations. Hamburg is well received on many evenings.

Reception of genuine entertainment value is the rule from Brussels No. 2, the Poste-Parisien and Breslau. Milan comes in strongly, but is occasionally heterodyned. Göteborg is a station well worth attention. Hilversum, Heilsberg, Turin and Frankfurt are all first-class transmissions, and Toulouse PTT has been showing greatly increased strength for some little time past.

Near the bottom of the medium waveband Trieste and Nürnberg are good, but Fécamp is often interfered with either by a heterodyne or by spark signals. D. EXER.



THE WAVELENGTH VIGIL. An engineer on duty at the Brussels checking station. Note the station frequency chart in the background.

I wonder whether any long-distance enthusiasts have discovered the excellent reception obtainable from Grenoble rather late in the evening. As the station uses a frequency of 526 kilocycles and has Ljubljana and Hamar with 522 kilocycles on the one side and Freiburg with 527 kilocycles on the other as neighbours, reception is impossible so long as all are working. When, though,



Interference Problems

The Bearing of Selectivity on Interference

THE fact that high selectivity does not necessarily reduce all types of interference has long been known, but many points in connection with this desirable attribute of a receiver are not always fully realised. In this article the general relationship between selectivity and interference is discussed.

THE relationship between interference and selectivity is one about which there are many misconceptions. The belief seems widespread that increased selectivity is a certain cure for all forms of interference, whereas in reality it is a cure only for certain types and will do nothing to alleviate others. It is well known that man-made static falls into the latter category, but many types of interference between broadcasting stations cannot be removed in the receiver without a sacrifice in performance.

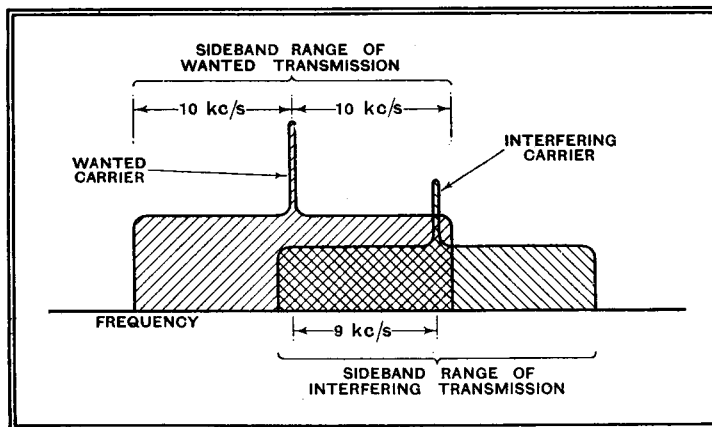
Let us consider first of all the type of interference in which the programme of an unwanted station is heard intelligibly as a background to that of the wanted transmission. This type of interference can always be eliminated by increasing the selectivity sufficiently. It should be understood, however, that to speak of a station being eliminated is merely a loose way of saying that it has been reduced to negligible proportions when it is compared with the strength of the wanted station. There is no such thing as the absolute elimination of a transmission. The apparent selectivity, therefore, depends upon the relative strength of the two stations which are to be separated.

This will be obvious if we consider the case of a circuit which gives one-hundredth of the response at 10 kc/s off-tune that it does at resonance. In the case of the reception of one of two stations of equal strength spaced by 10 kc/s, therefore, the wanted station will be one hundred times that of the other. Suppose, however, that the two stations are not of equal strength but that one is a hundred times stronger than the other. When the circuit is tuned to the stronger, the signal from the neighbouring station will set up a voltage at the detector of one-ten thousandth of that due to the wanted signal, and so will be quite negligible. If we tune to the weaker station, however, we shall find equal volt-

ages from the two stations, for although the circuit reduces an unwanted station by 100 times, the interfering signal is initially 100 times as strong. The circuit, therefore, would be quite inadequate for the reception of the weaker signal.

Neither in theory nor in practice is there any technical limit to the degree of selectivity which can be obtained beyond that imposed by cost and convenience. Since high selectivity normally leads to a discrimination against the upper sideband frequencies of the wanted transmission, it will usually be necessary to introduce tone-correction to prevent a loss of the upper audible frequencies. They may be completely restored by this method, and high selectivity, therefore, need cause no loss of quality. It will thus be apparent that intelligible interference may always be eliminated by increasing the selectivity, and quality need be in no way impaired if suitable tone-correction be introduced.

Apart from intelligible interference,



The overlapping of sidebands, which is largely responsible for sideband splash, is well brought out in this illustration, which shows how the highest sidebands extend even beyond the carrier of an adjacent station. For complete immunity from interference with reproduction up to 10,000 cycles a station spacing of 30 kc/s is necessary, but in practice 20 kc/s would probably be sufficient.

however, serious trouble may occur from heterodyning effects. The carrier of a neighbouring station will beat with that of the wanted one to give a continuous whistle, the pitch of which is equal to the frequency separation of the stations. The sidebands of the adjacent station may also

beat with the wanted carrier to give rise to momentary whistles which are commonly known as sideband splash. Since the process by which the interference occurs is by its nature similar to that by which the wanted programme is constituted through the beating of carrier and sidebands, there is no way of eliminating these whistles except by means which also remove notes of the same frequency from the wanted transmission.

Sideband Splash

For the best quality of reproduction audible frequencies up to 10,000 cycles are required, and if we build a receiver capable of such a response, a whistle will appear on nearly every station, because the usual spacing of stations is only 9 kc/s or 9,000 cycles. The exceptions are only those few cases where the station spacing is over 10 kc/s or where the transmitter is so close to the receiver that the whistle is of negligible strength. The steady whistle, however, is of minor importance, for it can usually be removed without affecting quality to any noticeable degree through the use of a special tuned rejector circuit to cut out only a very small band of audible frequencies. The real problem of quality reception is set by sideband heterodyning.

This may occur at frequencies as low as 3,500 cycles, and spread over the whole band of 3,500—9,000 cycles. Consequently, it can be removed only by limiting the high frequency response to some 3,500 cycles and the quality of reproduction then suffers considerably. Interference of this nature does not appear to be affected at all by selectivity, but only by the overall frequency response of the receiver, and any decrease of interference which results from increased selectivity occurs merely because this also reduces the upper register.

It would appear, therefore, that if the

Interference Problems—

best quality of reproduction be required one must confine oneself to local reception, for only then are sideband heterodyning effects likely to be completely negligible. The precise frequency at which it is necessary to limit the response obviously depends upon the frequency separation of stations and upon their relative strength. On this basis, therefore, the cut-off frequency in the L.F. circuits should be continuously variable, so that the best quality that circumstances permit can be obtained from any station. This is hardly a practicable course at present, however, on account of the expense, but it is perfectly feasible to introduce switching whereby a restriction of the upper register can be obtained when required and this was done in a recent *Wireless World* receiver.¹

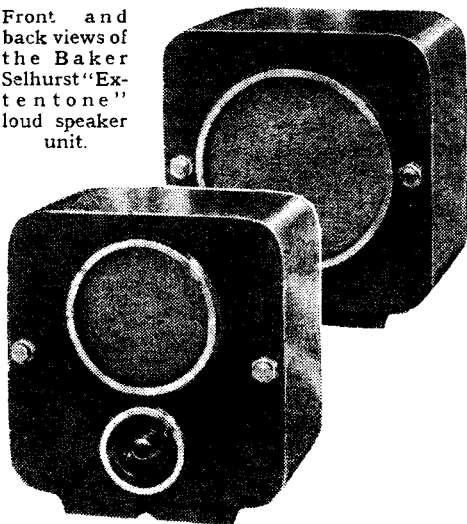
It will be apparent, therefore, that selectivity is not the cure-all for interference problems. It is readily possible to provide such a degree of selectivity that no further increase leads to any reduction of interference, and this has been reached in many superheterodynes. Further development in the quality v. interference question, therefore, must be looked for rather in the development of improved methods of providing a variable upper limit to the overall frequency response.

¹ The New Monodial Super, *Wireless World*, July 21st and 28th, 1933.

Baker "Extentone" Loud Speaker

ALTHOUGH produced primarily as an extension loud speaker for use with existing sets, this compact little model is well suited for use with a car radio receiver, and it can also be used as a microphone when connected to the pick-up terminals of a receiver. It measures only $6 \times 5\frac{1}{2} \times 3\frac{1}{4}$ in. and is contained in an ebony-finished cabinet with polished white metal rims. An on-off switch is fitted at the back of the cabinet, and apertures of different sizes are provided at the back and front. There is a considerable difference of tone between the back and front, and by adjusting the position of the loud speaker a gradual variation of tone is obtainable. The

Front and back views of the Baker Selhurst "Extentone" loud speaker unit.



unit incorporates an input transformer, and the price complete is 29s. 6d. It may also be obtained fitted with a synchronous electric clock for £3 15s.

In Next Week's Issue:—

The Wireless World

UNIVERSAL A.C.-D.C. III.

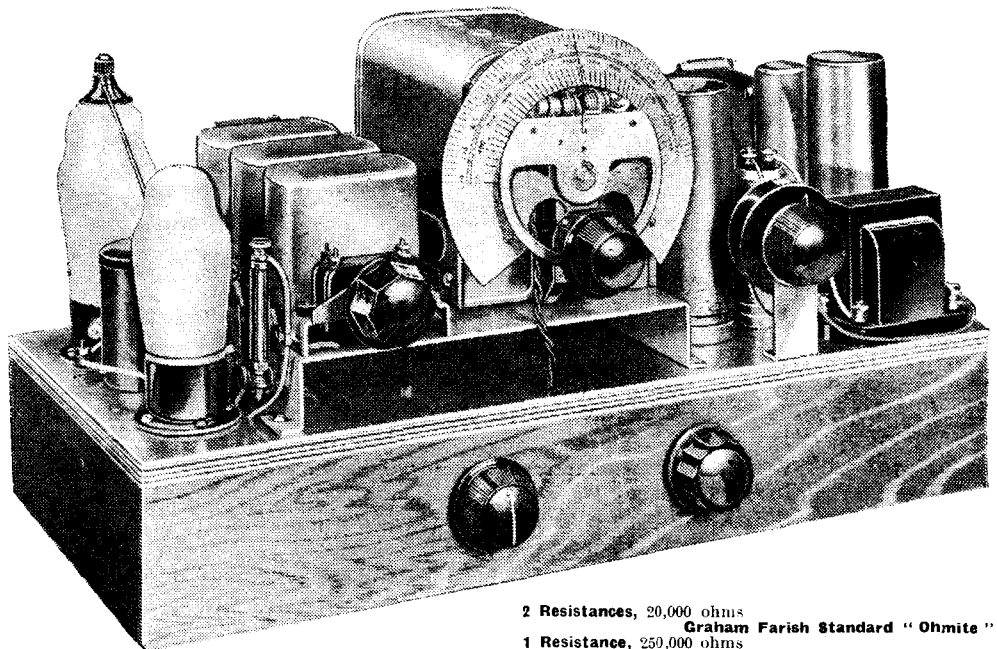
A Three-valve Straight Set for Operation on Any Mains

MANY designs for receivers for operation from D.C. mains have appeared in the past, and are capable of giving a highly satisfactory performance. Slowly but surely, however, D.C. mains are being changed over to A.C., and there are many at present on a D.C. supply who fear to invest in a receiver lest it be soon rendered useless by a change in the supply. The solution is obviously a receiver which will operate equally well on either type of lighting supply, but in the past this has presented serious difficulties. These difficulties have now been overcome, largely by the introduction of valves having special characteristics, and the construction of a set which functions equally well on both A.C. and D.C. mains has become practicable.

The Universal A.C.-D.C. III is a three-

valve receiver in which a variable-mu H.F. pentode is used for the H.F. stage. Iron-cored coils are used to provide the high selectivity so necessary for modern conditions, and a triode power grid detector provides distortionless rectification and permits reaction to be obtained. The output valve is of the pentode type and is specially designed to give a large output at a moderate anode voltage; the output, in fact, is between 2 and 3 watts, according to the mains voltage. Variable tone control is another attractive feature of the receiver.

The sensitivity, selectivity, volume, and quality are adequate for general reception, and the receiver functions without hum on both A.C. and D.C. mains. Constructionally, the set is particularly straightforward, and the initial adjustments are few.

**LIST OF PARTS**

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- | | |
|---|--------------------------------------|
| 1 Colpak, with coils Nos. 1, 2 and 3 | Colvern Model H |
| 1 Dial | Polar Semi-circular Drive |
| 2 Bulbs, 4 volts, 0.1 amp. | Bulgin 410 |
| 1 H.F. Choke | Wearite H.F.P. |
| 1 H.F. Choke | Kinva I.D.C. |
| | (Bulgin, R.I.) |
| 2 H.F. Chokes | Goltone W.H.F. |
| 2 Electrolytic Condensers, 8 mfd., 500 v. working | Dubilier |
| 1 Electrolytic Condenser, 4 mfd., 500 v. working | Dubilier |
| 1 Electrolytic Condenser, 25 mfd., 50 volts working | Dubilier 3003 |
| | (Peak, T.C.C.) |
| 3 Fixed Condensers, 0.1 mfd., 200v., D.C. working | Dubilier 9200 |
| 2 Fixed Condensers, 0.1 mfd., 250v., D.C. working | Dubilier L.S.B. |
| 3 Fixed Condensers, 0.0005 mfd., mica | Dubilier 665 |
| 1 Fixed Condenser, 0.0001 mfd., mica | Dubilier 665 |
| 1 Fixed Condenser, 0.001 mfd., mica | Dubilier 670 |
| 1 Fixed Condenser, 0.002 mfd., mica | Dubilier 670 |
| | (Peak, T.C.C., T.M.C. Hydra, Telsen) |
| 1 Resistance, 400 ohms | Graham Farish Standard "Ohmite" |
| 1 Resistance, 1,000 ohms | Graham Farish Standard "Ohmite" |
| 1 Resistance, 10,000 ohms | Graham Farish Standard "Ohmite" |

- | | |
|--|--|
| 2 Resistances, 20,000 ohms | Graham Farish Standard "Ohmite" |
| 1 Resistance, 250,000 ohms | Graham Farish Standard "Ohmite" |
| 1 Resistance, 400 ohms | Graham Farish Heavy Duty "Ohmite" |
| 1 Resistance, 20,000 ohms | Graham Farish Heavy Duty "Ohmite" |
| 1 Resistance, 25 ohms | Claude Lyons F.W.25 |
| 1 Mains Resistance | Bulgin M.R.20 |
| 1 L.F. Transformer, 1:4 | Multitone "Toco" |
| 1 Tone Control Potentiometer for above | Multitone |
| 1 Potentiometer, 10,000 ohms | Watmel T.2 |
| | (Colvern, Haynes Radio, Claude Lyons, Rothermel) |
| 1 L.F. Choke | Wearite H.T.12 |
| | (Challis, Heayberd, Rawwood, Rich and Bundy, Savage, Sound Sales, Vortexion) |
| 4 Valve Holders, 5-pin | Clix Chassis Mounting Standard Type |
| | (Bulgin, Ferranti, W.B.) |
| 1 Reaction Condenser, 0.0005 mfd. | Graham Farish "Lit-Ios" |
| | (Ormond) |
| 4 Ebonite shrouded terminals, A., E., L.S. (2) | Belling-Lee "B" |
| | (Igranice) |
| Loud Speaker, P.M.m/c. | Epoch Type 20C |
| | (Rola, W.B.) |
| Cabinet | C.A.C. |
| Plymax baseboard, 16in. x 8in. x $\frac{1}{2}$ in. | Peto-Scott |
| 2oz. No. 20 tinned copper wire, 4 lengths Systoflex, wood, lighting flex, etc. | |
| Screws:— | |
| 20 $\frac{1}{16}$ in. No. 4 R/hd.; 4 $\frac{1}{16}$ in. No. 4 R/hd.; 8 $\frac{1}{16}$ in. No. 4B R/hd. with metal thread and nuts and washers. | |
| Valves:—1 HP2118, 1 R2018, 1 PP4018, 1 V2018 (Tungsram). | |

NEWS of the WEEK

Current Events in Brief Review

I.B.U. to Meet in London

THE next annual general assembly of the International Broadcasting Union is to be held in London from June 12th to 20th, 1934.

Widening the Broadcast Band

SPACE for a dozen or more new broadcasting stations throughout the United States will shortly be made available by the Federal Radio Commission by virtue of the opening of the 1,500 to 1,600 k.c. band for broadcasting services. These are the channels lying just above the upper limit of the present band of broadcast wavelengths.

Floating Church

THE Dutch fishing fleet in the North Sea is now accompanied by "De Hoop," a remarkable wireless-equipped vessel which functions not only as a lifeboat, hospital, school, and picture house, but is also a religious centre. Every Sunday morning the chaplain preaches before a microphone, the service being picked up by the surrounding ships.

Jumping To It

FERY colonels of the old school could never understand, when conducting battalion drill, why the companies at the rear always acted a fraction of a second after the front-liners. As a result, many a wretched private spent Christmas in the guard room.

Officers are more enlightened in Poona, where, on January 1st, under Colonel F. G. Spring, 3,000 troops were drilled in perfect synchrony by means of loud speakers connected by underground cable with the Colonel's microphone.

Umbrella for Static

EVEN when all man-made static is overcome, it seems that we shall still have somewhere to lay the blame for crackles in our loud speakers. According to Dr. Willis E. Everette, an octogenarian radio enthusiast with a laboratory on "Radio Summit" at San Rafael, California, all frying sounds heard in the wireless set are caused by electrical dust emanating from a companion star of Sirius in the constellation of Orion. Dr. Everette has twenty-three radio receivers, ranging from an old crystal set to the most modern multi-valve instrument.

The Doctor is now fighting atmospherics with an overhead insulation system or "static umbrella," using no aerial or earth, which he claims yields an efficiency in the receiver more than thirty times greater than that of the ordinary set. In a word it practically excludes static and fading. Unhappily he admits that the arrangement is not practical for everyday use.

New Danish Station

ON Monday next, January 15th, the new Danish 20-kW. transmitter at Herstedvester will begin transmissions on 255 metres, replacing the old transmitter on the roof of the Central Post Office building. It is possible that the old transmitter may be removed to Thorshaven, Faroe Island.

France Means Business

THE changed aspect of French broadcasting since it was taken over by the State is reflected in the stringent regulations which have just been introduced by a State decree specifying the Lucerne wavelengths on which the transmitters must work and laying down the limits of frequency variation. Over-modulation is strictly prohibited, and any default may lead to cancellation of the transmitting licence.

A Permanent Wave?

THE Innsbruck broadcasting station is showing its independence by adopting the wavelength of 578 metres, which belongs to shipping. This wave can only become permanent if the maritime authorities raise no objections.

Everything for the Wireless Amateur

IN addition to a complete guide into the new wavelengths coming into force on Sunday next, *The Wireless World Diary* for 1934 includes a mass of handy information indispensable to the radio amateur throughout the year. Supplementing the Diary itself are 78 pages of facts, figures and explanations covering circuit diagrams, battery economy arrangements, means for suppressing interference, besides many useful hints and tips. The

Lectures on Cathode Ray

A COURSE of nine free lectures on "Cathode Ray Oscillographs" is to be given at the East London College on Mondays at 5.30 p.m., beginning on January 22nd. The lecturers are Professor J. T. MacGregor-Morris, M.I.E.E., Professor G. I. Finch, M.B.E., and Mr. L. H. Bedford. No tickets are required.

Hydrophones for Loch Ness Monster

THE Marconiphone Company is now co-operating in the search for the Loch Ness monster. Hydrophones of the type used in the British Navy during the War to detect the sound of German submarines are now actually in use, but we are unable to state on what wavelength the monster oscillates.

A Real Speaker

A LOUD speaker capable of being heard over a radius of thirty miles has been bought by the Soviet Government from the Hoover Automatic Typewriter Corporation, says a New York message. The speaker, which weighs nearly a ton, is to be installed in a large aeroplane from which propaganda, news, and Government orders will be broadcast.

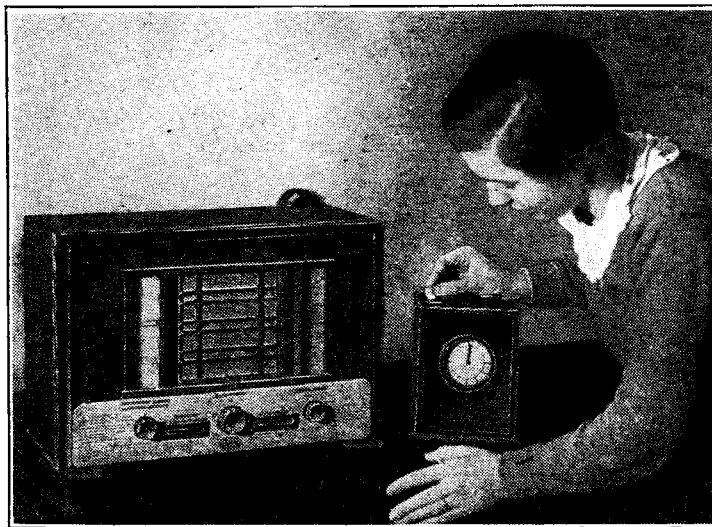
Moscow Broadcasts to America

REGULAR relays from Moscow over the United States are confidently expected as a result of the reopening of diplomatic relations between the two countries. The first Moscow relay to America took place recently, when a speech by Mr. Kalinin was broadcast from the short-wave station RNE Moscow. The talk was picked up by the Radio Corporation's international terminal on Long Island.

Appearances are Deceptive

RUSSIA now ranks second in the world in the number of its broadcasting stations, of which it has seventy-three, the United States heading the list with 585, according to a new Directory of Foreign Broadcasting Stations just compiled by the United States Department of Commerce. Canada is third in the list with sixty-three stations, Australia has sixty, Cuba fifty-seven, Mexico fifty-three, Argentina thirty-five, Uruguay thirty-three, New Zealand thirty-two, and Sweden thirty-one. Unfortunately, the figures are a very unreliable indication of any country's broadcasting prowess, for the stations listed include anything from a 1,000 kW. transmitter to one working on less than 500 watts. If this were not so, Great Britain, with her twelve stations, would cut a sorry figure against Cuba with fifty-seven.

China, it seems, holds the record for the lowest power, there being a broadcasting station in Shanghai working on half a watt.



PAYING BY INSTALMENTS. A new version of the easy payment system is in vogue in Germany. A 20 per cent. deposit secures the set, and the remainder is paid for in a slot machine at the rate of approximately 1d. per hour of listening.

Swiss Licence Increase

SWITZERLAND is nearing the 300,000 licence mark. German Switzerland supplies the largest share in this total, the Zurich area leading with 51,308. In French Switzerland, Geneva tops the list with 20,349.

Wireless Masts and Aircraft

A NEON beacon is being installed at the Rugby Wireless Station to warn aircraft of the presence of the twelve giant masts. The beacon takes the form of a tower 35 feet high on which is a sign composed of 14 feet of neon tubing. It is situated in the middle of the mast array and should be visible on an ordinary night some fifty miles away. It is being constructed by the General Electric Company.

The work was actually started a few days before the disastrous crash of the air-liner "Apollo" on December 31st at Russelede.

Diary is obtainable from all booksellers and stationers, price 1s. 6d. nett, or post free 1s. 7d. from the Publishers, Hiffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

Germany's "World Sender"

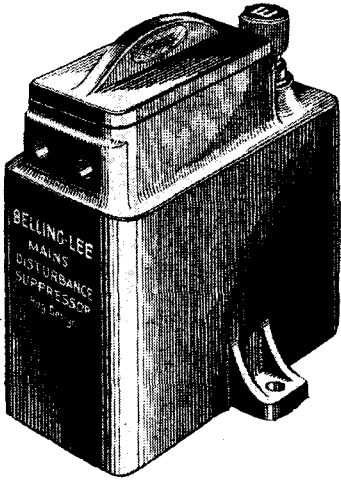
THE new German short-wave transmitters for the service to Africa, South America and the Far East, described in our issue of December 15th, conclude their experimental period at the end of this month. Regular zone programmes begin on February 1st.

Abu Zabal

IN our recent article on the exchange of world-wide greetings by wireless on Christmas Day, reference was made to the "Post Office Beam Station at Abu Zabal." Actually the station at Abu Zabal has been the property of the Marconi Radio Telegraph Co., Egypt, since January 15th, 1928.

New Apparatus Reviewed

Latest Products of the Manufacturers



Belling-Lee mains disturbance suppressor.

INTERFERENCE ELIMINATOR

THIS unit consists of two large-capacity, high-voltage-type condensers mounted in a neat bakelite case, on the top of which is a twin-fuse holder and an earthing terminal. Joined across the supply mains, and with a lead taken to the nearest earth point, it effects a very marked reduction in all interference noises brought in by the mains, even though they are produced by nearby electrical machinery. This was verified by a test in a building where a most troublesome interference was experienced from automatic lifts.

With the Belling-Lee unit fitted close to the electric point supplying the set, the background was reduced from objectionable to quite tolerable proportions. This was a severe test, but it served to show that, however bad the interference is, a very marked improvement can be effected. As a rule, however, the unit should be installed at the point where the supply mains enter the building, but on the house side of the fuse box and master switch.

The unit is suitable for silencing all types of motors, fans, and domestic apparatus, and the price is 10s. 6d. The makers are Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

KABI COMPONENTS

KABI components obtainable in this country consist mainly of volume controls and switches, but some are of more than usual interest in view of the style of construction adopted. The Midget wire-wound volume controls, for instance, consist of two moulded end-plates with the resistance wire spirally wound on a flexible core and carried on a grooved ring sandwiched between them. The back plate has moulded-in studs, the inside surfaces of which press against the loops of wire. These studs are traversed by a spring arm

insulated from the spindle and making contact between the studs and an annular ring of metal.

The 2-, 3-, and 4-watt types are just over one inch in diameter and have twenty-four contact studs, while the 5-, 7.5-, and 10-watt models are about 1½ in. across and each carry forty-eight studs. Potentiometers of from 100 ohms to one megohm are available, and prices range from 4s. 6d. to 22s. 6d. each.

Snap-action mains switches with lever movement, or actuated by push buttons, in two-pole, three-pole or change-over types, and assembled on bakelite with porcelain contact carriers, cost 4s. 6d. for the first-mentioned style and 6s. 6d. for the change-over model. A three-pole make-and-break switch costs 5s. 6d. and these handle 4 amps. at 240 volts.

A style of switch rarely seen these days is the stud pattern; these, however, are included in the Kabi range. Switches with from three to nineteen contacts are made, and cost from 2s. 6d. to 4s. 2d. each. There is a variation of this style arranged for wave-band switching, a single-circuit type being priced at 2s. 6d., whilst one for six circuits costs 5s.

Several specimen volume controls and switches were tested and found entirely satisfactory. The resistances, of course, change in steps, but there are sufficient contacts to give adequate control for normal requirements.

Supplies are obtainable from F. W. Lechner and Co., 61, Spencer Street, London, E.C.1.

NEW UNIVERSAL AVOMETER AND AVOMINOR

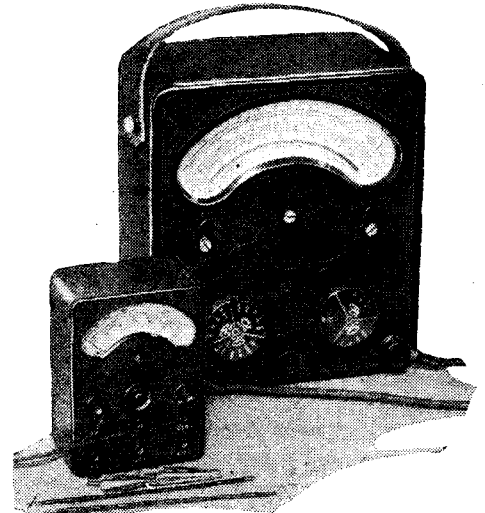
THE latest version of the well-known Avometer is the new 34-range Universal model. With this instrument A.C. and D.C. measurements from the smallest to the largest quantities ever likely to be encountered in wireless or light electrical work can be made without the aid of external resistances. The first instrument of this make which we tested some five years ago exhibited a very high order of accuracy, and in the most recent addition this high standard is still maintained, despite its much wider scope and consequent more complicated internal construction.

The new instrument has eight direct current ranges capable of measuring from 50 microamps. to 12 amps., and ten D.C. voltage ranges, the latter covering all

values from 500 microvolts to 1,200 volts.

There are six A.C. current ranges and a similar number for voltage measurements; they extend from 50 microamps. to 12 amps. and 500 microvolts to 1,200 volts respectively. Then resistances up to two megohms can be measured with the new instrument. This multiplicity of ranges is obtained without scale complication; indeed, the dial is even easier to read than hitherto, as the A.C. and D.C. scales, which in the first Universal model were close together, are now separated by the dial figures, one set only sufficing for the two scales.

The fifteen main ranges, which are all multiples of twelve, are selected as hitherto by the switches, and the other ranges are brought into being by a press-button switch which halves each range with the exception of the ohmeter scales, which are doubled. It is fitted with a dead-beat moving coil movement and a five-inch scale. A West-

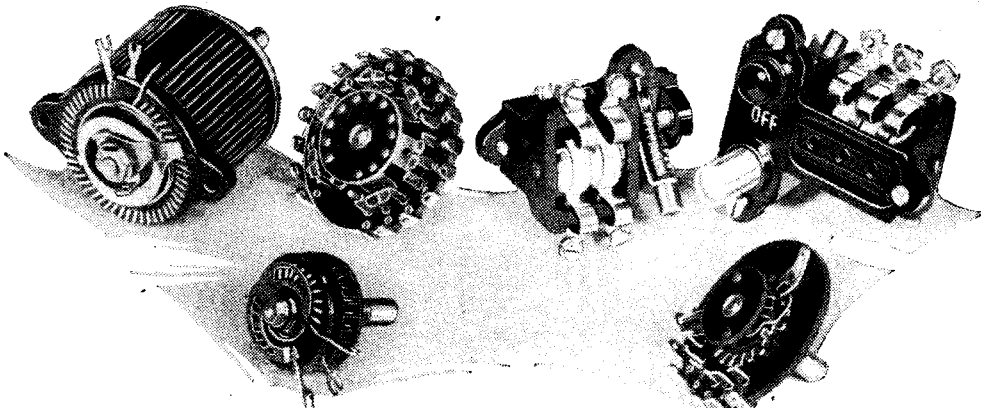


New 34-range Universal Avometer and 10-range Avominor.

inghouse rectifier is embodied, and the accuracy is well maintained up to 5,000 cycles on the A.C. ranges. The resistance of the meter is 166 ohms per volt on the major ranges, and 333 ohms per volt with the half-scale button depressed. The price is 12 guineas.

Some tests have been made also with the new Avominor, which is a miniature, but no less accurate, version of the larger instrument. It covers D.C. requirements only, and provides three current and three voltage ranges: namely, 0.6 mA, 0.30 mA, 0.120 mA, 0.6 volts, 0.120 volts, and 0.300 volts. There is an ohmeter scale giving readings up to 3 megohms. A small dry cell is incorporated for the latter purpose and enables measurements up to 10,000 ohms to be read directly from the scale. For the higher resistances external batteries and the voltage tappings are employed, the scale reading being multiplied by the appropriate voltage figure.

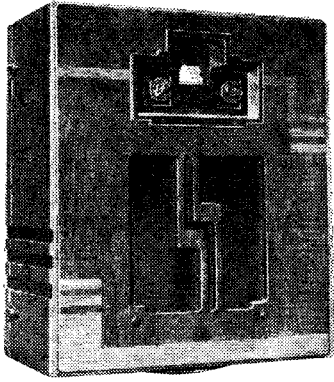
The Avominor is fitted with a 2½ in. dead-beat moving coil instrument, has a resistance of 333 ohms per volt, and costs 40s. The makers are Automatic Coil Winder & Electrical Equipment Co., Ltd., Winder House, Douglas Street, London, S.W.1.



Kabi components, including Midget volume controls, stud switches and mains switches.

H.M.V. Superhet A.V.C. Portable

MODEL 463



FEATURES. *Type.*—Six-valve battery superheterodyne portable with automatic volume control and Q.P.P. output. *Moving-coil loud speaker.* **Circuit.**—Screen-grid H.F. amplifier—S.G. det.-osc.—variable-mu I.F. amplifier—metal oxide 2nd detector—L.F. amplifier—Q.P.P. pentode output valves. **Controls.**—(1) Tuning with illuminated calibrated scale; (2) trimmer; (3) volume control; (4) wave-range and on-off switch. **Price.**—15 guineas. **Makers.**—The Gramophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.

removed from the cabinet without disturbing the control knobs, a spring-loaded escutcheon plate being provided to register neatly with the control window in the front of the set. The wave-range switch is provided with long contact springs, which should ensure reliable service for a long period, and the spring-loaded stop provides a particularly sweet action. The triple-ganged condenser is provided with a translucent illuminated drum dial calibrated in wavelengths.

The frame aerial for medium waves is fitted inside the cabinet, and a frame of smaller area mounted in the hinged back is used as a loading coil on long waves. The

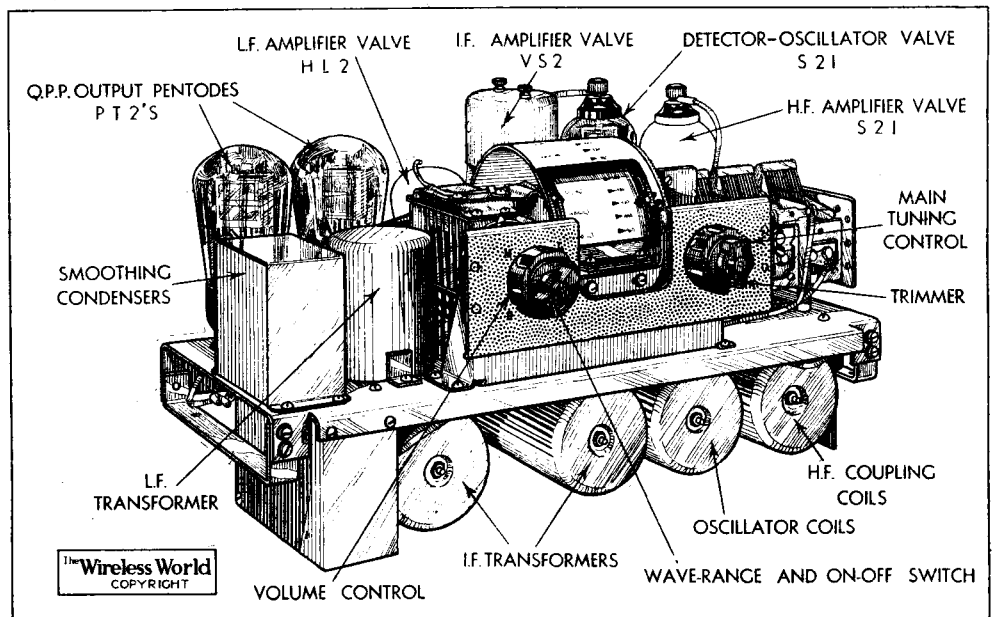
A Battery Set with a Comprehensive Specification

THE design of this instrument is based on the Model 459 "Superhet. Portable Six" of 1932. The number of valves employed is the same, but the circuit arrangement has been drastically revised, and the use of a "Westector" in the second detector stage has released an extra valve for use in the output stage as a quiescent push-pull amplifier. The consequent improvement in output volume and quality for a given H.T. consumption, and the addition of automatic volume control arising from the use of the "Westector," are probably the two most important improvements which have been made.

As in the earlier model, the first valve functions as an H.F. amplifier and is coupled to the detector-oscillator valve by simple tuned-anode coupling. The method of injecting the local oscillations in the latter stage is interesting, and is based on the cathode injection principle employed in A.C. sets with indirectly heated valves. In the case of a battery valve it is necessary to insert coupling coils in both filament leads, as, if only one coil were used, the filament would act as a short-circuit.

Four tuned circuits are associated with the I.F. amplifier as against three in the preceding circuit. The I.F. valve is of the variable-mu type and is controlled by the automatic bias provided by one side of the "Westector." The input H.F. amplifier is also controlled, but the valve in this stage is of the normal screen-grid type. The audio-frequency output from the other half of the "Westector" is amplified by a separate L.F. stage before passing through

a push-pull transformer to the quiescent push-pull pentode output valves, which feed a permanent-magnet type moving-coil loud speaker.

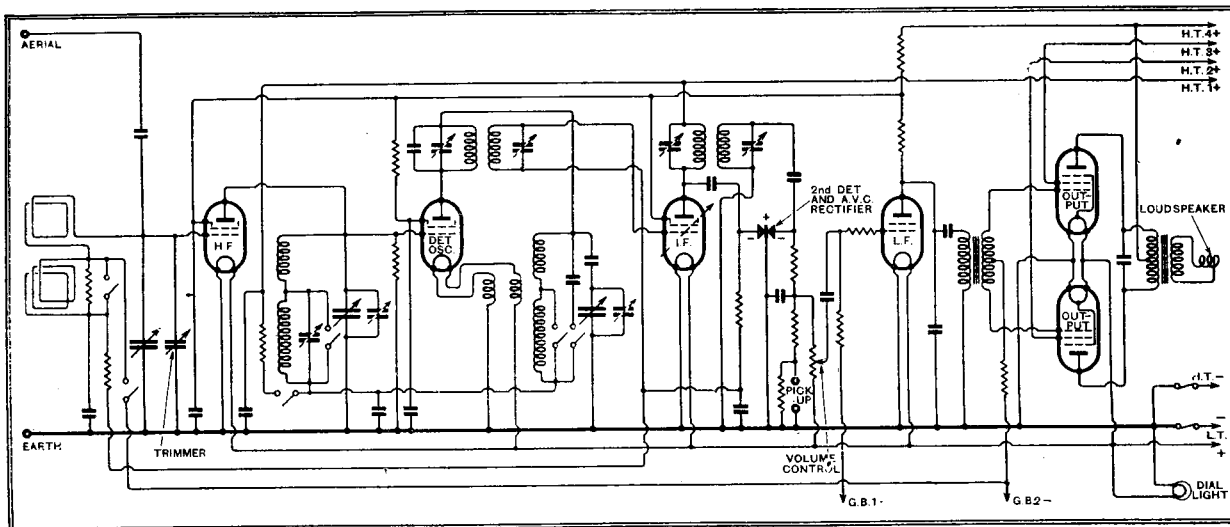


The chassis is exceptionally light and compact in view of the number of stages employed.

In view of the comprehensive specification of the circuit, the makers are to be congratulated on the lightness and compactness of the receiver chassis. The valves are accessibly placed and the chassis is easily

H.T. and L.T. batteries fit neatly into the lower half of the cabinet, and are prevented from moving by felt-lined stops projecting from the hinged door. The cabinet itself is well constructed and finished, and is of modern design, recesses at the sides being provided for lifting.

The performance of the set is quite unlike that of any portable which we have previously tested, and the volume and quality available are more in keeping with a small radio-gramophone than with a set of such small dimensions. In particular the depth of the bass response is especially good, having regard to the small effective baffle area. In spite of the high overall magnification of the circuit there is no suggestion of fierceness in its perform-



The equivalent of cathode injection is employed in the frequency-changer valve and a metal oxide rectifier is used to provide the automatic bias.

H.M.V. Superhet A.V.C. Portable—

ance, and the automatic volume control effectively prevents overload distortion even with the volume control turned to maximum on the local station. Another commendable feature is the almost entire absence of background hiss, even between stations where the receiver is working at maximum sensitivity. The pre-selector H.F. stage and frame aerials contribute to the selectivity, which is better than that of the average four-valve superhet, while the range on medium waves is comparable with the latter type of set when working on an outdoor aerial. On long waves the frame aerial is of necessity less efficient, but, at the same time, the amplification available is sufficient to give a good service from all the more

important stations on the long-wave band.

In a set of this type the behaviour of the H.T. current under varying reception conditions is interesting. When no signals are being received, the H.F. stages are taking maximum current, and on the set tested the measured value was 14.5 mA. Under the influence of the unmodulated carrier from the local station this was reduced to 7.5 mA., and with strong modulation the peak currents released by the output stage rose to 16 or 18 mA. A prolonged test with a copper voltmeter would be necessary to ascertain the true average current, and our experience of circuits of this type indicates that 9 to 10 mA. would be a reasonable figure to assign for the average current consumption on the local station.

Readers' Problems

Adjusting Band-Pass Filters

UNDER the above heading some extremely useful information was given in last week's issue with regard to the trimming of closely coupled circuits. Like most of the best ideas, the plan suggested was delightfully simple, nothing more being involved than the shunting of each of the component circuits with a resistance of fairly high value. By thus reducing artificially the dynamic resistance of individual circuits it is possible to obtain temporarily an overall single-humped resonance curve, which at one sweep overcomes the usual difficulties associated with the ganging of filters.

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.

them directly across the tuning coils, as in Fig. 1 (a); by connecting them across the condensers, there is a possibility that the original bias arrangements may be upset (see Fig. 1 (b)).

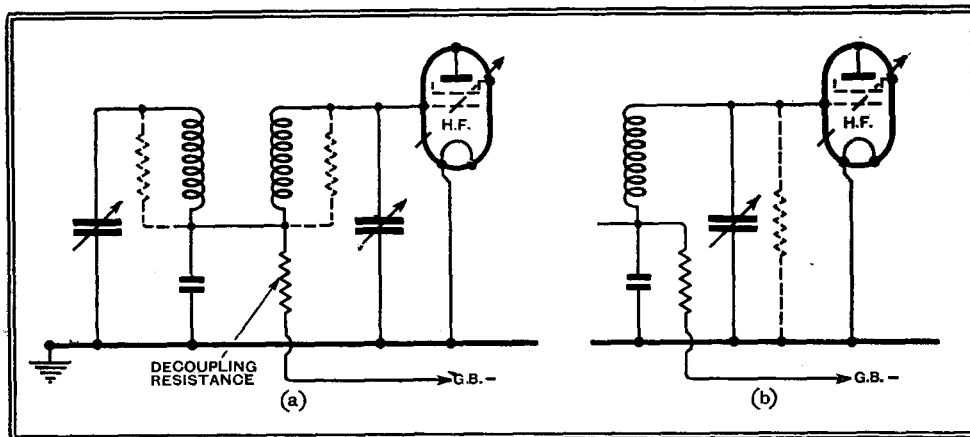


Fig. 1.—Artificially reducing the band-width of a band-pass filter for purposes of adjustment: the resistances should be joined directly across the coils, as in diagram (a), and not across the condensers, as in diagram (b).

Although especially advocated as an aid to making adjustments of band-pass filters in the I.F. amplifier, the arrangements under discussion may also be applied to signal-frequency circuits, and we doubt if we can do better than recommend the plan to a queriest who has apparently been unable so far to realise his extremely high standards of accuracy in adjusting his own receiver.

The exact value of shunting resistance to be connected across each of the circuits cannot be specified without a full knowledge of the circumstances, but it is fairly easily determined by trial; we suggest that a start be made with 50,000 ohms.

When connecting the temporary damping resistances, it will generally be safest to join

Finding the New Wavelengths

THE owner of a carefully calibrated absorption wavemeter who has recently altered his receiver by fitting modern screened coils finds that the instrument is no longer operative, at any rate in the original manner. It is impossible to obtain the usual indications of resonance (a perceptible reduction in signal strength) by coupling the wavemeter circuit to one of the tuning coils of the receiver. As there will be plenty of work for the wavemeter when the Lucerne plan comes into operation in a few days' time, we are asked how it may be used with the rebuilt receiver.

As it is no longer possible to couple the wavemeter coil directly to one of the receiver coils, it will be most convenient to

make arrangements for absorbing energy from the aerial-earth circuit. This is done by adding a tightly coupled primary winding, consisting perhaps of four or five turns,

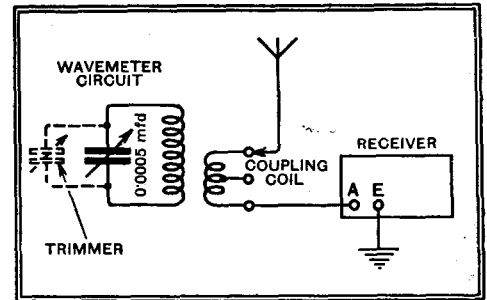


Fig. 2.—An absorption wavemeter coupled to the aerial circuit.

which is connected in the manner shown in Fig. 2. The primary winding should be tapped in order that the best coupling may be ascertained by trial and error. Coupling should be just tight enough to give a perceptible reduction in signal strength when the meter circuit is tuned to the wavelength of the incoming station.

As a result of adopting this method of connection it will probably be found that the initial calibration of the wavemeter has been slightly affected, due to the fact that a very small proportion of the aerial-earth capacity will now be transferred to the wavemeter tuned circuit. However, this may easily be compensated for by a slight readjustment of the trimming condenser, which no doubt is already wired across the main tuning capacity.

Absorption Wavemeters and A.V.C.

ANOTHER topical query—in view of the forthcoming wavelength reshuffle—comes from a reader who proposes to make a station-calibrated absorption wavemeter as an aid to station identification, but seems to remember having read that such instruments are unsuitable for sets with A.V.C.

Up to a point this statement is quite correct. The automatic volume control will naturally make good the loss of signal strength due to absorption, and as the time lag is so small the change in volume of incoming signals will naturally be imperceptible. But if some form of tuning indicator, such as a meter in the common anode circuit of the controlled valves, be fitted, it will be possible to obtain a very good indication; when the absorption wavemeter circuit is brought into tune with the incoming signals, a slight but quite definite rise in the anode current of the controlled valves should be observed. Resonance will be indicated by maximum rise in current.

The Wireless World

INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

The Wireless World

THE
PRACTICAL RADIO
JOURNAL
23rd Year of Publication

No. 751.

FRIDAY, JANUARY 19TH, 1934.

VOL. XXXIV. No. 3.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

COVENTRY: Hertford Street.

Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.

Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:

Home, £1 rs. 8d.; Canada, £1 rs. 8d.; other countries abroad, £1 3s. 10d. per annum.

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.

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EDITORIAL COMMENT

Synthetic Sound

A Walt Disney of Acoustics

THE method of recording "sounds that have never been born," as devised by Herr Rudolf Pfenninger, has been considerably developed since it was first described in *The Wireless World* of Feb. 3rd, 1933. With almost super-human patience the German originator of the principle of painting sound tracks on films has now succeeded in recording long musical items such as Handel's *Largo* and sound accompaniments to film cartoons. During a lecture recently delivered by Mr. A. G. D. West, of Gaumont-British, all these effects were demonstrated, and the origin and development of the system described.

Manual recording bears the same relation to ordinary sound recording as does "straight" cinematography to the amazing productions of Walt Disney, of Mickey Mouse fame. Just as the work of the caricaturist is in some respects an improvement on that of the photographer—or truthful portrait painter for that matter—so may synthetically produced sounds be considered for certain purposes to improve upon nature or the best possible recording of natural sounds. For instance, Mr. West's audience was obviously impressed by the way that Herr Pfenninger was able to "caricature" the firing of a gun by slightly exaggerating the reverberations. This is a sound we have never heard previously reproduced so convincingly on either film or broadcast.

What are known as "sound effects" are an admittedly weak point in broadcasting and sound recording. Although sound painting is still in course of development, it certainly opens up new possibilities for artistic presentation in both arts,

Perhaps the really important thing here is that by judicious faking certain sounds can be reproduced realistically and convincingly without the need for a reproducer covering an exceptionally wide frequency range. Another feature is the way that *pizzicato* passages in music and percussion sounds can be dealt with.

The B.B.C. could give listeners an entertaining half-hour with Herr Pfenninger's records if these could be available for the purpose of a broadcast.

New Wavelengths

Evidence of Success

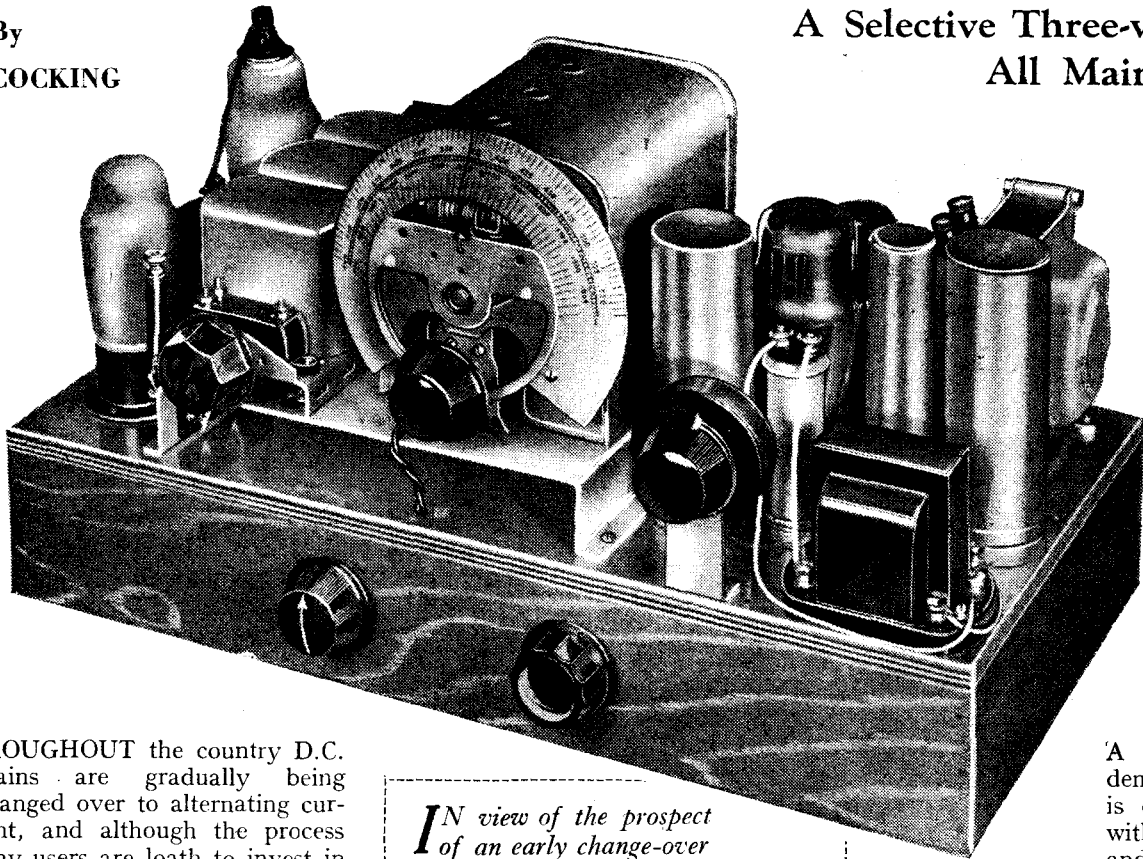
AT the time of going to press it is too early to express a final opinion as to the degree of success which has attended the reallocation of wavelengths in Europe. We can, however, feel confident that when one or two points of disagreement still outstanding have been settled the position of reception in Europe promises to be far more satisfactory than it was prior to the change, and that, after all, was the purpose of the Plan. Considering the magnitude of the task of changing over within a limited space of time and to a somewhat elaborate schedule, we think it is only right to express admiration for the way in which the broadcasting authorities in Europe co-operated to carry through the scheme successfully. Naturally, there were minor misunderstandings here and there, but in the main it was a commendable piece of work.

It looks as if the long waves may continue to give trouble as some overlapping persists, aggravated, no doubt, by the greater range and high power of the long-wave transmitters. The possibility of a second long wave for this country seems as remote as ever.

The Universal A.C.-D.C. III.

By
W. T. COCKING

A Selective Three-valve Set for
All Mains



THROUGHOUT the country D.C. mains are gradually being changed over to alternating current, and although the process is slow many users are loath to invest in an expensive D.C. mains receiver when the set may at any time be rendered useless by a change in the supply. In addition, there must be many who wish to use their receiver in more than one house, and it may often happen that the supplies are sometimes A.C. and sometimes D.C. Their requirements can only be met completely by a design which permits operation from either D.C. or A.C. mains without any alteration either in performance or to the set. Such a receiver is by no means an impossibility, but considerable difficulty has been found in the past in obtaining hum-free operation with a high standard of quality of reproduction. Moreover, the valves are required to withstand a large difference of potential between heater and cathode.

The voltage available on a D.C. supply is naturally limited to a figure somewhat less than that of the mains, so that the problem of obtaining high quality largely resolves itself into the production of a valve capable of giving a large undistorted output at a moderate anode voltage. A range of valves specially designed for "Universal" operation has now made its appearance, and a satisfactory A.C.-D.C. receiver comes within the bounds of possibility.

The new receiver is of the three-valve type, the valves being arranged as an H.F. stage, a detector, and an output stage, for this combination can provide a very satisfying combination of sensitivity, selectivity, quality and volume when efficient tuning coils are employed. The complete circuit diagram is shown in Fig. 1, and it

IN view of the prospect of an early change-over to alternating current, D.C. mains users are naturally chary of investing in a receiver suitable only for a D.C. supply. The present design, therefore, should prove particularly attractive since it may be operated from an A.C. supply without any alteration and without the performance being affected. The latest principles of design are embodied and the volume and quality obtainable represent a distinct advance in this class of receiver.

will be seen that, apart from the mains equipment, the arrangement is in no way unusual.

The first valve, which is a variable-mu H.F. pentode, is preceded by a two-stage band-pass filter and coupled to the power grid detector by a single tuned circuit to which reaction is applied. A tuned grid coupling is adopted, and the connections to both the H.F. valve anode and the detector grid are tapped down the tuned circuit to reduce damping and give maximum selectivity. The coils are all of a highly efficient iron-core type and tuned by a three-gang condenser, and these components actually form a single unit, thus simplifying the construction and reducing the number of connections.

Since no mains transformer is used, the chassis of the set is connected to the supply mains, and it is necessary to isolate the circuits from the aerial and earth in order to prevent any chance of a short-circuit.

A 0.002 mfd. condenser C1, therefore, is connected in series with the aerial lead, and a 0.001 mfd. condenser C2 in the earth

lead. This small value may appear unusual, and it is true that on a D.C. supply a capacity of 2 mfd. is often used. On A.C., however, there is a current flow to earth through the condenser, and a small capacity is advisable in order to keep this as small as possible. The efficiency of the set does not suffer to any appreciable degree under normal operating conditions.

In order to prevent H.F. currents from reaching the L.F. circuits, and to ensure good reaction effects an H.F. choke Ch2 is connected in the anode circuit of the detector, and this functions in conjunction with the two 0.0005 mfd. condensers C8 and C9. The coupling between the detector and output valves is by means of a transformer of the tone-control type, the potentiometer connected to which permits a wide variation in the frequency response to be obtained. The transformer primary is shunt-fed, so that it is operated under conditions of no D.C., and the inductance remains at a high value.

The Mains Equipment

It will be noted that the condenser C10 in the feed circuit is given the unusually low value of 0.1 mfd. This is done for a variety of reasons. The condenser resonates with the transformer primary between 60 and 70 cycles, and gives increased amplification over this range. At lower frequencies the amplification falls off rapidly, with the result that feed-back effects have less effect than usual. The chief advantage, however, lies in the small

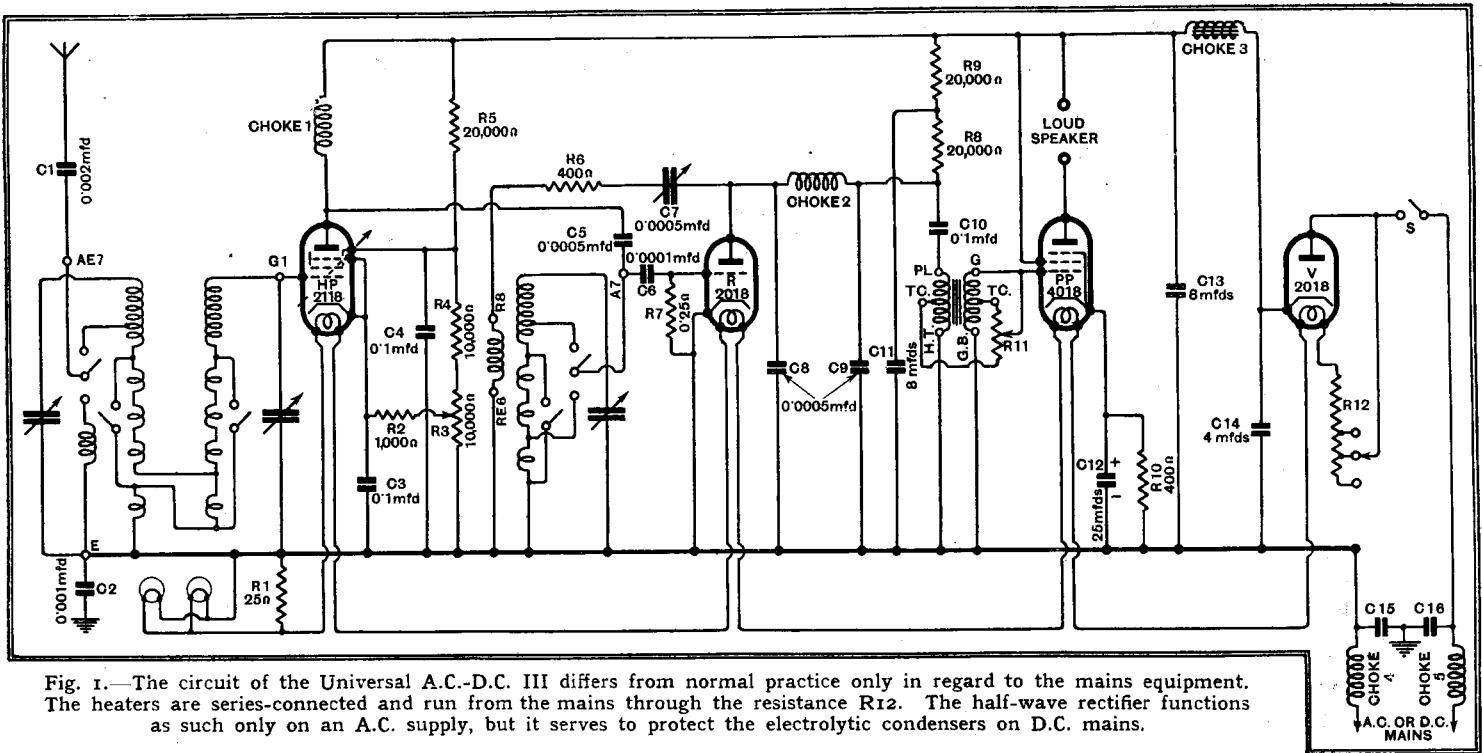


Fig. 1.—The circuit of the Universal A.C.-D.C. III differs from normal practice only in regard to the mains equipment. The heaters are series-connected and run from the mains through the resistance R12. The half-wave rectifier functions as such only on an A.C. supply, but it serves to protect the electrolytic condensers on D.C. mains.

degree of smoothing which need be used for the avoidance of hum on an A.C. supply.

Owing to the use of half-wave rectification the chief hum frequency is the same as the mains frequency, usually 50 cycles. It is permissible, therefore, to reduce hum by the simple expedient of restricting the frequency response of the set in this region. This does not affect the quality of reproduction adversely, for a 50-cycles note is not audible as such

equipment. The average volume level required for 50-cycles notes occurring in an ordinary programme is far greater than can be used in an ordinary room.

In view of this, it might be thought that little precaution against 50-cycles hum would be needed. This is not the case, however, for although it may be inaudible as such, it would partly load the output valve and so reduce the maximum undistorted volume

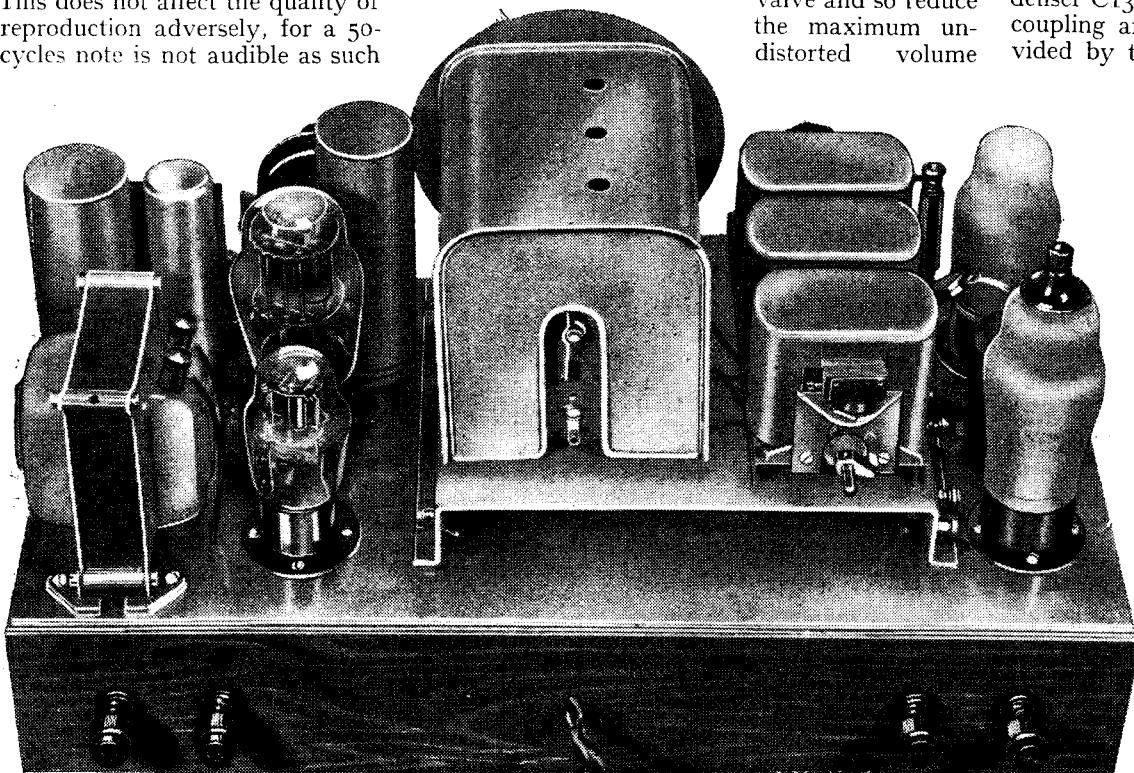
theoretically twice as great as that for full-wave, but in practice it is actually less, on account of the poorer efficiency of the ear and loud speaker at the lower frequency, and because it is permissible to restrict the frequency response.

Sufficient smoothing, therefore, can be obtained with the single choke Ch3 in conjunction with the 8 mfd. electrolytic condenser C13. In the detector stage decoupling and further smoothing are provided by the 20,000 ohms resistance R9 and the 8 mfd. condenser C11. The anode supply of the H.F. valve is taken directly from the main H.T. line, but the screen grid is fed from the network comprising R5, R4, and R3, the last of which forms the volume control.

The heaters of all the valves consume 0.18 ampere, and the H.F., detector, and rectifier valves are rated for operation, at 20 volts; the output valve, however, requires 40 volts. The total heater supply is thus 100 volts at 0.18 ampere, since the drop across the dial lights is small enough to be neglected. Some 100 to 150 volts, therefore, must be dropped in a resistance for mains supplies of 200 to 250 volts, and the tapped resistance R12 is used for this. The rectifier valve, of course, has its cathode connected to the positive H.T. line, so that

in this valve there is a large heater-cathode potential difference. It is connected at the positive end of the chain, however, in order to keep this as small as possible.

Although the rectifier is essential on an A.C. supply, it is not so on D.C. Its use here, however, leads to an important advantage, namely, that it becomes possible



The clean layout obtained and the small number readily be seen in this view of the chassis. The next to the smoothing

of parts employed can rectifier valve is mounted choke.

unless the loud speaker is of exceptionally high quality and is used with a very large baffle; and moreover, unless the output of the receiver is large, such a low frequency would be inaudible even with perfect

obtainable, and if the loud speaker were of a type giving frequency doubling of low notes the hum would become audible as a 100-cycles note. The amount of smoothing needed for half-wave rectification is

The Universal A.C.-D.C. III.—

safely to employ electrolytic condensers for smoothing. Without such a rectifier, it would be dangerous to use electrolytic condensers, for they would be destroyed if the set were to be connected with the wrong polarity to a D.C. supply.

It is well known that the mains normally pick up a considerable amount of H.F. energy, and that if this be allowed to reach the receiver circuits it can cause a considerable amount of trouble, such as modulation hum and kindred effects. In a normal A.C. set this is overcome by using a mains transformer fitted with a screened primary, but here we have no mains transformer. It is necessary, therefore, to include an H.F. filter in the mains leads and this comprises the two chokes Ch₄ and Ch₅ and the 0.1 mfd. condensers C₁₅ and C₁₆. These components, it should be noted, are mounted on the side of the cabinet well away from the receiver chassis in order that stray capacities may not reduce their efficiency.

The two condensers are earthed at their

junction and, if need be, this point may be joined to the earth terminal of the set. If possible, however, it is better to use an entirely separate earth, since the efficiency of the filter in reducing mains interference is then at its highest.

The rectifier valve is rated for a maximum output of 60 mA. so that sufficient surplus current is not available for feeding the field winding of a moving-coil loud speaker, and a permanent-magnet type is accordingly used. The speaker specified is fitted with a multi-ratio output transformer, which enables accurate matching to the output valve to be obtained.

Performance

The construction and initial adjustments of the receiver will be described in a further article, but, in the meantime, some notes on the performance may be of interest. The set has been tested on both A.C. and D.C. supplies and there was found to be no difference in the performance. Hum was completely absent and the sensitivity and selectivity both

reached the standard associated with good A.C. apparatus of normal design. The volume proved adequate for ordinary requirements, as might be expected when it is remembered that the output pentode delivers over 2 watts to the loud speaker, the exact figure depending upon the mains voltage. The balance between high and low notes was entirely satisfactory and could be adjusted at will by means of the tone control to suit the particular conditions prevailing.

The volume control had a sufficient range of control to reduce the strongest local station to a whisper, and reaction proved effective in increasing both the sensitivity and selectivity for distant reception. Without reaction, however, these attributes were sufficiently high for good reception of many distant stations with a reasonably good aerial.

It may perhaps be well to repeat that this receiver may be operated from any mains supply, either A.C. or D.C., having a voltage between 200 volts and 250 volts, without any alteration other than to the tapping points on the mains resistance.

(To be concluded.)

LIST OF PARTS

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- | | |
|---|--|
| 1 Colpak, with coils Nos. 1, 2 and 3 | Colvern Model H |
| 1 Dial | Polar Semi-circular Drive |
| 2 Bulbs, 4 volts, 0.1 amp. | Bulgin 410 |
| 1 H.F. Choke, Ch ₂ | Wearite H.F.P. |
| 1 H.F. Choke, Ch ₁ | Kinva I.D.C. |
| | (Bulgin, R.L.) |
| 2 H.F. Chokes, Ch ₄ , Ch ₅ | Goltone W.H.F. |
| 2 Electrolytic Condensers, 8 mfd., 500 v. working | Dubilier C11, C13 |
| 1 Electrolytic Condenser, 4 mfd., 500 v. working | Dubilier C14 |
| 1 Electrolytic Condenser, 25 mfd., 50 volts working | Dubilier C12 |
| | (Peak, T.C.C.) |
| 3 Fixed Condensers, 0.1 mfd., 200v., D.C. working | Dubilier C3, C4, C10 |
| 2 Fixed Condensers, 0.1 mfd., 250v., D.C. working | Dubilier C15, C16 |
| 3 Fixed Condensers, 0.0005 mfd., mica | Dubilier C5, C8, C9 |
| 1 Fixed Condenser, 0.0001 mfd., mica | Dubilier C6 |
| 1 Fixed Condenser, 0.001 mfd., mica | Dubilier C7 |
| 1 Fixed Condenser, 0.002 mfd., mica | Dubilier C1 |
| | (Peak, T.C.C., T.M.C. Hydra, Telsen) |
| 1 Resistance, 400 ohms | Graham Farish "Ohmite" R6 |
| 1 Resistance, 1,000 ohms | Graham Farish "Ohmite" R2 |
| 1 Resistance, 10,000 ohms | Graham Farish "Ohmite" R4 |
| 2 Resistances, 20,000 ohms | Graham Farish "Ohmite" R8, R9 |
| 1 Resistance, 250,000 ohms | Graham Farish "Ohmite" R7 |
| 1 Resistance, 400 ohms | Graham Farish Heavy Duty "Ohmite" R10 |
| 1 Resistance, 20,000 ohms | Graham Farish Heavy Duty "Ohmite" R5 |
| | (Dubilier, Erie, Claude Lyons, Scradex, Watmel) |
| 1 Resistance, 25 ohms | Claude Lyons F.W.25 R1 |
| 1 Mains Resistance, R12 | Bulgin M.R.20 |
| 1 L.F. Transformer, 1:4 | Multitone "Toco" R14 |
| 1 Tone Control Potentiometer for above | Multitone R11 |
| 1 Potentiometer, 10,000 ohms | Watmel T.2 R3 |
| | (Colvern, Haynes Radio, Claude Lyons, Rothermel) |
| 1 L.F. Choke, Ch ₃ | Wearite H.T.12 |
| | (Challis, Heayberd, Rawwood, Rich and Bundy, Savage, Sound Sales, Vortexion) |
| 4 Valve Holders, 5-pin | Clix Chassis Mounting Standard Type (Bulgin, Ferranti, W.B.) C7 |
| 1 Reaction Condenser, 0.0005 mfd. | Graham Farish "Lit-los" (Ormond) |
| 4 Ebonite shrouded terminals | A., E., L.S. (2) Belling-Lee "B" (Igranic) |
| Loud Speaker, P.M.m/c. | Epoch Type 20C (Rola, W.B.) |
| Cabinet | C.A.C. |
| Plymax baseboard, 16in. x 8in. x 3/4in. | Peto-Scott |
| 2oz. No. 20 tinned copper wire, 4 lengths Systoflex, wood, lighting flex, etc. | |
| Screws:— | |
| 20 3/16in. No. 4 R/hd.; 4 1/2in. No. 4 R/hd.; 8 3/16in. No. 4BA R/hd. with metal thread and nuts and washers. | |
| Valves:—1 HP2118, 1 R2018, 1 PP4018, 1 V2018 (Tungs-rain). | |

THE SHORT-WAVE WORLD**40-Metre Signals "the Long Way Round"**

WITH the shortest day well behind us, we are beginning to notice the later "fade-out" on the short waves below 30 metres, although it changes only by a matter of minutes from day to day. This fact, however, coupled with an apparent improvement in conditions, has been responsible for the reception of 19-metre stations (such as W2XAD and W8XX) as late as 7 p.m. on favourable evenings.

The best reception from North America is still provided by the 49-metre stations, which, at this particular part of the "sun-spot cycle," are certainly affected less seriously by varying conditions than those below 30 metres.

Nairobi may be heard from 4.30 p.m. onwards with quite a fair degree of reliability. At present his "peak" time seems to be between 6.30 and 7 p.m. Listeners who find that the Americans are beginning to bore them (so regular have they been of late!) may well amuse themselves by scanning the 45-49-metre band earlier in the evening, or possibly during the afternoon.

The "DX" possibilities of this band quite early in the day are proved by the amazing conditions that often prevail on the amateur 40-metre band, when Java, the Philippines, Australia, and sometimes New Zealand, may be heard between 2.30 and 4.30 p.m. The Antipodes are received well until 8 p.m. or even later.

Suggested stations to listen for at these hours are Nairobi (49.5), Johannesburg (49.2), Calcutta (49.1), and possibly Vancouver VE9CS (49.43). The last-mentioned station has been known to come through during the afternoon, in which case his signals are almost certainly coming "the long way round"—across the Pacific and Asia!

This, too, is backed up by the occasional reception, on 40 metres, of amateur signals from Hawaii and the West Coast of the U.S.A. and Canada during the afternoon. In these days, when the reception of the Anti-

podes is in danger of becoming a commonplace, it is refreshing to know that one can receive signals that have covered more than half of the earth's circumference.

Incidentally, the writer of these notes would be very pleased to receive, from readers, any reports of unusual reception, whether of new stations or of well-known stations at strange times.

It is impossible for one man with a receiver at a fixed location to keep in touch with all that goes on within the various short-wave bands, even if he works in 24-hour shifts!

Unofficial Broadcasting

A strange feature of the short waves, now becoming more and more noticeable, is the large number of so-called commercial stations that seem to devote half their time to unofficial broadcasting. Quite a number of stations that exist for the purpose of handling transatlantic telephone messages, for instance, may be heard from time to time giving gramophone recitals.

Presumably this is done only for experimental purposes, but it has the effect of giving the short-wave listener a wide variety of programmes to choose from. The only disadvantage is that he may suddenly find his music cut off and replaced by "scrambled" speech that leaves him with the impression that his receiver is in trouble.

Stations in this category do not work within the official short-wave broadcast bands. On the other hand, quite a number of genuine broadcast stations also work outside their bands. This applies particularly to the numerous transmissions to be heard between 32 and 42 metres, such as the two Brazilians, the two "Radio Nations," Quito, Guatemala and Rabat.

The official short-wave broadcast bands are not yet overcrowded, but it is only because of these various "off-wave" stations that that is so. MEGACYCLE.

Housing the Wireless Set

Readers Contribute Their Ideas

A FEW weeks ago we drew attention to the lack of originality displayed in the matter of housing the wireless set, and suggested that our readers might be interested in forwarding to us for publication their personal ideas or preferences in this direction. We have had a considerable response to this suggestion, and in the following pages we publish sketches and suggestions selected from the considerably larger number which we actually received.

We do not suggest that any one of these designs yet approaches the ideal, but we think there may be ideas here which will serve to stimulate other readers and provoke them to putting forward still further proposals.

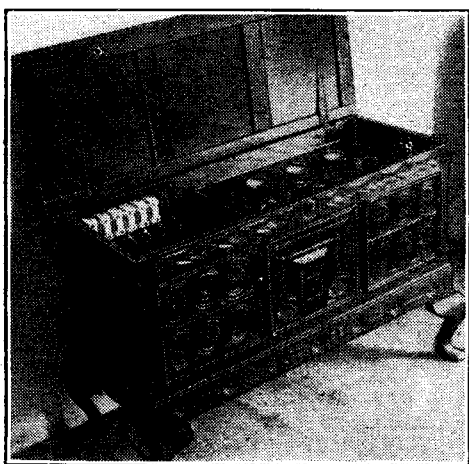
We would specially draw attention to the fact that some of the designs reproduced here have been registered by the authors and, therefore, remain their property.

It should be remembered that our invitation did not confine itself to the design of a cabinet. We invited suggestions from readers as to how the wireless set should be accommodated, and this does not, of course, necessarily imply a cabinet design. Some readers have put forward ideas where a cabinet would not be in evidence at all.

When readers have had the opportunity of considering the suggestions advanced here, we shall hope to receive their further ideas for later publication.

FOR the past six years I have employed the method for housing my home "quality receiver" which is shown in the photograph.

The chest used is 3ft. 6in. long, 1ft. 6in. deep, and 2ft. 6in. high. The method necessitates a fairly large room and



separate speaker, but as both these are desirable for good quality they are hardly disadvantages. The definite advantages of the system are:—

1. The controls and dials are easy to operate and read without stooping.
2. There is almost unlimited space for dials, etc., and as these are not visible when the lid is shut, they need not be arranged in a symmetrical order—a great advantage when one designs one's own sets.
3. As there are no holes in the container, other than at the back for ventilation and the lead-in of wires, it does not become obsolete when the set is re-designed.
4. It facilitates the building of the set in units, which merely rest in position and can be withdrawn in a few seconds for

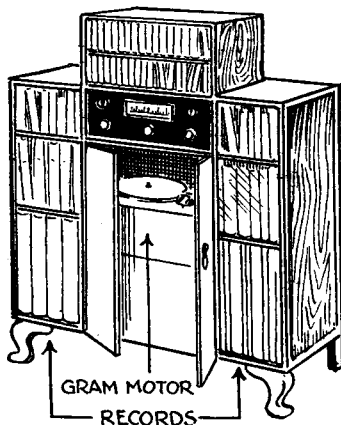
adjustment, repair, or complete rebuilding.

Although no gramophone arrangements are shown in the photograph, there is provision for mounting a turntable in front of the fuse panel.

This particular set may seem rather large for ordinary use, but I see no reason why this system should not be used with a container about 2ft. long. The height, 2ft. 6in., is ideal for easy operation. The set is in harmony with other furniture.

CHAS. L. ARCHDALE.

THE subject of the Receiver in Outward Form interests me chiefly because, after following the various forms from a long cardboard former crystal set to the usual box in cupboard containing wireless and gramophone, I am at last going to make a cabinet to suit my needs.

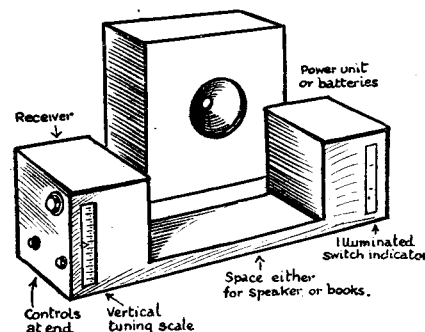


I do not mind the cabinet looking like a wireless set, and, therefore, my panel will be arranged in the front where it is handy to tune. I also want to be able to operate the gramophone without standing up. The accompanying sketch illustrates the general idea. The height of the wire-

less set is just convenient for tuning from my armchair, and the gramophone equipment being in the lower part inside the doors is easily accessible. Books and records are nearby as required. I have the loud speaker away from the set at a point where it gives best results.

J. W. BAMENT.

THE illustration shows the possibility of two alternative arrangements, one for a table model, receiver only, and one with speaker included.



In the one case it will be seen that the speaker is a separate unit which can be placed in the centre of the set, or, if it is required to mount it away from the receiver, the space can be used as a book rest.

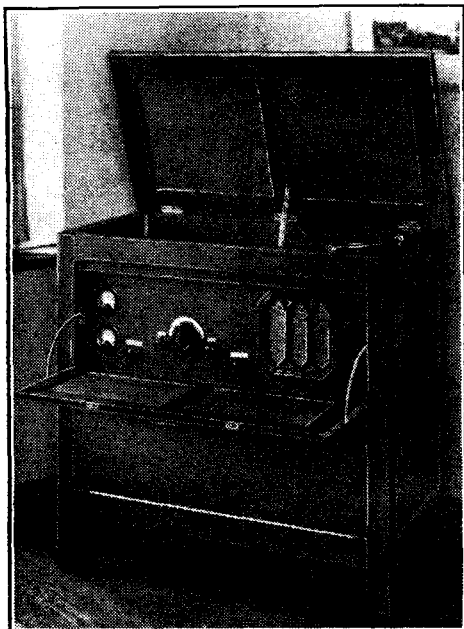
D. A. BELL.

THE accompanying photograph is of a receiver which I built about two years ago and which, although certainly not claiming to be ideal, may be of some interest.

The receiver itself is based on *The Wireless World* Four, but modified to suit my conditions—100 volt D.C. supply from private plant. The cabinet design, it will be noticed, is plain and straightforward; no attempt has been made to disguise it as anything other than a radio-

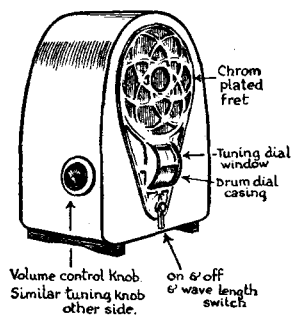
Housing the Wireless Set—

gramophone, although at the same time it is not obtrusive. All the controls and the speaker grille are covered up when not in use, not so much with the object of hiding them as to protect them from dust and damage; this, to my mind, is important, as any receiver with exposed controls is hopeless to keep clean.



There are some points which may be of interest in connection with design. Lowering the panel in front of the controls automatically switches on the receiver. The speaker grille is at a reasonable height, and the controls are reduced to a minimum. J. B. BROCKBANK.

MY sketch for a design for a radio cabinet has no pretensions to originality. It embodies what is, in fact, a variation of the system of dial used in the Philips receivers, but has clearly



visible scales and large sunk tuning knobs at the side of the cabinet which allow of tuning and control with the minimum of discomfort. G. D'O. GOWAN.

THAT the subject of cabinet design should be raised in our leading radio journal at the present time is most opportune, as developments in this direction appear to be at a standstill.

In my opinion it is seldom convenient for the receiver and reproducer to be placed in the same cabinet, for the simple reasons, first, that if the person who

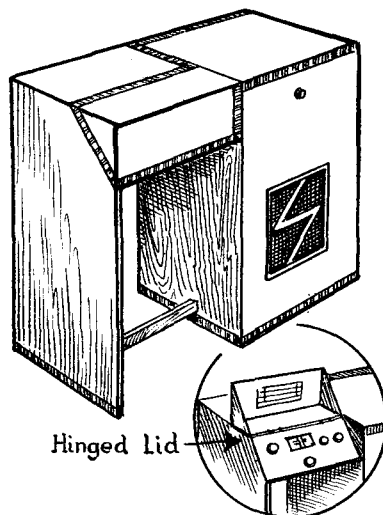
usually selects the programmes is seated alongside the receiver the result is far from pleasant for him. Secondly, if the receiver is placed at a convenient listening distance for those who wish to hear the programmes it then becomes necessary to walk over to the receiver in order to adjust volume, tune in to other stations, or switch off. For these reasons it seems that the most satisfactory arrangement is to separate the receiver from the reproducer.

The receiver itself should be in the room most generally in use by the occupants, in a position so that it is easy of access to control. Single or dual loud speakers might well be accommodated in the ceiling. A grille could be designed to harmonise with the general furnishing scheme. This would, perhaps, only be permissible where the ceiling is fairly high.

On the question of the tuning indicator, would not all confusion in tuning be eliminated by omitting station names altogether from the tuning scale and printing wavelengths only?

A. R. KINGSTON.

I WAS interested in your request for readers' ideas for improved cabinet designs for wireless receivers.



The accompanying sketch is of a rather unusual type of radiogram cabinet, which would obviate many of the disadvantages of the present styles. The sloping panel and the opening for the operator's legs would ensure absolute comfort when sitting at the receiver for long periods, and for this reason the height of the cabinet has been kept low.

The receiver is isolated from the loud speaker side of the instrument, and this should ensure that no vibration of valves, etc., takes place.

The gramophone side can be used without touching the receiver control panel.

H. W. KOHLER.

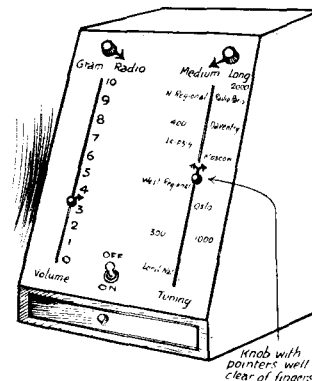
I COMMENCED wireless experimenting over twenty years ago with a coherer, and was a reader of your magazine in its first year. I enclose a rough sketch of my suggestions for the wireless set. Briefly, they are as follows: —

1. The whole of the tuning scale should

be visible at once and should be reasonably large.

2. Knobs which have to be turned through more than a right-angle should be abolished. The tuning and volume controls should, therefore, take the form of sliding knobs, and these should carry the pointers.

3. Names of stations should appear on the tuning scales, the addition of wave-



lengths serving for the location of new stations. The name-strips (long wave and medium wave) should be readily removable and replaceable, and of material on which alterations or additions to names could be made in ink.

4. Since names of stations are to appear, the scale should be vertical so that all names may be written horizontally. For this reason, and also so that the set will take up less table space, the cabinet should be of the upright type.

5. If both volume control and reaction are fitted one knob should increase the volume from zero to maximum, and then proceed to increase reaction from zero to maximum, the numerical scale being continuous.

6. The wave-range switch should carry a pointer which indicates the scale in use.

7. A knob changes from radio to gramophone. The on-off switch should not be incorporated in this or in the wave-range switch, but should be quite independent. It should be of the tumbler pattern, with a prominent knob the position of which (up or down) can easily be seen from a distance.

8. The front of the cabinet should slope back at such an angle as will facilitate reading the scales.

9. A loud speaker should not be incorporated in the set, but the cabinet of one or the other should contain a number of different lengths of flexible twin wire which may be used singly or plugged together for connecting the loud speaker to the set. The connecting plugs should be keyed.

10. When the circuit will allow of it a frame-aerial might be supplied to plug into the top of the set. It should rotate independently of the set. There should be a switch to change over from the internal aerial-coils to the frame-aerial.

11. If it is a mains set, its cabinet should contain several lengths of mains connecting wire. It should also contain an adaptor which, plugged into a 15 amp. socket, will take the 15 amp. plug of a

Housing the Wireless Set—

fire as well as the 5 amp. plug of the set; and also an adaptor which, inserted into a lampholder, will take a lamp as well as the plug of the set.

Incidentally—but I think the point is significant—the controls suggested would make a set almost ideal for a blind person. It is intended; of course, that pointers should be actual projections and not simply marks on round knobs.

W. LL. LAWRENCE.

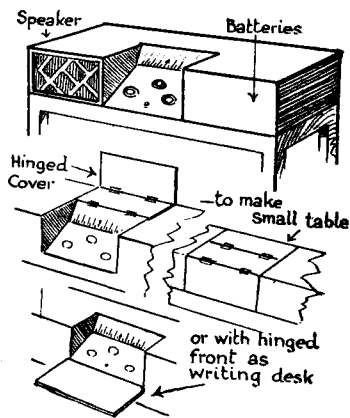
THE accompanying photograph shows an oak corner receiving set which was made up for me by Jonathan Fallowfield, Ltd., of Newman Street, W.I. The loud speaker is behind the upper doors, which open when the set is in use. It is placed at the correct height, and the wireless



receiver is enclosed in the centre section, which has a drop door. At the base there is ample room for accumulators, batteries, and other articles.

F. DUNCAN HINDLEY.

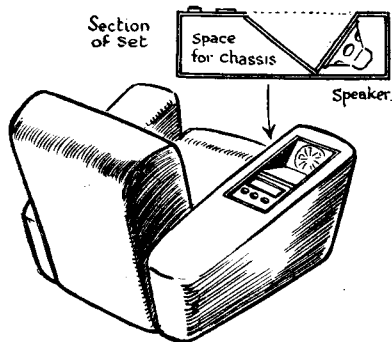
THE accompanying sketch indicates my suggestions for receiver design. I fail to understand why manufacturers make the tuning scale so small. The scale could be an endless band adjustable by means of a hand screw with the principal station names prominently printed on it.



My idea of a cabinet is that it should be a simple stand or table which is removable to any position, with a speaker self-contained.

A. H. McDONALD.

THE illustration shows a method of accommodating a midget aerial-less mains set to be fitted into the arm of a modern armchair. Such a set might be built to slip in and out of the chair, with



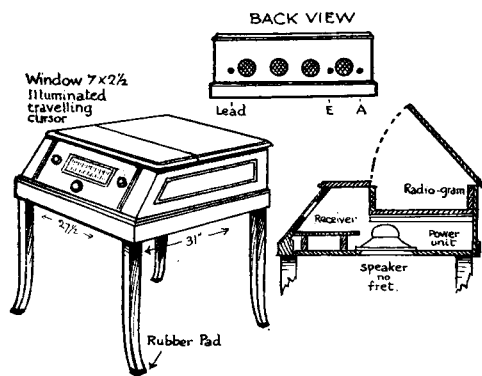
a wooden cover to go over the place which accommodates the set when the set is not in use. The speaker, if a midget moving-coil unit is used, can be fitted on an inclined baffle so as to direct the sound towards the listener.

CLAUD POWELL.

MY cabinet has been designed for my latest preparations for a new powerful radiogram. The arrangement of the speaker, which is a Celestion M.C. PPM29, is unconventional, but locating it in this manner did not reveal any ill effects, and I observed an increase in the reproduction of bass. The set stands on felt padding and rubber buffers to protect components, valves, etc., from vibrations set up by the speaker.

The sketches are, I think, self-explanatory. The arrangement has advantages:—

(1) Adaptability to harmonise with the general style of furnishing.



(2) It is a radiogram with its own individuality.

(3) The control knobs have been arranged on a sloping front at a convenient height from the floor level, and tuning can be carried out with perfect ease and comfort, either standing or sitting.

(4) The loud speaker is concealed.

(5) No fret is required, a plain round hole only being necessary.

(6) The gramophone motor can be accommodated in a convenient position.

(7) Easy access to all parts of the radio receiver power components, loud speaker, and gramophone motor is an important feature.

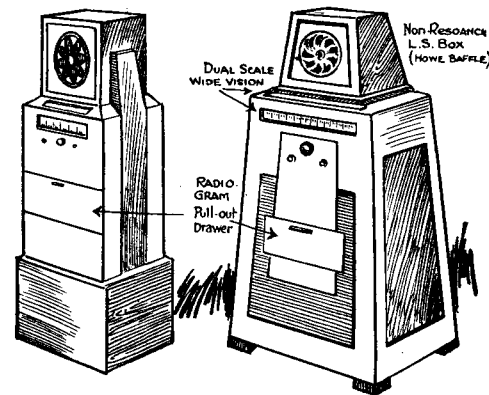
C. G. ST. AUBYN POWELL.

I LIKE to listen in comfort somewhere near the fire and dislike jumping up and down to alter the set or change records. Everything must be controllable from my armchair, but I will not tolerate a loud speaker blaring in my ear, nor at my feet from the bottom of the console. The loud speaker must be a separate unit.

My ideal arrangement, therefore, is to have the loud speaker in a corner at the other end of the room at about head height when sitting down. If I want the loud speaker beside me on occasions, it is so designed that its cabinet will fit securely on top of the set. I find there is not much wrong with the old-fashioned numbered condenser dials, if well illuminated and if only the makers would make the numbers big and clear enough. After all, the instrument is a wireless set, and ease of reading should be the first consideration.

G. PRIDE.

THE accompanying sketches show two designs where no attempt has been made to avoid the appearance of a wireless set, my personal opinion being that this is the proper way to approach the problem.



Pleasing effects can be obtained by a choice of different woods. The loud speaker box can, for example, be in black and very dark wood used for the rest of the design, with slightly lighter tone wood for the side panel in the left-hand design, which, incidentally, is the one I prefer.

C. RANDALL-COOK.

MY suggestion for a radiogram is a two-unit system, having the wireless set and the speaker in one side and the gramophone equipment in the other. The tuning scale is inclined and is thus easily visible from a standing position. The main tuning controls are located on each side of the top of the cabinet, whilst switching, volume, and tone controls are on the top of the front of the cabinet. The speaker is mounted below the radio chassis, preferably on an inclined baffle.

The gramophone has a motor board flush with the top of the cabinet, with a deep lid hinged at the back. The cabinet below the turntable provides space for accommodation of records.

J. G. STOTT.

(To be concluded.)

Practical HINTS AND TIPS

IN a great number of gramophone pick-ups, movement of the armature to which the needle is secured is damped by small pieces of indiarubber. Possibly the climatic changes we have recently experienced—from an exceptionally hot summer

Pick-up Damping

to a cold winter—are responsible for the fact that a great deal of trouble has lately been experienced through perishing of this damping rubber. The possibility of this trouble should always be borne in mind when a pick-up fails to function.

As a rule the replacement of the rubber is rather beyond the capabilities of the average amateur, but in many cases satisfactory repairs have been effected with the help of bicycle-tyre patching rubber or a piece of car-tyre inner tube—depending on the thickness required.

IT is no exaggeration to say that certain forms of interference can be either eliminated entirely or at least mitigated by directional reception—and in no other way. In spite of this, owners of portable or transportable sets with frame aerials seldom seem to turn the valuable directional properties of their receivers to good account.

Directional Reception

More often than not, the user of a frame aerial set swings the frame to the plane of the wanted station (as indicated by maximum signal strength) and considers that nothing more can be done.

Although this procedure is correct enough when there is no interference, it can generally be improved upon if the directional properties of the frame are to be employed for silencing an interfering transmission. Take as an example the conditions illustrated diagrammatically in

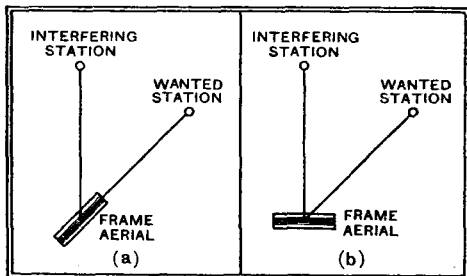


Fig. 1.—Illustrating the possibilities of directional reception, and the best way to eliminate interference.

Fig. 1 (a): by swinging the frame in the manner indicated, the "wanted" station will admittedly be heard at full strength, but, equally, signals from the interfering station will hardly be weakened at all, as the plane of the frame aerial is also quite favourable for their reception.

AIDS TO BETTER RECEPTION

The right course to adopt is illustrated in diagram (b). The rule is that the frame aerial should be oriented for *minimum* signal strength from the interfering station, irrespective of its position with regard to the wanted station. One must take one's chance as to whether this latter station will suffer serious attenuation. In the example given it will not, but in any case nothing can be done; it will merely be proved directional reception cannot help in that particular instance.

The main reason for the course of procedure at present advocated is that the adjustment of a frame aerial is quite critical about the point of minimum signal.

THE undesirability of indiscriminate screening of H.F. leads has already been pointed out; excessive stray capacity, with consequent restriction of tuning range is the most probable penalty for excess of zeal in this direction. With regard to

Screened Reaction Leads

reaction circuits, however, it may be pointed out that no harm is likely to result from using quite long-screened leads. In a reaction circuit ample energy should be available, and a little extra loss may be faced with equanimity. With regard to extra stray capacity, too, trouble need hardly be anticipated as the capacity of the screened lead will be either in parallel with that already connected between detector anode and earth, or else in parallel with the reaction coil. In neither case is its presence likely to be prejudicial to results, although it may be necessary to use rather more reaction condenser capacity than usual in order to provoke self-oscillation.

In view of the interest lately shown in receiver design from the point of view of convenience in operation, it may be remembered, then, that the reaction condenser may be mounted in the most convenient position, and its connecting leads may be screened if they are likely to provoke instability.

THE mains connection to an A.C. receiver in theoretical circuit form (Fig. 2 (a)) appears to be almost disarmingly simple, and one would hardly expect that any special precautions need be taken with regard to this part of the set. Experience would

The On-off Switch

indicate, however, that an appreciable amount of hum and other background noises are often introduced by a carelessly made connection.

For this state of affairs, the blame must be ascribed to the fact that the mains leads are usually led into the back of the receiver, and, naturally enough, the on-off switch is mounted in an accessible position at the front. Consequently, the leads to the switch are likely to run in close proximity to the tuned circuits and other parts of the receiver, and so any interfering potentials that they carry may easily be induced into circuits where they are liable to cause a good deal of annoyance.

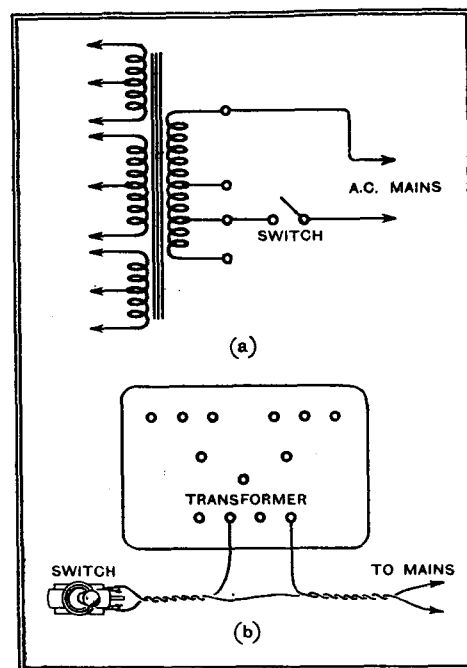


Fig. 2.—The wiring of an on-off switch in an A.C. mains set. Fuses, though often fitted in the mains leads, are omitted.

It is for this reason that designers of mains sets for home construction sometimes prefer to omit the switch altogether, on the assumption that it will be convenient to control the supply of mains current from a wall switch or similar fitting. In many cases this is quite a practicable plan, as a mains set is not like one operated from batteries; it does not greatly matter if it be allowed to consume current for a few minutes when it is doing no useful work, and so there is no great need for a switch immediately under the user's hand.

When the switch is mounted in the receiver it is worth while to devote a little thought to its position, and also to the "run" of the wiring through which it is connected. The leads should be twisted together as shown in diagram (b) and they should be kept well clear of the receiver wiring and components. In some cases it is worth while using a length of twin lead-covered cable for the switch connection. Of course, the metal covering should be earthed.

Q.A.V.C.

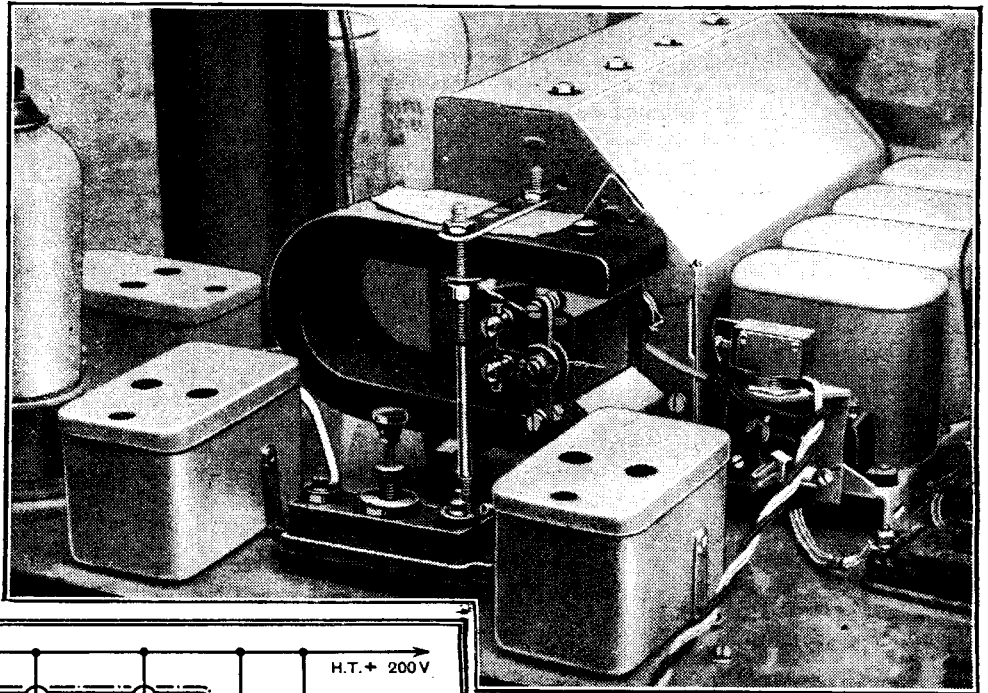
A Mechanical System of Quiet Automatic Volume Control

AUTOMATIC volume control is sometimes regarded as a mixed blessing on account of the strong background noise which usually appears between stations. Quiet A.V.C. systems have hitherto been looked upon with disfavour since they required an additional valve and complicated the receiver. In this article a mechanical system is described which is extremely simple and readily fitted to an existing receiver.

By F. L. HOSSELL

WHILE the principle of automatic volume control is now generally considered essential in any receiver intended for more than purely local-station reception, it cannot be denied that the system makes tuning rather a nerve-racking business owing to the rise to maximum sensitivity which occurs immediately the set is tuned away from a carrier. A purely palliative measure is to reduce the sensitivity of the set while searching, as with the now-familiar "noise suppressor." This requires the manipulation of an extra control, however, which is apt to be forgotten until the noisy background reminds one of its function—and then it is often left in the less-sensitive position so that the full sensitivity cannot be used.

These troubles can be largely done away



The Weston relay used in an experimental receiver can clearly be seen at the back of the gang condenser in this illustration.

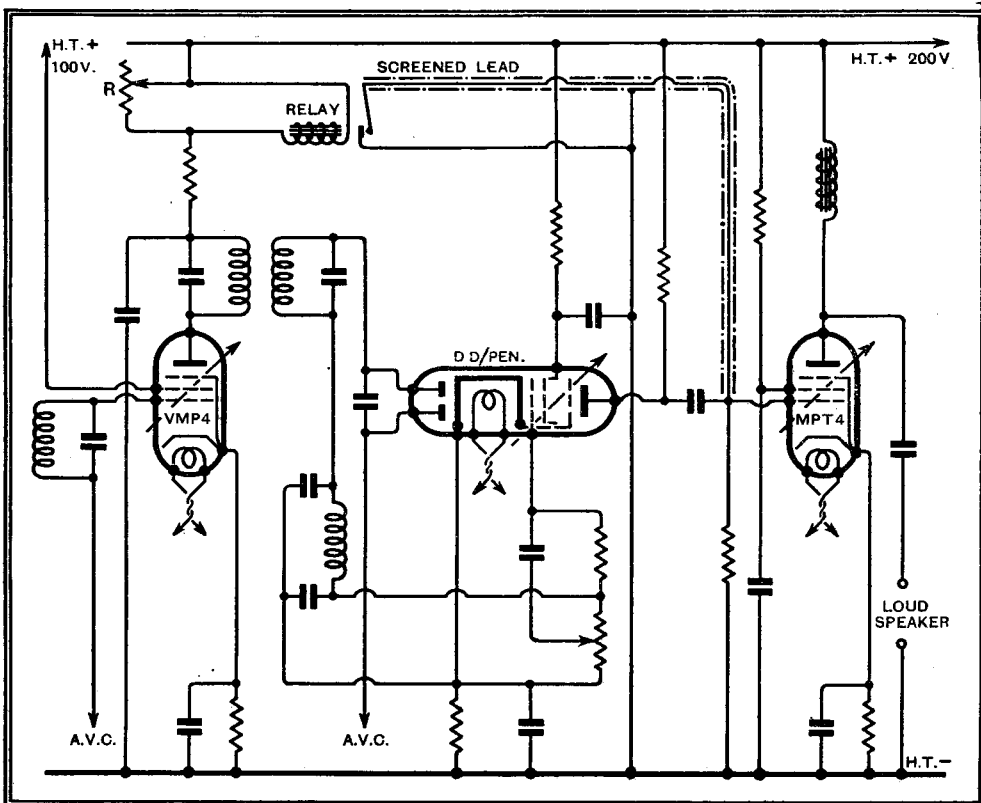


Fig. 1.—This diagram of the I.F., detector, and L.F. circuits of a superheterodyne shows how readily a set can be adapted to Q.A.V.C. when a mechanical system is employed.

with by "quiet A.V.C.," but to add this system to an existing set calls for much re-designing if the usual method of arranging for an L.F. valve to be overbiased in

the absence of a signal is used. A system which can be added to an existing set, however, is the mechanical method, which makes use of a relay. This relay is con-

nected in a low (signal) potential part of the anode circuit of a controlled valve and prevents signals of less than a pre-determined strength from being passed through the L.F. amplifier.

A sensitive relay is fully energised by a very small current only, and thus it is necessary to shunt the winding with a variable resistance approximately equal to that of the relay winding, in order to prevent saturation by the anode current of the valve. The relay used in the Fultograph equipment, which can often be obtained very reasonably, is quite suitable, and has a resistance of 2,000 ohms. The well-known ex-Government Weston moving-coil relay has a resistance of 350 ohms, and is also satisfactory for this purpose. The variable resistance R (Fig. 1) is also important as a control.

The circuit diagram of the I.F., det., and L.F. stages of a typical modern superheterodyne is shown in Fig. 1, and it will be seen that the relay coils are connected in the anode circuit of the I.F. valve, while the contacts are employed to short-circuit the L.F. output of the detector valve. In the absence of a current flow through the relay coils the contacts are open. The normal no-signal anode

Q.A.V.C.—

current of the I.F. valve, however, is sufficient to close the contacts and short-circuit the L.F. output, thus preventing any background noise. When a signal is tuned in, the I.F. valve anode current decreases through the action of the ordinary A.V.C. system, and the energisation of the relay decreases so that the contacts open to permit reception.

Any valve which is controlled by the A.V.C. system will serve to operate the relay, but the valve which shows the greatest *change* of anode current on a signal being tuned in is most suitable. A V.M.P.4 used in an I.F. amplifier showed a current drop from 4.6 mA. to 1.35 mA., or approximately 46 per cent. drop on a strong signal, whereas the anode current of a D.D./Pen dropped from 8.5 mA. to 7.5 mA., or only 12 per cent. The contact points of the relay must not be connected in a circuit carrying any appreciable current, so that it is convenient to arrange them to short-circuit the secondary of the L.F. transformer, or the grid leak of a resistance-coupled valve, thus preventing any signal being passed through the amplifier.

The Operation of Q.A.V.C.

With the set switched off the relay should be adjusted to its most sensitive position, that is, the movement should be restricted as much as possible, and the moving armature brought close to the magnet. With the set switched on, but the aerial disconnected, the resistance R should be adjusted so that the contacts are *just* held closed by the anode current. The pull-off spring can often be adjusted with advantage at this time. Any decrease in the value of the variable resistance will result in a smaller current passing through the relay and the points will open; and vice versa, any increase in resistance will increase the current through the relay and the points will be held closed by a rather greater force.

With the aerial connected and the set tuned to a strong station the drop in the anode current, owing to A.V.C. action, will at once allow the points to open, and the signal will be heard. As the tuning is moved away from resonance the anode current will rise and the points close again. In practice, the change in anode current necessary to operate the relay depends upon the precise setting of the resistance R, which should be mounted in an accessible position. On a "noisy" evening a station that is of entertainment value should first be tuned in and the control moved until it is just "silenced"; a slight backward movement will bring it "in" again and, provided that the control is then left alone, only stations that are of equal or greater strength can be heard, a dead silent background when tuning being assured. If full use of the sensitivity of the set is required the control should be moved to the position of lowest resistance, when, of course, the contacts will be permanently opened and all stations heard.

Any intermediate position can be selected as required.

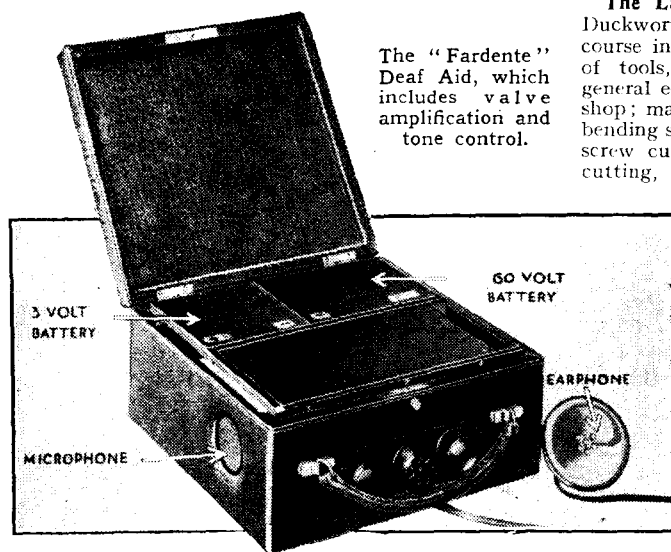
The success of the device depends upon how carefully the relay is adjusted, the sensitivity of the instrument, the percentage change in anode current and how near to "closing point" the variable resistance can be adjusted. The use of the lowest possible total resistance for R leads to the smoothest operation, and a little patience in the adjustment of the armature contact points will be well repaid by reliable operation.

If the speaker is mounted in the same cabinet as the receiver (and relay) the relay should be mounted on sponge rubber to prevent vibration from affecting the contacts. It will probably be necessary to screen the lead from the grid (or transformer secondary) to the relay contact to avoid hum.

It will be seen that the addition of this form of Q.A.V.C. leads to little modification of a receiver, and it undoubtedly removes the chief drawback of A.V.C.—the noisy background while tuning. It should be realised, however, that the success of the system depends almost entirely upon the use of a suitable relay, and if an insensitive or poorly constructed instrument be used an unsatisfactory performance will be inevitable.

"FARDENTE" DEAF AID

ALTHOUGH weighing only 4½ lb. and measuring 8 × 7 × 3 in., this unit incorporates a valve amplifier complete with H.T. and L.T. batteries. Not only is the sensitivity superior to that of the ordinary battery-energised carbon microphone type, but the quality of reproduction shows a marked improvement. In addition to the usual volume control, a tone control transformer is included so that the quality of reproduction can be modified to meet special requirements. We have had an opportunity of hearing a demonstration of this instrument, and can vouch for the high degree of sensitivity attained. It was speci-



The "Fardente" Deaf Aid, which includes valve amplification and tone control.

ally noted that, in spite of the high overall amplification, the feed-back between the ear-piece and the microphone was negligible.

The unit is obtainable with or without volume control, and particulars of prices are available from the maker, Mr. R. H. Dent, 309, Oxford Street, W.1.

THE RADIO INDUSTRY

THE makers of the Eclipse combination tool, reviewed in our issue of December 29th last, ask us to make it clear that the appliance is only obtainable from tool dealers—not direct from the makers.

Those without mains whose tastes nevertheless run to highly ambitious multi-valve receivers will be interested to learn that Siemens' "Power" type triple-capacity batteries have been drastically reduced in price. Reductions average nearly 25 per cent.

Mullards have just introduced a new indirectly heated pentode, type Pen.4VA, which has a considerably greater output than the Pen.4V. Normally, a seven-pin base will be fitted; Mullard H.F. pentodes with the same type of base will shortly be available.

Hydra paper dielectric condensers are now being made in this country by the Telephone Manufacturing Company, Ltd., of West Dulwich, for whom Harwell, Ltd., of The Sessions House, Clerkenwell Green, London, E.C.1, are agents and distributors. A list of the various types is now available.

The G.E.C. announce a substantial reduction in price of the triple capacity 60-volt high-tension H.T. battery (No. L.260), which is to cost only 8s. 6d.

It is indicative of the increasing robustness of modern valves that in future all mains-operated sets despatched from the Marconi-telephone factory at Hayes will have the valves already in position in the appropriate sockets.

A special tuning system, using Braille characters, is employed in the wireless receivers for the blind made by Burne-Jones and Co., Ltd. This firm tells us that already some 24,000 sets have been supplied, and further orders have just been received.

BOOKS RECEIVED

Les Redresseurs de Courant by Raoul de Bagneux. The construction, use and characteristics of various types of current rectifiers, including commutators, vibrating reeds, electrolytic, metal, thermionic, mercury vapour and other gaseous rectifiers. Pp. 124, with 59 diagrams. Published by Etienne Chiron, 40 rue de Seine, Paris, VI. Price 10 francs.

The Laboratory Workshop by E. H. Duckworth and R. Harries. A simple course in apparatus making and the use of tools, including the selection and general equipment of a laboratory workshop; marking out, cutting, drilling and bending sheet metal, rod, strip and tube; screw cutting, soldering, woodworking; cutting, drilling and grinding of glass; electric wiring, etc.; also the design and manufacture of various scientific apparatus and models. Pp. 246 + xi, with 428 illustrations and diagrams and 8 plates. Published by G. Bell & Sons, Ltd., York House, Portugal Street, London, W.C.2. Price 10s.

Wireless, its Principles and Practice, by R. W. Hutchinson, M.Sc. 2nd edition, revised and enlarged. A notice of the first edition appeared in our issue of February 17th, 1933. In the revised edition the author

has added important new sections dealing with recent developments such as Class "B" Amplification, Q.P.P., A.V.C., Loud Speaker Baffles, etc. Pp. 308 + xii, with frontispiece and 220 diagrams and illustrations. Published by the University Tutorial Press, Ltd., Burlington House, Cambridge, and High Street, New Oxford Street, London. Price 3s. 6d.

BROADCAST BREVITIES

By Our Special Correspondent

Encouraging Sounds

ALTHOUGH no egg has yet been hatched by the Committee appointed by the Institution of Electrical Engineers to investigate problems of interference with radio reception, I have heard a few encouraging cackles.

Bad Economics

I have heard, for instance, that the Committee has decided that it is thoroughly bad economics to concentrate on eliminating the interference at the receiving end. Better far, argues the Committee, that one malefactor be put to expense than that a hundred honest neighbours should have to pay for anti-interference chokes.

But Who Will Pay?

This is splendid reasoning so far as it goes, but who is to make the malefactor pay? No amount of heroics and rhetoric from the I.E.E. will bring about a change of heart in the pork butcher whose sausage machine is performing the job required of it.

Government Action Seems Inevitable

When legislation does come, it will probably affect only such radiations as interfere with the reception of B.B.C. stations. If a listener chooses to put his set in the extremely sensitive condition required for distant reception, he must expect a higher proportion of man-made static.

Static-measuring Instruments

Some very interesting interference-measuring equipment is now being examined by the I.E.E. Committee. Hitherto there has been no quantitative method of measuring man-made static. Opinions of observers on the question of sound-levels differ as widely as those of the village policeman and idiot respectively regarding car speeds.

Now the Committee is seeking an instrument which will give the same readings with different observers.

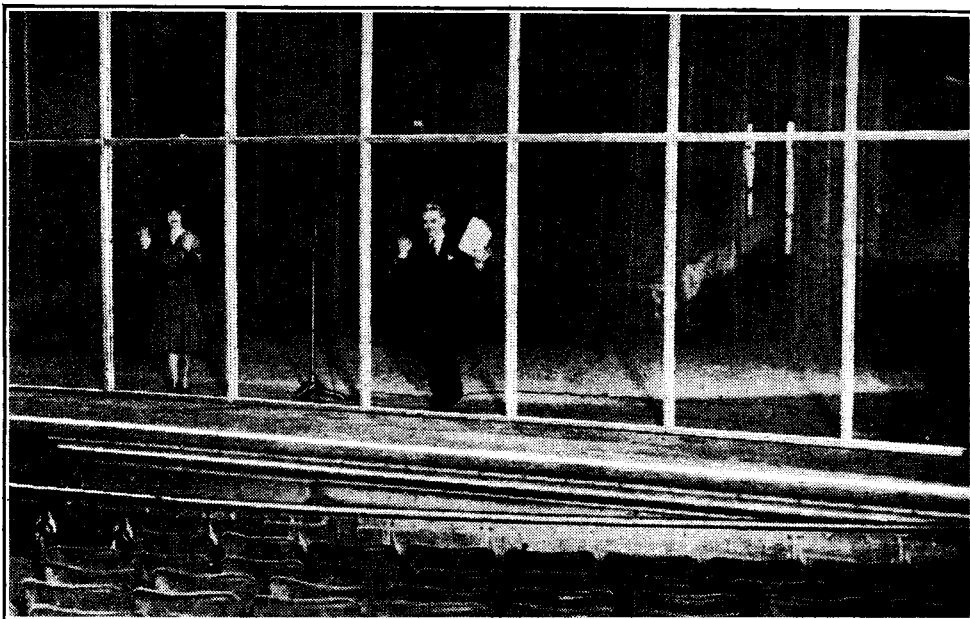
New Short-wave Masts at Daventry

NEVER the people to take troubles lying down, the B.B.C. engineers are trying hard to improve the Empire transmissions. Two 350-foot steel self-supporting towers are now shooting up at Daventry to provide a mammoth omni-directional short-wave aerial.

Mr. Ashbridge is determined to cover the world at all costs, and I believe that, despite any loss of engineering prestige, he would even be prepared to take my hint of last week, if need be, and erect relay points at such places as Cairo, Gibraltar, St. Helena, and Hong Kong.

Where Britain Lags

At present Britain is undoubtedly lagging behind in the matter of world transmissions. The new *Weltsender* at Zeesen is proving a doughty rival, while the French *Poste Coloniale* has attained a world-wide popularity which Daventry has never had, notwithstanding its five different transmitting periods.



CUTTING OUT THE APPLAUSE. When acts are broadcast from the New Amsterdam Theatre, West 42nd Street, New York, this six-ton glass "curtain" is lowered to eliminate all sounds from the auditorium. Yet the audience continues to clap!

Colonial Listeners are Technical

No fewer than 11,000 letters were received last year in regard to the Empire programmes. Many of these contained valuable hints and resulted in the changing of aeriels and wavelengths.

The Colonial listener seems to take wireless more seriously than the pampered darlings at home. Whereas no one in Poplar or Pudsey would proffer advice to a short-wave station at the other side of the world, the Empire pioneer who gets a thrill out of Big Ben will go to any amount of trouble to let broadcasting engineers know how their signals are coming across. Advice from the Colonies is very often valuable because the exile from home, being a resourceful kind of chap, has had to master the general principles of the radio art. His technical qualifications are often of a high order.

Breakfast Broadcasts are Coming

ONE of these days the B.B.C. announcer will blandly state that it has been decided to inaugurate early morning transmissions. The innovation is bound to come, notwithstanding these tiresome explanations about technical and staff difficulties. With the money at its disposal, the B.B.C. could quite easily maintain a twenty-four-hour service, although this would certainly entail duplication of existing plant.

Overworked Transmitters

Just now the B.B.C. transmitters are really being overworked. The only time for thorough repairs and replacements is on Sunday mornings when the engineers go round the apparatus and inspect the masts.

Long-lived Valves

Valves, I am told, are rarely replaced until they actually "blow," for there is no saying how long any valve may last. It may have a short life of twenty minutes, or, like a certain water-cooled valve now in use at Daventry, continue for three or four years.

Replacement valves are always standing by and can be switched in at a second's notice.

Programme Expenses—Nil

As for programme expenses in connection with breakfast broadcasting, these could be practically nil. For what does that expensive Gramophone Department exist, and why did the B.B.C. expend so many pounds on the Blattnerphone system?

An American Speaks

IF the B.B.C. announcers would take a lesson from a citizen of the United States they might be interested in the "ten guiding principles for announcers" recommended by Dr. Frank H. Vizetelly, the American lexicographer.

No False Inflexions, Please

A clear-speaking voice is, of course, essential, but Dr. Vizetelly demands also "a knowledge of the tonal quality of words and their psychological effects beyond their dictionary meaning."

There is wisdom, too, in this exhortation: "The announcer must never try to inflate by false accentuation what is essentially a simple home-like phrase to the proportions of grandeur."

The Listener as a Human Being

You must also remember, Mr. Announcer, that you are "talking to live, human beings who have loved, struggled, laughed, dreamed, despaired, and hoped."

What a picture of the typical ten-shilling licence-holder!

Taking the Mike to Rugby

VERY few readers of *The Wireless World* will want to miss the ambitious broadcast to be undertaken by the Midland Region on February 17th, when a tour of "G.P.O. Radio" at Rugby will be broadcast. The programme, which will also be relayed to London Regional listeners, will include a visit by microphone to the top of one of the 820-foot masts, whence an engineer will give listeners a bird's-eye view of the layout of the station.

This fine programme item is typical of the Midland Region, which is supreme in the realm of outside broadcasts.

News of the Week

Current Events in Brief Review

High Power from Brittany

A SITE has at last been chosen for the French 120-kilowatt regional station in Brittany. During the construction of the new station, the Rennes transmitter, which it replaces, may be temporarily increased to a power of 40 kilowatts.

Short Waves from Germany

THE times of transmission from the German short-wave station at Zeesen have again been altered. The new time-table is as follows:—

Asia: DJA, 31.38 metres (1300 to 1600 G.M.T.).

Africa: DJD, 25.51 metres; DJC, 49.8 metres (1800 to 2130 G.M.T.).

South America: DJA, 31.38 metres (2200 to 0100 G.M.T.).

North America: DJC, 49.83 metres (2300 to 0230 G.M.T.).

Sunspots and Wireless

ASTRONOMERS predict that 1934 will be a good year for wireless. Authorities at Greenwich Observatory told the *Morning Post* last week that the year is expected to see the lowest ebb of sunspot activity for more than eleven years. Short-wave wireless, therefore, should now steadily increase in strength, while medium-wave reception, which is now very nearly at its best, may tend to deteriorate within the next few years. Long-wave reception over long distances should gradually improve.

Police Radio in Yugoslavia

THE possibilities of police wireless are being considered by the Yugoslavian Government, and negotiations are now being conducted with a British firm for the supply of short-wave apparatus.

Atomic Physics

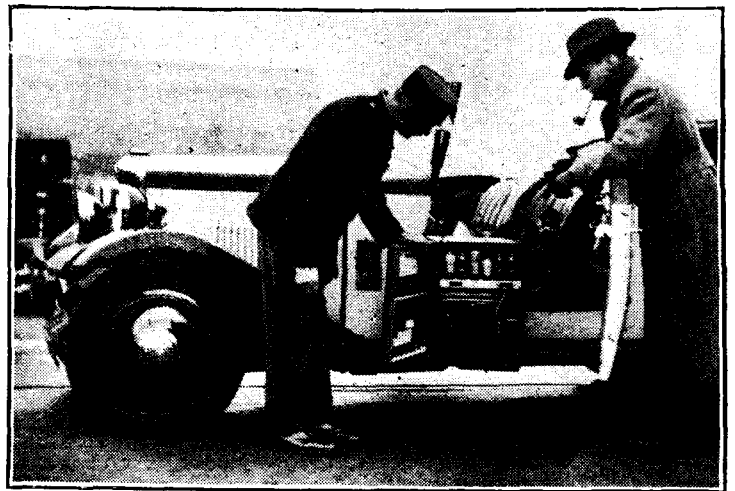
UNDER the auspices of the Physical Society, a Conference on Atomic Physics will be held in 1934. The Conference, which will be opened by Lord Rutherford, will be the first of this kind to be held in England.

100 Kilowatts from Czechoslovakia?

IT has been decided to build a 30-kilowatt broadcasting station at Banska Bystrica, Czechoslovakia. Ultimately, the power may be increased to 100 kilowatts with the closure of the station at Bratislava.

Electrical Heckling

DANISH broadcasting has had its first taste of electrical heckling. During a recent talk by a well-known politician, M. H. P. Hanssen, a harsh voice suddenly broke in on the transmission, excitedly contradicting the speaker and continuing with a string of political slogans. The engineers, who at once switched over to another line, consider that the interference must have been brought about by the coupling of a field microphone to the land line. The offender has not yet been identified.



TAKING WIRELESS ABROAD. This English owner of an H.M.V. Portable A.V.C. set was "snapped" on the quay at Boulogne during the customs inspection. Wireless makes an ideal travelling companion.

The Radio Magazine

WHAT goes on behind the scenes in broadcasting is faithfully mirrored in *The Radio Magazine*, Newnes's illustrated six-penny monthly edited by the well-known wireless journalist, Mr. Garry Allighan.

The February number includes intimate interviews with famous microphone personalities and contains a picture gallery of portraits. Printing is by photogravure process.

The Engineer's Year Book

NO fewer than 2,623 pages go to make up the 40th Edition of the Engineer's Year Book for 1933-34 (Morgan Bros., Ltd., 28, Essex Street, Strand, London, W.C.2). The wireless and electrical engineer will be specially interested in Sections XXIX and XXX, in which every phase of the subjects is covered. The useful data relating to radio communication has been supplied by *The Wireless World* and includes formulae for wavelength, capacity, inductances, etc., together with wire tables and tuning charts. Price 31s. 6d.

English Programmes from China

CHINA'S most powerful broadcasting station, XGOA, Nanking, working on 75 kilowatts with a wavelength of 455 metres, will send out "international good-will broadcasts" on January 28th, 29th, and 30th next from 10 to 11 p.m. (G.M.T.) under the auspices of the International DX'ers Alliance. We understand that all announcements will be made in English and that the music will have a Western flavour.

British listeners who can cut out Langenberg, on 455.9 metres, may succeed in picking up these interesting programmes. We shall gladly welcome reports.

Television on the Screen

TELEVISION pictures 5 feet square were shown on the screen during an interesting lecture recently given by Mr. H. M. Dowsett before an audience of two hundred people at the Marconi Works, Chelmsford. The apparatus employed was the Marconi fifty-line system, and the pictures were projected some 20 feet on to a transparent screen and viewed by the

audience at a distance of 100 feet on the farther side of the screen. The picture required a frequency band of 18 kilocycles, which gave much more detail than the narrower band television at present transmitted by the B.B.C., but it is stated that a band even as narrow as 9 kilocycles can provide pictures of interest to the public.

The year 1934, said the lecturer, will be a great testing year of various systems of television.

Luxembourg Undaunted

THAT Radio Luxembourg is not perturbed by the Lucerne Plan is evident from the publication of an impressive programme for the coming months.

Variety is to be the key-note of the transmissions, and an effort is to be made to suit the programmes to the time of day. Between 12 and 2 p.m. and 7 and 9 p.m., when the workers are "in repose," the music is to be gay and amiable. After 9 in the evening a severer note will be struck with symphonic and chamber music, though there will be relaxation on Saturdays from 9 to 10 with the *Pèle-Mêle* feature consisting of jazz, drama, cinema news, and other causeries in French and German.

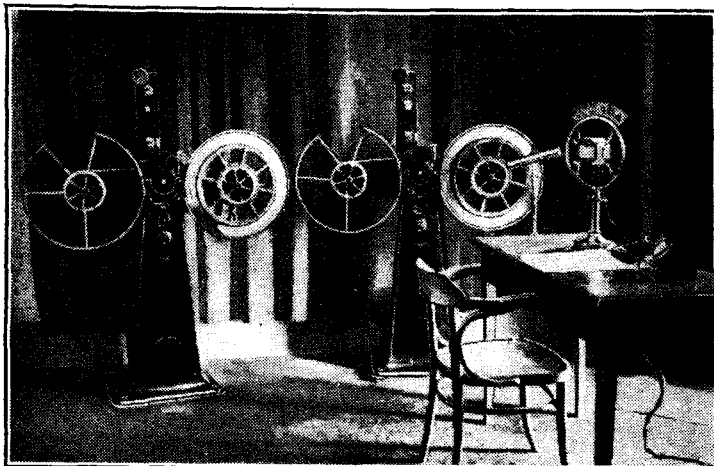
Bessel Functions and Acoustics

ON Monday next, January 22nd, Dr. N. W. McLachlan will open a series of twelve weekly lectures at the Borough Polytechnic on "The Applications of Bessel Functions to Acoustical Engineering, Including Loud Speakers, Electrical Transmission Lines, Skin Effect in Conductors, and Induction Furnaces." The lectures are from 6.15 to 7.45 p.m.

No previous knowledge of the subject is expected, though a knowledge of the elements of the Calculus and simple infinite series is required. Full particulars can be obtained from the Principal, Borough Polytechnic, Borough Road, London, S.E.1.

Five Million

GERMAN licence figures have now passed the five million mark, the total of 5,052,607 being recorded on December 31st. During 1933 the number of licences in Germany increased by three-quarters of a million, or 17.3 per cent.



BLATTNERPHONES AT BARI. A large proportion of the programmes from this popular Italian station are of the recorded variety. Steel tape versions of the transmissions from other stations are often included.

Not Wanted

LISTENERS to the Norwegian station at Vardoe have made a strong appeal to the Post Office for the closing down of the station. The reasons given are, first, that the programme consists entirely of gramophone records, and, secondly, that the people of Finmarken, for whom Vardoe is the "local," can manage quite well without a regional transmitter. They have all acquired the habit of long-distance listening and prefer the Swedish and British programmes.

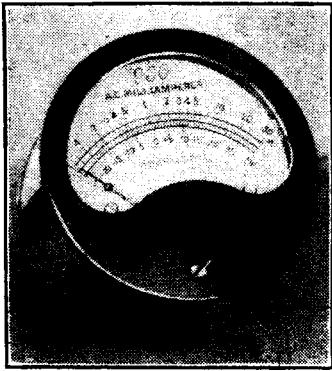
Australia Buys British

THE Australian Government has placed an order for four new 7-kilowatt broadcast transmitters with the Standard Telephones and Cables, Ltd. The four stations, which will act as relays, will be installed at Launceston, Tasmania; Townsville, Queensland; Sale, Victoria; and Grafton, New South Wales. The first of these four stations will be manufactured by Standard Telephones and Cables, Ltd., in London, while the other three will be made by their associated company in Australia.

Wireless at the Physical Society's Exhibition

Measuring Instruments for Research and Testing

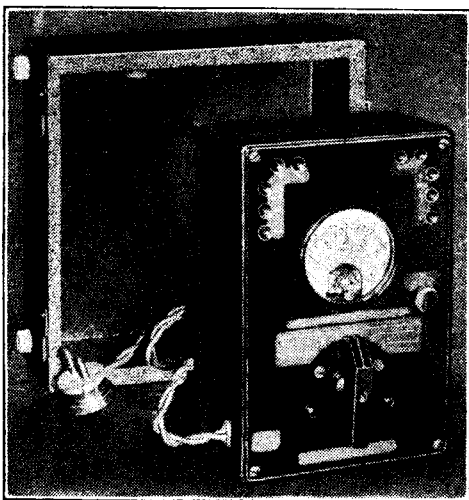
TO those engaged in the development of wireless apparatus the annual Exhibition of the Physical Society at the Imperial College of Science and Technology is one of the year's most important events. Not only are the latest designs of commercial measuring instruments available for inspection, but the numerous demonstrations in the research section can always be relied upon to provoke discussion and stimulate interest in



Salford logarithmic scale A.C. milliammeter calibrated in decibels.

the fundamentals underlying the art of wireless communication. This year's Exhibition, which was the twenty-fourth of the series, was held on January 9th, 10th and 11th, and of the stands devoted to the industrial applications of physical phenomena nearly 30 per cent. were showing apparatus of direct interest to the radio industry.

Meters for the measurement of A.C. and D.C. voltage and current were well represented in the displays of Ernest Turner Electrical Instruments, Ltd., and Ferranti,



Weston Model 664 capacity test set (0.001 to 200 mfd.).

Ltd. The latter firm were showing a new type of electrostatic voltmeter with the extraordinarily low range of 0-150 volts. The instrument is magnetically damped and is suspended on springs inside a heavy cast-iron case. Another exhibit on this stand was the Universal Valve Tester, which has been designed to check all the

latest types of valve, including H.F. pentodes, double-diode-triodes, heptodes and Class "B" output valves. For taking all the essential measurements of voltage, current and resistance in a receiving set under working conditions, the Weston Electrical Instrument Co. have produced a portable radio set analyser (Model E665).

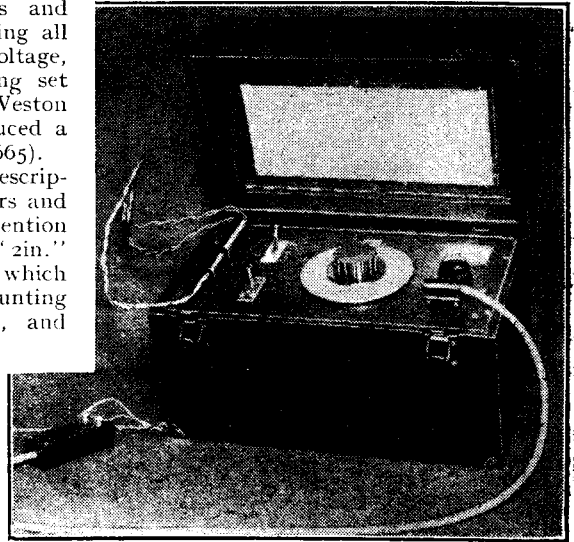
Space does not permit a detailed description of all the new types of voltmeters and ammeters which were shown, but mention should be made of the Elliott "2in." miniature moving-coil instruments, which are available as normal flush-mounting instruments or with edgewise dials, and the logarithmic-scale milliammeter produced by Salford Electrical Instruments, Ltd. The latter instrument has a centre zero and a range of plus or minus 30 db. referred to 1 mA.

The routine testing of fixed condensers plays an important part in the production of wireless receivers, and this year's Exhibition was notable for the wide range of instruments designed to carry out this test with the least possible loss of time. A direct-reading scale is employed in all cases. In some instruments, such as the Evershed and Vignoles A.C. "Megger" type and the Weston Model 664 capacity meter, the indication depends on the current passed by the condenser for a given voltage and frequency.

In other cases, such as the Muirhead and Cambridge Instrument models, a bridge method is employed. The latter model is specially suitable where a high degree of accuracy is required, and a sensitive galvanometer with rectifier is used to indicate the exact balance. It has a range from 5 micro-mfds. to 2.4 mfds., and the accuracy is 0.3 per cent. For the measurement of very small capacities a special bridge having a range of 0.30 micro-mfds. was shown by Sullivan.

Signal Generators

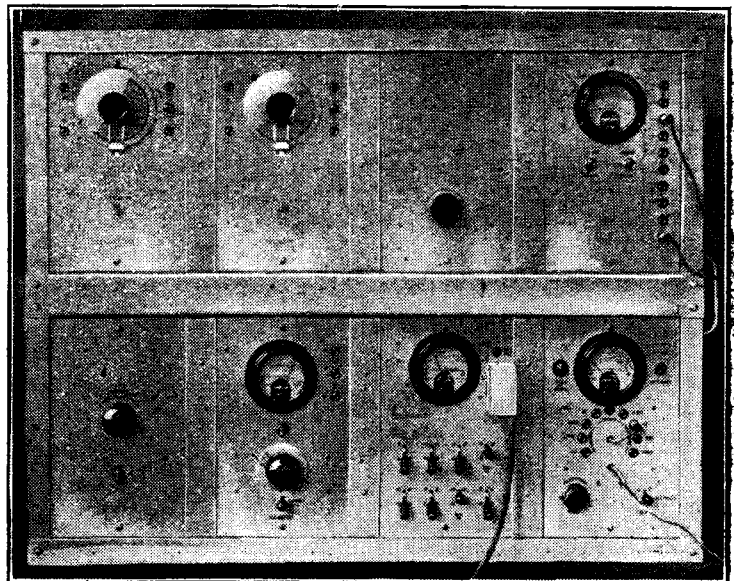
Signal generators and service test oscillators are finding an increasingly wide market, and new models were shown by Muirhead and Co., Ltd., and Standard Telephones and Cables, Ltd. The Muirhead instrument, Type 5-A, is designed for the service man, and covers the usual medium, long and intermediate frequency ranges, and is provided with internal modulation of fixed frequency. The Standard Telephones signal generator is of a more ambitious type, and is particularly well suited for use in works development departments. Unit



Muirhead type 5-A service test oscillator.

construction has been adopted, and the instrument is designed to run from A.C. mains. A dynatron radio-frequency oscillator is followed by a screen-grid amplifier, and the output is monitored by a valve-voltmeter built into the instrument. This is followed by a "T" type variable attenuator giving a loss of 120 db. in 2 db. steps. The R.F. oscillator may be modulated internally at 400 cycles or by means of an external variable L.F. oscillator. The output from the set under test is connected to a rectifier-type meter calibrated in decibels, and the load impedance is variable in steps from 1.5 ohms upwards. To complete the equipment one panel is devoted to continuity tests and measurements of voltage and current in the receiver.

The Standard Telephones Model 74300 A.C. mains-operated L.F. oscillator, which is suitable for providing external modulation for the signal generator, has been redesigned, and is now fitted with rotary-

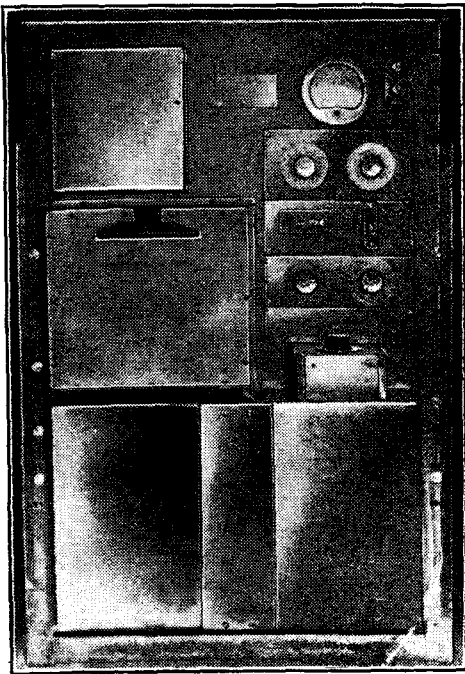


Standard Telephones signal generator for overall receiver characteristics.

Wireless at the Physical Society's Exhibition—

type decade condenser switches in place of the miniature tumbler switches fitted to last year's model. This instrument is of the self-oscillating type, and the harmonic content does not exceed 2 per cent. between 200 and 10,000 cycles, or 7 per cent. from 200 down to 20 cycles.

It is well known that it is very difficult



Ryall-Sullivan precision heterodyne oscillator (0-12,000 cycles).

to obtain purity of wave-form in the heterodyne type L.F. oscillator, but an extraordinarily low value of harmonic content has been achieved in the Ryall-Sullivan precision heterodyne oscillator shown by H. W. Sullivan, Ltd. This instrument, which has been developed by Dr. L. E. Ryall, of the Post Office Research Laboratories, has a range of 0-12,000 cycles. The oscillators are of the dynatron type, and the frequency stability, which is of the order of 1 cycle per second per diem, is independent of variations in power supply and load. For output powers of the order of 50 milliwatts the harmonic content at all frequencies is less than 0.3 per cent., and the variation of output with frequency over the entire range is within 0.1 db.

Although designed primarily for use on telephone lines, the direct-reading attenuation meter made by the Salford Electrical Instrument Co., Ltd., is of interest. It is of the diode rectifier type, and is associated with an amplifier and a reflecting type galvanometer, the curved translucent scale of which is built into the front panel. Accurate adjustment of the zero is obtained by means of a second diode in shunt with the output load, and the range of the instrument is 0 to -45 db.

As was the case at last year's Exhibition, the cathode-ray tube occupied an important place among the exhibits. A very compact oscillograph unit was shown by the Edison Swan Electric Co., Ltd. The overall dimensions of the steel carrying case are 24in. x 8in. x 15in., and the axis of the tube is inclined to facilitate viewing. A linear time base circuit making use of a mercury-vapour relay is incorporated in the instrument, and a "locking" control is included to ensure a stationary image.

The Standard Telephones cathode-ray equipment has been extended by the addition of a special film camera working in conjunction with the existing cathode-ray unit. Ordinary cinematograph film is used, and continuous records with film speeds up to 10 ins. per second (36 ins. per second with an external drive) may be taken, or the film may be moved forward one frame at a time for photographing stationary wave-forms. Sections of film may be removed in a light-tight box for development as desired. Other interesting cathode-ray exhibits on the Standard Telephones stand included a demonstration of the possible use of the Micromesh "Tunograph" as a miniature cathode-ray tube with external magnetic excitation. It was interesting to contrast this miniature tube with the Cambridge Instrument high-speed cathode-ray oscillograph, which employs an anode to cathode potential of 10-70 kilovolts, and is capable of making photographic records of transient phenomena having a duration of less than one-hundredth of one micro-second.

New Components

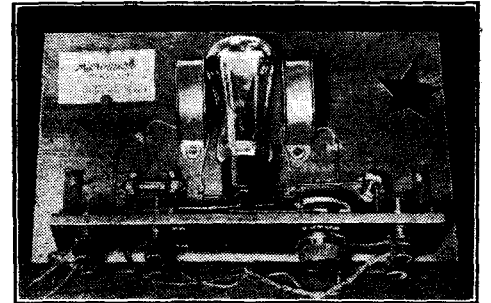
There were several exhibits of direct interest to the set constructor. On the Dubilier stand, for instance, a new reversible dry electrolytic smoothing condenser for D.C. and universal mains receivers was demonstrated. No damage can result from accidental reversal of the mains polarity, and a much more compact condenser for a given capacity is obtained than with paper types, which have hitherto been used in sets of this type. For the home constructor there is an 8-mfd. 275-volt working model in an aluminium case at 7s. 6d., and a series of waxed carton models for the manufacturer.

On the Marconiphone stand a demonstration of the copper voltammeter method of measuring the average H.T. current of a superhet. A.V.C. portable was in progress, and an experiment showing the increase of voltage magnification with the

latest battery variable-mu pentode valves was also shown.

The Westinghouse exhibit included the new low-capacity type WX "Westector," designed for use on frequencies up to 1,500 kc/s, and an experimental type of high-voltage rectifier suitable for the H.T. supply to cathode-ray tubes.

The application of high-permeability alloys to output transformers is a new



Experimental miniature oscillograph using the Micromesh "Tunograph" with external field coils.

development of which more is likely to be heard in the future, and the Telegraph Construction and Maintenance Co., Ltd., were exhibiting an output transformer with a mu-metal core having a characteristic flat within 0.1 db. from 20 to 12,000 cycles. It is interesting to learn that mu-metal covered three-ply is now available from Venesta, Ltd., for the construction of screening boxes. This material should prove invaluable for the screening of cathode-ray apparatus from external magnetic interference.

New Output Valve

A NEW valve of particular interest to the battery user has been announced by Marconi and Osram, and it is claimed to offer important advantages over other types. It consists essentially of two identical pentodes mounted in a single glass envelope, and it is intended for operation in the quiescent push-pull system.

In its action, the valve differs in no way from previous Q.P.P. systems employing two separate pentodes. It is, however, unnecessary to match the valves by applying separate potentials to the space charge grids, and this is an important simplification. An even greater point is the saving in cost of the new valve as compared with two ordinary pentodes.

The valve may be used in several ways, but in any case it functions on the Q.P.P. principle. As a result, neither driver valve nor special intervalve transformer is needed as with Class "B." Quality of reproduction is consequently likely to be improved, particularly at low volume.

The ordinary use of the valve, of course, necessitates a push-pull type input transformer, but a special circuit, known as the duo-phase system, enables the valve to be fed from an ordinary transformer or resistance coupling. In this arrangement, the input is taken only to one valve, and the opposite phase input for the other side of the system is derived from an extra winding on a special output transformer.

Full details of the valve are not yet available, but it is understood that the output is over 1,000 milliwatts, and it is hoped to deal more fully with its characteristics in next week's issue.



Ediswan cathode-ray oscillograph.

Letters to the Editor:—

Disturbance or Interference?

Do Transmitters Tire? : An Automatic Control Engineer

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

Disturbance or Interference?

I WAS very interested to read Mr. Stott's letter in your issue of the 1st Dec., and I note that he agrees that some better definitions are needed, but that he does not like my suggestion that the word "disturbance" should be used rather than "interference."

The word "interference" in scientific language is used solely to denote the interference between two wave motions, which in wireless is responsible for what we term "heterodyning." It has, therefore, quite rightly been the custom for several years to refer to one station "interfering" with another when their transmissions overlap, and up to a year ago one understood by the name "interference eliminator" some device intended to improve selectivity or to cut out heterodyne whistles.

It therefore seems a great pity to me that the word "interference" was ever extended to cover single or repeating transient noises resulting from the operation of electrical apparatus. Some six months ago I had hopes of securing agreement to use the names "disturbance" and "disturbance suppressor" to apply to these noises and to apparatus intended to reduce them. Unfortunately, however, the I.E.E. chose the word "interference," and this has made it difficult to keep to the word "disturbance." I still think, however, that it is not too late for this desirable change-over to be made.

As an example of the chaos which now exists, I would point out that an inexpensive little device was recently advertised as an "interference eliminator," and I am afraid that many thousands of people must have bought it in the hope that it would cut out mains disturbance. Actually, it was purely a selectivity device, and one cannot accuse the advertiser of misrepresentation, as the name "interference eliminator" was applied to selectivity devices long before the public ever heard anything about mains-carried high-frequency noises.

In order to clean up our nomenclature and know definitely what we are talking about, I would go so far as to suggest that the double-meaning word "interference" should be dropped entirely, and I put forward the following suggested classifications:—

1. Devices intended to prevent overlapping of broadcasting stations should be called "selectivity devices" or "selectivity units."
2. Devices intended for connection to or in the electric supply for the suppression of parasitic noises on the mains, or radiated from electrical plant, should be called either "disturbance suppressors" or "mains filters."
3. Devices intended to reduce the parasitic noises picked up on the aerial and earth systems by either screening or balancing methods should be classified either as "screened down leads," or the more scientific name, "screened transmission lines."

While on this subject I would commend

the general use of the following definitions, which are used by the Post Office, in dealing with this question. They use the word "aerial" to apply only to the horizontal part of the aerial, the remainder being the transmission lines. They divide the disturbance entering a receiver into two components, namely, "conducted disturbance" for the component, if any, entering *via* the mains lead, and "radiated disturbance" for the component picked up by the aerial and earth systems, this latter being sub-divided into "direct radiated disturbance" if picked up direct from its source, and "mains-borne radiated disturbance" if carried by the mains and re-radiated from the house wiring, this latter being the type which is responsible for 80 to 90 per cent. of the cases which the Post Office have been called upon to diagnose.

I think that *The Wireless World* could do a great deal towards getting suitable nomenclature universally adopted.

Enfield, Middlesex. E. M. LEE,
Belling & Lee, Ltd.

Do Transmitters Tire?

NO, transmitters do not tire, but I am inclined to agree with your correspondent that an "earth" may deteriorate.

It was my good fortune to be responsible for the erection of a wireless station near London, and we used a capacity earth; it is of interest to note that whenever the earth insulators were cleaned we got more aerial amperes.

This station used a multiphase valve transmitter, and during the period it was in use no deterioration was observed; in fact, by care of the balanced earth greater radiation and range were obtained. It would be interesting to hear from the Post Office what is their experience of a buried earth at Rugby.

N. H. HAMILTON.

YOUR leading article in the issue of December 15th and Mr. Dinsdale's letter have interested me very much, although it is some considerable time since I have taken any practical interest in transmission.

No doubt many other amateurs will agree that it was possible for a transmitting station to increase range rather than lose distance with age, partly due to improved experience on the part of the operator. However, one practical point of interest occurs to me which bears out Mr. Dinsdale's opinion.

Instead of depending upon the conductivity of the earth, copper strips were run under the aerial in shallow channels a few inches below the surface, and buried. The range immediately increased fully three times without any alteration being made to the transmitting apparatus and the power input. This range at the same power was maintained for many months, maintaining contact with the same station in America.

Correspondence, which should be as brief as possible, should be addressed to the Editor, "The Wireless World" Dorset House, Stamford Street, S.E.1, and must be accompanied by the writer's name and address.

I would like to suggest that an experiment of this nature on some B.B.C. station, particularly North Regional, which was phenomenally good at the beginning, and is now particularly weak, might be of interest to many and a general benefit to a large number of listeners.

I shall be extremely interested to hear the opinion of others on this subject.

W. WINKLER, Hon. Sec.
Edinburgh and District Radio Society.

Control

A RECENT letter suggested the possibility of an automatic control engineer; this has already been realised in the United States, where a "volume range compressor" was shown last November at the I.R.E. meeting in New York. This apparatus reduces a 70-decibel range to 35, and could no doubt be made to give other proportionate reductions as required.

The point may, however, have been missed that, although automatic control may be vastly preferable to the average control engineer, or, it would be fairer to say, to the control engineer working under his normal difficulties of insufficient rehearsal and the like, yet a control engineer who is himself a really good musician can subtly improve on the best automatic device. Take, for example, a lengthy *mf* passage ending in a startling *crescendo*; he can greatly increase the effect of this without running over the limit allowable by slowly and imperceptibly reducing the volume of the *mf* towards the end of it so as to have more room for his coming *crescendo*.

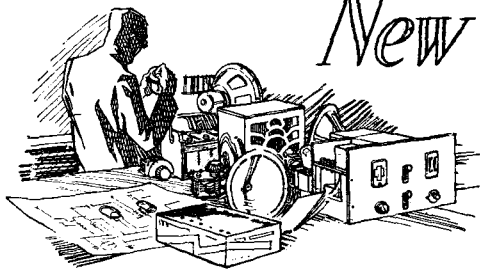
This, of course, means that he must be just about as perfect a musician as the conductor; but why, then, in the name of all that is sensible, not make the *conductor* himself do the job? Is there really any possible defence, other than inertia, for studio performances being given the full volume range suitable to public performance and then scaled down? Exactly the same applies, of course, to studio performances by soloists (except on the organ and, perhaps, in a few rare other cases). And, as for public performances used as outside broadcasts, they are bound to disappear in any case, except where their news value exceeds their musical interest, so it is a relatively unimportant matter how they are treated.

Incidentally, the point should not be missed that the conductor or soloist would, if doing his job properly, also alter the *balance* between the various parts of the audible range so that, when the music is reproduced at the decreased average volume level normally associated with wireless reception, the balance as intended by the composer shall be restored, instead of (as is usually the case at present) performing with this correct balance so that no listener can hear what the composer intended unless he brings his loud-speaker reproduction up to the original level, having, presumably, first moved into the depths of the country or built a sound-proof hall for the sake of his neighbours.

R. RAVEN-HART.
La Ciotat (B. du R.), France.

New Radio Products Reviewed

The Latest Apparatus from the Manufacturers



MARCONI AND OSRAM V.P.21 VALVE

THIS valve appears in the Marconi and also the Osram lists under the same type number, its characteristics being similar in both makes. It is a variable- μ H.F. pentode for battery operation, and the filament requires 0.1 amp. at 2 volts. The normal function of the valve is that of an H.F. or I.F. amplifier in a circuit in which the stage amplification is controlled by a variation of the valve's grid negative potential; this may be manual controlled or regulated by the strength of the signal carrier wave, as in an A.V.C. arrangement.

The normal anode potential is 150 volts, while the screen grid may be given between 50 and 60 volts. It is fitted with a seven-pin base, of which, however, six pins only are used, and these join to the filament, suppressor grid, control grid, metallising and screen grid respectively.

Some specimens of each make were tested and the mutual conductance and amplification measured with several different negative grid bias potentials up to the maximum of -9 volts and with 150 volts on the anode and 60 volts on the screen grid, the suppressor grid and metallising being joined to the L.T. negative pin of the valve. As in the majority of the specimens these values were in close agreement, it will suffice to give the



Osram and Marconi V.P.21 battery variable- μ H.F. pentodes.

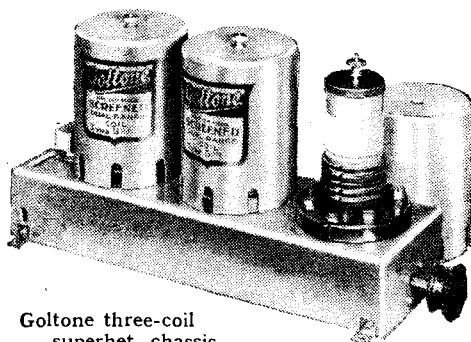
figures for one valve only, this being a good average specimen and not the best of those tested:—

Type.	Grid Bias Volts.	Amplification.	Mutual Conductance (mA/V.).
V.P.21	0	640	1.15
Variable- μ Pentode	-1.5	777	0.84
	-3	790	0.48
	-4.5	655	0.177
	-6	455	0.07
	-7.5	345	0.03
	-9	310	0.017

The average anode current, with zero grid bias, is approximately 3 mA. and the screen grid current 0.9 mA. To obviate grid current damping the valve should be operated with a small minimum grid bias—about 0.5 volt will suffice—and the anode current will then be about 2.6 mA., while the screen current will have fallen to 0.7 mA. The price of the V.P.21 is 15s. 6d.

GOLTONE COIL AND SWITCH CHASSIS

GOLTONE screened coils are now available mounted on a metal chassis in which is incorporated the waveband switches and a mains on-off switch, the whole being operated by a single knob; and any combination of coils up to four in number can be obtained in this form.



Goltone three-coil superhet. chassis.

The specimen chassis examined carried three coils, two type GBS and one type GAC, this combination being suitable for use in a superhet receiver. It measures approximately 10in. long and 3in. wide. Low capacity wave-change switches with self-cleaning contacts are fitted, and the three-position, medium, long and off, are well defined.

The two GBS coils are very closely matched, the inductance being approximately 172 mH. for the medium-wave sections and 2,010 mH. for the long-wave portion, while the values obtained with the GAC oscillator coil were 140 mH. and 1,900 mH. respectively. Using a standard 110 kc/s superheterodyne, condenser tracking was entirely satisfactory.

The inductances of the medium-wave sections on these coils are slightly higher than usually employed now, but we understand that coils of lower value can be supplied if required.

The makers are Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester, and the price is 26s. for the three-coil superhet unit.

MAINS TRANSFORMER FOR THE A.V.C. THREE

A MAINS transformer for *The Wireless World* A.V.C. Three has been submitted for test by the British Radio Gramophone Co., Ltd., Pilot House, Church Street, Stoke Newington, London, N.16.

The transformer has secondaries rated for 275-0-275 volts at 60 mA., 4 volts 2.5 amperes centre-tapped for the rectifier heater, and 4 volts 4/5 amperes centre-tapped for the receiver valves, and tests showed that the output was well maintained at full load. Using the MU12 rectifier valve, an output of

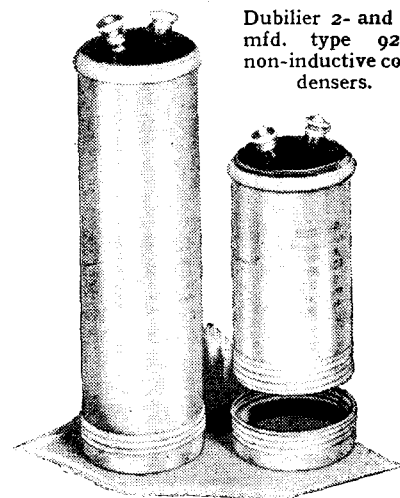
some 290 volts at 60 mA. was obtained. The primary is tapped for 200-210, 220, 230, and 240-250 volts mains, and is electrostatically screened from the secondaries. The transformer is priced at 20s., and can be confidently recommended for use in the A.V.C. Three.

DUBILIER TYPE 9200 CONDENSERS

IN the new range of Dubilier type 9200 condensers special care is taken in the construction to keep the inductance of the condenser as small as possible, for not only is contact made throughout along the edges of the foil, but the wires to the terminals are arranged as a non-inductive pair. This style is now assembled in cylindrical aluminium cases fitted with a screw-on base-board mounting so that condensers can be changed or replaced with the minimum of trouble.

This style is made in eight types, viz., BS, 9200, LSB, LSA, LEC, LSG, LCG, and LBG, the working voltages ranging from 200 to 650 D.C. Capacities up to 10 mfd. are available, and prices are from 1s. 9d. to 17s. each, according to type and capacity.

The several specimens tested were entirely satisfactory in every respect; the test voltage is approximately three times the working potential, and affords a big margin of safety, whilst all capacities are very close indeed to the marked values.



Dubilier 2- and 4-mfd. type 9200 non-inductive condensers.

The makers are Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

Catalogues Received

Rawswood Electrical Company, Preston New Road, Blackpool.—Power transformers, L.F. chokes, H.T. supply units, etc.

J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1.—Short wave converters and modulated oscillators.

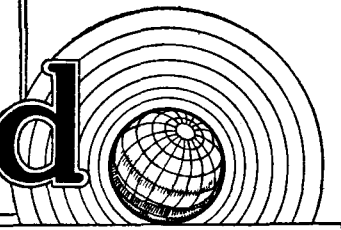
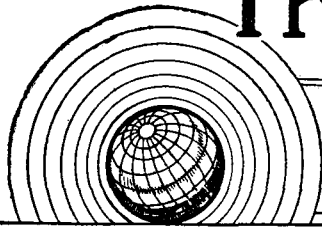
Union Radio Company, Ltd., U.R. Works, Campbell Road, Croydon.—Unirad All-wave superheterodyne receivers, covering wavelengths between 16 and 2,000 metres.

Trevor Pepper, 575d, Moseley Road, Birmingham, 12.—Leaflet concerning Seradex resistors and other components for the "Wireless World D.C. Superhet."

Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware—Hy-Watt wire-wound resistors, with useful abac.

The Wireless World

THE PRACTICAL RADIO JOURNAL
23rd Year of Publication



No. 752.

FRIDAY, JANUARY 26TH, 1934.

VOL. XXXIV. No. 4.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone : Hop 3333 (50 lines).
Telegrams : "Ethaworld, Watloo, London."

COVENTRY : Hertford Street.

Telegrams : "Cyclist, Coventry." Telephone : 5210 Coventry.

BIRMINGHAM :

Guildhall Buildings, Navigation Street, 2.
Telegrams : "Autopress, Birmingham." Telephone : 2970 Midland (3 lines).

MANCHESTER : 260, Deansgate, 3.

Telegrams : "Iliffe, Manchester." Telephone : Blackfriars 4412 (4 lines).

GLASGOW : 26B, Renfield Street, C.2.

Telegrams : "Iliffe, Glasgow." Telephone : Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :

Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

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.

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EDITORIAL COMMENT

Reliability or Cheapness?

Cross Roads for the Set Manufacturer

IN discussing progress in technical developments in these columns something under a year ago, we issued a note of warning in the matter of price reductions of receivers. We said : " Only one aspect of progress need cause us anxiety for the future. There has been a recent tendency to cheapen the product to a point where performance begins to show signs of suffering. There is so much competition amongst manufacturers to-day that commercial success, instead of going hand-in-hand with progress, is tending to come into conflict with it. The ideal should be to give the public the advantage of every new development of importance, and to regard the selling price of the article as a subservient consideration.

" We recognise that price must always remain a very important factor, but we sincerely trust that progress will not be stayed as a result of over-emphasis of the significance of price reduction."

A Timely Warning

It is often instructive to look back to statements of this nature and see whether such a warning has been justified by time. The experience of the last twelve months can only serve to emphasise that not only was that warning a timely one, but that a reiteration of this view, in the hope that it will be heeded for next season's products, would be fully justified. Wireless receivers have reached a very high standard of technical progress, and theoretically they are a finer product than ever before, but from a practical point of view it would seem

that there is much room for criticism. Reports generally confirm that commercial receivers, with certain outstanding exceptions, are requiring far too much servicing after sale, with consequent disappointment to the purchaser. Many cases have come to our notice of late where persons who ordinarily would not have constructed their own sets have done so in order to be sure, by following a dependable design, that at least the material used shall be of good quality and not the shoddy products which we fear so often find their way into the price-reduced commercial sets.

Quality Before Price Reduction

We confidently believe that if the manufacturer of sets would pay rather less attention to price and set out to earn a high reputation for dependability and absence of service troubles, it would be a policy which would not only prove profitable, but would do much to raise the general standard of reception of broadcasting. The responsibility for quality in broadcast reception rests very largely with the set manufacturer. If quality suffers, broadcasting itself will fall into disrepute. Apart from all other considerations, quality of reproduction must suffer with uneconomic price reduction. At the moment, however, the most serious aspect is the unreliability of commercial sets rather than real poverty in actual quality of musical reproduction.

We may summarise our view by suggesting that the set manufacturer has now arrived at the cross roads and must decide whether, in choosing his route for next season, he will proceed along the road to quality or pursue the direction of further price reduction, small profits to himself, and a dissatisfied public.

Eliminating Second Channel Interference

How to Build a Superheterodyne Whistle Suppressor

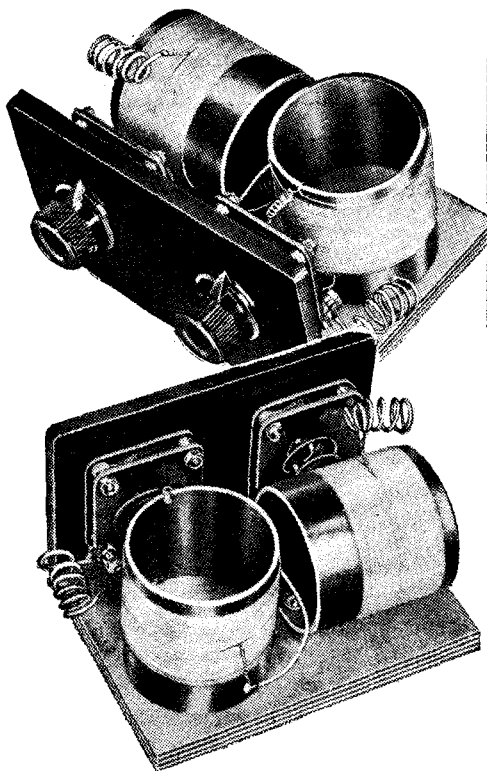
THE superheterodyne is now widely recognised as capable of providing a higher degree of adjacent channel selectivity than any other type of receiver, and, in consequence of this, it has become extremely popular. Although its selectivity is so high, it may suffer from certain special forms of interference which arise through the process of frequency changing, and which, under normal conditions, manifest themselves as whistles. Experience has shown that two tuned circuits operating on the signal frequency and preceding the first detector are sufficient to remove all traces of these whistles other than those for which local stations may be responsible.

Two local stations will normally cause whistles to appear at two points on the tuning dial corresponding to received signal frequencies lower than those of the locals by twice the intermediate frequency; these are the points of second channel interference, and if they are the only whistles that occur they are not of very great importance. In cases where the ganging is not accurately carried out, however, other whistles may make their appearance, and the second channel whistles become unusually strong, for the degree of preselection is then lowered.

Overloading by the Local

The local stations may cause a host of whistles to appear, however, if conditions are such that any valve preceding the I.F. amplifier becomes overloaded, and the ease with which this may occur is not generally appreciated. When a good aerial is used at a distance of ten miles from a modern broadcasting station some 7 volts R.M.S. may be applied to the grid of the first valve when the receiver is tuned to it. This represents a peak potential of 10 volts, which, during deep modulation, may rise to 18 volts. When receiving this station, therefore, the first valve must be biased by 18 volts if grid current is to be avoided. With variable- μ valves a bias of this order will generally be present for local station reception, owing to the necessity for reducing the amplification, so that little difficulty arises here.

Let us consider the conditions when receiving a station on a wavelength close to



THE problem of whistle suppression is one of considerable importance in a superheterodyne which is used close to a local station. The causes of these whistles are discussed in this article, and constructional details are given of an effective and inexpensive whistle-suppressor which is readily applicable to any superheterodyne.

that of the local, however, for then the set will be working much nearer its maximum sensitivity, and the bias on the first valve may not exceed 3 volts. If the station is about 30 kc/s different in frequency from the local, an averagely efficient tuned circuit will reduce the latter to about one-sixth of its maximum value, so that the input to the first valve from the local will be about 3 volts. In addition to this there is the voltage due to the wanted signal and that caused by other interference which may be present at this early stage in the receiver. It is highly probable, therefore, that grid current will flow; amplification will then no longer be distortionless, and the harmonics which are produced can give rise to whistles when they reach the frequency changer circuits.

This is not the whole story, however, for the H.F. stage will give some amplification of the local station even when the signal frequency circuits are not tuned to it. At 30 kc/s off tune, the stage ampli-

fication may easily be 16 times, so that the 3 volts due to the local station at the grid of the first valve become 48 volts at the grid of the first detector. In practice, of course, such a large degree of amplification would not be obtained, for overloading in the H.F. stage would probably curtail it. It is easily possible to obtain a first detector input of 20 volts or so, however, when the set is tuned not to the local but to a station nearby in wavelength. Now the first detector input consists of the wanted signal and the oscillator voltages in addition, so that it can hardly total less than 25 volts, and a bias of at least this figure is necessary for the avoidance of grid current. On the score of efficiency, of course, this is usually impracticable.

Using a Small Aerial

These figures are given chiefly to emphasise the importance of this question of overloading—overloading due to the local station, although the set may not be tuned to that station. It is obvious that a sufficient degree of preselection will remove the trouble entirely, but this is to remove much of the benefit of the superheterodyne in conferring high selectivity in a simple and inexpensive manner through the action of the I.F. circuits. Apart from the question of the local stations, two tuned circuits are sufficient for all second channel interference elimination, and the use of more circuits represents an appreciable increase in the cost of the set.

It has become a common practice, therefore, to reduce the size of the aerial when using a superheterodyne close to a local station, for the maximum input from the local is thereby reduced and overloading troubles are avoided. The reduction in size of the aerial may be actual, or artificially carried out by inserting a small condenser in series with the lead-in. All stations are weakened equally, however, by this remedy, so that more amplification must be employed for their reception, and this may involve an increase in background hiss. What is needed is a method of reducing the strength of the local station without affecting other stations.

We can, therefore, have recourse to the

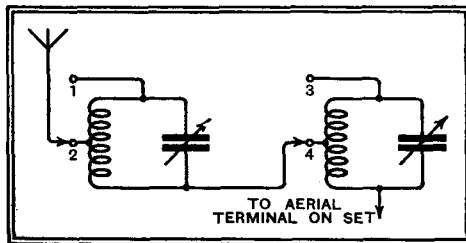


Fig. 1.—The circuit diagram of the unit shows the arrangement of the wavetraps which are used for whistle suppression.

Eliminating Second Channel Interference— familiar wavetraps. If it be tuned to the local it will greatly reduce it and so relieve the early valves from the overloading effect which has been described. Stations on wavelengths close to that of the local will also be reduced in strength, although not to the same extent, but stations widely different in wavelength will hardly be affected, so that the arrangement also serves to reduce second channel interference proper.

The Wavetraps

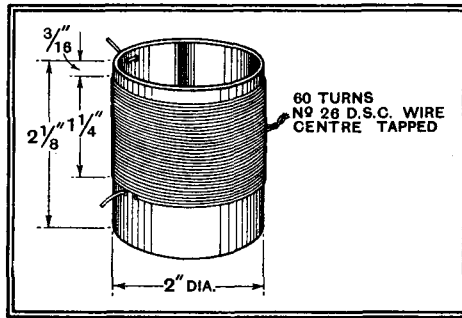
Experience with wavetraps in the past has left many with a prejudice against them, and there is no doubt that as often applied to simple receivers their operation calls for a high degree of skill. With a superheterodyne, however, their adjustment is simplicity itself, and they are extraordinarily effective in reducing all types of whistle interference.

Since there are in general two local stations to cause trouble, it is necessary to employ two wavetraps, one tuned to each station, in order to eliminate whistles. The circuit diagram of a suitable type of unit for adding to any receiver with a low impedance aerial circuit is shown in Fig. 1, and the construction of the unit can be clearly seen from the drawings. Whistles are most effectively suppressed when the whole of the tuned circuits are included in series with the aerial lead to the set, but the maximum weakening of stations adjacent to the locals is then experienced, so that a centre-tap is provided on each coil to permit of looser coupling being obtained. With the aerial joined to the tapping (2) on the first coil, and the low potential end of this coil taken to the tapping (4) on the second coil, the whistle rejection is less, but stations on wavelengths close to those of the locals are less affected. The best arrangement, therefore, should be found by trial.

The unit is inserted between the aerial and the aerial terminal of the receiver, so that no alteration to the latter is required, and its adjustment is extremely simple. At first sight the easiest method of adjustment would be to tune the set to one of the locals, and then tune one of the wavetraps to give minimum signal strength. In practice, however, this is not so, for the tuning of the wavetraps is affected somewhat by the tuning of the aerial circuit.

The best procedure, therefore, is to set each wavetraps condenser to maximum and tune the receiver to a station upon which a whistle occurs. In the London area the second channel whistle from the London Regional usually occurs on the North Regional, and the set can be tuned to this station. One of the wavetraps condensers should then be very slowly rotated from its maximum position. At first nothing will happen, and then a point will be found at which the signal strength and the whistle are both greatly reduced, but their ratio remains unaffected. The wavetraps is then tuned to the received signal, and it is necessary to continue reducing the capacity of its condenser.

Another critical point will be found some distance lower than the first at which the whistle is suddenly greatly reduced in strength, or entirely eliminated, without the strength of the received signal being affected. This is the correct setting.



The construction of the coils can clearly be seen from this drawing. Ebonite, Paxolin or Micanite tubing makes a satisfactory former, and the gauge of wire employed is not critical. Two identical coils are required.

The other wavetraps must now be adjusted, and this is done in exactly the same manner, but with the set tuned to a station upon which a whistle due to the other local appears. In the case of the London National transmitter, second channel interference usually occurs on Poste Parisien or Breslau, and it is a good plan to tune the set to this point. The setting of the condenser of the appropriate wavetraps is now reduced, and as before nothing happens until the setting is reached at which both signal and whistle are reduced. The capacity must be still further reduced until the critical setting for whistle reduction only is found.

Adjustments

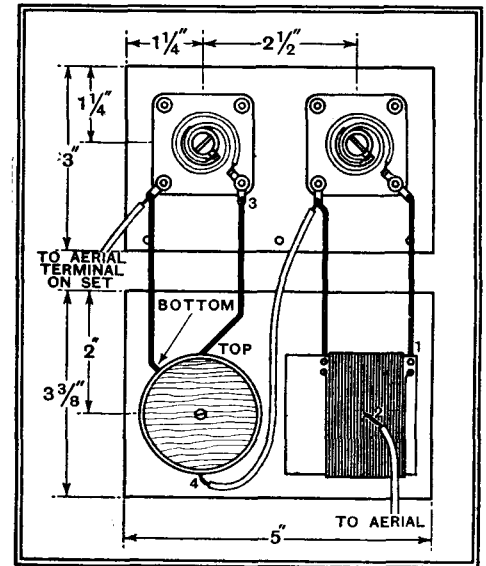
Since the tuning of one wavetraps is almost certain to affect that of the other, it is a good plan to return to the first (longer wavelength) station and readjust the first condenser. Afterwards a re-adjustment to the second wavetraps should be made. It should be pointed out that in certain cases a whistle other than the true second channel may enable a more accurate adjustment to be obtained. In the London area a whistle, due to the London National station, is often experienced on Heilsberg, and the best suppression may be obtained by tuning in this station and adjusting the wavetraps as previously described.

Once these simple adjustments have been made, and they take much longer to describe than to carry out, the wavetraps can be forgotten, for it is not necessary to touch them even when local reception is desired. The reduction of the locals is by no means complete, and enough energy filters through to enable satisfactory reception to be obtained. It may be said, in fact, that it reduces the locals to the level of strong Continental stations. As a result, the use of a local-distance switch is usually unnecessary, and in a set fitted with automatic volume control the strain upon the A.V.C. system in holding down the locals is greatly reduced.

As regards the reception of stations immediately adjacent to a local in wavelength, it has been the writer's experience that this is improved. In general, the reception of Mühlacker at short distances from the London Regional is difficult, not because of any inability to provide adequate adjacent channel selectivity, but because the strong signal from the local chokes up the early valves. It is usually necessary to employ a very small aerial for the reception of this station in order to avoid overloading. When the wavetraps is used, however, this becomes unnecessary, for the reduction in strength which it causes gives a similar effect.

It may be remarked that the unit may fail to function satisfactorily in cases where the aerial circuit of the receiver is of the high impedance type, and an acceptor form of wavetraps would then be better. The vast majority of superheterodynes, however, have low impedance aerial systems, to which the unit is directly applicable. It should be noted that a low impedance aerial circuit is the type in which the aerial is normally taken to a tapping on the first tuned circuit or to a small coil coupled to that circuit. A high impedance aerial system is usually one in which the connection to the first coil is made through a small condenser.

The coils employed can be wound at home in a few minutes, and the only additional components required are two variable condensers of 0.0005 mfd. capacity.



The assembly of components and wiring are illustrated in this drawing. The two coils should be mounted at right angles to one another in order to avoid unwanted coupling.

A Bakelite dielectric type, the Ormond, No. 8 Square Grid Plate R/509 with knob R/355, was used in the original model on account of its small size.

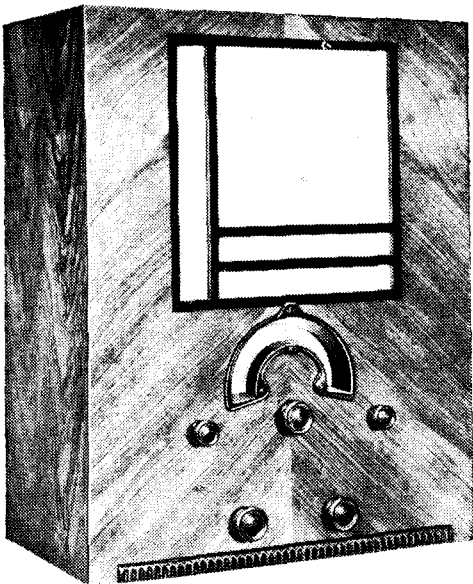
In conclusion, it should be pointed out that the unit is designed for removing second channel and kindred types of whistle, and it will do nothing to reduce steady heterodyne notes caused by an excessively close spacing of broadcasting stations. The unit will reduce, and usually eliminate, those whistles which vary in pitch as the tuning dial is rotated.

The UNIVERSAL A.C.-D.C. III

The Construction of the New All-Mains Set

THE theoretical considerations underlying the design of this new receiver were dealt with in last week's issue, and it will be remembered that the chief feature lies in its ability to operate from any type of lighting supply. In this article the construction, operation, and initial adjustments are dealt with, and some notes are given of the performance obtainable.

By W. T. COCKING



THE employment of a unit in which the coils and variable condenser are assembled greatly reduces the constructional work necessary in this receiver, and in the H.F. circuits there are but few components to mount and to wire. Small fixed condensers are carried by the wiring or by the terminals of other components, and the resistances also are suspended in the wiring, and both the assembly and wiring are straightforward and need little comment.

It should be pointed out that the mains resistance is mounted on the side of the cabinet above the chassis and connected by a pair of twisted flex leads, and that the H.F. filter is also screwed to the side of the cabinet. The method of connection will be clear from the drawings, but it should be emphasised that the mains leads themselves from Ch4 and Ch5 must be kept well away from all other circuits. No fuses are fitted, since they often lead to difficulty through their habit of blowing under the surge current when the set is switched on. Should it be desired to include them, however, they should be joined in series with Ch4 and Ch5 and on the mains side of the chokes. Fuses rated at 1 ampere should prove satisfactory.

Owing to the fact that the chassis is in direct connection with the supply mains, it is recommended that the set be operated only in a cabinet in order to avoid any chance of a shock through an accidental contact with the chassis. For the same reason the grub screws in the control knobs should be deeply countersunk. There is, of course, no risk of a shock under operating conditions if these pre-

cautions be observed, and if care be taken to touch nothing else at the same time it is possible to handle the chassis without any ill-effects. For the adjustment of the ganging, however, it is recommended that an insulated screwdriver be employed.

When setting up the receiver, the connections to R12 should be made in accordance with the mains voltage, and the only adjustments necessary are to the ganging. Even with the circuits ungangd, some station should be receivable, and this should be tuned in on the main dial with reaction at zero, if possible. The volume control should be turned down so that the signal is only just audible, and each trimmer then adjusted for maximum signals.

When this has been done, a weak station on a wavelength below 250 metres should be tuned in, using as much reaction as possible without the set actually oscillating. Each trimmer should then be readjusted for maximum signal strength, and it will probably be found that to avoid oscillation a reduction in the setting of the reaction control is necessary as the circuits come into tune. Should it so happen that this procedure leads to a definite optimum setting for each trimmer and it is possible to tune down to 200 metres, this completes the ganging and no further adjustments are needed.

If it be found, however, that one trimmer is fully unscrewed, all trimmers

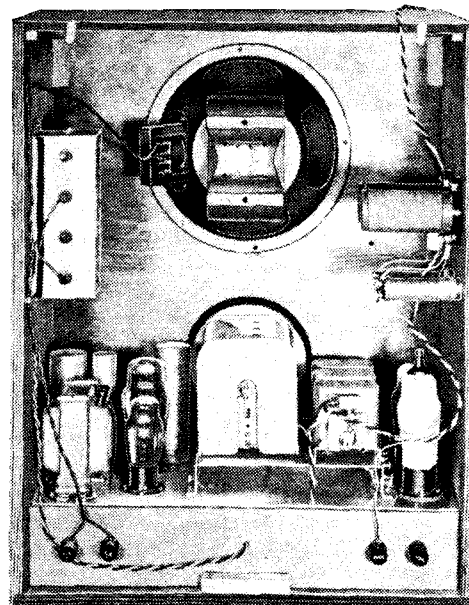
must be screwed up slightly and the station retuned at a slightly lower dial setting. This procedure should be carried out until it is possible to obtain a definite optimum setting for each trimmer such that any increase or decrease in its setting reduces signal strength. Of course, if it

should occur that one trimmer must be fully screwed up, the procedure should be reversed and all trimmers unscrewed somewhat.

It may happen that the receiver can be ganged accurately and yet it will not tune down to a sufficiently low wavelength. Provided that the receiver is correctly constructed, this is a sign that ganging has been carried out using too much capacity in each trimmer. The remedy, therefore, is to unscrew each trimmer slightly and re-gang.

It has already been mentioned that a separate earth connection is advised for the centre point of C15 and C16, and this will usually confer the maximum immunity from mains interference. It is, however, often permissible to join it to the earth terminal on the set and thence to a single earth. No special terminal is provided for the earth lead to C15 and C16, for it is intended that the connection be made with the aid of one of the terminals mounted on the condensers.

A table showing the voltages and currents prevailing in a typical case is included with this article, and it will serve as a guide for checking the operation. It should be understood, however, that the figures obtained depend to some extent upon the mains voltage. With high voltage supplies a general rise in voltage



A rear view of the receiver showing the arrangement of parts in the cabinet. The mains resistance can be seen on the left, and the H.F. filter at the right.

VALVE VOLTAGES AND CURRENTS.

Valve.	Anode Volts.	Screen Volts.	Grid Bias.	Anode Current. mA.	Screen Current. mA.
H.F. : HP 2118	180	80	- 2.5	2.35	0.5
Det. : R 2018	80	—	—	2.4	—
Output: PP 4018	160	180	-22	45	8.9
Heater Current = 0.18 amp. Total Current = 0.23 amp.					
Mains Voltage = 220 volts.					

The Universal A.C.-D.C. III.—

through the set is to be expected. The heater supply, of course, remains substantially constant, for variations here are compensated for by the tapped resistance R12.

The output valve is rated by its makers to deliver an output of 3,400 milliwatts with a load impedance of 3,000 ohms, and an anode supply of 180 volts. The bias required is 22 volts so that the full output is only likely to be obtained on 250 volts mains owing to the drop in the output transformer, the smoothing choke, and the rectifier. On a 200 volts supply, the anode voltage is below 180 volts, and the output is consequently less. Even under the least favourable conditions, however, the output is unlikely to be less than 2,000 milliwatts, which is sufficient for most normal requirements.

Operation and Performance

It should be noted that the valve requires an unusually low value of load impedance, so that the usual pentode output transformer is of incorrect ratio for matching the loud speaker to the valve. The specified speaker is fitted with a tapped transformer giving a number of different ratios, but if a different speaker is used it should be remembered that a triode type transformer will be better than a pentode type, although the valve is actually a pentode.

The selectivity of the receiver will be found to reach a very high order for a straight set embodying only three tuned circuits; it is, in fact, higher than that of many sets with four circuits using less efficient coils. It should be noted, however, that by careful operation it is possible appreciably to increase it by the use of reaction, even although this may be unnecessary from the point of view of signal strength. The selectivity may be increased by reducing the setting of the volume control so that the signal is weaker than is required, and then bringing back the strength to normal by the

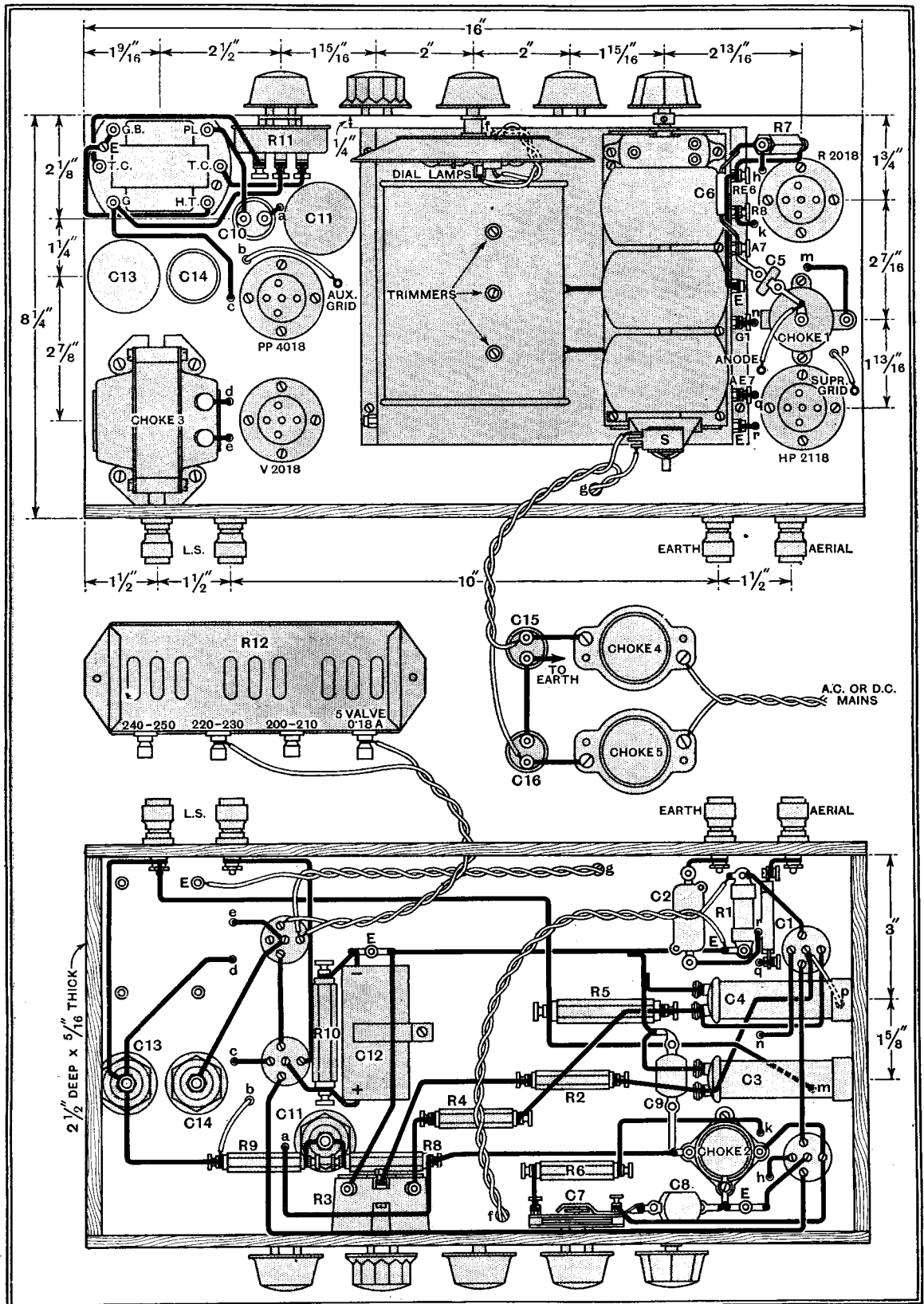
application of reaction while retuning slightly.

This procedure, of course, leads to some loss of quality through the increased sideband cutting which occurs, but it is unimportant in this case, for the relative amplification of the bass and treble can be altered, by means of the tone control, to compensate for it. This control, it should be noted, does not merely reduce the upper register. It will do so at one end of its

travel, but at the other end it permits the amplification of high frequencies to be increased above the normal figure, so that it is possible to obtain adequate compensation for sideband cutting.

It will be noticed that while the wave-change switch assembly includes a radio-gramophone change-over switch, no use is made of this, and, in fact, no provision is made for gramophone reproduction. This has been done because it is felt that the

PRACTICAL WIRING DIAGRAM.



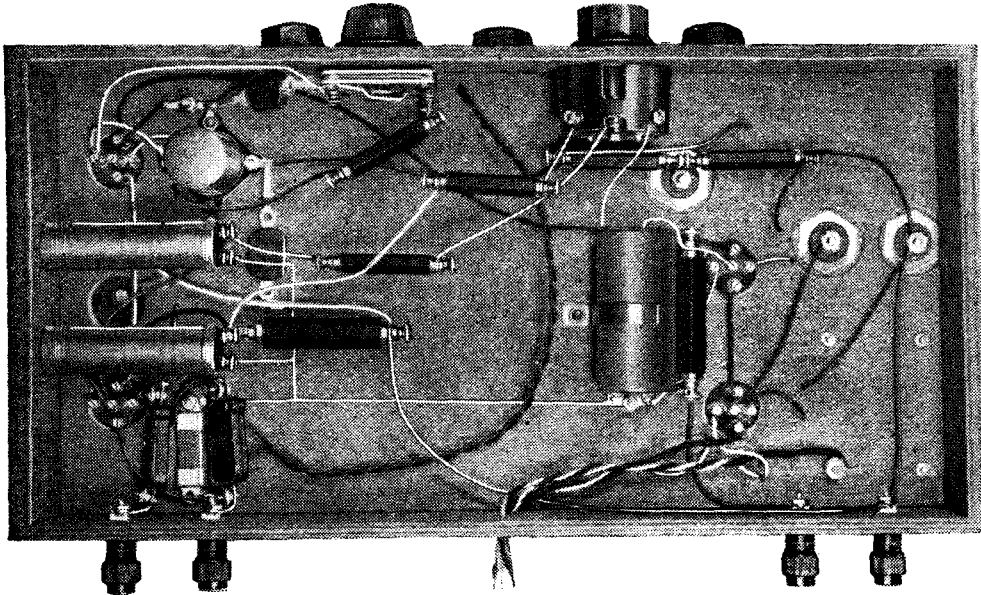
A full-size blue print of the wiring diagram is obtainable from the publishers, price 1/6 post free.

The straightforward arrangement of the wiring and components is apparent from this drawing. The parts shown between the two views of the chassis are mounted on the sides of the cabinet.

The Universal A.C.-D.C. III.—

use of a pick-up with a Universal receiver must at the present time be largely experimental, and that a satisfactory performance might not be obtainable in all cases. The problems involved are chiefly con-

on the medium waveband were available at good strength in daylight, while on the longer wavelengths Huizen, Radio Paris, Eiffel Tower, and Luxembourg were all strong. After dark, dozens of stations were receivable, and very many programmes



This underbase view of the chassis clearly shows the positions of the chief components.

nected with the avoidance of hum, and are due to the long leads which are inevitably present in a pick-up circuit, and to the large external field of the high-voltage heater wiring. The remedies for the avoidance of hum, therefore, would probably vary in different cases.

The receiver has been tested in London on a good outdoor aerial, and it gave a very satisfactory account of itself. Stations such as Fécamp, Langenberg, and Brussels

were sufficiently free from interference to be of entertainment value. The spread of the local station proved to be quite small, and only a few nearby channels were lost.

The volume of reproduction proved adequate for normal needs, and the quality was of a very satisfying order, the tone being adjustable to suit individual tastes by the tone control. Mains hum proved negligible on both D.C. and A.C. supplies.

A specimen receiver built to the specification described in this article is available for inspection at 116, Fleet Street, E.C.4.

NEWS FROM THE CLUBS

Members at the Microphone

Potential microphone stars entertained Slade Radio (Birmingham), at the last meeting, when parties of four members, known only by numbers, spoke into a microphone for three minutes, their voices being reproduced on the loud speaker. The test was for quality of voice, interest of subject and manner of delivery. The two most popular speakers were Mr. C. Game and Mrs. W. Tryhorn. Hon. Secretary: 110, Hillaries Road, Gravelly Hill, Birmingham.

Musical Frequencies

Musical frequencies were discussed by the Technical Adviser of the Croydon Radio Society at a recent meeting, and interesting experiments were conducted with a special home-made oscillator which could emit more or less pure notes.

All communications regarding membership should be sent to the Hon. Secretary: Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

Television in Theory and Practice

The London and Home Counties Section of the Institute of Wireless Technology will hold their next meeting at the Cosmo Hotel, Southampton Row, London, W.C.1, at 6.45 p.m., on Wednesday next, January 31st, when a paper will be given by Mr. H. J. Barton Chapple, B.Sc., entitled "Television—Theory and Practice."

Assistant Hon. Secretary: Mr. B. Hogben, 272, High Road, London, N.15.

Britain's Oldest Wireless Club

The oldest wireless club in the country—the Derby Wireless Club—held its twenty-third annual general meeting on January 11th last when Mr. S. Grimwood Taylor was elected President and Mr. F. J. Cowlishaw Vice-president. The Hon. Secretary is Mr. R. H. Hodgkinson, Field House, Allestree, near Derby.

Wireless in Walworth

The Rodney Radio Club now holds weekly meetings at the L.C.C. Schools, Victory Place, Rodney Road, Walworth, S.E.17. Full particulars are obtainable from the Hon. Secretary: Mr. S. Parr, 18, Harris Street, Camberwell, S.E.5.

Anglo-American Radio Society

Regular meetings are held on Thursdays at the Uxbridge Branch of the Anglo-American Radio and Television Society. All interested in wireless are welcomed and full particulars of the Society will be sent (upon receipt of stamp) by Mr. Leslie W. Orton, "Kings-thorpe," Willowbank, Uxbridge.

For Croydon Enthusiasts

At the last meeting of the Croydon Wireless and Physical Society, Dr. L. E. C. Hughes delivered a lecture on "Acoustics in Radio."

Visitors are heartily welcomed to the meetings of the Society. Hon. Secretary: Mr. H. T. P. Gee, 51-52, Chancery Lane, London, W.C.2.

THE RADIO INDUSTRY

STANDARD TELEPHONES AND CABLES, LTD., inform us that new station dials, calibrated in accordance with the Lucerne Plan, for their S.333 Band-pass receiver (1932/33) are obtainable from Money, Hicks, Ltd., 102-110, Hackford Road, London, S.W.9, at 1s. 6d. each, post free.

A "Standard" battery set, of the H.F.-det.-output type, and with an attractive specification, has just been introduced at the low price of £7 9s. 6d.

We are able to announce the introduction of a new Marconiphone receiver, described as the "Marconi Lucerne Special," which has been designed specifically to provide adequate selectivity for the new allocation of broadcasting channels. The chassis embodies a four-valve superheterodyne circuit, and, in spite of the extraordinarily low price (12 gns. for A.C.; 13 gns. for D.C.), includes special "break-through" and second-channel interference suppressors, an improved moving-coil loud-speaker, and variable tone control. Radiogramophones with the same chassis cost respectively 20 gns. and 21 gns.

Colloidal graphite has obvious attractions for the lubrication of the moving parts of wireless apparatus. The uses of "Oildag"—graphite colloidal dispersed in oil—are fully set forth in a technical bulletin (No. 102.5) just issued by the makers, E. G. Acheson, Ltd., of 40, Wood Street, Westminster, London, S.W.1. Copies are available for anyone interested in the subject.

A full range of Mullard D.C. valves has just been released. Triodes, screened pentodes, double-diode-triodes, and an output pentode are included; heater ratings are either 20 or 25 volts, 0.18 amp.

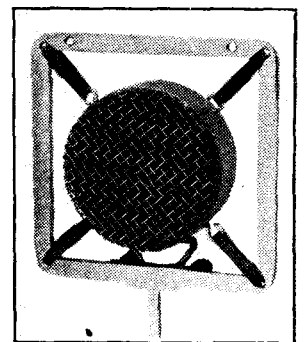
An 8-valve superheterodyne chassis is built into the new G.E.C. radio-gramophone, which includes an automatic record changer. Although the new production is definitely of the "de luxe" type with twin speakers, it costs only 50 guineas.

Richard Cooper & Son (Wolverhampton), Ltd., inform us that they are now prepared to undertake the manufacture of receiver chassis in any of the usual metals and finishes.

Carbon Microphone Developments

AS compared with its prototype of a few years ago, the present-day carbon microphone has been improved almost beyond recognition. In its latest form it has extremely good frequency characteristics, is sensitive, and requires no attention.

Modern developments are exemplified in the new double-cell carbon microphone which has just been introduced by Marconi's Wireless Telegraph Company. The instrument, the cost of which



A new high-quality Marconi carbon microphone.

is relatively low, is intended for broadcast or public address work, and covers a wider band of frequencies than the average condenser microphone; of course, it is much more convenient to use, as no local amplifier is required. The instrument is effectively sealed, and its characteristics are unlikely to be influenced by changes in atmospheric humidity or temperature.

Clearing the Air

The Lucerne Plan in Practice

By "D. EXER"

THERE has now been time to obtain some idea of the way in which the Lucerne Plan is working. On the morning after its first full day's trial some of the less responsible lay papers ran scare headlines about its utter failure. Most of the accounts which followed can best be described as hysterical nonsense. There certainly was confusion on the long waveband on the Monday. But everyone who had followed the march of broadcasting events knew that this was almost inevitable owing to the action of certain stations in appropriating wavelengths to which they had no right. Matters have since improved very greatly, and there is little doubt that the long-wave stations will soon settle down amicably.

On the medium waveband conditions were surprisingly good. If I give the results of my first rather rapid search over the medium waveband on the Monday evening this will be perhaps the best way of indicating how the Lucerne Plan made its bow on the medium waves.

Good and Bad Stations

Working downwards from 549.5 metres, Budapest was received strongly and clear of interference. Beromünster and Athlone were both good and clear, but Stuttgart was jammed. Riga, Vienna, Florence and Brussels No. 1 had no interference, but Lyons PTT had a slight heterodyne. Langenberg came in well; the North Regional and Prague were both slightly heterodyned; Söttens had a vague background of interference; Belgrade was clear; Paris PTT was strong, but accompanied by a whistle.

A Russian station, probably Kiev, was interfering with both Rome and Stockholm; Munich was excellent. Marseilles PTT was quite clear; the Midland Regional was free from interference.

Both Toulouse PTT and Leipzig were strong and clear, though the former is assigned a wavelength shared with Stalino; the Scottish Regional, Milan and Berlin provided magnificent reception; the London Regional was completely clear of trouble; Hamburg was slightly heterodyned; Radio Toulouse was as good as ever; Brno was well received; Breslau was heterodyned; the Poste Parisien came in well; Grenoble was heterodyned; Hilversum, the Scottish National and Bordeaux were all as good as they could be; Frankfurt was perfectly clear. In the neighbourhood of Trieste there was what I can describe only as a mass heterodyne involving a large number of stations.

Most, if not all, of the heterodynes were caused by the inability of stations to adhere exactly to their prescribed wave-

lengths. This is a matter which should right itself as crystal or tuning fork control is installed in transmitter after transmitter.

On the whole, I feel that the Plan has started very well, particularly when the enormous difficulties bound up with its inauguration are considered. There has been a marked improvement on each night after the first, and a prediction that I made recently in these notes has been amply fulfilled. This was that within a few days of the coming into operation of the Lucerne Plan the number of foreign stations receivable clear of interference would certainly be no smaller than it had been under the Prague Plan.



The "Brussels" wavemeter in use at Tatsfield. An important part was played by the B.B.C. checking station during the wavelength change-over.

Readers should note, by the way, that at present Riga is transmitting on 514.6 metres, the wavelength assigned to Madona, whilst Madona is using 271.7 metres, that shown in the lists as belonging to Naples and Kuldiga.

Listening on the Continent

By "Wandering Wave"

Zero hour on Sunday, January 14th, found me and a friend in a Berlin suburb armed with two multi-valve receivers, the one a commercial set with A.V.C. and all the latest luxuries, and the other a home-made receiver consisting of two H.F., one

AFTER the inevitable confusion of the first few days, Europe's broadcasting stations are now gradually adapting themselves to the new wavelengths. Here are two accounts, by observers in Great Britain and Germany respectively, of the manner in which the stations are acclimatising themselves to the new order of things.

detector, and two L.F. stages. One of the sets was kept permanently tuned either to the Deutschlandsender or to Warsaw to obtain the results of the measurements. With the second set we were able to pick up the calibration signals from one station after another. As a preliminary "scoop," we tuned in Königsberg on the international common wave at 11.54 G.M.T. with very little interference, and at 12.15 we were able to log Sweden's most northerly station at Sundsvall. Scottish National, heard at 12.29, had a slight heterodyne. At 12.44 Berlin came up for its preliminary test, followed by the Italian stations.

B.B.C. Official at Brussels

One sensation of the evening was the announcement that the Leipzig aerial mast had caught fire, but at 12.48 we heard the announcement that the outbreak had been subdued. A few minutes after starting transmission, Leipzig retuned slightly to avoid a Russian transmitter. Then general silence seemed to settle down over Europe, intensifying the volume of Juan Les Pins, which maintained a concert by an English company despite strict international injunctions that only those stations to be measured should broadcast. Punctually at 2.30 G.M.T., Radio-Paris started broadcasting the results of the Brussels measurements. These announcements came from Brussels and were given by M. Brailard and Captain Hayes, of the B.B.C., the latter announcing in both English and German. A curious phenomenon at 2.40 G.M.T. was the reception of a German radio drama which was heard very faintly on Berlin's wavelength. Later it was discovered that this was the programme of the German short-wave station which was being picked up by induction.

Another minor sensation was the sudden appearance of Munich a hundred kilocycles above its normal frequency. Later on the station returned to its assigned wavelength.

The first night gave the general impression that, with the exception of the French, Italian, and Spanish stations, all the transmitters had come on to their new wavelengths with extraordinary precision.

Clearing the Air—

On the second night of the change-over I sat alone in a Berlin apartment house with a four-valve home-constructed D.C. mains set, which, I may mention, proved considerably more efficient than the expensive factory-made three tuned circuit receiver which I had used the night before. Tuning in Warsaw, I learned that the Deutschlandsender was changing its wavelength, that Radio-Paris and Daventry were doing likewise, and that later on Daventry and Deutschlandsender would begin broadcasting the results from Brussels, while Lyons PTT and Strasbourg PTT would take over the duty from Radio-Paris.

WHY THE LONG WAVES WAVERED

The following list of measurements on the long-wave band during the first and second nights of the change-over will explain the chaos that resulted:—

	Scheduled Frequency in kc. s.		Actual Frequency in kc. s.	
	Original.	Lucerne.	1st Night.	2nd Night.
Kaunas	155.00	183.00	155.00	155.08
Huizen	160.00	223.00	—	160.00
Lathi	167.00	262.00	—	166.88
Radio-Paris	174.00	167.00	173.87	—
Deutschlandsender	183.00	191.00	194.00	191.00
Daventry	193.00	200.00	203.01	200.00
Minsk	—	208.00	208.00	208.53
Eiffel Tower	207.50	—	—	207.48
Ankara	194.00	183.00	199.45	199.47
Moscow	202.50	175.00	*	201.61
Warsaw	212.50	230.00	211.97	212.00
Motala	222.50	216.00	221.00	220.94
Reykjavik	250.00	183.00	—	260.98
Luxembourg	252.00	1249.00	*	229.91
Kalundborg	260.00	238.00	237.53	237.54
Monte Ceneri	265.00	1167.00	—	1154.30
Oslo	277.00	253.00	—	253.08
Leningrad	350.00	245.00	244.96	241.03

* No transmission.

Perhaps the most astonishing event in this great wave-change has been the attitude taken up by the French Postal Administration in permitting the continuance of transmissions from the Eiffel Tower. Although a signatory to the Lucerne Plan, the French Postal authorities seem to have treated it as a "scrap of paper."

A Luxembourg Disclosure

Another surprise was the appearance of Luxembourg on 1,304 metres. I am



The "Radio Orchestra" at Brussels serves both the French and Flemish transmitters. There are 25 performers.

able to disclose why Luxembourg took this wavelength. The authorities claim that they waited twenty-four hours before transmitting, and then, finding the 1,304-metre wavelength free, appropriated it. They now hope to maintain their position on the grounds of priority. It is quite possible that this claim will succeed, as, under the Lucerne Plan, Poland was to have used this wavelength. However, Warsaw remained on 1,412 metres, when, by complying with the Lucerne Plan, it would have secured for itself freedom from interference. It would appear that Luxembourg has won its first victory.

A very interesting experiment was tried at the Brussels Control Station during the second night after 1.30 a.m. G.M.T. The Zagreb transmitter was obviously unable

to tune exactly to its new wavelength, probably because it lacked an efficient wavemeter. As Zagreb was to be synchronised with Falun, it was important that the waves of both stations should be identical. Brussels, therefore, picked up the carrier wave of Zagreb and "grafted" it on the exact frequency of 401 kilocycles (Zagreb's correct frequency) produced by the wavemeter in Brussels; the resultant beat frequency was passed on to the stations taking the results of the measurements. Unfortunately, Zagreb was still unable to tune to its exact wavelength, and the experiment failed. At the time of writing, Zagreb is now less than half a kilocycle out, but this is enough to cause a bad heterodyne on its wavelength neighbours.

ON THE SPOT

Visits to Foreign Broadcast Stations

XIII.

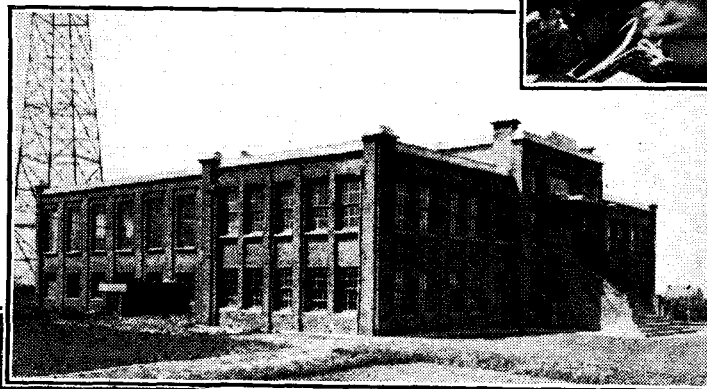
Brussels No. 1
483.9 metres
620 kc/s
15 kW

Brussels No. 2
321.9 metres
932 kc/s
15 kW

YOU approach the offices and studios of the Belgian station through attractive boulevards flanked with modernistic buildings. The precise address is Rue du Bastion, Porte de Namur. Here I received a sort of "S.B." welcome in English, French and Flemish, and I was given a thorough description of Belgian broadcasting. It is modelled to some extent on the lines of our own B.B.C. To solve the bilingual difficulties Brussels has two transmitters, and the same musical programmes serve both. Naturally the spoken programmes are quite divergent. The French



(Above) M. Bracony, the popular announcer in French.



(Left) The transmitter building at Velthem, 15 miles from Brussels.

are relayed from a large concert hall in the Rue Royale, the Rue du Bastion studios being small

and temporary pending the construction of a real Broadcasting House.

Belgian listeners, I was informed, have a bias in favour of light music. Like listeners the world over, they are not backward in criticism, and the station letter-bags are well filled.

The transmitters are situated at Velthem, between Brussels and Louvain, about fifteen miles distant, and are connected by land line. The Rue du Bastion building has a single control room with separate panels for the two transmitters. The equipment is of Belgian design and appears to be remarkably efficient.

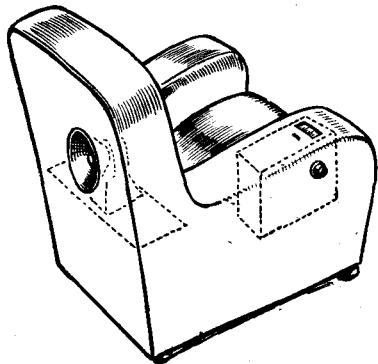
WANDERLUST.

Housing the Wireless Set

More Ideas Contributed by Our Readers

(Concluded from page 41 of last week's issue)

MY idea of convenient accommodation for a wireless receiver is to include it in a Berkeley chair; a small aperture can be provided with thumb drive on the right arm of the chair for tuning, volume control, and part of the side of the arm can be removable to give access to valves and the set.

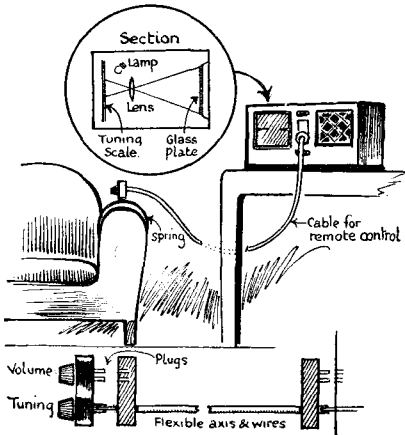


A moving-coil speaker on a baffle can be accommodated in the back of the chair with mains aerial, or frame aerial, or outside aerial all possible. A well-upholstered back would give a box baffle effect and prevent the occupant of the chair from feeling as if he were, in fact, sitting on top of the speaker.

The illustration shows the general idea.
L. M. RICKETTS.

TO arrive at the ideal arrangement for a radio set it is, in my opinion, essential that the following points should be observed:—

- (1) The listener should be able to sit in comfort in an easy chair.
- (2) The loud speaker should be at a certain distance from the ear, allowing the listener to make the best use of the acoustic properties of the room.



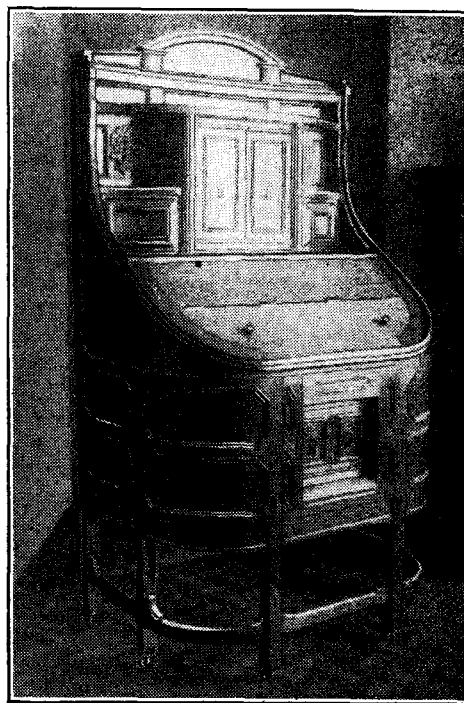
These considerations necessitate some form of remote control for both tuning and volume. Volume control at a distance is easy, as this is electrical, but the mechanical tuning is not so simple. For this pur-

pose my arrangement consists of a flexible cable attached to a slow-motion knob on the receiver; the two wires for the volume control can be carried with the same cable. With modern small tuning scales, if you are sitting at any distance, you cannot see the accurate tuning positions of the stations on the scale, so that the scale may have to be projected on to a glass plate in front of the cabinet, as shown in the sketch.

I do not think that experts will have any difficulty in finding a solution to these problems.

It will be noticed that the knobs for remote tuning control and volume control are mounted on a panel so that they can be operated either direct on to the cabinet or through the medium of the extension leads and cable.
TORE SJÖGREN.

THE accompanying photograph may interest your readers. It shows a bureau containing an all-electric receiver and radio-gramophone. The bureau was constructed entirely by myself to my own



design. The height is 5ft. 6in., 3ft. 6in. wide, and 2ft. deep back to front. Two moving-coil speakers are included, one behind the small doors in the front and another behind the two larger doors over the desk. This latter speaker has the whole of the back surface of the bureau as a baffle board.

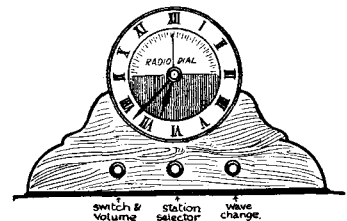
The controls for the set are arranged under the lower leaf of the sloping front and the gramophone gear and pick-up

EVERYONE seems to agree that the broadcast receiver is susceptible to improvement in outward form, and our readers are to be congratulated on their efforts to devise something better. Several original and promising ideas are included in this second batch of designs.

behind, accessible when the second leaf of the sloping front is turned back.

The set may be switched on without opening it up, as the volume control and mains switch are in the left-hand curved door.
A. C. N. SEARLE.

MY design may be of interest for those who prefer that the set should be camouflaged in some article of furniture.



The set is built into a clock case; the speaker is concealed behind an oil painting, which is tilted at an angle from the wall. The speaker wires run round the picture rail so that nothing is visible.
L. C. SPENCER.

THE article on the "Receiver in Outward Form" and your editorial comment on cabinet design were most interesting.

I suggest that the problem should first be approached from the "Fitness for Purpose" point of view, based on the following analysis of requirements:—

(1) The ideal way to operate both radio and gramophone is while seated in an armchair by the fireside so that the instrument is under complete control without the necessity for getting up.

(2) The loud speaker should be so situated that the armchair position is also the best position for hearing the music.

The Ferranti "Gloria Companionette" complies with the first condition but might be deficient with regard to the second.

The usual "all-in-one-cabinet" radio set and radio-gramophone of to-day also fails to comply with (2) and the majority fail in regard to (1) as well. The first *sine qua non* that emerges, therefore, is a separate loud speaker: whether this is housed in a cabinet fitted with a baffle board, placed in a bookcase, etc., is a question of individual requirements.

Housing the Wireless Set—

There would appear to be three ways of complying with (1):—

(a) By remote control of a radio set housed out of sight (in a cupboard, etc.), and by the provision of a playing desk beside the armchair.

(b) By the provision of radio set and playing desk in separate cabinets both placed beside the armchair.

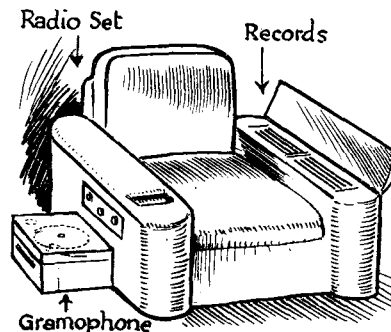
(c) By building the playing desk over the radio set in one cabinet to stand at the side of the chair.

In the house or flat of the future maybe a cubby hole will be built into the wall for the radio set so that at most a new panel would be required by a new tenant.

In the case of the radio-gramophone it is useless to provide armchair control unless handy record storage is also available. Bookshelves may be convenient in radio sets, but in radio-gramophones, if enough space cannot be provided for a reasonably

sized collection of records, at any rate there should be a suitable compartment for a selection of records taken from the separate record cabinet for the evening's programme.

Turning now to the æsthetic and artistic side of the cabinet design, the views ex-



pressed by Betty Joel in the two heavy-type paragraphs in the article cannot, I feel, be improved upon. Far and

away the finest cabinet I have ever seen is the latest design by Mr. H. B. Davey, in which is housed the radio set and playing desk of the Davey reproducer made by E.M.G. Hand-Made Gramophones.

My present instrument is a *Wireless World* Baby Superhet with an amplifier specially designed for record reproduction by Mr. N. Tebbitt, proprietor of Hope, Norman and Co., Ltd., Westbourne Grove. This is a three-unit instrument, and some of the controls are on the front of the radio set cabinet and some are flush-fitted at the L.H. side. I find this arrangement very convenient.

For a two-unit instrument, all controls on the motor-board or some at the side and some on the motor-board, so placed as to be easily handled from the armchair, would probably be a better arrangement.

Why not an armchair radio-gramophone as sketch enclosed?

J. W. S. STANLEY.

News of the Week

Current Events in Brief Review

Portugal Calling

THE new Portuguese State broadcasting station at Lisbon, which is under construction at Barcarena, will begin testing next month on a wavelength of 476.9 metres.

English Programmes from China

BRITISH listeners have a sporting chance of picking up an English programme from China's most powerful broadcasting station, XGOA, Nanking, at 11 p.m. (G.M.T.) on Sunday next, January 28th, and at the same time on the 29th and 30th. The transmissions will be on 455 metres with a power of 75 kW. and will be given under the auspices of the International DX'ers Alliance.

We shall be glad to receive reports from any readers who succeed in picking up these unique programmes.

Talking it Over

THE French daily paper *L'Intransigeant* proposes the establishment of a radio parliament consisting of representatives of the broadcasting interests, technical bodies and ordinary listeners. The discussions would cover the whole sphere of broadcasting in the interests of all concerned.

Music for Dinner

THE sharp contrasts afforded by broadcasting are exemplified in the story of a journalist who recently visited the Greenland port of Umanak. A whale, which had been stranded on the beach, was surrounded by the Eskimo population of all ages who were engaged during the whole night in tearing the oily flesh and eating it raw to the accompaniment of languorous dance music on loud speakers, picked up from a great London hotel.

"Radio Day"

FEBRUARY 11th is to be "Radio Day" in Germany. Special propaganda broadcasts will be made, and it is stated that the day will be one of the jolliest in the history of German broadcasting.

Luxembourg Again

THE strong criticism aroused in French ecclesiastical circles by the abolition of religious talks from Radio-Paris has been stilled by the action of Radio-Luxembourg in according microphone hospitality to the celebrated prelate, Father Lhlande. Father Lhlande's sermons are broadcast regularly from the high-power station.

Busy Amateurs

AN interesting census of British amateur transmitting activity has just been taken. During a period of four Sundays no fewer than 706 different British stations were heard, indicating that 70 per cent. of the licensed amateur transmitters were working. On 40 metres 446 stations were heard and over 200 on 80 and 160 metres. Even on the 5-metre band several stations were recorded.

Radio Society of Great Britain

"ALUMINIUM Electrolytic Condensers" is the title of a lecture to be delivered this evening (January 26th at 6.15 p.m.) at a meeting of the Incorporated Radio Society of Great Britain, to be held at the Institution of Electrical Engineers, Savoy Place, London, W.C.2. The lecturer is Mr. N. C. Moore. Mr. Arthur E. Watts will deliver the Presidential address.

Mr. Watts, the new President, is a leading North London amateur transmitter and has been the Society's publicity manager for several years.

A Record Mast

THE new wooden tower containing an experimental "ground wave" aerial at Mühlacker is nearing completion and will be more than 500 feet high. It will be the highest wooden structure in Europe.

Both Mühlacker and Munich are at present working on temporary aerials. Reception should improve in a few weeks' time.

Hamburg's 100-kilowatt Station

HAMBURG'S new 100 kW. broadcasting station, which began transmission on January 15th, is practically identical in design to the new Berlin-Tegel transmitter recently described. It is situated at Billwärder Moorfleth. The mast is nearly 500 feet high and is a permanent landmark to travellers on the main railway line between Berlin and Hamburg.

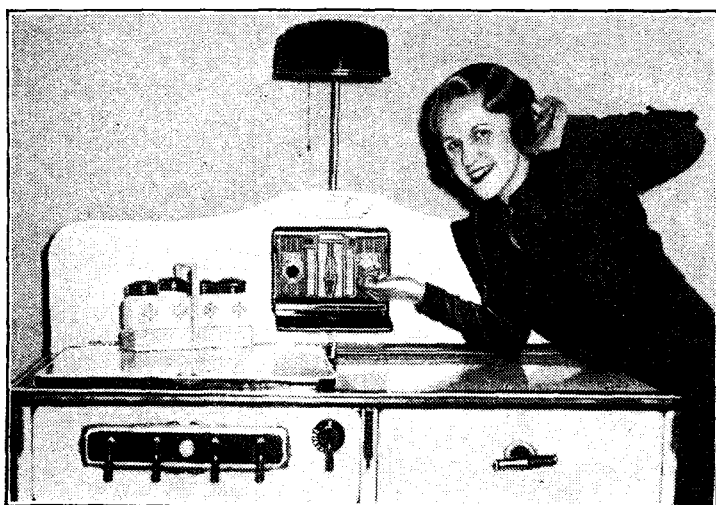
English Talks from Warsaw

MR. THAD ORDON, the Polish journalist whose gifts of books and pamphlets have aroused great interest in his talks from the Warsaw station, will give another talk to-morrow (January 27th) at 9.40 p.m. (G.M.T.). His subject will be "The Beauty of the Polish Mountains."

What's in a Name?

DANISH wireless pirates are congratulating themselves on the removal of a stigma. Hitherto they have been given the description of *tyvelytter*, or thief listener. The new name for unlicensed listeners is *planhevaerkslyttere*, or plank listener. The expression is meant to ally the illicit listener with the people who climb palings and planks in order to have a free view of football matches.

Some 4,000 prosecutions took place last year, yielding a State income of 65,000 kroner.



MRS. BEETON'S WIRELESS SET. At least 100 per cent. improvement in the family cooking should be expected with this radio-equipped stove, displayed at the Chicago furniture mart.

UNBIASED

A Scratch Record

AN enormous amount of correspondence has reached me since my revelation the other week that the gramophone was invented several centuries ago in China.

Such trumpety criticism as I have had to the effect that the stone record arrangement I described could only produce meaningless scratching sounds can be dismissed at once. It should be realised that to the untutored ear such sounds are not readily distinguishable from certain Chinese dialects. Which reminds me of when, in the very early days of the gramophone in this country, I attempted to emphasise the inventive genius of western civilisation by demonstrating this latest wonder to a Chinese native.



Specially for him.

He had listened with stolid patience while I played through a lot of very indifferent recordings. I murmured an apology as I placed on the turntable my last record, which was considerably worn and had an unusually large amount of scratch even for those days. To my surprise, however, his stolid countenance became wreathed in smiles as the playing of the record proceeded, and he thanked me for preparing a record specially for him, containing such truly charming references to the nobility of his ancestors.

An Early Rise

IRELINQUISHED my laboratory work at nine o'clock the other evening to retire to rest, having a very important appointment at 9 o'clock the following morning with an official in a northern city. Just before going upstairs I had the misfortune to blow the household fuses, but I soon replaced them, not forgetting to restart my all-mains bedroom clock before tumbling into bed.

On crawling between the sheets and switching on my electric blanket I immediately sank into that deep repose which scientists tell us is only associated with a clear conscience. At any rate, when I next opened my eyes and switched on the light to see the time I found to my horror that I had overslept badly. It was six o'clock and I had only three hours in which to reach my destination, over a hundred miles away.

By

FREE GRID

Springing into my clothes I ran out breakfastless and, jumping into my car, was soon roaring away up the Great North Road. About two hours later I entered the outskirts of the large industrial city which was my destination. I was pleasantly surprised at finding such a clear road through the streets and mentally gave credit to the municipality for being so much in advance of the metropolis in their traffic arrangements. At the same time, I could not help wondering what had become of the early rising habit of which the people of these industrial cities are so proud, for the streets were nearly deserted.

Arrived at my destination, I found the doors of the City Hall were fast closed. After a few polite knocks I was eventually compelled to beat a tattoo on the door with a spanner, and almost simultaneously I was attacked from the rear by a policeman and from the front by a sleepy-eyed watchman who had suddenly flung open the door.

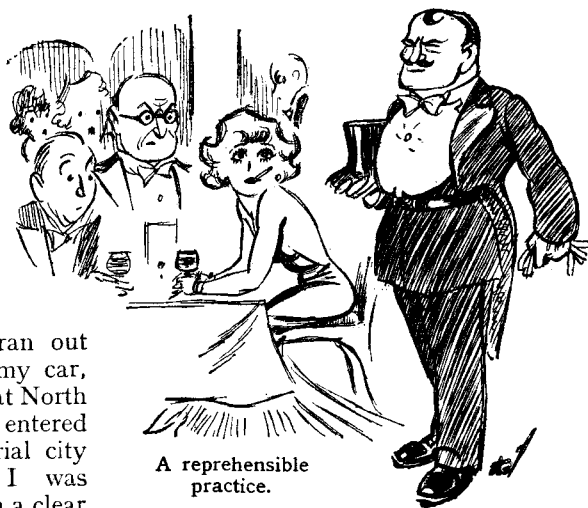
My loud protests were unavailing and I found myself subjected to an ignominious cross-examination in the street.

After some argument it was brought home to me that it was only three o'clock in the morning, instead of nine, as I had supposed, and I realised that I must have risen from my bed and left home at midnight. Following an uncomfortable six hours in the cells I finally kept my appointments in very undignified circumstances.



Uncomfortable six hours.

Not till I reached home did I plumb the mystery of my early rise. The makers of my electric clock had criminally forgotten to provide a one-way starting knob. Thus it was possible to set the timepiece going either backwards or forwards. I can only suppose that, as the result of weariness brought on by honest toil, I must have inadvertently started it off backwards.



A reprehensible practice.

Boiled Shirt Problem

THE other evening I spent a pleasant time in a well-known night club inspecting the elaborate new police alarm installation which had just been carried out by a reputable firm specialising in all types of burglar and such like alarms.

The apparatus was interesting in that, so I was told, it represented the first attempt to use photo-electric cells in this particular kind of alarm. The detection of an ordinary uniformed policeman—or "harness bull" as our American friends so picturesquely put it—is child's play, the photocells being merely connected up to an adaptation of the colorimeter instrument described in *The Wireless World* of December 30th, 1931.

This, of course, enables them to ring the bell whenever a person wearing clothing of the colour and shade of a policeman's uniform passes through the portals of the club.

Matters are more difficult, however, in the case of the plain clothes or rather evening dress sleuths, and the whole idea of photocells would have been abandoned had not some scintillating genius found out that policemen are addicted to the reprehensible practice of placing their boiled shirts over their uniform. Even with the aid of this profound psychological discovery, however, little could have been done if the same genius had not thought of combining the colorimeter principle with X-rays.

The only remaining possibility of trouble was the sounding of a false alarm, which might happen if a member entered the club wearing a blue set of under-clothing or a blue dress shirt. It was felt, however, that such things were seldom done in the best regulated circles.

I am afraid, however, that I rather threw the club officials into a panic by pointing out that when Lord Trenchar's pukka dress clothes policemen are put into service they will dispense with uniform when wearing evening dress.

The authorities of the club have, therefore, asked me to help them out of their difficulty by designing some new method to overcome this difficulty. I appeal to readers to save my prestige by submitting suggestions.

Practical HINTS AND TIPS

ALTHOUGH the superheterodyne system of reception is now so universally popular, it seems likely that a large proportion of readers still confine their activities to "straight" circuits. Equally, a number of those who have built super-

The Superhet in Embryo

heterodynes have followed implicitly a published design without obtaining any real insight into the working of the system. Both kinds of amateur will derive much interest and benefit from

AIDS TO BETTER RECEPTION

ference with neighbouring listeners; if this stage be omitted special care should be taken to avoid interfering.

The various coil assemblies shown in the diagram may be improvised from those in ordinary use in straight sets. Coil L is an ordinary aerial or intervalve winding (depending on whether a preceding H.F. stage be used), while L2 and L3 in the oscillator circuit are respectively

obtain the latest type of Heptode frequency changing valve, there is no reason why the function of the first detector and oscillator valve should not be combined in it for experimental work.

H.T. Voltage Indication
 IN cases where a suitable voltmeter for checking the condition of an H.T. battery is not available, it is worth while remembering that experimental adjustments of grid bias afford a reasonably good indication as to its condition. If, for example, a temporary reduction of grid bias voltage has the effect of improving the quality—and sometimes even the volume—of reception, it can be assumed with some confidence that H.T. voltage is abnormally low.

Long-wave Instability
 IN those cases—fortunately comparatively rare—where an "H.F." receiver is quite stable on the medium band, but bursts into uncontrollable self-oscillation on switching over to the long waves, we can at least assume with certainty that the valve is not at fault. If the internal shielding of an S.G. valve be complete enough to prevent undue feedback on the medium waves, it is certain to be more than adequate at lower frequencies. In probably nine cases out of ten, troubles of this nature are due to inadequate filtering of H.F. energy in the detector anode circuit, and consequent feedback of H.F. energy from the L.F. amplifier—or more probably the loud speaker and its leads—to the aerial end.

In the tenth case, the defect may possibly be ascribed to the use of H.F. decoupling condensers of insufficient capacity.

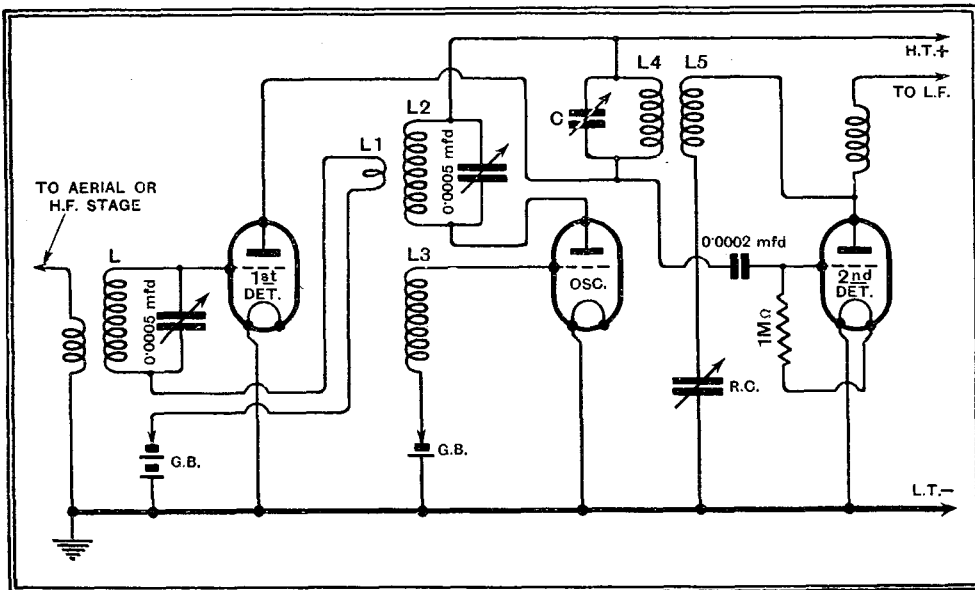


Fig. 1.—Getting to know the superheterodyne: a recommended experimental circuit.

a practical exploration of the process of frequency changing, and it is the purpose of this note to show that the experiment may be carried out with little, if any, apparatus beyond that which usually accumulates in the "junk-box."

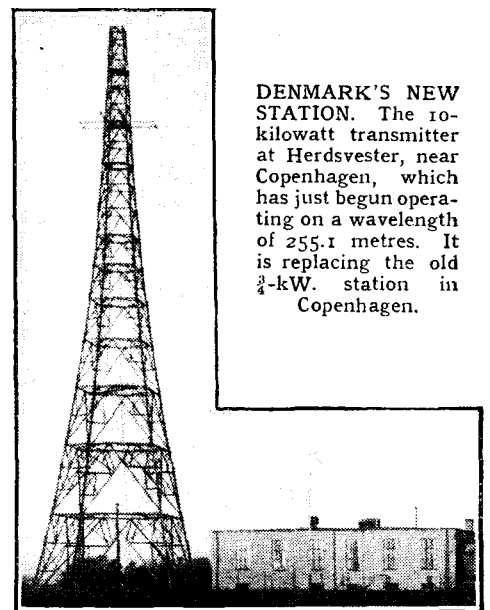
One can hardly do better than to make a start with the simplest type of superhet without an I.F. amplifying valve, but in which a measure of I.F. amplification is obtained by reaction between plate and grid circuits of the second detector valve. The selectivity of such an arrangement is not necessarily of a very high order, but the gain due to the process of frequency changing may be appreciated.

A suitable circuit arrangement for use in experiments is that shown in Fig. 1. First and second detector valves are included, together with a separate oscillator, as it is not recommended that the beginner should complicate matters by trying to make a single valve of the ordinary type perform the function of frequency changing. An L.F. amplifier of practically any type may succeed the second detector, or, if preferred, a pair of headphones may be used in its anode circuit without additional amplification. A preceding H.F. stage is desirable, mainly to prevent re-radiation and consequent inter-

ference with neighbouring listeners; if this stage be omitted special care should be taken to avoid interfering. The tuned and reaction windings of a similar coil. The pick-up coil L1, through which oscillations are transferred to the detector grid circuit, consists merely of four or five turns, and may easily be added. As an intervalve coupling (L4, L5) an ordinary long-wave broadcast coil may be employed, although to work at the usual frequency of 110 kc/s it is necessary to rewind the tuned section L4, using about 50 per cent. more turns than formerly; this coil may be tuned by a compression condenser C. The reaction winding L5 may be that originally fitted to the coil, perhaps with a few extra turns.

Other components do not call for special comment; neither do the valves, as any triodes of the general-purpose type will function satisfactorily. It is intended that the input and oscillator circuits should be tuned by separate condensers; attempts at ganged control may come later, when the experimenter has decided to tackle the superheterodyne question seriously, and to obtain special coils and condensers.

The builder of a set on these lines will not have a "Monodial," but should acquire valuable experience that will stand him in good stead when he decides to go in for something more ambitious. If, in anticipation of doing this, he decides to



DENMARK'S NEW STATION. The 10-kilowatt transmitter at Herdsvester, near Copenhagen, which has just begun operating on a wavelength of 255.1 metres. It is replacing the old 4-kW. station in Copenhagen.

BROADCAST BREVITIES

By Our Special Correspondent

An International Engineer

MR. L. W. HAYES, the B.B.C. engineer who assisted M. Raymond Braillard at Brussels during the nights of the change-over, has not had what the biographers would call a meteoric rise to fame. Famous he is, but the climb has been gradual.

Lucky Discovery

A few years ago he was in the ranks of the control engineers. Then it was discovered that he knew more than Ohm's Law—was quite a linguist, in fact—and the discovery came just at the moment when a highly non-technical little delegation was setting out from Savoy Hill to attend the first wavelength conference at Geneva.

At Every Conference

Since that day Hayes has attended practically every meeting of the International Broadcasting Union. In radio circles he is an international figure, and what he does not know about the "radiosyncrasies" of every European nation, large or small, would go under a threepenny bit.

He is a great personal friend of M. Brailard and also of Herr Geiss, the Chief of the German Post Office and one of the prime sponsors of the Lucerne Plan.

Slick Work

It was Hayes who helped the B.B.C. engineers on the night of January 15th in that very slick piece of business which resulted in the B.B.C. men obtaining a few hours sleep. Originally, the B.B.C. stations were to come up for their final check at 6.25 a.m., but they asked to be checked at 1.30 a.m., being satisfied by then that all British stations were duly calibrated. They won their point.

The Prince's Broadcast

TO - MORROW, Saturday, January 27th, at 6 p.m., the Prince of Wales will broadcast on the subject of "Voluntary Service." It was two years ago—on January 27th, 1932—that the Prince addressed the memorable meeting in the Albert Hall, arranged by the National Council of Social Service, dealing especially with the problem of unemployment and asking that every local community would face up to the problem.

To-morrow, His Royal Highness will broadcast the result of his observations, and will suggest the further opportunities for voluntary service that exist to-day.

High Power for Northern Ireland

SIR JOHN REITH has given his personal approval of the site at Blaris, Lisburn, about ten miles west of Belfast, for the new Northern Ireland Regional station. Although there will be only one transmitter for this Regional station, it will have a power in excess of that employed for the British regionals. No doubt the B.B.C. considers that the fairly close proximity of

Athlone, with its power of 60 kW., demands something out of the ordinary in the North.

The New Wavelength

The new transmitter will take the wavelength of 307.1 metres now used by West Regional, so Athlone will not be troubled by the Belfast wavelength.

A Radio Film

IMAGINE that you have been honoured with a special invitation to the B.B.C. studios and occupy an armchair a foot or two from the microphone. You will then have some idea of the entertainment provided by the British Lion film, "On the Air," which makes its debut in a few days' time.

Last week I was privileged to attend the first showing at the Prince Edward Theatre, and enjoyed the fun of watching how Anona Winn, Clapham and Dwyer, Teddy Brown, Davy Burnaby, Derek Oldham, Betty Astell and other stars viewed themselves on the screen. Nearly all of them were there in person and had every right to be vastly pleased with themselves.



WIRELESS ON THE SCREEN. Davy Burnaby and Reginald Purdell in a radio episode in "On the Air," the new British Lion film to be released shortly. The radio dealer becomes a very disappointed man.

No Depressions

There are some really clever scenes in this "radio musical comedy," as it is called, and no one who enjoys the lighter side of broadcasting should miss seeing it.

The film contains no talks, no news bulletins, no weather forecasts, no depressions and no atmospherics.

The Official Film

Talking about films, I hear that the "official" picture, "Broadcasting House," which Mr. John Grierson was preparing on behalf of the Empire Marketing Board (now defunct) has not been jettisoned. It will be more severe in tone than "On the Air." The "shooting script" is still being prepared, but the question of dialogue does not seem to have been discussed. In all probability the film will be silent in the first place, a descriptive pow-wow being grafted on afterwards.

Too Bad

This arrangement will unfortunately preclude the filming of some of those bright remarks which the staff have been saving up for screen patrons who imagine that life at Broadcasting House is too bureaucratic and devitalised for the survival of human hopes, fears, passions, and other primal instincts.

Close-ups at Droitwich

The film will not be confined to activities in Broadcasting House. The new Droitwich transmitter will be featured. The difficulty in filming radio stations is the lack of movement, and the only spectacular thing about Droitwich will probably be the pounding cranks of the Diesel engines in the Generator Hall. But I have no doubt that a few bustling engineers in the Transmitter Hall and a judicious flicking on and off of the valve filaments will produce a satisfying effect.

Helpful Engineers

Personally, I have always found the B.B.C. engineers ready to oblige when a photograph is to be taken, but they prefer to do the posing themselves. When a Press photographer gets his hands on the control knobs anything may happen, from the blowing of a £50 output valve to the wrecking of a wavelength plan.

Manual Recording

I HOPE to bring you news next week that the B.B.C. has decided to adopt the suggestion in last week's *Wireless World* and to give us a half-hour with the new manual records prepared by Herr Pfenniger.

This art of painting sound tracks on film should have immense possibilities, especially in the Effects Department, and there would be no better way to demonstrate what could be done than by a National broadcast.

100,000 Kilowatts Broadcast!

ONE of the most difficult outside broadcasts yet undertaken will be heard by London Regional listeners on February 23rd, when microphones will tour the Battersea Power Station. The present output of the station is up to 100,000 kilowatts, and the problem will be to screen the broadcasting apparatus in order to secure effective transmission. The B.B.C. and L.C.C. engineers are now studying this question.

Unique Talks Booklet

LISTENERS who are following the Sunday afternoon talks on British art, coinciding with the Burlington House Exhibition, will obtain real help from the finely produced pamphlet on the subject which the B.B.C. has published at the price of 7d. (by post, 9d.). This 32-page book includes a number of excellent photographic plates, together with notes on each of the talks by Mr. R. M. Y. Gleadowe.

Letters to the Editor:—

The Listener's "Birthright"

Do Transmitters Tire? : Disturbance or Interference?

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

The Listener's "Birthright."

IN *The Wireless World* of January 12th, under the heading "Broadcast Brevities," your correspondent jocularly alludes to "every listener's birthright to criticise the programmes." In this instance he is referring, of course, to the Colonial listener, and it brings up a very interesting point.

In the first case, has any listener any "rights"? In this country the listener pays a tax to the Government for the privilege of purchasing a receiver, and there is a gentleman's agreement between the listener and the Government that a proportion of that tax shall be spent in supplying the listener with programme entertainment. Actually, a moral "right" exists, but it is doubtful whether the listener has any legal "right." In the case of the Colonial listener the position is totally different. He has no "rights" at all. He pays nothing for his programme and logic would suggest that he is entitled to nothing. What he is getting, of course, is the result of the expenditure of moneys taken from the home country listener, and this brings up another interesting point, or rather two points. In the first instance, it seems highly improbable that there are more than 20,000 Colonial listeners on S.W. I suppose it is a safe bid to say there has been at least £100,000 spent on the Empire S.W. stations; in other words the listener in this country has spent about £5 per head (probably more) on each of these Colonial listeners. On the principal that the one who pays the piper calls the tune, the listener in this country should be canvassed as to his wishes on this matter, i.e., whether this money should be spent on better programmes for this country or for overseas programmes. Personally, I think the vote would unanimously be in favour of the former.

The second point is that the wireless licence represents an inequitable form of tax which presses much more heavily on the poor than on the rich, and the poor represent the bulk of the listeners. It is the poor of this country who are paying for programmes for Colonial listeners, whose standard of living, generally speaking, is considerably higher than that prevailing in this country. No doubt Empire broadcasts are essentially a matter of political expediency, and in that case the expenditure should not come out of English broadcast funds.

C. CARPENTER.

London, W.C.1.

Do Transmitters Get Tired?

WITH interest I read your correspondent's letter in the current issue, and your editorial under the same heading. May I be permitted to offer a few comments (for what they are worth) on this matter?

Regarding Mr. Dinsdale's suggestion that there might be a sort of H.F. electrolysis of the earth-matter surrounding the ground connection of a transmitter, it seems to me that this is very improbable, since, in the

case of a direct ground connection, the depth of penetration of the H.F. current is hardly likely to be great owing to the skin travelling effect of a low resistance medium; and the area of connection at the grounded point is not a small one (as a telephone "earth"), but already widely diffused before physical contact is made. Furthermore, if there is an electrolytic effect by direct electrical connection, what of a counterpoise return? Possibly it may be suggested that the surface below a counterpoise would be so electrolysed, but this can hardly be the case, since the area of diffusion with a counterpoise is much greater than from a direct earth. A reference to the early text books on the subject of diffusion and propagation of H.F. radiations will possibly clarify my meaning, although I cannot, offhand, remember any particular work to quote.

From experience gained during many years of radio experimental and practical work, I am rather more than inclined to think that such "tiring" of a transmitter is merely the normal effects of cumulative wear

and tear, under which heading one could consider corrosion of radiating wires, loss of liveliness of valves, dust leakages, minute maladjustments of apparatus, absorption of structures erected since station was opened; in fact, a thousand and one small considerations which may amount to a perceptible total with the passage of time. Of course, I shall be corrected for suggesting that dust might accumulate upon insulation in sufficient quantities to cause H.F. leakage; that apparatus can get even very slightly out of adjustment; and that the loss of that delightful original brilliance of valves can be eliminated as a contributing cause, but a little thought and the result of practical ex-

perience weigh the balance in favour of my employing these assertions.

In conclusion, I may add (as a final death-blow to Mr. Dinsdale's electrolysis suggestion) that, when I was operator of a 500-watt broadcasting station in a far corner of the earth some time back there *was* just a falling-off in efficiency after the first few months of operation, although the building upon which the transmitter was situated was a four-storey ferro-concrete structure, and the ground connection was by means of a counterpoise suspended above the tar-covered flat concrete roof. Surely it could hardly be suggested that the whole building was "electrolysed." No, the truth was that just such causes as I have listed above were far more likely to have been the culprits (the matter of valves was actually proved) than anything else.

Trusting to hear some comments from other interested persons. "STATIC."

Birmingham.

Disturbance or Interference?

MAY we again trespass on your columns to reply to Mr. Lee's answer on the "disturbance" or "interference" question.

We admit the scientific meaning of interference; it is not, however, the only one. For example, in a mundane sense, the action of a policeman in stopping a street fight is considered as "interference" by at least one, and often both, of the parties.

It must be conceded that radio is chiefly concerned with entertainment, and we maintain that the harsh, tearing noise superimposed on reception of, say, Sir Henry Wood and the Queen's Hall Orchestra, or on perhaps Henry Hall and the B.B.C. Dance Orchestra, by the refrigerator next door, is just as much an interference with an entertainment as an unexpected and unwelcome fire at a theatre or music-hall. While the fire is an interference with the entertainment it is not a disturbance. Like the refrigerator, it creates in the hall noise to the listener's ears and mind. It is well known that if the set is in a sound-proof room, and the listener leaves (probably in disgust), shutting the door, the disturbance no longer exists there, only an interference in the air-wave motion of dulcet strains in the room by the wave motion caused by the refrigerator. The disturbance is subjective, but the interference is actual. If we witness the street fight it causes a subjective disturbance, but if no one witnesses it, it is still an interference with law and order, but not a disturbance.

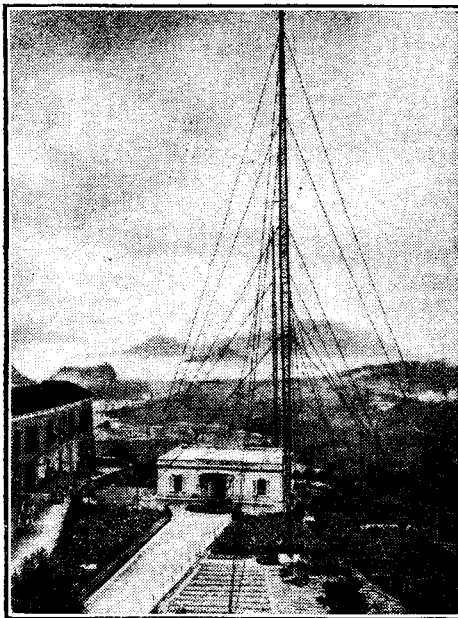
We note Mr. Lee's agreement with us on classification (1), and we would agree to "mains interference filter" for (2). But with regard to his penultimate paragraph, if an aerial is to be considered as a collector, then vertical conductors are often more efficient in collecting than horizontal ones.

The Wireless World could do much to help to get interference, the general word with the general meaning to ordinary listeners and people, properly qualified.

Barking, Essex.

H. T. STOTT,

A. F. Bulgin & Co., Ltd.



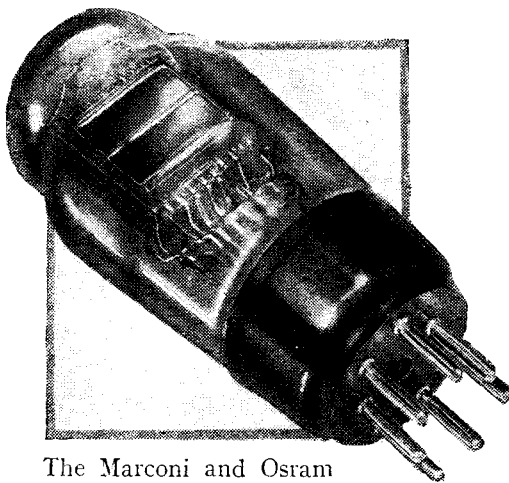
ITALY'S OLDEST BROADCASTING STATION is Naples, seen above. Under the Lucerne Plan, Naples is now working on a wavelength of 271.7 metres.

New Battery Output Valve

The Marconi and Osram Q.P.21

RECENT development in battery valves has largely taken the form of systems which permit a reasonable volume being obtained without an excessive current drain on the H.T. battery. The first step in this direction was taken by the introduction of the quiescent push-pull arrangement, embodying two ordinary pentodes in the output stage. As distinct from ordinary push-pull, the system is characterised by the valves being biased nearly to their current cut-off points, so that in the absence of a signal their anode currents are very low. When a signal is applied, the current consumption necessarily increases, but only to a degree determined by the volume. As the average volume of a broadcast programme is quite small, there is a big saving in current consumption as compared with the ordinary output stage in which the current remains constant at all volume levels. Two push-pull connected valves are necessary with Q.P.P. in order to balance out the distortion which would otherwise occur.

The chief disadvantage of the arrangement was its high cost on account of the necessity for using two pentode valves, and as a result it has largely been superseded by the Class "B" system. This is not unlike Q.P.P., but the output valves are of the triode type, and the pair necessary are obtainable built into a single glass envelope, at a considerable saving in price.



The Marconi and Osram Q.P.21 operates on the Q.P.P. principle, and consists of two pentodes mounted in one bulb and fitted with a seven-pin base. Details of its price are not yet available, nor has the date of its release been announced.

The valve is designed to take 0.4 ampere filament current at 2 volts, and with a 150 volt H.T. supply it requires a grid bias of -10.5 volts. Under these conditions the total quiescent current is 2.6 mA., and the valve is capable of an output of 970 milliwatts, with a load impedance of 24,000 ohms. At 120 volts the output is 570 milliwatts, the current consumption 3 mA., and the valve requires a load impedance of 28,000 ohms.

These currents are of the same order as those found with a Class "B" valve, but it must not be forgotten that a driver valve is not needed, for the Q.P.21 may be fed directly from the detector. A saving of

worked under conditions of no grid current, any ordinary push-pull or Q.P.P. component may be used, and it is only the output transformer which must be carefully chosen. The requirements here are, first, a suitable ratio for the speaker employed; secondly, a low primary D.C. resistance; thirdly, a high primary inductance under instantaneous current conditions; and fourthly, low leakage inductance. Any good quality Q.P.P. component will function admirably.

The connections to the seven-pin base are shown in Fig. 2, and it will be noted that the two space-charge grids are brought out to a single pin. This has been done since it has been found unnecessary to match the two valves by applying different values of screen potential, as in the case of the original Q.P.P. system employing two separate valves. This represents a distinct improvement, and makes it unnecessary to employ a millimeter for matching purposes when setting up the receiver.

As regards quality of reproduction, it is claimed that up to its maximum rated output the system is at least the equal of Class "B," and that it is capable of rather better quality at low volume. A greater maximum output can be obtained from Class "B," of course, but at low volume the Q.P.P. circuit is claimed to be distinctly better. The fact that grid current does not flow, moreover, permits a wider choice of input components.

There seems to be some possibility that the duo-phase system might be applied to it, and this would permit the use of resistance coupling between stages. The duo-phase system, of course, is not unlike the paraphrase amplifier, and the input for one half of the output valve is derived from the output of the other half. Special output components are required, and it is as yet too early to express any opinion on the efficacy of such an arrangement.

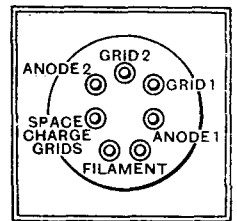
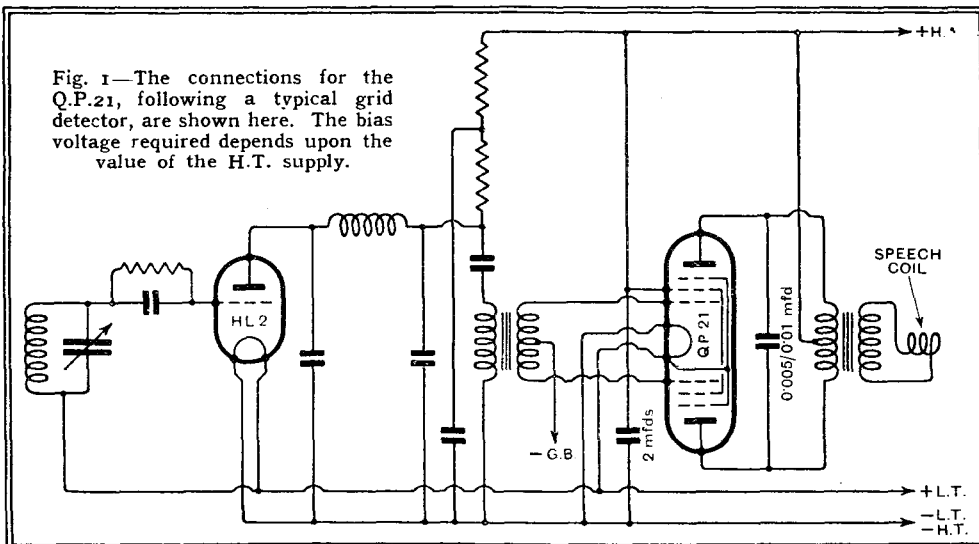


Fig. 2.—An underside view of the valve-holder identifying the connections.



The valves, moreover, are usually worked at zero grid voltage, or with only a small negative bias, so that grid current flows during the application of a signal. A driver valve and a special coupling transformer, usually of step-down ratio, are consequently necessary in order to avoid distortion.

several milliamperes is thus to be expected. In the matter of cost, too, the absence of a driver must be considered.

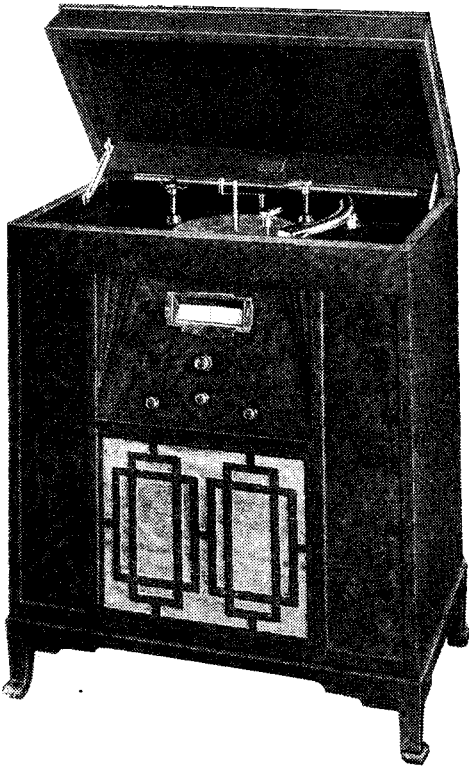
A typical diagram showing the connections for the new valve is shown in Fig. 1, and it is recommended that the input transformer be of high ratio when a grid detector is employed. Since the valve is

The Wireless and Gramophone Trader Year Book and Diary, 1934. (Tenth year of issue.)

The page size has been doubled and in its new form it is more convenient for reference purposes. In addition to the very comprehensive Directory of Manufacturers, Traders and Proprietary Names, the Useful Data Section contains a quantity of technical information of practical use to those engaged in radio-servicing, testing and repair work, including notes on the construction and uses of the new valves. A very useful list is also given of the Supply Voltages available in various towns and districts in Great Britain, Ireland, and the principal foreign towns.

Published by "The Trader" Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1, and supplied to the trade only. Price 5s. 6d. post free.

Haynes Quality Radiogramophone



FEATURES. *Type.*—“Straight” circuit radiogramophone with 15-watt output stage and twin moving-coil loud speakers. *Circuit.*—Variable-mu pentode H.F. stage with band-pass input—power grid detector with reaction.—L.F. amplifier—duo-phase push-pull output valves. Full-wave valve rectification with separate valves. *Controls.*—(1) Tuning with illuminated horizontal scale calibrated in degrees and wavelengths. (2) Volume control and on-off switch. (3) Reaction. (4) Wave-range and gramo. switch. *Price.*—£17 (with automatic record changer, £51 7s. 6d.). *Makers.*—Haynes Radio, Ltd., 57, Hatton Garden, London, E.C.1.

Duo-phase Coupling in the 15-watt Output Stage

secondary winding, a coupling coil for exciting the grid of the second output valve. A push-pull input transformer is unnecessary, as the input is fed only to the grid of the first output stage, and resistance-capacity coupling, with its attendant advantages of good transient response and uniform amplification in the bass, can be used throughout with the exception of the iron-cored output transformer, which is essential in any case. The grid coupling coil is so designed that the primary valve is running well within its capacity when the second valve is fully loaded. As a result, second harmonic distortion is minimised.

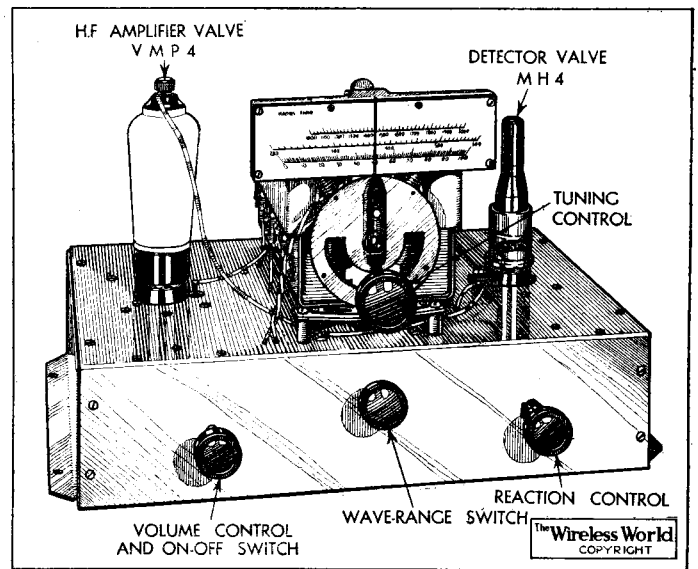
The output valves are preceded by a stage of resistance-coupled L.F. amplification in which a low-impedance power valve is employed. Two U14 rectifiers supply the H.T. current, and the mains transformer is of unusually good quality and size. An electrostatic screen is inserted between the primary and secondary windings and is provided with a separate terminal on the exterior of the transformer. The screen makes an efficient mains aerial, or it may be earthed to reduce pick-up from the mains when using an external aerial. A separate stage of smoothing is used for the output valves, and the H.T. current to the earlier stages is further smoothed by one of the loud-speaker fields, the other being con-

nected in parallel with the supply to the receiver unit.

The latter comprises an H.F. stage in which the latest type of variable-mu H.F. pentode is used and a power grid detector. The aerial circuit is tuned by an inductively coupled band-pass filter, and the input is

THE chassis produced by this firm are not intended to compete with the ordinary run of mass-produced receivers in which a compromise in design and specification has been effected in relation to price. They should appeal especially to those who take an interest in the technical aspects of reception and who are in a position to appreciate the refinements which make for high performance and reliability. The series includes a range of 2½-, 6-, and 15-watt amplifier-eliminators which may be used in conjunction with superheterodyne or straight receiver units to form a receiving equipment closely approximating to one's individual ideals.

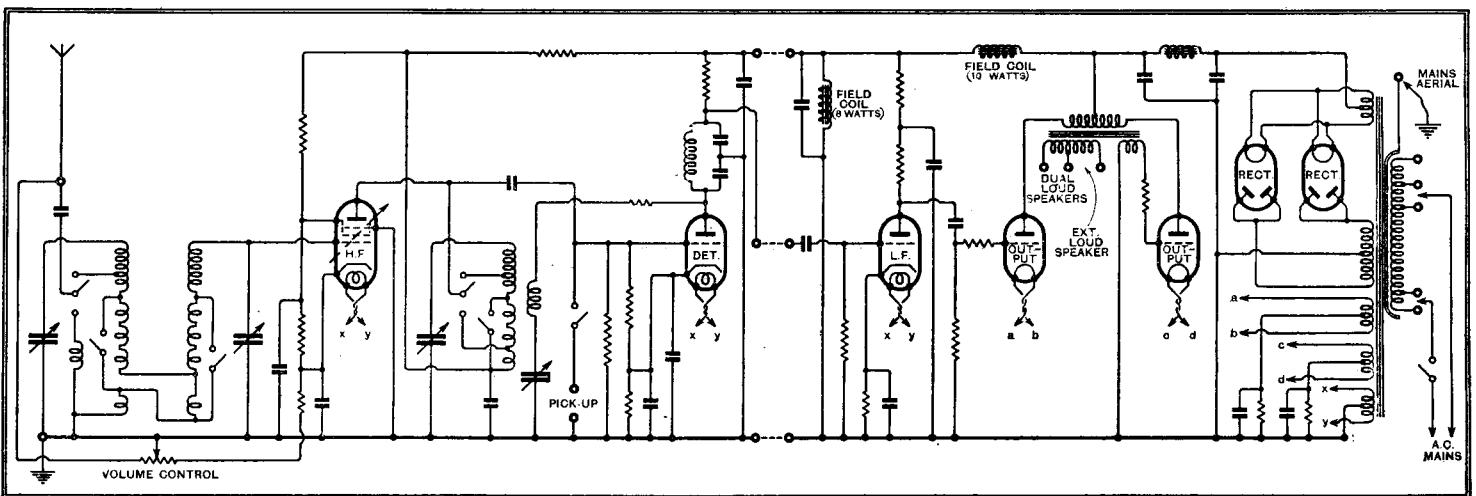
The equipment tested comprised the H.F.-det. Quality Receiver unit and the latest 15-watt duo-phase amplifier and power unit in radiogramophone form with dual moving-coil loud speakers. Probably the most interesting feature of the amplifier unit is the duo-phase output stage, in which two Osram PX25 valves are employed. The anodes are connected through the centre-tapped primary of an output transformer which carries, in addition to the loud-speaker



Ferrocart coils are mounted under the base in the tuner unit, which includes the H.F. and detector stages.

controlled by a variable shunt resistance which simultaneously controls the bias of the H.F. stage. Tuned anode coupling follows the H.F. valve, and reaction is applied to this circuit, which is also tapped down both on long and medium waves in the interest of selectivity.

In order to ensure smooth reaction at



Complete circuit diagram. Duo-phase coupling in the output stages avoids the use of iron-cored transformers in the intermediate L.F. couplings.

Haynes Quality Radiogramophone—

small input voltages, the grid of the detector valve is given a slight negative bias. This is accomplished by connecting a high-resistance leak between grid and earth. As the value of this resistance is high compared with the grid leak proper, it does not affect the time constant of the circuit, but in conjunction with the grid leak it forms a potentiometer which applies a fraction of the bias provided for the gramophone pick-up to the grid during radio reception.

The reaction is, in fact, delightfully smooth, and with its aid a remarkably high degree of sensitivity is at the command of those who like to feel that the results obtained are in some measure proportional to their skill in tuning. Under these conditions the performance is comparable with that given by the average four-valve superhet., but with the reaction control at zero the number of stations available by merely turning the tuning control is still sufficient to ensure a wide variety of programmes of entertainment value.

The use of Ferrocart coils ensures a high degree of selectivity for three tuned circuits, and in Central London, on a full-size outdoor aerial, twenty-two free channels are available between the two Brookmans Park transmitters under the new order of wavelengths. At the moment it is difficult to give definite data for the long waves, but there is no doubt that when conditions are less congested no difficulty will be experienced in separating stations, though slightly more reaction may be required than is necessary on medium waves.

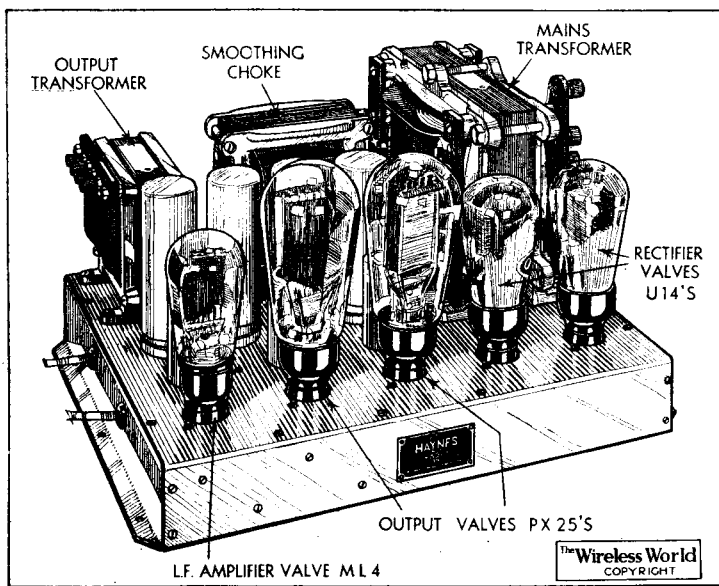
Reserve Output Power

A set with such a wide margin of safety from the point of view of overloading gives unusually satisfying results when operated under normal domestic conditions. Sufficient L.F. amplification is provided to permit full loading of the output stage with an H.F. input well within the capacity of the power grid detector. In the average room, full orchestral effects are possible without the slightest suggestion of roughness on isolated volume peaks. The bass response is particularly good, and the dual Magnavox loud speakers give crisp reproduction in the middle and upper register without letting through the highest frequencies which give rise to mush and heterodyne whistles. Gramophone reproduction is free from needle scratch, and the quality does full justice to the excellence of modern recordings.

The cabinet is built throughout of 3/4 in. solid mahogany, the top and front panels being veneered with walnut. No plywood is used, and the rigidity of construction ensures freedom from cabinet resonances.

To summarise, the Haynes Quality Radiogram should commend itself to the discriminating enthusiast as a sound and straightforward design, executed with

thoroughness both from an electrical and mechanical standpoint. While capable of an excellent performance in the hands of a novice, it gives scope for the exercise of skill in handling, which is absent in the majority of modern commercial designs.



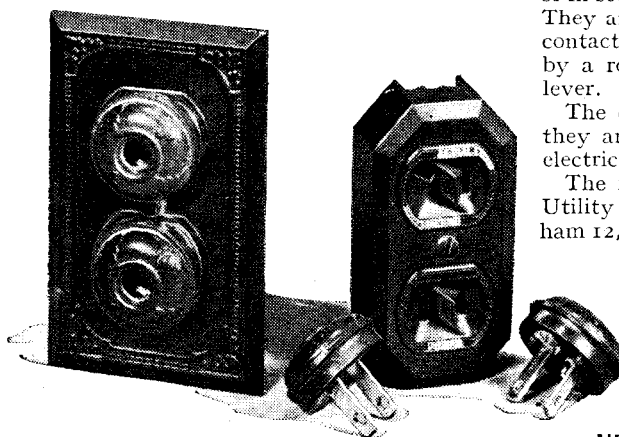
The amplifier-eliminator unit. Twin rectifier valves supply the H.T. current for the 15-watt output stage and the loud speaker fields.

**NEW APPARATUS
REVIEWED**

ARROW FOUR-WAY RADIO OUTLET

THIS device consists of a neat four-way wall fitting to which the supply mains as well as the aerial and earth wires can be joined permanently. Connection is then made to the set by a pair of two-pin plugs, but as these are not interchangeable it is impossible to insert the aerial and earth plug into the mains socket or *vice versa*. Also, the former is non-reversible.

As the metal inserts in the wall fitting are sunk well below the cover plate and contact with these can be made only with the correct plug, the device is a perfectly safe and foolproof one. Two styles are available: one for screwing on to the wall, or



Arrow four-way wall fittings combining aerial and earth and mains sockets.

skirting board, and the other for sinking flush with the wall; the prices are 4s. and 4s. 6d. respectively.

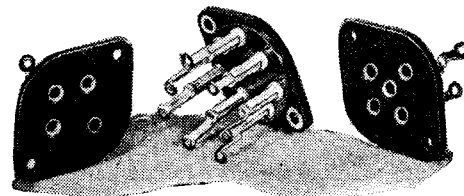
The two sockets are electrostatically screened by a small metal dividing plate, and the bakelite cover has moulded lead-in

guides to facilitate inserting the plugs.

The makers are Arrow Electric Switches, Ltd., Newton Works, Whitfield Place, Tottenham Court Road, London, W.1.

FERRANTI VALVEHOLDERS

THE chassis-type valveholder that has been fitted in Ferranti sets for some time past is now released for general use, and is available in 4-, 5- and 7-pin models, the prices being 9d., 1s. 3d. and 1s. 9d. respectively. These are fitted with resilient sockets having long tags, so that when scl-



Ferranti chassis-mounting valveholders.

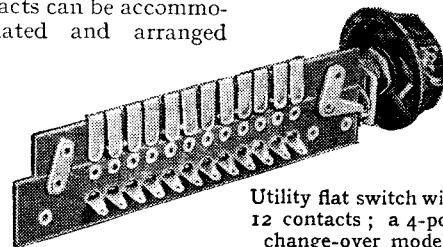
dering the connecting wires there is little likelihood of flux or solder running into the sockets with the possible consequence of bad contact developing.

The body of the valveholder is a flat moulded bakelite plate having a raised disc 1 1/8 in. in diameter, and on this is mounted the sockets. It serves also to position the valveholder, which, incidentally, is intended mainly for use with metal chassis.

The makers are Ferranti, Ltd., Hollinwood, Lancs.

UTILITY FLAT SWITCH

THIS switch has been designed mainly for use in H.F. circuits, and special attention has been given to the avoidance of capacity effect between contacts. These are assembled on a long flat strip of bakelite material, and the depth occupied behind the panel is about 5 in. A total of twelve contacts can be accommodated and arranged



Utility flat switch with 12 contacts; a 4-pole change-over model.

either in pairs, for single pole-single throw, or in sets of three for single pole-change-over. They are interconnected by a set of moving contacts, the carrier for these being actuated by a rotating knob and a small bell-crank lever.

The contacts are made of German silver, they are self-cleaning and make very good electrical contact at all points.

The makers are Wilkins & Wright, Ltd., Utility Works, Holyhead Road, Birmingham 12, and the prices are: 1s. 6d. for a three pole-single throw type, and 2s. for a three pole-change-over style. Several other combinations can be supplied, and units can be coupled together, thereby affording a multiplicity of switches operated by a single knob.

NEW UNIVERSAL AVOMETER

IN the review of the New Universal Avometer published in our issue of January 12th last, the extent of the A.C. ranges were, unfortunately, incorrectly stated. The six current ranges extend from 500 microamps to 12 amps, while those for voltage measurement cover from 50 milli-volts to 1,200 volts.

Further, it should be noted that the lowest resistance measurable is 0.1 ohm.

Long-wave Trimming

WE are asked to enumerate the possible causes for failure to obtain accurate "ganging" on the long-wave side in a receiver where no perceptible divergences in circuit alignment can be detected over the whole of the medium waveband. The operation of trimming was carried out, as usual, at the lower end of the medium band.

Inaccuracies in ganging on the long waves can, in the circumstances described, be due only to two causes: (a) inaccurate matching of the long-wave coils, or (b) failure to arrange matters so that an equal proportion of the incidental stray capacities is transferred to each tuned circuit on both medium and long wavebands.

We suggest that our correspondent should carefully consider his circuit arrangement to assure himself that the latter condition is satisfied; if not, the coils might be returned to the makers for checking.

Interference Filter

IT is admittedly quite conceivable that the fitting of the usual type of anti-interference filter (consisting of a pair of condensers in series) may be ineffective in removing interference, but if properly fitted it is hardly possible that the addition could do any harm.

The exception which, perhaps, will prove the rule seems to have been experienced by a reader, who writes to express his disappointment on finding that the fitting of a condenser filter to his A.C. mains receiver has done nothing to improve matters, but, on the contrary, definitely increased background noises.

This unfortunate experience can only be ascribed to the fact that the junction point between the two series-connected condensers (see Fig. 1 (a)) has been connected to the

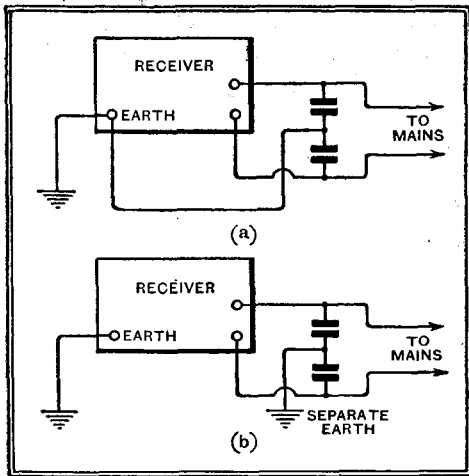


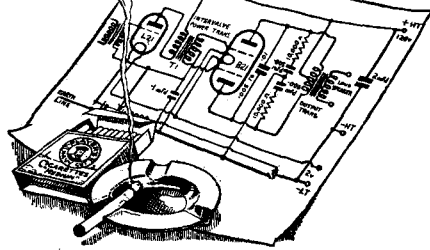
Fig. 1.—It is safer to use a separate earth (diagram b) for an anti-interference filter.

earth terminal of the set. In many cases an earth connection made in this way is quite satisfactory, but experience shows that it is much better to provide a separate earth for the filter—generally made quite conveniently to the metal tubing in which the supply wires are run.

Incorrect I.F.

FOR maximum accuracy in the ganging of a superheterodyne receiver, it is necessary that the frequency of the I.F. amplifier should be that intended by the designer. If the trimming of the oscillator circuit in a superheterodyne fails to hold over the whole wave-range covered it is therefore quite possible that the frequency of the I.F. amplifier is incorrect.

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.

This point is raised by a reader, who refers to a published paragraph giving instructions for estimating the exact I.F. to which the circuits are tuned by observing the frequency of the stations that are subject to second-channel interference. In this particular case there is no local station to give rise to this form of interference, and so information is requested regarding some other simple method of estimating intermediate frequency.

We are afraid that without a calibrated oscillator it will not be possible to make an accurate measurement. However, the right adjustment of the I.F. transformer trimmers can generally be found fairly quickly by trial and error; a change in one direction or the other should be made in the setting of all the I.F. trimmers, and if ganging is then found to hold more accurately it can be assumed that one is working in the right direction.

Coil Matching

WE are asked to describe a method of matching several unscreened coils to a common standard, it being stipulated that no elaborate apparatus shall be used. In spite of this, our correspondent apparently wishes to attain a high degree of accuracy.

On the assumption that all the coils are physically similar—of the same diameter and wound with the same gauge of wire—no difficulty should be experienced in matching with extreme precision, although a certain amount of patience will be required. Generally speaking, the most con-

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.

venient plan is that illustrated in Fig. 2, where a valve oscillator (which may consist of the detector circuits of an ordinary receiver, with the addition of an anode current milliammeter) is used. The receiver must cover roughly the same wave-range as the coil to be matched.

The procedure of matching is as follows: (1) Tune the receiver to a fairly high wavelength; place the coil to be taken as a standard in inductive relationship with the grid coil, and then tune the matching circuit to resonance by rotating condenser C. Resonance will be indicated by a "kick" of the milliammeter needle. Reduce coupling until the meter needle flickers to an extent that is only just perceptible, and note carefully the setting of C. (2) With all other conditions remaining unchanged, replace the standard coil by one of those to be matched, and again tune the test circuit for resonance, which will be indicated by the meter as before. (3) If the setting of

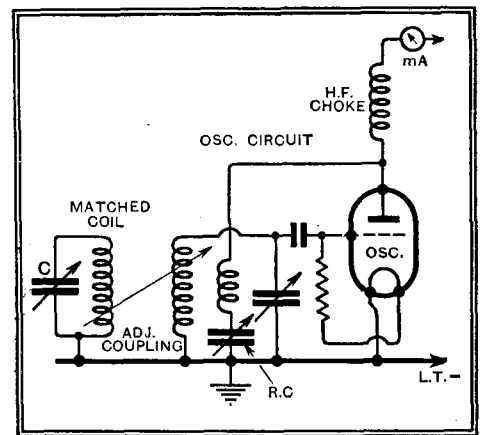


Fig. 2.—Coil matching by absorption: the condenser C may be shunted with a "vernier" to give closer readings if desired.

condenser C (which must be fitted with a pointer or dial) is exactly the same as before, the coil is accurately matched. If C reads high the coil is deficient in inductance, and vice versa. (4) Large discrepancies may be corrected by adding or reducing turns, but small errors may best be corrected by "spreading" or closing together the end-turns of the coil.

In matching by this method no account is taken of differences in self-capacity, but these do not arise except when widely different coils are to be matched as to their inductance values. It would, however, be impossible to match, say, a frame aerial and a small compact coil in this way.

Open to Criticism

IT is rather difficult nowadays to say a good word for any system of H.F. volume control other than that which operates by varying the sensitivity of the H.F. or I.F. valves. In particular, control of aerial input to the receiver is likely to be unsatisfactory nowadays, especially in high-sensitivity mains sets; the reason is that valve noises remain constant whatever the strength of signals, and so become unnecessarily prominent.

This is in reply to a reader who asks our opinion on the possibilities of an ingenious method which he has devised regulating aerial input without disturbing tuning. The arrangement suggested could no doubt be made to work satisfactorily, but, as applied to a highly sensitive superheterodyne, it would not be pleasant to use.

Volume adjustment by control of aerial input should be confined to simple sets.