The Wireless World

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EDITORIAL COMMENT

Television

The B.B.C.'s Responsibility

IN October last year a rumour got about that the B.B.C. intended to discontinue the 30-line television transmissions when their agreement with the Baird Company expired in the spring. In the following month we said that these rumours, which were still circulating, should not be taken too seriously, because the short-wave transmissions which it was suggested would replace the 30-line television could not be expected to give a service at present, but would at first be only experimental. We went on to say that if a television *service* was to be maintained, it would be by continuing transmissions along existing lines for the present.

The intention of the B.B.C. to curtail the present 30-line transmissions to two instead of more a week has recently been disclosed, their excuse for doing so being based on the assumption that there is insufficient public interest in these broadcasts.

The B.B.C. does not seem to appreciate that so long as they have a monopoly of broadcasting they have also a responsibility to the public in the matter of television. When their more frequent transmissions began public interest was very small, but it has undoubtedly grown, and to-day there are a far larger number of enthusiasts than at any previous time, so that it seems to be a most inopportune moment to suggest a curtailment of the service when no better system has yet been made available to the public. We still regard the high definition transmissions as only experimental, and even if the transmission problems have been overcome, reception difficulties outside the laboratory have not been tackled to a point where the public can join in and take advantage of them.

In this issue we publish an article written by a prominent engineer who has had much experience with the development of television. He states the case for a continuance of 30-line transmissions, and suggests that these transmissions should be used to better advantage. He criticises the present arrangement whereby pictures far too ambitious for the system are frequently broadcast. The 30-line system can be definitely good if the subject televised is sufficiently large, but to try to put over pictures of detail merely serves to discredit the system and emphasise its limitations. In a recent issue a contributor to our Broadcast Brevities column deliberately implied dissatisfaction with 30-line transmissions in order to stimulate protests from those who are really interested in these tests. A large number of post-cards and letters has been received at our offices as a result, and in this issue we have thought it of interest to publish extracts from representative communications.

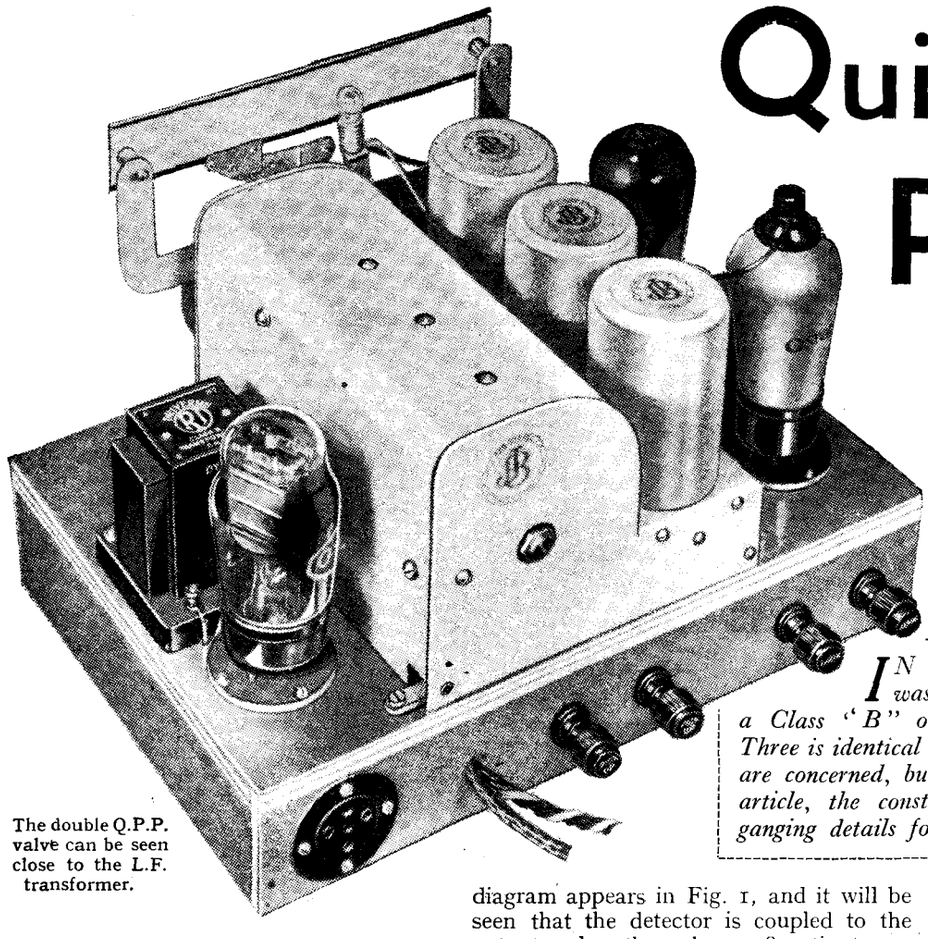
30-line Broadcasts Must Go On

We would urge the B.B.C. to give the 30-line transmission more attention, with at least some transmissions during more convenient listening periods.

High definition transmissions are on their way, but since these necessitate ultra short-wave reception, with a very restricted range for the transmitters, we cannot expect any speedy progress on the reception side, and until the short-wave transmissions can be regarded as giving an equivalent *service* to what is now possible on the medium broadcast band there should be certainly no curtailment of the present facilities.

Quiescent Push-Pull Three

A Battery Receiver Embodying an H.F. Pentode



The double Q.P.P. valve can be seen close to the L.F. transformer.

IN last week's issue the H.F. Pentode Four was described, and this set was fitted with a Class "B" output stage. The Quiescent Push-Pull Three is identical as far as the H.F. and detector stages are concerned, but has a Q.P.P. output stage. In this article, the construction of this set is described and ganging details for both receivers are given.

AT the conclusion of the article describing the H.F. Pentode Four in last week's issue, it was stated that the receiver would be re-described with an alternative output stage. The H.F. and detector circuits of the present set are identical with those of the H.F. Pentode Four, and the only changes occur after the detector. The complete circuit diagram appears in Fig. 1, and it will be seen that the detector is coupled to the output valve through a 1-8 ratio transformer. This component, unlike the driver transformer of a Class "B" system, is of the ordinary push-pull type.

Previously, the quiescent push-pull system has necessitated the use of two output pentodes, and has been rather unpopular on account of the high initial cost of the apparatus. This drawback has now been removed by the appearance of the QP.21, which is a double valve consisting essentially of two pentodes built into a single bulb, and selling at a lower price than the two equivalent separate pentodes. From the point of view of the user, the most important point about it is that it requires no driver valve, and it can be fed directly from the detector, provided that the coupling transformer is of high enough ratio. As compared with a Class "B" system, therefore, fewer components are needed.

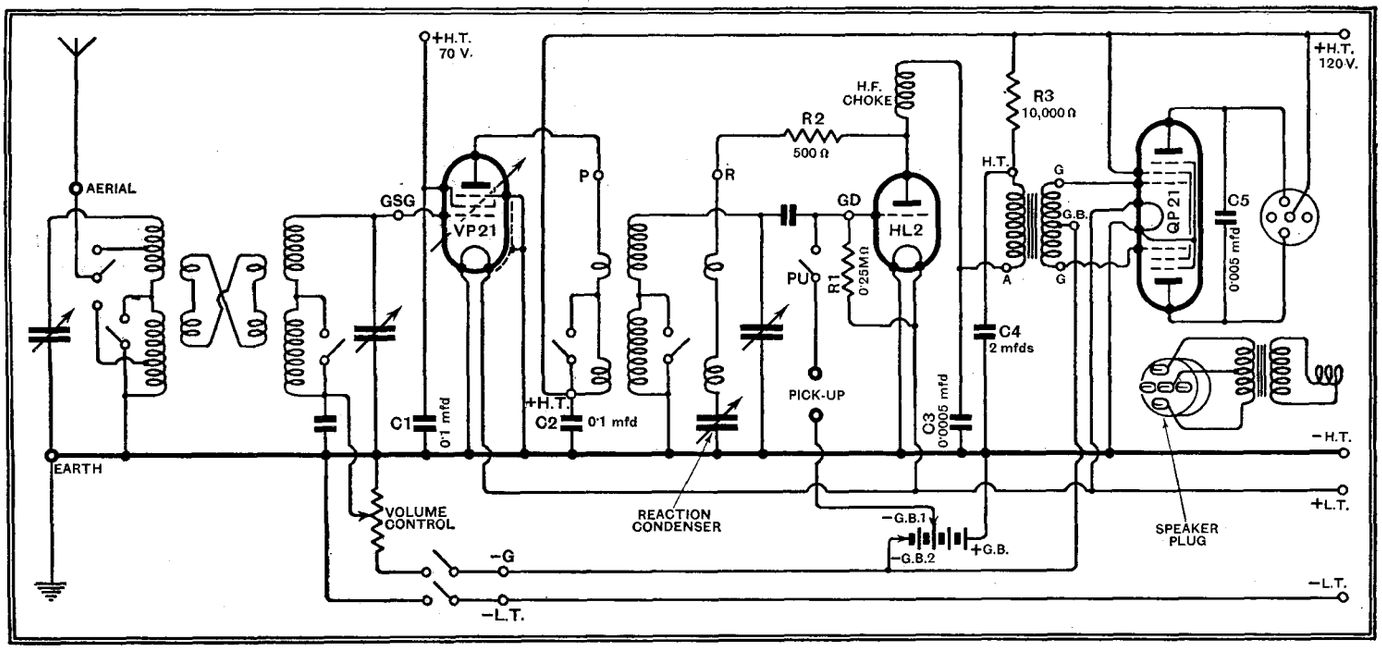


Fig. 1.—The circuit diagram of the receiver embodying the Q.P.P. output stage.

Quiescent Push-Pull Three—

The maximum undistorted output of the QP.21 is less than that of the B.21 when both are operated at the same anode potential. Thus, at 120 volts, the QP.21 will give an output of about 570 milliwatts, as compared with the 900 milliwatts of the Class "B" system. At 150 volts some 970 milliwatts are obtainable from the Q.P.P. valve, and 1,500/2,000 milliwatts from the B.21. The choice between the two systems, therefore, will be dictated very largely by the output required.

One point should be noted specially, however. If an output of some 900 milliwatts be needed, it may be obtained in two different ways. The Q.P.21 may be used with a 150 volts H.T. supply, or the B.21 with 120 volts. The Q.P.P. system thus requires a higher voltage battery, but it imposes a lighter current drain upon it, so that there will probably be very little to choose in the matter of running costs, and a choice should be made upon other considerations. In general, the Q.P.P. system will give slightly better quality of reproduction than Class "B" for an output less than the maximum. At the maximum output, of course, there is no difference, for the output figures are quoted for the same harmonic content in each case. The point is, however, that, as the output is reduced, harmonics fall off more rapidly with the Q.P.P. system.

The higher anode voltage will also lead to an improved performance in the H.F. stage, although it will naturally also cause an increase in the current consumed by this valve. The choice, therefore, will be dictated by a large number of different factors which must be balanced by the individual, for they will obviously vary considerably in different circumstances. The sensitivity and selectivity remain largely unaffected whichever output stage be used, the balance on sensitivity being slightly in favour of Class "B," since the driver valve does give some amplification.

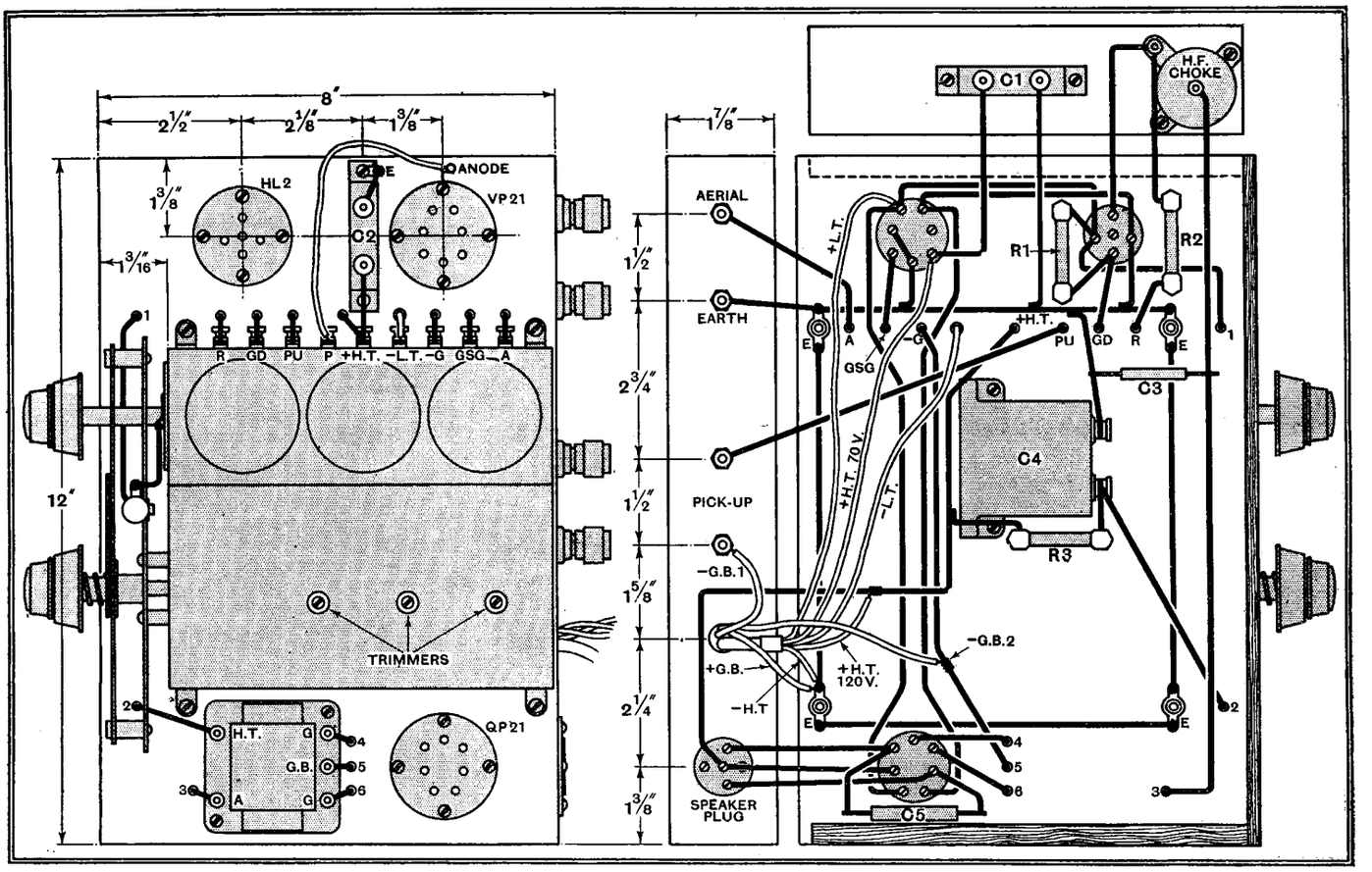
On test, the receiver proved to have substantially the same performance whichever output stage were used, and in consequence the notes on performance given in the previous article may be taken as applying also to the set with the Q.P.P. output stage. The total anode current consumption with no signal is about 8.8 mA. with a 120 volts H.T. supply, and the filament current is 0.66 ampere, including the dial light. The filament current is higher than with the four-valve arrangement, since the QP.21 valve requires 0.4 ampere, whereas the B.21 needs only 0.2 ampere, and the L.21 0.1 ampere.

Whichever output stage be adopted, the initial adjustments are the same, and are only to the ganging. They are simple and readily carried out. A station on the medium waveband should be tuned in and the volume adjusted to a convenient level by means of the volume control. Each trimmer should then be adjusted for maximum response, simultaneously turning down the volume control if the response becomes too great.

The circuits are now roughly ganged, and no difficulty should be experienced in tuning in a station on a low wavelength, preferably below 250 metres. A weak station should be selected, so that it is necessary to use a certain amount of reaction for adequate volume. Each trimmer should then be carefully adjusted for the loudest signals, slacking off the volume control knob if the set goes into oscillation as the circuits come into tune with one another. If a definite optimum setting can thus be found for each trimmer, such that any further increase or decrease in its capacity reduces signal strength, the ganging is completed, and there is nothing further to do.

Should it be found, however, that one trimmer is fully unscrewed, it is a sign that ganging is being attempted with too little capacity in the trimmers. All trimmers, therefore, should be screwed up somewhat, the station retuned at a slightly lower dial setting, and the ganging process recommenced. On the other hand, if one trimmer is fully screwed home, it is a sign that too

PRACTICAL WIRING DIAGRAM



The assembly and wiring of the set are clearly shown in these drawings.

A full-size blue print of the wiring diagram is available from the Publishers, Dorset House, Stamford Street, London, S.E 1. Price 1s. 6d. post free.

Quiescent Push-Pull Three—

much trimmer capacity is being used on another circuit. All trimmers should be unscrewed a little and the station retuned at a slightly higher dial reading, after which correct ganging should be obtainable.

Once these adjustments have been properly carried out, the ganging should hold accurately over the whole of both wavebands, and no further adjustments should be necessary. Quite a moderate amount of reaction is needed for the reception of many foreign stations, and with some of the stronger the volume will probably have to be reduced. The range of control obtainable depends upon the bias employed for the output valve, since the terminal for this connection on the "pack" is commoned with the bias supply to the output stage.

Bias Voltages

With the Class "B" output stage, therefore, the bias range available will be from zero to 4.5 or 6 volts according to the H.T. supply used. With the QP.21 valve a somewhat higher bias will be available, since the output valve requires from 7.5 to 9 volts according to the anode voltage. Under normal conditions the voltage required for the operation of the volume control is not critical, and $4\frac{1}{2}$ volts is usually sufficient. In a few cases, however, where the set is used close to a local station, a somewhat increased range may be advisable to permit that station to be reduced sufficiently. This may easily be obtained by wiring the "−G" terminal of the "pack" to the −9 volts terminal of the bias battery instead of connecting it *via* the internal wiring to the same point as the output valve.

In conclusion, it may be remarked that these two receivers are economical to operate from batteries, and that they can be used for the reproduction of gramophone records by the connection of the usual pick-up and volume control potentiometer to the terminals provided. They are essentially sets for battery operation, however, and it is not recommended that any attempt be made to obtain the H.T. supply from the mains. Class "B" and Q.P.P. output systems are intended for battery operation, and do not lend themselves nicely to mains working. Where mains are available, a mains receiver should be used, not a battery set with an H.T. eliminator.

It may be remarked that the QP.21 valve is a new type, and has only just been released by the makers. It is not anticipated that there will be any difficulty about obtaining the valve, but it should be remembered that supplies may be somewhat restricted for a short period.

LIST OF PARTS

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

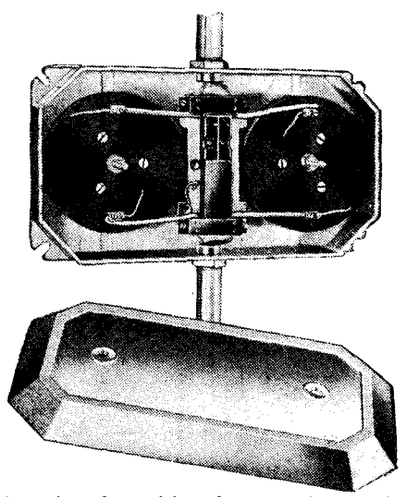
1 Linacore Bandpass Tuner — **J.B. Type BPB**
1 Bulb, 2 volts, 0.06 amp. — **Bulgin Type H**
1 H.F. Choke — **Kinva**
(Bulgin, Wearite.)
2 Fixed Condensers, 0.1 mfd., 200 v. D.C. working, **C1 C2** — **T.C.C.50**
1 Fixed Condenser, 2 mfds., ditto, **C4** — **T.C.C.50**
1 Fixed Condenser, 0.005 mfd., **C5** — **T.C.C. Type M**
1 Fixed Condenser, 0.0005 mfd., **C3** — **T.C.C. Type M**
(Dubilier, Peak, T.M.C. Hydra, Telsen.)
1 Metallised Resistance, 500 ohms, 1 watt, **R2** — **Dubilier**
1 Metallised Resistance, 10,000 ohms, 1 watt, **R3** — **Dubilier**
1 Metallised Resistance, 250,000 ohms, 1 watt, **R1** — **Dubilier**
(Claude Lyons, Erie, Graham Farish, Seradex, Watmel.)
1 Q.P.P. Transformer, 1: 8 — **R.I.**
(Multitone, Varley.)
2 5-pin Valve Holders — **Clix Chassis Mounting Standard Type**
2 7-pin Valve Holders — **Clix Chassis Mounting Type**
1 G.B. Battery, 9 volts
1 5-way Battery Cable, 30in., with wander plugs and spade ends — **Belling-Lee**
3 Wander Plugs — **Clix Type B**
4 Ebonite Shrouded Terminals, A., E., Pick-up (2) — **Belling-Lee Type B**
Plymax Baseboard, 8 in. x 12 in. x $\frac{3}{8}$in. — **Peto-Scott**
2 oz. No. 20 tinned copper wire, 3 lengths Systoflex, wood, flex, etc.
Screws:—
24 $\frac{3}{8}$in. No. 4 R/hd., 6 $\frac{1}{2}$in. No. 4 R/hd., 4 $\frac{3}{4}$in. No. 4 B.A. with metal thread and nuts and washers.
Valves: 1 Osram or Marconi VP21; 1 Osram or Marconi HL2; 1 Osram or Marconi QP21.
1 Microlode Loud Speaker — **W.B. Type PM4A**

A Quieter Background

WIRELESS users are at last waking up to the fact that there is no longer any real reason to accept passively a background of crackling, buzzing, or frying noises as an accompaniment to the programmes.

True, atmospherics will always be with us, and no one has yet found a satisfactory way of disposing of them. But in these favoured latitudes we may expect virtual immunity from serious atmospheric interference for at least 90 per cent. of our listening time—at any rate, so far as short- or medium-distance reception is concerned.

Again, it is admitted that certain forms of man-made electrical interference are susceptible only to suppression at the source, and so the listener can do little or nothing to improve matters. Fortunately, it is to be anticipated that such forms of interference will tend to decrease.

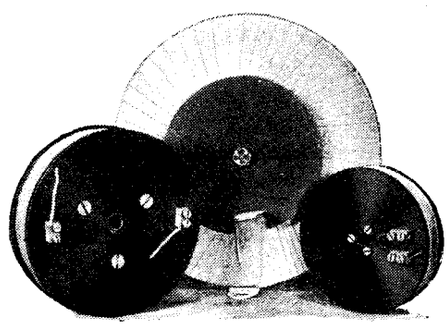


A pair of anti-interference chokes, in screening case, wired in the mains leads.

There is undeniable proof that the average listener can himself do a great deal to clear away background noises, and there is no risk in saying that, at a conservative estimate, fifty per cent. of sufferers have it in their power to improve matters to a more than acceptable extent. A few years ago little was known of the nature of electrical disturbances or of how to cure them, but now, largely as a result of intensive research on the part of the Post Office engineers, much valuable information on the subject has been made public. Further, anti-interference devices have become available from a number of sources.

The firm of Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex, have for some time concerned themselves both technically and commercially with the problems of interference suppression, and it is the purpose of this note to draw attention to a 16-page booklet entitled "Disturbance Suppression," which they have just issued. Readers may obtain copies at 3d. each, post free.

The various uses of the simple condenser suppressor are described at length in the clearest possible language, and with a number of diagrams and wiring plans. Information is also given on the use of the new Belling-Lee chokes in cases where an unaided condenser filter is insufficient.



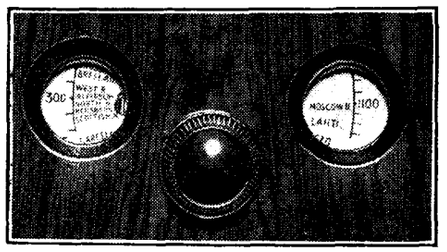
Specimen Belling-Lee heavy-duty H.F. chokes; the largest is wound with copper tape.

Negligible Voltage Loss

These chokes have current ratings of between 3 amps. and 100 amps., and are made in accordance with Post Office recommendations, the higher ratings being wound with copper tape. The 50-amp. choke, for example, has a resistance of only 0.0127 ohm, and, run at its maximum rating, would absorb only 0.635 volt, which is entirely negligible. For ordinary domestic use it is seldom that a choke with a higher rating than 25 amps. would be necessary, even assuming it to be so wired that the whole of the domestic supply would pass through it.

The uses of other Belling-Lee anti-interference devices are also described. The booklet is one that can be thoroughly recommended, even to those who think that they stand but a slender chance of reducing background noises.

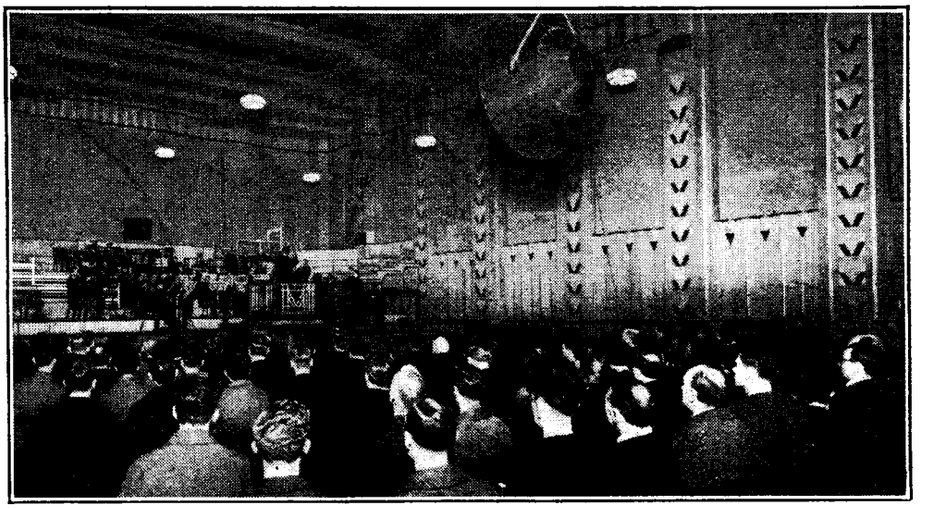
EASIER TO READ



Improving the tuning dial: the viewing apertures of the latest Ferranti sets are fitted with magnifying lenses.

Behind the Scenes at the H.M.V. Recording Studios

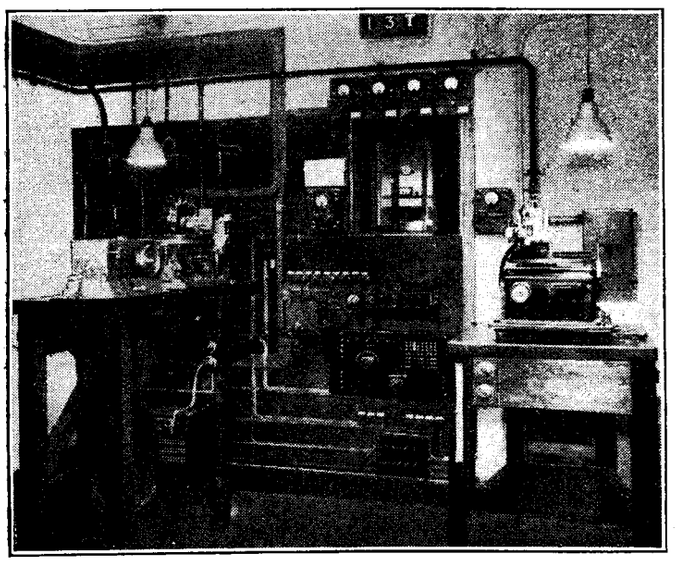
How Modern Electrical Recordings are Made



General view of the No. 1 studio for recording choral and orchestral works

IN November, 1931, the whole of the recording organisation of the Gramophone Company was transferred from Hayes, Middlesex, to St. John's Wood, London, N.W. The move was made primarily in the interests of the recording artistes, who can now fit in a recording session more conveniently with their London concert engagements; but the technical staff were quick to seize the opportunities presented to them, and the new building is probably unique inasmuch as it is designed throughout for the exclusive purpose of gramophone recording.

All the studios have been acoustically designed for the special requirements of recording, and the temperature of the building as a whole is kept at a level suitable for the wax discs. The warning lights outside studios create an atmosphere reminiscent of Broadcasting House, and this impression is strengthened when it is discovered that a special department is devoted to the cataloguing and storing of music.



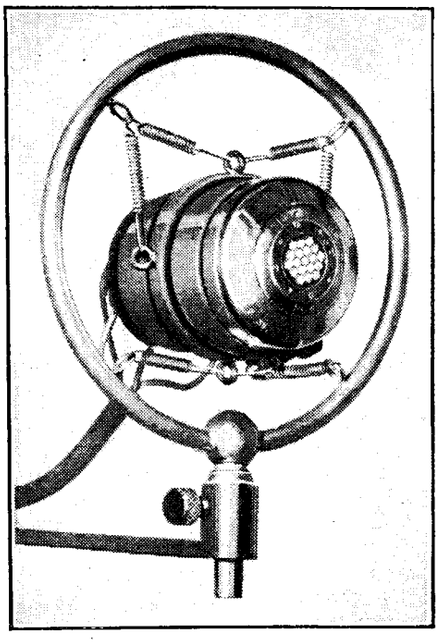
Interior of one of the machine rooms, showing twin recorders and double window communicating with the studio.

There are four studios ranging from the No. 1 orchestral studio, capable of accommodating two hundred performers on the stage and seven hundred on the floor, to the small talks studio. The acoustic properties of the large studio can be modified for different types of performance by movable screening partitions and damping curtains. It is possible to use as many as four microphones simultaneously, and there is a parabolic reflector which may be used to obtain the required balance in special circumstances.

The microphones are of the moving-coil type, and have been designed and developed by the Gramophone Company. They are energised from accumulators, and the field strength is adjusted to a predetermined value as it exercises some control over the frequency characteristic. It is interesting to note that the miniature diaphragm attached to the moving coil is of balsa wood.

Each studio has its own recording room, and the recording engineer is able to communicate with the studio staff through a small double window. In the general view of one of the recording rooms will be seen the four small control panels and meters immediately above the window which supply the field current to the microphones. The two similar panels at the lower corners are for the moving-coil recorders. Immediately below the window are the mixing and fading controls for the microphones, a system of tone correction filters, and the main volume control which is calibrated in decibels.

The recorder turntables are driven by gravity weights, and governors of special design are employed to keep the speed constant. The recorder head is fixed, and the turntable is gradually moved sideways by the lead screw. The recorder head works on the moving-coil principle, and the speech coils are fixed on the pole pieces of a powerful electro-magnet. The drive is transmitted to the cutting stylus by a single-turn coil which is closely coupled magnetically to the speech coils. The unit as a whole is carefully counterbalanced, and a micrometer feed is provided to vary the depth of the cut. An air suction tube immediately behind the stylus removes all traces of wax shavings from the surface of the record. Although



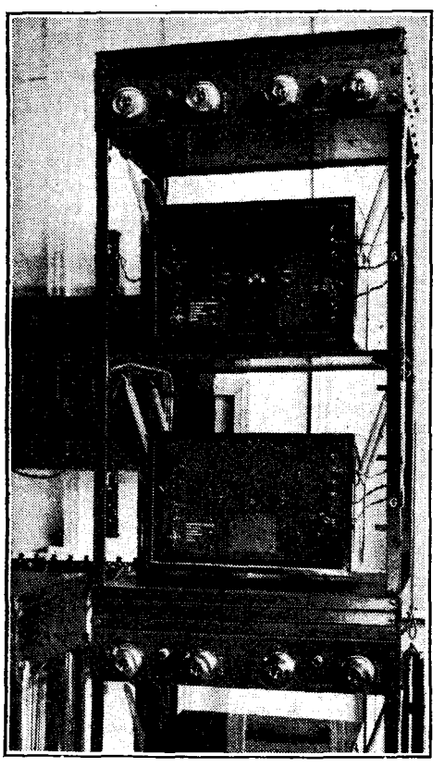
The moving-coil microphone.

Behind the Scenes at the H.M.V. Studios—

it is not often necessary, an immediate play-back may be taken from the wax by a specially designed pick-up mounted on the opposite side of the swivel head.

Wax blanks are stored in a thermostatically-controlled heating cupboard in the machine room itself. As the room temperature is very little below that of the store cupboard, the heat radiated from the electric lamp immediately over the turntable is sufficient to maintain the wax at the correct consistency during the comparatively brief period taken to complete the recording.

The microphones and recording amplifiers for all the studios are assembled together in a room on the first floor, and by an elaborate system of screened permanent wiring any desired combination of microphones, amplifiers and recorders can be arranged. Thus, in the case of an important broadcast several master waxes can be cut simultaneously. H.T. current

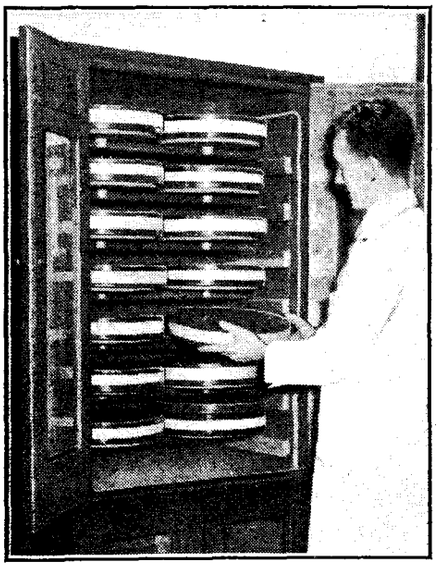


Spring-suspended microphone amplifiers.

for the amplifiers is obtained ready smoothed from the adjacent rectifier room in which there are five separate channels employing mercury vapour rectifier valves. There is also a battery room from which filament heating current is obtained. As in the case of the microphones and recording machines, the whole of the amplifying equipment has been developed and built by the H.M.V. Research Department.

The sapphire cutting points are all prepared, on the premises, from the rough stone, and the equipment includes a powerful projection microscope by means of which the cutting angles can be accurately measured.

The editing of records such as the Aldershot Tattoo is carried out in the Transfer Room, where excerpts from a series of master records can be combined to give a playing time of the required



The recording waxes are stored in a temperature-controlled cupboard.

length. The Acoustics Section is provided with a research laboratory, and a special room is set aside for recording from Broadcasting House, to which a permanent private line is connected.

The air-conditioning plant occupies most of the basement, and is important not only in keeping the building at the temperature required by the waxes, but also to eliminate variations in the humidity of the sound-absorbing material in the walls of the studios.

In conclusion, the skill of those responsible for the disposition of microphones and studio technique in general should not be overlooked. The modern record is the result of a happy combination of art and science.

Twenty Years Ago

Extracts from *The Wireless World* of March, 1914

Notes of the Month:—

"A mild sensation was caused during the past month by the report that 'a well-known French engineer' (of whom, by the way, we do not appear to have heard before) had 'discovered' that 'dangerous explosions are liable to occur at the meeting points of wireless electric waves.' This startling theory was backed by the reminder that 'the *Volturno* disaster took place just at the junction point of the Eiffel Tower and Glace Bay Wireless lines (!) and the recent mining explosion near Cardiff on the Clifden-Paris line (!), while Toulon, where the explosions on board the battleships *Jena* and *Liberté* occurred, is on the Paris-Bizerta line,' Some of our friends in the Press appear to have taken this report seriously. . . . We hope that timid persons will accept our assurance that nothing of the kind predicted can happen. Anybody at all acquainted with wireless knows that the waves do not leave the station like a bolt! They spread out like a vast fan."

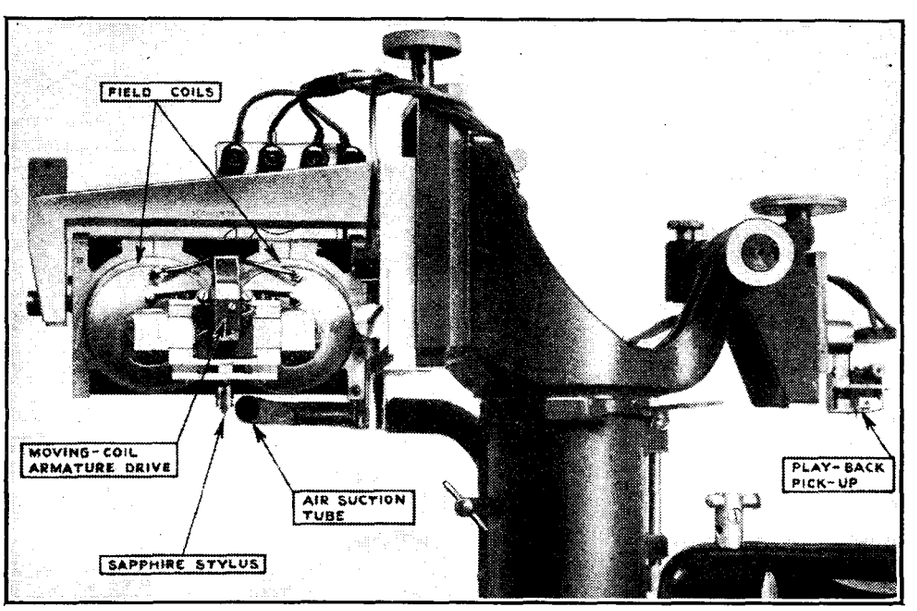
Amateur Notes:—

"We were only able to refer briefly in our last issue to the inaugural meeting of the Wireless Society of London (now the Incorporated Radio Society of Great Britain—ED.) on January 21st, which, from every point of view, was an unqualified success. Never have we seen the large lecture theatre of the Institution so crowded.

"An aerial was erected on the roof, and arrangements were made to receive a message from the Eiffel Tower. This was received on a syphon recorder, and the movements of the pen marking the strip were clearly shown on the screen by the use of a Lietz Universal Projector."

Questions and Answers:—

"A.C. (New Brighton) has a one-slide tuning-coil, which he puts in series with a two-tappings coil; he puts the aerial on to one end of this combination, and then leads the other end to earth through his silicon-platinum detector, across which he shunts a pair of phones, 100 ohms each, and connected in parallel. He is altogether wrong; he has got a high-resistance crystal in series with his oscillating aerial circuit; not only that, but the crystal is situated at the point of lowest potential instead of highest; and he is using telephones which are not in the least suited to 'wireless' unless used in conjunction with a telephone transformer."



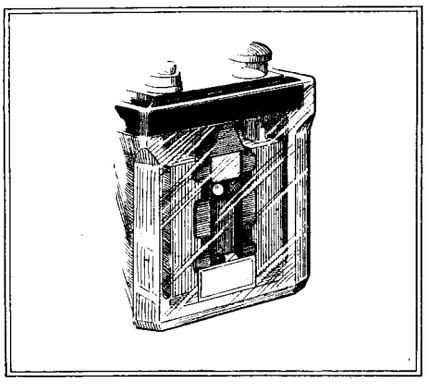
A close-up of the moving-coil recorder showing play-back pick-up.

Practical HINTS AND TIPS

AIDS TO BETTER RECEPTION

FOR several years past a number of accumulator manufacturers have adopted the practice of fitting built-in "charge indicators," usually in the form of hydrometer beads which are immersed in the acid, but are visible through the container. The beads are coloured distinctively, and their respective specific gravities are so adjusted that as the density of the acid electrolyte decreases during discharge the beads, one after the other, fall to the bottom of the compartment in which they are retained.

Charge Indicators



Visual charge indicator, as fitted to an L.T. accumulator cell (Exide).

It is easy to see that in this form of charge indicator we have most of the advantages of a hydrometer without the messiness usually associated with the use of the instrument. But if full benefit is to be derived from the system the user should bear in mind a few special points. For instance, during the changing of the accumulator, gas is evolved and bubbles will often lodge on the beads. In consequence, the specific gravity of the bead as a whole may be greatly reduced, and so a false indication may be obtained. It it as well to shake the cell vigorously, or else to tap it on the table, in order to dislodge any small bubbles, and thus to make sure that the beads are really floating without help.

Again, it is possible by observing the behaviour of the beads to form a good idea of intermediate states of charge. Let us assume that the read bead sinks when the cell is fully discharged; if this bead is noticed to sink slowly when shaking the cell, and then to rise very sluggishly towards the surface, one knows that the need for recharging is imminent.

Obviously, these charge indicators depend for their effectiveness on the initial gravity of the electrolyte being correctly adjusted, and so it is important that the manufacturers' recommendations be followed implicitly. It is also wise to maintain the electrolyte at a constant level, and of course any acid that may be spilled must be made good.

IT is fairly safe to say that no method has yet been devised whereby a ready-made receiver shall be entirely independent of the variations in capacity between one aerial and another. In the design of a few sets, special precautions are taken to minimise the effect of these variations, but more often than not the matter is left to chance.

The Aerial Trimmer

A difference in capacity of only 25 micro-mfds. between the standard artificial aerial on which the receiver is ganged at the factory and the actual aerial with which it is used will appear on the average as a difference of 5 micro-mfds. across the input circuit. Even this small variation is enough to impair efficiency; the moral is that there is a very good chance of improving the performance by adjusting the trimmer associated with the aerial circuit when the set is installed.

Although those who have no experience of the somewhat delicate operation of trimming should be strongly discouraged from making wholesale alterations to initial adjustments, it may be pointed out that the alteration *of a single trimmer* requires no special skill, and is usually carried out in a few moments.

The reader may be reminded that a visual tuning indicator, as fitted to many modern sets, is a very useful aid to making adjustments of this nature. The procedure is first to tune in a low-wavelength station very carefully, so that maximum response is indicated, and then to make the trimming adjustment.

IT is not always realised that a condenser anti-interference filter, fitted at the point where the mains enter the building, is likely to prevent the egress as well as the ingress of interference. Nevertheless, there is little doubt that it generally does function in this way, and it will be reassuring to the conscientious user of electrical appliances to know it.

A Two-way Device

If the filter is working according to plan, interference from such domestic appliances as vacuum cleaners, sewing machine motors, etc., although it may be transferred to the electrical wiring of the house, will not be allowed to get any further, and so will not upset the reception of neighbouring listeners.

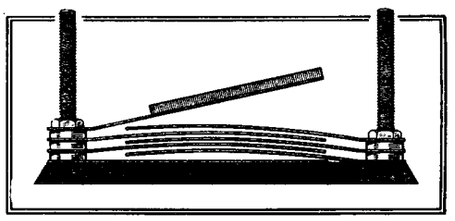
It may be urged that, in his own interests, the listener should fit suppressors directly on all apparatus that is found to cause interference, but in the case of appliances that are never used while his own wireless set is in operation, individual treatment is probably quite unnecessary, and may be neglected with a clear conscience, provided a mains filter be fitted.

AN important application of the semi-variable compression condenser nowadays is for "padding" purposes in the oscillator circuit of superheterodyne receivers. Comparatively large capacities (up to 0.002 mfd.) are generally specified for this purpose; it would appear that defects in such condensers are not altogether unknown, and that they are perhaps rather more likely to arise than in smaller condensers of the same type.

Testing Compression Condensers

After a certain amount of use, it may be found impossible to obtain a wide range of capacity adjustment; here we have an indication either that the plates are made of unsuitable metal and have lost their springiness, or just possibly that the top plate has become displaced and is bearing against the side of the container. The accompanying sketch, which shows the construction of a typical padding condenser, will make it clear how such troubles can arise.

It is often possible to form a shrewd opinion as to whether the condenser is working properly by removing the adjusting screw and then inserting a piece of stiff wire, or even a small nail, through the tapped hole. As the nail or wire is



Construction of a padding condenser; mica interleaving sheets omitted.

pressed downwards it should be possible to feel a gradual increase in resistance; as pressure is released the wire should again be forced upwards by the natural springiness of the plates.

If, after constant use, the plates have become slightly flattened, the minimum capacity of the condenser will be unduly high. It is not difficult to reduce it to the original value by judicious rebending, but care must be taken in handling the mica interleaving sheets, and also in replacing them.