The Wireless World AND RADIO REVIEW

(16th Year of Publication)

No. 458. WEDNESDAY, JUNE 6TH, 1928. VOL. XXII. No. 23.

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COVENTRY: Hertford Street.
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Telegrams: "Autopress, Birmingham." *Telephone:* 2970 and 2971 Midland.
MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." *Telephone* 8970 City (4 lines).
Subscription Rates: Home, 17s. 4d.; Canada, 17s. 4d.; other countries abroad, 19s. 6d. 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.

CONTENTS OF THIS ISSUE.

RAISING THE STANDARD OF BROADCASTING.

IF we look back over the years which have intervened since the initiation of broadcasting, it becomes apparent that progress towards perfecting reproduction has come about in a series of very definite stages, with periods of comparative stagnation in between, and not, as has often been suggested, by a gradual process of improvement of existing apparatus, with no outstanding landmarks of major achievement. There have undoubtedly been definite steps leading up to the present high quality of reproduction. We need only cite a few instances. In the days when the transformer used for coupling L.F. stages was a poor product, the aim being to achieve a high degree of amplification almost regardless of equal amplification of the audio-frequency range, an important step forward in quality of reproduction occurred with the introduction of resistance coupled amplification in the L.F. stages. The later production of low-frequency transformers, giving almost equal amplification over the whole audio-frequency range, brought about a definite improvement in quality of reproduction, as did also the introduction of valves specially designed for low-frequency amplification.

Shortcomings of Loud-speakers.

For quite a considerable time, however, the loud-speaker remained a source of some disappointment to those who aimed at the ideal. Many of the early types of loud-speaker were, of course, excellent in their way, and were often superior in their performance to the sets to which they were connected, but with the improvement in the receiver itself the shortcomings of the loud-speaker became more apparent, and to-day it can be said that it is the loud-speaker, and in particular the moving coil type, which has served to introduce a new standard in broadcast reproduction.

With a well-designed receiver operating a modern coil-driven loud-speaker, we arrive so near to perfection at the receiving end that the least error in the transmissions becomes obvious; whilst this fact shows up to a remarkable extent the very high standard which the B.B.C. have achieved in their transmissions, it also serves to indicate that nothing short of the highest standard in transmission will hereafter be tolerated by the public because of the inability of the modern receiver and loud-speaker to fail to reproduce possible errors in transmission. Just as the moving coil loud-speaker is exacting in respect of the transmissions, so the user is now realising that it is also necessary to pay particular attention to the operation of the loud-speaker in the home, and because its performance enables the listener to be more critical of reproduction than hitherto, questions such as whether reproduction should correspond in volume to the original performance hitherto ignored also begin to exercise the minds of critical listeners.

Importance of a High Standard.

It is undoubtedly in the interests of broadcasting generally that the listening public should be trained to be critical and should appreciate the best in reproduction, and for this reason we welcome the popularity which the coil-drive loud-speaker has achieved, and feel that we can take some credit to ourselves for our part in popularising loud-speakers of this type and bringing their construction within the scope of the modest workshop and so providing a new field of amateur interest.

The present issue is devoted mainly to the loud-speaker and a review of the types of coil-driven instrument and parts which are now available on the market, whilst various contributions deal with the conditions under which the coil-drive loud-speaker should be used in order to ensure ideal reproduction.

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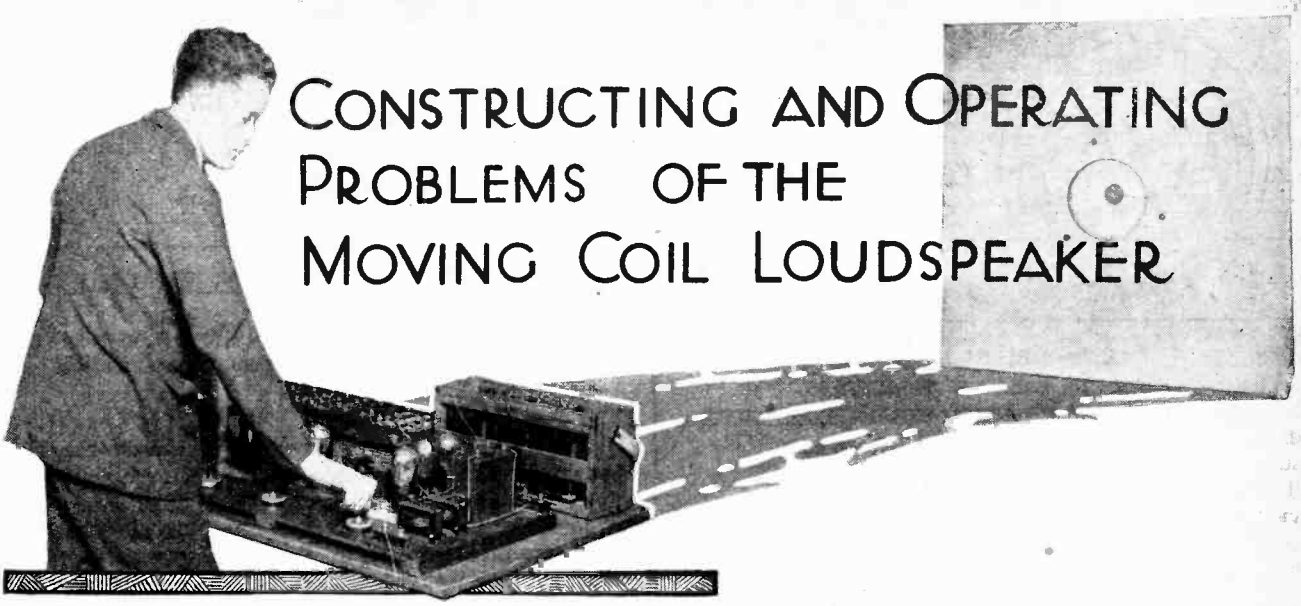

CONSTRUCTING AND OPERATING PROBLEMS OF THE MOVING COIL LOUDSPEAKER

Some Notes on the Practical Difficulties Encountered.

By F. H. HAYNES.

QUALITY in broadcast reception, as dependent on receiver and amplifier design, has been very carefully threshed out during the past two years. Problems arising out of the obscure networks existing in low-frequency amplifiers have been carefully considered, and the divergence of views formerly held on circuit component values have been replaced by a common unanimity and the setting up of "a standard practice." Novelty of circuit system is fast disappearing, and there is now only one right way of designing the home broadcast receiver. *Wireless World* readers have been appreciative of the part played by this journal in pushing forward to apparent finality modern receiver design, including those stepping stones, long-range receivers without reaction, the Everyman Four receiver, battery eliminator design, valves and values and voltage swings in L.F. amplifier construction, as well as the method of avoidance of incipient oscillation, and followed more recently by a realisation that to bring the moving coil loud-speaker before the listening public would lead to an advancement in the musical status of broadcasting.

Much information has appeared in these pages concerning the construction and the underlying principles of the moving coil loud-speaker, and it has not been the aim in this article to repeat information to which the reader already has access. The purpose is rather to deal with the many practical operating difficulties that have arisen and to put forward a summary of facts.

Following the series of lectures and demonstrations of the moving coil loud-speaker arranged in many centres by *The Wireless World* during 1926, and the development of the first constructional design for building and operating loud-speakers of this type, a band of enthusiasts has sprung up specialising in this new branch almost on a parallel to the transmitting amateurs of old, though in much greater number. To-day there are over thirty manufacturers catering for their needs, and the number of sets of moving coil loud-speaker parts and complete loud-speakers sold has long been expressed by five figures. This rapid development has given rise to many queries based on difficulties encountered in setting up and working the loud-speaker, and the aim in this article is to answer briefly some of the typical questions asked.

Selectivity and Quality.

Incidentally, the difficulties met with are relative to circuit practice rather than the loud-speaker itself, the associated receiving set being stringently put to the test when operating a coil-driven loud-speaker. First there is the ambitious listener who asks for details of a receiver that will bring in the European stations, and arranged for operating the moving-coil loud-speaker. To this question the reply is that the loud-speaker will reveal to the trained ear the imperfections of the long-range set and its inability to maintain quality. Efficient high-frequency amplification demands selectivity, while for quality it is essential that the wide spectrum of frequencies which it is hoped is set up by the transmitter shall be present in the tuned input circuit to the detector, the frequencies being represented in their correct relative amplitudes. A modulated wave occupies a frequency band equal to twice the highest note-frequency involved; thus if note frequencies as high as 10,000 cycles, such as are emitted from the instruments in the studio, are to be carried by modulated waves to the receiver, then the frequency band is 20,000 cycles, so that at a wavelength of 300 metres there is a broadening of the response peak to some 6 metres either side of 300. Bass notes are conveyed by wavelengths close to the value of 300, but the

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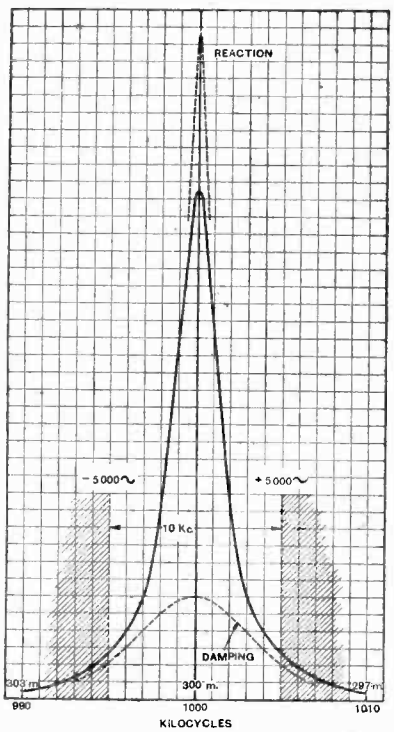
very high note frequencies may be so far displaced on either side of the fundamental wavelength as not to be embraced in their correct relative amplitudes by a sharply tuned receiver circuit.

With a single stage of high-frequency amplification in a stable condition, the effect of sharp tuning, though observable, is perhaps not serious, but with two efficient stages, both sharply tuned to the same wavelength, a modification of the modulated wave occurs with a marked cutting off of the side bands. This results in a lowering of pitch and the predominance of bass, coupled with a general impairing of quality. Musical instruments are identified by their characteristic timbre conveyed in their harmonic overtones, and the loss of the high note frequencies brings about that difficulty of distinguishing between such instruments as the violin and the flute. The characteristic tone of the violin is created by harmonic frequencies of four and five times the fundamental note which it may be emitting, yet the peculiar pureness of the sound given out by the flute marks the absence of harmonics. Percussion instruments, as well as articulated speech, are even more difficult of faithful reproduction, for in place of sustained multiple or harmonic frequencies transients built up of complex and abrupt harmonics are present, which, when analysed, involve exceedingly high note frequencies. Certain of the sounds of speech are identified by the presence of high overtones, while it must be recognised that if musical reproduction is to be "crisp" and "clean," audio-frequencies up to the limit of 10,000 cycles must be faithfully maintained.



The range of audio-frequencies conveyed by a modulated wave are ranged about a carrier, the wave-band spreading as the note frequency increases. Bass notes are associated with the peak of the resonance curve. A receiver rendered too selective by the use of reaction, or incidental to excessive H.F. amplification, brings about a predominance of the bass. Unless the high note frequencies are preserved the characteristic tone of particular musical instruments is lost.

Avoid Reaction.

For this reason also the regenerative receiver fitted with any form of reaction for use as a means of increasing oscillation amplitude is objectionable, as it mainly stimulates those oscillation frequencies associated with the bass. Another point arises here, for it is obvious that detuning of a single circuit as a means of volume control results in a cutting off of side-band frequencies on one side of the fundamental, as well as a reduction of the bass frequencies. Detuning of a sharply tuned circuit at once renders reception by a moving coil loud-speaker thin and high-pitched. From these considerations it will be realised that long-range reception by two tuned H.F. stages is not easy, as it involves the devising of a method of flattening the tuning which, incidentally, may bring with it considerable interference.

Apart from range there is the querist in search of a "quality receiver." He generally asks, and rightly too, for two or more resistance-coupled L.F. stages. Although resistance coupling as a single stage can undoubtedly be arranged to be more free from distortion than the alternative systems of L.F. intervalve coupling, a multi-stage resistance amplifier is probably not the best arrangement. Two stages may not give sufficient amplification to occupy the maximum grid voltage swing permissible at the output valve. Practice reveals that even with two stages resistance coupled, with carefully selected values for intervalve couplings, a high note loss results. In three stages the effect is more marked, unless a very small amplification gain per stage is the aim. All of the troubles cited in connection with excessive selectivity appear to an even more marked extent, so that the instruments of the orchestra lose their brightness, and the result sounds "dull" and "rounded." On the other hand, a good L.F. transformer coupled stage will invariably possess a rising characteristic so that when combined with a single resistance stage it effectively compensates for the declining response of the resistance coupling. Assuming the use of an anode bend detector valve, needing as it does a liberal input if quality is to be maintained, then a resistance stage followed by a transformer stage, each coupling being designed for low magnification, will create the maximum permissible voltage swing that can be applied to the output valve.

On the subject of detection a test is very convincing as to the inferiority of the leaky grid arrangement. Anode bend detection is recommended, and it is questionable whether a two-electrode detector sometimes suggested is worth while. True, the by-pass condenser of the anode circuit is injurious to quality, yet it is doubtful if a non-amplifying diode ameliorates this condition as it calls for greater magnification in the subsequent amplifier. Crystal detection still lingers as the ideal in the minds of those who have not forgotten the good listening provided by crystal and headphones. Apart from any failings of the crystal detector itself, the problem of designing a coupling transformer from a crystal of uncertain resistance to the amplifier is best avoided, as it entails the risk of serious distortion arising at the input to the amplifier.

Summary of Practical Data.

Summing up, our experience in circuit design indicates that one cannot do better for local station reception than use an anode bend detector valve followed by a resistance-coupled valve and a transformer-coupled valve with output choke filter. For moving coil loud-speaker work adopt the following values: 150 volts at the battery terminals feeding the detector and first L.F. valves, a coupling resistance of 100,000 ohms shunted by 0.0001 mfd., followed by a mica coupling condenser of

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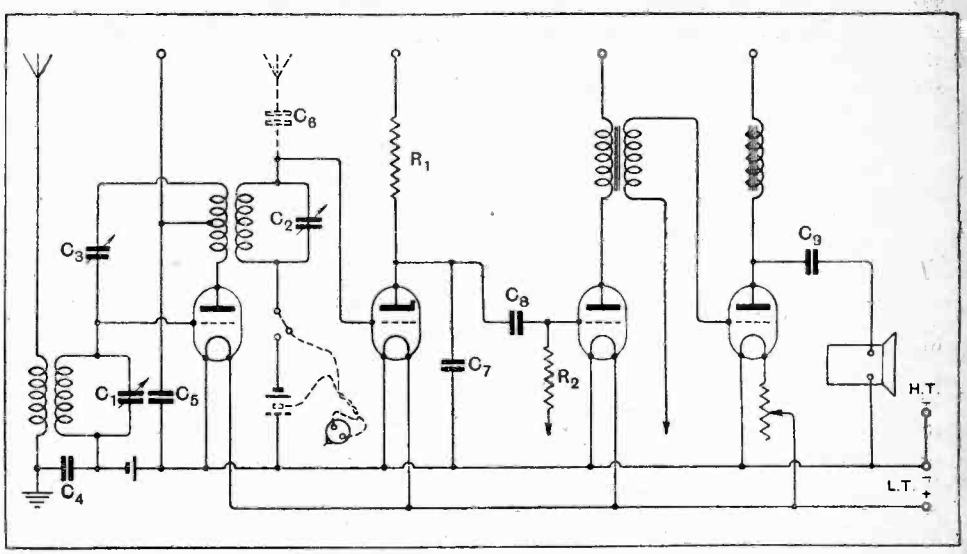
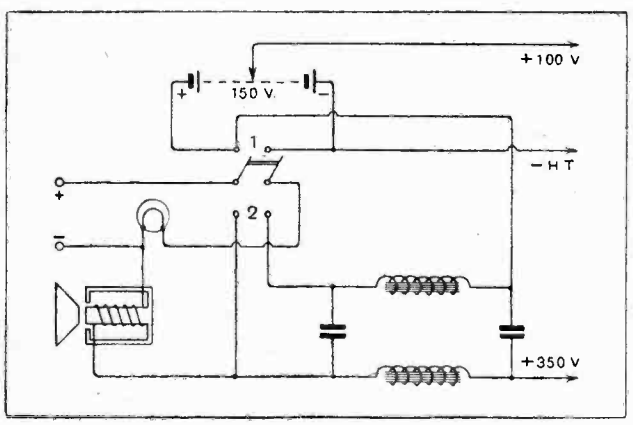
0.01 mfd. and grid leak of 2 megohms; use a low ratio intervalve transformer of good design, an output choke of ample current-carrying capacity of about 30 henries or more, at 50 to 100 mA.; a feed condenser of 3 mfds. As to valves, the anode bend detector is of the H.F. type (20,000 ohms) in preference to an R.C., and biassed to some 3 volts. If volume is excessive it is best reduced by substituting an L.F. valve (7,000 ohms) and slightly increasing the grid-bias. The second valve is of the L.F. type, followed by a power output valve (2,500 to 5,000 ohms). The grids of parallel connected valves must each be separately fed through leak resistances of 0.25 megohms to avoid parasitic oscillation. At the same time grid current must be most carefully guarded against.



Typical receiving circuit for moving coil loud-speaker. C_1, C_2, 0.00035 mfd.; C_3, neutralising; C_4, 1 mfd.; C_5, 1 mfd.; C_6, about 0.0002 mfd. or variable; C_7, 0.0001 mfd.; C_8, 0.01 mfd.; C_9, 3 mfds.; R_1, 100,000; R_2, 2 megohms, taking care to most carefully guard against grid current.

If an alternative programme is required, the aerial bad, the distance from the local station more than about six miles or local frame aerial reception required, the introduction of a single neutralised H.F. stage with *Wireless World* type H.F. intervalve transformer becomes essential. An H.F. valve may be used for this stage, yet if volume is too great, or sharpness of tuning excessive, it may be replaced by one of lower impedance. Satisfactory results can be obtained with 170 volts fed to the output stage and with a moderate power valve, which, with a grid bias of 20 volts, will pass a current of about 14 mA. If mains are available, a valve of the LS5A type should undoubtedly be adopted, fed with 350 volts and a grid bias of about 70.



Method of supplementing the D.C. mains voltage and providing a charged accumulator battery for the early valve stages. Switch in position 1, battery on charge through the lamp; position 2, current applied to loud-speaker field winding and H.T. accumulator series-connected to the mains.

Two such valves in parallel may be provided for, though the merit of the additional valve is doubtful.

Hints on Using Mains.

On D.C. supply an accumulator battery of 150 volts may be readily charged through a lamp and discharged in series with the mains in order to create the high anode potential to the output valve, and at the same time providing high-tension supply of low internal resistance for the earlier stages. To keep clear of the danger of distortion arising from incipient oscillation by virtue of back coupling through the resistance of the battery, wire-wound resistances of 20,000 ohms should be interposed in the leads to all valves other than the output stage, while each H.T. + terminal on the set is connected across by means of a 2 mfd. condenser to a common L.T. minus.

In the push-pull method of intervalve coupling the solution is provided by way of accommodating the liberal grid swing demanded, if the bass notes are to appear in their correct relative amplitude, while anode voltages between 150 and 240 suffice. Complications by way of lack of balance in the valves or the transformer windings may be the cause of most distressing distortion, though the conditions in the circuit are now better appreciated and precautionary measures worked out for preventing distortion by oscillation.[1] As regards dry battery working, however, in the absence of D.C. mains the push-pull system creates an almost uneconomical drain on the cells.

A.C. mains call for a high voltage rectifier with R.H.1 type rectifying valves, the transformer being wound for secondary potentials of 375 +375. The inclusion of a separate filament heating winding for the output valves on the transformer is worth while. Details of such a rectifier have already appeared.[2] For the

[1] "Push-pull Problems." Elsewhere in this issue.

[2] "The Moving Coil Loud-speaker. How to Build and Operate." Published from the offices of *The Wireless World*. (Iliffe and Sons. 1s. 6d. Post free 1s. 8d.)

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early valve stages a separate rectifier is more convenient than using a single high voltage rectifier for all valves owing to the excessive voltage drop, and the considerable watts to be dissipated across the necessary resistances. Variation of potential moreover caused by a change of grid bias on the output stage would modify the voltages applied to other valves.

Field Current Economy.

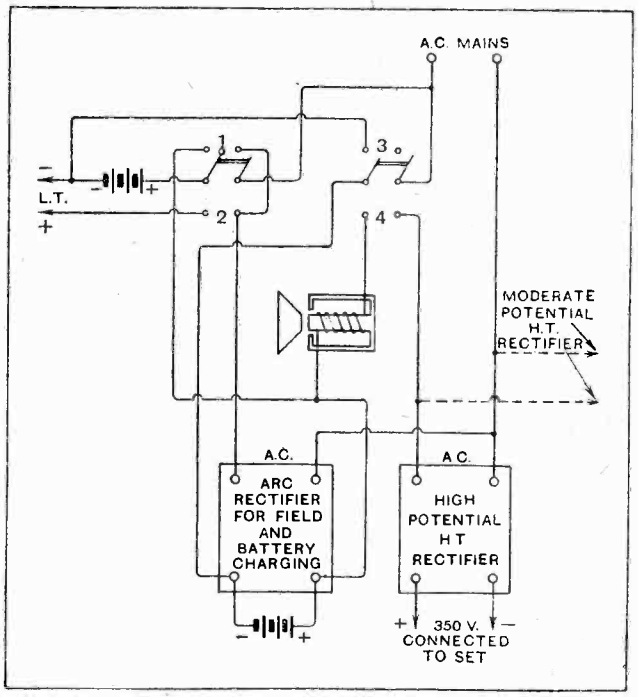
Referring to the loud-speaker itself, the principal question raised is that of field current. As previously stated, a minimum of some 30 watts is necessary owing to the high magnetic leakage to create the required flux density across a moving coil gap of 5-32in. assuming the general dimensions shown in the casting designs included in these pages. Gap width and energising watts vary roughly according to the square, so that by halving the width of the gap to 5-64in. affects a quartering of the watts required to produce the same magnetic flux. It is thus obvious that as we cannot get "something for nothing," a current of 1.5 ampere at 6 volts must be considered the very minimum. Liberal gap width is, from the practical standpoint, undeniably desirable unless the moving coil is entirely supported by a centring device arranged to be independent of the pull exerted by the diaphragm and its supple mount.

However well a coil may be set up, even with the aid of strings, it will require periodical readjustment, though the greatest danger is that the coil may after a while change its shape when rubbing on the pole is inevitable. Contact with the sides of the gap is by far the most common fault in moving coil loud-speaker operation. Even the merest friction gives rise to a buzzing effect. True, it may only be detected by most careful listening, and then only on a particular note brought about by some critical displacement of the diaphragm, yet to the trained ear the effect is distressing. It is a wise plan to have in reserve a finished diaphragm and coil already mounted on its ring for substituting in the case of difficulty in clearing the walls of the gap, while there is always the danger that the winding may become faulty. No centring device is required in the liberal gap of 5-32in. or even $\frac{1}{8}$in., yet for the small gap with battery energised field three light adjustable cottons, 120 degrees apart, afford a solution to the centring difficulty.

Complete field winding data have already been published, and, in brief, are as follows: For maximum flux density with floating 6-volt battery, use 7 lb. of No. 14 D.C.C.; 6-volt, 30-watt winding, 6 lb. of No. 16 D.C.C.; 6-volt, 8-watt winding, 7 lb. of No. 18 enamelled; 200-240 volts, 4 lb. of No. 34 enamelled, or with a slight temperature rise an increased field strength will be obtained by using 4 lb. of No. 32 enamelled.

Manufacturers are involved in deciding upon details of the diaphragm and coil-winding data, some of which depend upon rather varying and uncertain properties. From an experience which has been gained in the constructing, examining, and demonstrating of a large number of loud-speakers, varying in dimensions, materials, and winding, and operating data, the following summary is that of the form of construction giving probably the best results. Diaphragm of "two-sheet" (10 mils.) Bristol board, $7\frac{1}{2}$in. diameter, coil about 2in. diameter, and consisting of 1,400 turns of No. 46 or 47 enamelled wire operating from an LS5A output valve. What might be considered as a fairly tight mounting, such as is provided by a sheepskin (brown variety) ring free from bagginess, appears to give better results, especially in the upper register, than a diaphragm carried on a free or excessively elastic suspension.

The diaphragm with coil attached and edge flared over is secured to the skin while laid flat and unstretched. When fixed it is next secured to the mounting ring, after which the surplus centre disc is easily



A.C. mains connections. Switches up (positions 1 and 3), both 6 volt. accumulators on charge. Switches down (positions 2 and 4), filament and field current on, arc rectifier and H.T. battery eliminators in operation. Contact 2 to be closed before and opened after contact 4 so as to discharge the smoothing condensers of the eliminators.

pared away with a razor with blade lying flat along the inside conical face of the diaphragm. An eddy current damping ring is to be found near to the moving coil in certain of the commercial loud-speakers. Its purpose is to equalise the speech currents through the coil over the frequency scale, while, incidentally, it serves to hold a centre pole of the bolted-in type correctly in position. This is mentioned as the effect of the ring is very similar to that which arises from a few accidentally short-circuited turns. No detrimental effect will arise providing that the short-circuited turns can carry the induced current. Movement of the coil becomes damped by virtue of short-circuited turns resulting in a slight reduction in volume, yet the effect may even be beneficial.

Remote Control.

As a means of entertainment in the home the moving coil loud-speaker, with carefully designed receiving set and battery eliminator, is worthy of an attractive cabinet. The large size baffle type, not too deep and

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with a well-ventilated back, is preferred by the writer. Just as a skilled piano maker depends for tone (suppression of certain harmonic frequencies) upon the properties of the frame and the cabinet, so a slight coloration may be introduced by the loud-speaker cabinet. Adding tone to a loud-speaker is almost avoided in the type of cabinet having a large front panel.

As so much internal space is available, a set may well be self-contained and mains operated, taking the precaution to carefully pack the detector valve in a cotton-wool padded box to prevent acoustic reaction. On the other hand, the receiver may be set out on a baseboard and stowed away even in a loft, and brought into operation by a pair of simple relays. For example, on A.C. supply a large type rectifier, with 6-volt battery permanently connected across it, and housed in the loud-speaker cabinet, might be switched on from a nearby lighting point by one arm of a two-pole two-position switch, the other arm closing the battery circuit to the field. Two pairs of wires will connect with the set, one for conveying the transmission to the moving coil and the other linked across the field winding would convey 6 volts to the relays when the field is energised. Thrown over to the opposite position, the two-pole switch could be arranged to provide battery charging. The relays would close the eliminator circuit, including output valve filament heating, as well as an accumulator circuit connecting to the earlier stage valves.

Remote volume control is not easily arranged, though it would seem desirable owing to the wide changes which occur in respect of broadcast transmissions as to the speech voltage delivered by the detector valve. Almost every change of control by way of change of modulation is most apparent, and is particularly marked in connection with outside broadcasts, though often arising to a distressing extent in the switching over between items. Changes in signal strength call for a substitution in the valves of the receiver, so that if a reduction in volume is required to be made an increased grid swing can, if necessary, be accommodated.

Alternative programmes are readily provided by the use of a pair of tuning condensers in association with a common inductance and a two-position remote controlled relay switch. Quality in our broadcast transmissions is not consistently maintained at its highest standard, and occasional failings are readily revealed by the moving coil loud-speaker. Often a good item is marred to the critical listener with his coil-driven loud-speaker, while it may be appreciated by the user of a more modest set whose ear has been trained to be more tolerant.

Short-wave Stations.

A correspondent at Kingston-on-Thames sends us particulars of a few more short-wave stations which supplement the list published in our issue of February 8th.

APV	Malabar, Java, on 14 metres.
GLL	Dorchester (Beam Station) on 21.962 metres working with Maadi, Egypt.
PJD	San Martin, Dutch West Indies, on 17.7 metres, working with Holland and New York.
SPP	Rio de Janeiro, Brazil, on 13 metres.
SUX	Cairo, Egypt, on 19 metres.
XGA	Mukden, China, on 29 metres.

We understand that the short-wave station on SS. "Derbyshire," **GLYX,** is no longer working.

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Brazil Heard in Kent.

A correspondent in Tunbridge Wells tells us that early in the morning of May 20th he picked up signals from the Roosevelt Memorial Expedition in Brazil, the strength on an 0-v-1 receiver being R2—R3. The note was pure D.C., with a tendency to high-speed fading, the wavelength about 20 metres, and the call-sign SB GMD. The station was endeavouring to call up U.S.A., but appeared to get no reply. The signals faded out at about 0120 B.S.T.

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General Note.

Mr. J. E. Johnson (2ADC), 7, Chestnut Avenue, Wood Street, Walthamstow, asks us to state that he is willing to stand by and report on signals on all wavelengths between 11 and 60, 150 to 200, and on 440 metres, from 1900 to 2200 B.S.T. during the week and at any time on Sundays, by arrangement.

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Foreign Hon. Memberships for G 6CL.

Mr. J. Clarricoats has been elected a member of the Czecho-Slovakian Amateur Radio Society (R.K.C.S.), in addition to being the only British member of the German (D.F.T.V.) and Danish (E.D.R.) amateur organisations.

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TRANSMITTERS' NOTES AND QUERIES.

Radio Jargon.

Apropos the strictures in our issue of May 2nd on the misuse of "Radiese" in written correspondence, the occurrence of these abbreviations even in formal business communications seems to be increasing. We could pick out dozens of examples from our weekly budget of correspondence; one recently received, on a purely formal business matter, ended up "Thanks very O.M., best DX es 73." Now we, no, *I*, the compiler of these notes, am painfully conscious of an increasing spread of grey hair, but have not yet fallen into senile decay, and, therefore, strongly object to being called "Very old man" by a total stranger. To adopt an historical saying, "Please don't do it!" It is merely silly and not very courteous.

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QRA's Wanted.

EU DSKW JZR EAHW EWAA EWAD.

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International Prefixes.

Apropos our note on page 550 of our issue of May 16th, we understand that the following list of nationality prefixes has been provisionally recommended as the result of discussion at the Washington Conference :—

CI	Chile.	**PK**	Dutch East Indies.
CF	Canada.	**PP**	Brazil.
CL	Cuba.	**PZ**	Surinam.
CN	Morocco.	**RA**	Russia.
CP	Bolivia.	**RV**	Persia.
CR	Portuguese Colonies.	**RX**	Panama.
CS	Portugal.	**RY**	Lithuania.
CV	Rumania.	**SM**	Sweden.
CW	Uruguay.	**SP**	Poland.
CZ	Monaco.	**SU**	Egypt.
D	Germany.	**SV**	Greece.
EA	Spain.	**TA**	Turkey.
EI	Ireland.	**TF**	Iceland.
EL	Liberia, E.	**TG**	Guatemala.
ES	Esthonia.	**TI**	Costa Rica.
ET	Ethiopia.	**TS**	Sarre.
F	France and Colonies.	**UH**	Hedjaz.
G	England.	**UI**	Dutch East Indies.
HA	Hungary.	**UL**	Luxemburg.
HB	Switzerland.	**UN**	Yugo-Slavia.
HC	Equador.	**UO**	Austria.
HH	Haiti.	**VE**	Canada.
HI	Dominican Republic.	**VH**	Australia.
HJ	Colombia.	**VO**	Newfoundland.
HP	Honduras.	**VP**	English Colonies.
HS	Siam.	**VT**	India.
I	Italy.	**W**	U.S.A.
J	Japan.	**XA**	Mexico.
K	U.S.A.	**XG**	China.
LA	Norway.	**YA**	Afghanistan.
LO	Argentine.	**YH**	New Hebrides.
LZ	Bulgaria.	**YI**	Iraq.
M	England.	**YL**	Lettonia.
N	U.S.A.	**YM**	Danzig.
OA	Peru.	**YN**	Nicaragua.
OH	Finland.	**YS**	San Salvador.
OK	Czecho-Slovakia.	**YV**	Venezuela.
ON	Belgium and Colonies.	**ZA**	Albania.
OU	Denmark.	**ZK**	New Zealand.
PA	Holland.	**ZP**	Paraguay.
PJ	Curacao.	**ZS**	South Africa.

We believe that this list has not yet received the approval of all countries concerned and must only be regarded as tentative. The change from the system devised by the A.R.R.L., to which we are just getting accustomed, is likely to lead to considerable confusion, and we trust that if this, or any other list of prefixes, is authoritatively adopted, it will be fixed, final, and satisfactory to all countries concerned.

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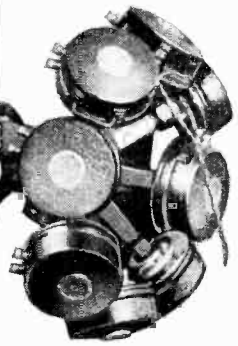
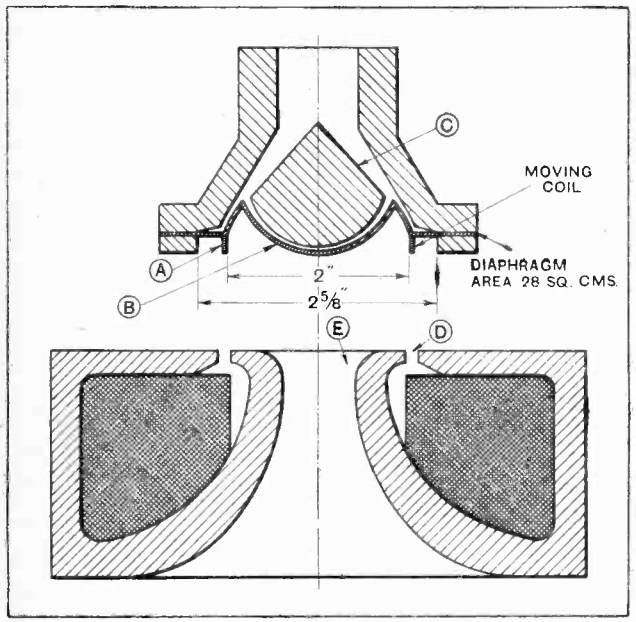
COIL DRIVE HORN LOUD-SPEAKERS



Design Details of a High-efficiency Moving Coil Unit.[1]

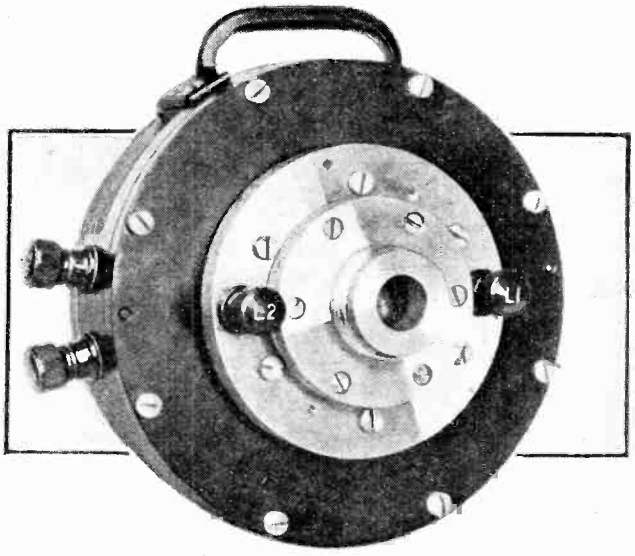
BEFORE the advent of radio-broadcasting, practically the only loud-speakers in commercial use were of the horn variety. In recent years this type has been largely supplanted by others of more compact design. However, where size is not of prime importance, a loud-speaker with a horn still has a large field of service, as, for instance, in public address systems. For such uses, the greater directional effect obtained by the use of a horn has in some respects definite advantages. In the design of the unit about to be described, we have had in view particularly the requirements for such services, where the following qualifications were deemed of the greatest importance: a good response-frequency characteristic up to frequencies of at least 5,000 cycles, large power output without distortion, high efficiency, and constancy of performance.



Sectional drawing through field magnet and diaphragm support. A is the moving coil; B, the dished aluminium diaphragm; C, an obstruction which causes the sound waves to reach the throat of the horn in phase for the purpose of preserving high notes; D, moving coil gap; E, ventilating aperture at rear of diaphragm.

A loud-speaker movement of the moving coil type is here described which is particularly adaptable to the horn type of instrument, and represents a notable advance over similar devices at present available. Its design is such as to permit of a continuous electrical input of 30 watts as contrasted with the largest capacity heretofore available of about 5 watts. In addition, measurements show that the receiver has a conversion efficiency from electrical to sound energy varying between 10 and 50 per cent. in the frequency range of 60 to 7,500 cycles. Throughout most of this range, its efficiency is 50 per cent. or better. This contrasts with an average efficiency of 1 per cent. for other loud-speakers, either of the horn or cone type. Combining the 50-fold increase in efficiency with a 5- or 6-fold increase in power capacity, a single loud-speaker unit of the type here described is capable of 250 to 300 times the sound output of anything heretofore available.

This device is in commercial use in connection with the Vitaphone and Movietone types of talking motion



The complete unit.

[1] An Extract from a paper by E. C. Wente and A. L. Thuras, American Telephone and Telegraph Co., New York.

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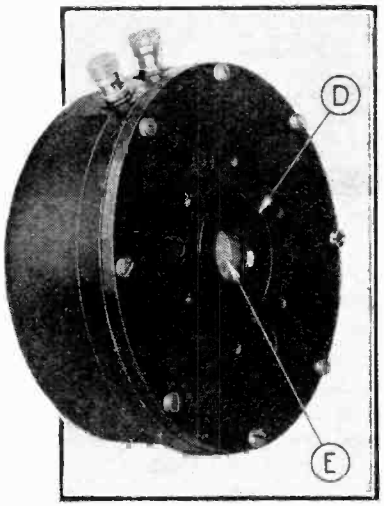
Coil Drive Horn Loud-speakers.—

pictures.[1] As commercially produced in quantities numbering several thousand, an average efficiency of the order of 30 per cent. has been realised.

As this paper is concerned with the design of the driving mechanism, or the unit proper, and not with the horn, we shall confine our discussion to the operation of the unit when connected to a tube of infinite length and of the same cross-sectional area as the throat of the horn.

In order to cover the desired frequency range, the method of coupling the diaphragm to the horn is as shown on the accompanying sectional drawing. By this means the disturbances reach the horn more nearly in phase without having to pass through any restricted passages. The throat of the horn is flared annularly to the point where it meets the edge of dished diaphragm. The disturbances reach the throat of the horn from the inner and outer portions of the diaphragm aproximately in phase up to comparatively high frequencies. With this type of construction it is possible to use a fairly large diaphragm so that large amounts of power may be delivered without a great sacrifice in efficiency at either the high or the low frequencies. An experimental test showed that with this type of coupling for a particular size of diaphragm and throat area, the cut-off frequency was raised from approximately 3,500 to 6,000 cycles per second.

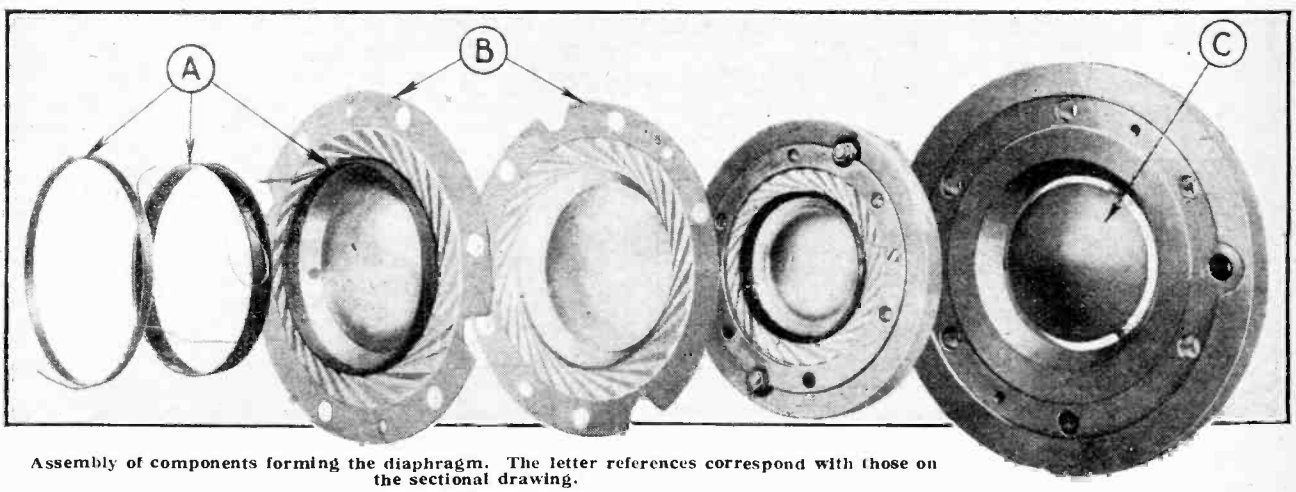


Field magnet with diaphragm support and moving coil withdrawn.

The diaphragm is made of a single piece of aluminium alloy 0.002in. thick; metal was used in preference to other materials because of its superior mechanical properties. A driving coil is attached directly to the diaphragm near its outer edge. With this arrangement the diaphragm can be driven nearly as a plunger, and it has little tendency to oscillate about a diametrical axis, as there is great rigidity against a radial displacement of any part of the coil. The portion of the diaphragm lying between the coil and the clamping surfaces has tangential corrugation, while the inner portion of the diaphragm is drawn into the form of two re-entrant segments of spherical shells; this part is thereby made very rigid, so that it moves as a unit up to high frequencies.

For the driving element of loud-speakers either a moving coil or a moving armature is commonly used. The latter is in general satisfactory if driven at a small amplitude. However, where large powers are involved, the moving coil drive can be much more simply constructed, so that it is free from amplitude distortion; it has the further advantage of having a resistance nearly constant with frequency and a practically negligible reactance. These were the primary reasons for choosing this type of drive.

The coil used consists of a single layer of aluminium ribbon 0.015in. wide and 0.002in. thick wound on edge, the turns being held together with a film of insulating lacquer about 0.0002in. thick and thoroughly baked. This type of coil has the following advantages. It is self-supporting, no spool being required; 90 per cent. of the volume of the coil is occupied by metal; the distributed capacity between turns is small, giving a coil whose impedance varies only slightly with frequency; the metal is continuous between the cylindrical surfaces, allowing heat to be conducted rapidly outward from the centre of the winding and diminishing the possibility of any warping of the coil; it can be accurately made to dimensions, thus permitting small clearances between the coil and the pole pieces. Small clearances not only permit the use of quite a small magnet, but they facilitate the dissipation of heat.



Assembly of components forming the diaphragm. The letter references correspond with those on the sectional drawing.

[1] The Movietone, by W. I. G. Page, *The Wireless World*, December 14th, 1927.

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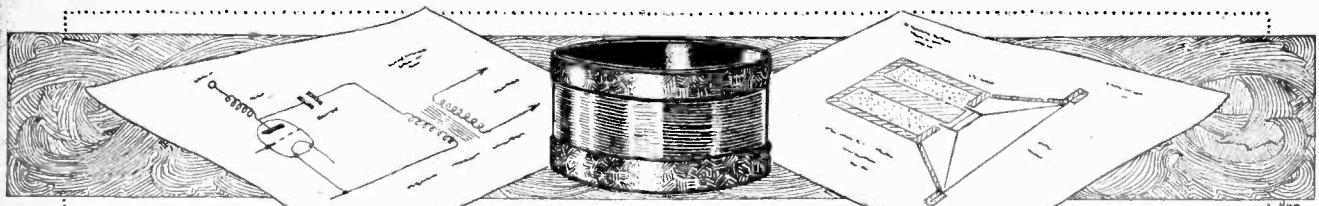

THE DESIGN OF THE MOVING COIL

How the Relationship Between Output Valves and Moving Coil Winding is Determined.

By L. E. T. BRANCH, B.Sc.

THE usual moving coil of the high resistance type which is used in moving coil loud-speakers consists of about 1,000 turns of No. 46 S.W.G. wire, wound upon a former of 2in. diameter. When such a coil operates in a gap in which the strength of the magnetic field is about 10,000 lines per square centimetre and the last stage of the receiver consists of one valve of impedance 3,500 ohms (*e.g.*, P.M.254), the response curve, neglecting focussing, is very nearly

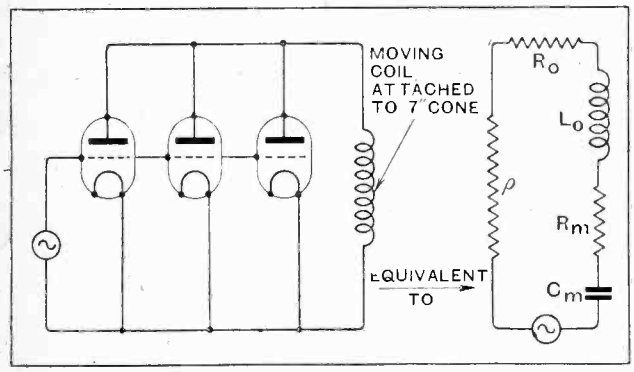

Fig. 1.—Paralleled output stage and equivalent network. ρ = combined A.C. resistance of valves; L_o = coil inductance (for a coil of 1,000 turns in a field of 10,000 lines and with total mass of coil and disc equal to 18.5 grams, C_m = 0.74 mfd.); R_o = radiation resistance never greater than about 50 ohms, hence negligible when compared with the other impedances of the circuit.

even. This is shown by curve A, Fig. 2(b). The reason for this is simply that the impedance of the whole of the output circuit, comprising the output valve and the moving coil, is approximately 6,000 ohms at the very low (54 cycles) and very high (4,000 cycles) frequencies,[1] and is 4,500 ohms at the middle frequencies near middle C on the piano (*i.e.*, at electrical resonance).

It is frequently the practice to place two or more valves in parallel in the last stage (Fig. 1) in order to increase the power output. This increase is purely the result of the lowering of the output circuit impedance. It should be remembered that the combined impedance of two valves in parallel is half the impedance of one of them, and for three valves one-third the impedance of one of the valves, and so on. It is clear, however, that no matter how many valves are used the total impedance of the whole of the output circuit consisting of valves and coil cannot be less than the impedance of the moving coil, and since the power output is inversely proportional to the square of the impedance of the output circuit the effect of even one hundred valves in parallel is merely to magnify the power output by about four at the very low and very high frequencies and to magnify it by about thirty-five at middle C. This latter magnification depends solely upon the D.C. resistance of the moving coil, which is usually about 1,000 ohms.

Valve Impedance and Coil Characteristic.

The following values are used in curves A, B, C, D and E in Figs. 2(a) and 2(b):—Curve A is for one valve of ρ=3,500 with coil of 1,000 turns of wire of resistance 5.3 ohms per yard (No. 46 S.W.G.). Curve B is for three valves under the same conditions, while Curve C is for five valves. Curve D is for three valves of ρ=3,500 with coil of 580 turns of wire of resistance 3.07 ohms per yard (approximately No. 44 S.W.G.).

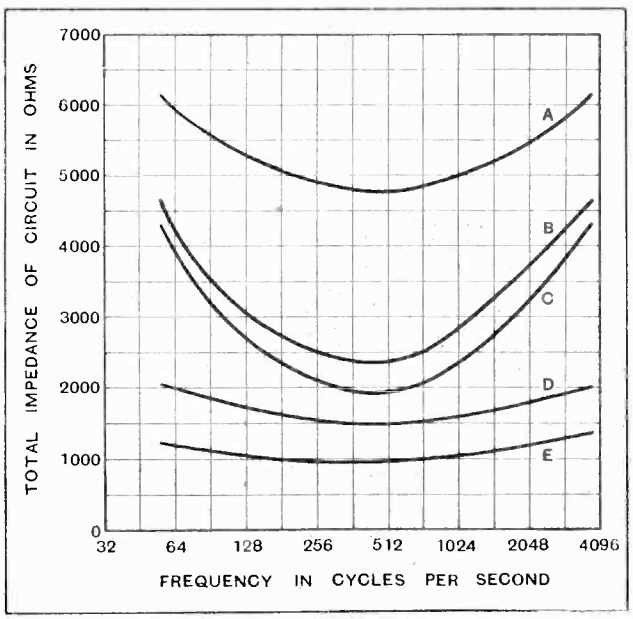

Fig. 2(a).—Total impedance of circuit plotted against frequency.

[1] A New Method of Push Pull, by L. E. T. Branch, *The Wireless World*, May 23rd, 1928.

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Curve E is for five valves of $\rho = 3{,}500$ with coil of 450 turns of wire of resistance 2.38 ohms per yard (approximately No. 43 S.W.G.).

If, however, the moving coil is carefully designed as regards the number of turns and gauge of wire the response curve can be kept fairly even. The more valves in parallel, *i.e.*, the lower the combined valve impedance, then the fewer should be the number of turns and the greater the diameter of wire used. For

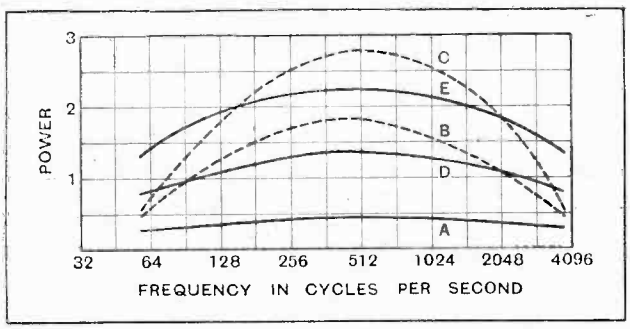

Fig. 2(b).—Power plotted against frequency. Power is expressed as that at a point on the axis and at a great distance from the cone.

the best results the coil should be made in accordance with the following table, or if a very large number of valves are used the curve given in Fig. 3 can be used:—

Valves.	Combined Impedance.	No. of Turns.	Nearest Gauge of Wire.
1 P.M.254	3,500 ohms	1,000	No. 46 S.W.G.
1 L.S.5A	2,750 ,,	890	No. 46 ,,
1 Cosmos A.C. (red spot)	2,500 ,,	845	No. 46 ,,
2 P.M.254	1,750 ,,	710	No. 45 ,,
2 L.S.5A	1,375 ,,	630	No. 44 ,,
2 Cosmos A.C. (red spot)	1,250 ,,	600	No. 44 ,,
3 P.M.254	1,167 ,,	580	No. 44 ,,
3 L.S.5A	917 ,,	510	No. 43 ,,
3 Cosmos A.C. (red spot)	833 ,,	490	No. 43 ,,

If a step-down output transformer is being used in conjunction with a so-called low resistance coil, this latter should likewise be designed to match the impedance of the output valve or valves. Since the impedance of the valves in the primary circuit throw an impedance into the secondary[2] equivalent to $\frac{1}{\sigma^2}$ of their combined impedance, this relation should be used in making calculations for the coil design. For example, two L.S.5A valves in parallel have a combined impedance of 1,375 ohms, and if a 25 : 1 transformer is used in making calculations for the coil secondary is $\frac{1375}{25^2} = 2.2$ ohms. This figure is then the "valve impedance," which has to be taken into account when making the moving coil. The coil which will be most efficient for these circumstances is seen from the curve of Fig. 4, which is really an extension of Fig. 3, to be 24 turns of No. 28 S.W.G.

As a guide for those who wish to calculate the correct number of turns and gauge of wire to suit particular cases we will now treat the subject a little more exactly with one or two examples.

It has been shown in a previous article, already referred to, that the impedances of the whole of the output circuit at approximately 54 and 4,000 cycles, when one P.M.254 valve is used, are both

$$Z_1 = \sqrt{(4000)^2 + (3500 + 1000)^2} = 6030 \text{ ohms.}$$

Hence, if, for instance, three P.M.254 valves in parallel are used the impedances at 54 and 4,000 cycles will both be

$$Z_2 = \sqrt{(4000)^2 + \left(\frac{3500}{3} + 1000\right)^2} = 4650 \text{ ohms,}$$

while the impedance at resonance (500 cycles) becomes $\left(\frac{3500}{3} + 1000\right)$ ohms. Moreover, it is clear that no matter how many valves are placed in parallel the impedance of the circuit cannot be reduced below $\sqrt{(4000)^2 + (1000)^2} = 4120$ ohms at 54 and 4000 cycles, in which case the power at these frequencies cannot be increased more than $\left(\frac{6000}{4120}\right)^2$ times (the power output being inversely proportional to the square of the impendance of the whole circuit), although, of course, at 500 cycles the power becomes very great indeed. For correct working the moving coil should be designed in accordance with the number of valves used in parallel, the design depending, other things being equal, entirely upon the combined anode impedance of all the valves in the last stage. If, for example, we use the information already at hand for the case of one P.M.254 valve, we can work out the design of the moving coil suitable for n valves in parallel. The combined impedance of the n valves is $\frac{3500}{n}$ ohms. Now

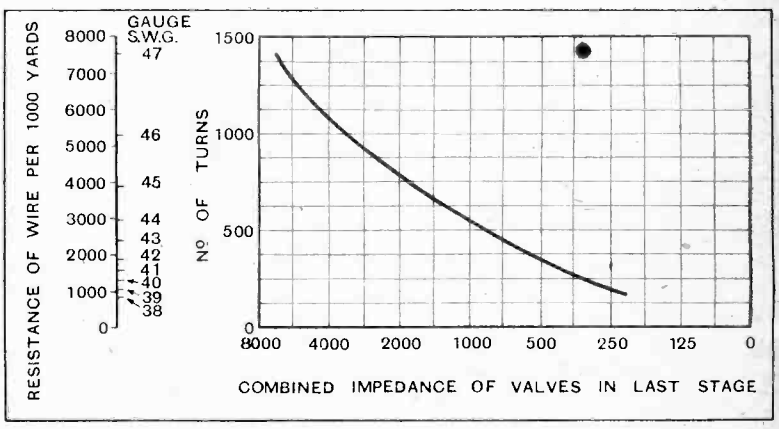

Fig. 3.—Chart giving coil design data.

[2] *The Wireless World*, January 18th, 1928, p. 63.

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to maintain the same shape of response curve given by one valve of 3,500 ohms driving our 1,000-turn coil and to obtain the maximum efficiency, the impedance of the moving coil should be reduced to $\frac{4000}{n}$ ohms at 54 and 4,000 cycles. This is done by winding the coil with $\frac{1000}{\sqrt{n}}$ turns and increasing the diameter of the wire proportionately. With a coil of $\frac{1000}{\sqrt{n}}$ turns the inductance is reduced from 0.15 henries to $\frac{0.15}{n}$ henries, and the ohmic impedance of this at 4,000 cycles is $\frac{4000}{n}$ ohms, while the motional capacity is reduced from 0.74 mfd. to [3]

$$\frac{m \times 10^{15}}{\left(\frac{1000}{n} \times 10{,}000\right)^2} = n \times 0.74 \text{ mfd.}$$

the impedance of which at 54 cycles is

$$\frac{1}{2\pi \times 54 \times n \times 0.74} = \frac{4000}{n} \text{ ohms.}$$

The impedance at resonance is likewise reduced to $\left(\frac{3500}{n} + R_0\right)$ ohms.

We have assumed that the radiation resistance remains practically negligible. This condition is fulfilled if n is not greater than about ten.

There still remains the diameter of the wire with which the coil should be wound. In order to arrive at this we have to remember that R_0 is to be reduced from 1,000 ohms to $\frac{1000}{n}$ ohms. Since the turns have been reduced from 1,000 to $\frac{1000}{\sqrt{n}}$ the ohmic resistance of the wire must be reduced in the ratio of $1 : \frac{1}{\sqrt{n}}$.

With a coil having such characteristics the total impedance of the circuit is

$$\sqrt{\left(\frac{4000}{n}\right)^2 + \left(\frac{3500}{n} + \frac{1000}{n}\right)^2} = \frac{1}{n}\sqrt{(4000)^2 + (3500 + 1000)^2} = \frac{1}{n} Z_1.$$

Now the power output is given by $R_m(NI)^2$, where N is the number of turns on the moving coil and I the current. If the R.M.S. voltage change on the anode (on open circuit) for one valve is V the power output is $P_1 = R_m(NI)^2$, where $N = 1000$ turns and $I = \frac{V}{Z_1}$. Hence for n valves in parallel and a coil of $\frac{1000}{\sqrt{n}}$ turns the power output is

$$P_n = R_m\left(\frac{N}{\sqrt{n}} I\right)^2, \text{ where } I = \frac{V}{\frac{1}{n} \times Z_1}.$$

Thus we see that $P_n = n \times P_1$, which means that with n valves in parallel and by suitably adjusting the construction of the coil, the power over the whole range of the musical scale can be increased n times.

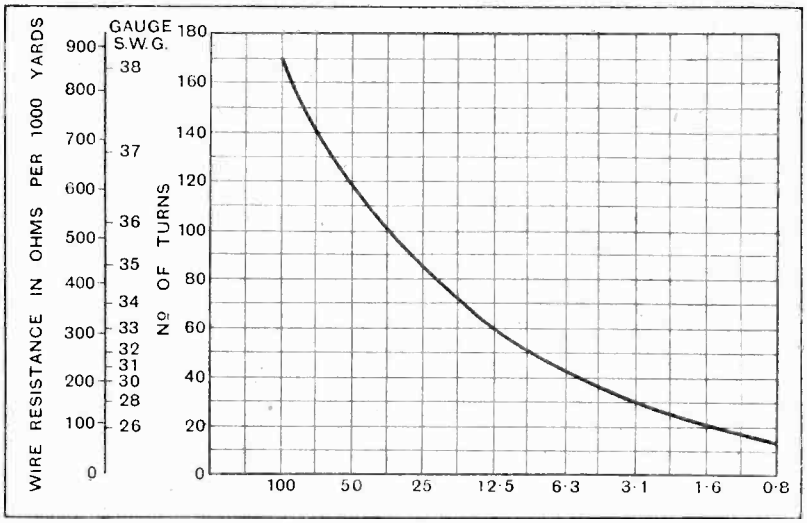

Fig. 4.—Various gauges of wire for speech coil plotted against the combined impedance of valves in the last stage divided by the square of the output transformer ratio.

Consider as an example that five valves each of 3,500 ohms are used in parallel, *i.e.* $n = 5$. A suitable coil for such conditions is then made of $\frac{1000}{\sqrt{5}} = 450$ turns of wire having an ohmic resistance per yard of $\frac{1}{\sqrt{5}}$ of the resistance of No. 46 wire. The nearest gauge of wire which will be suitable is, therefore, No. 43 S.W.G. and the coil resistance is approximately 200 ohms. The A.C. impedance of this coil at 54 and 4,000 cycles is then $\frac{1}{5} \times 4{,}000$ ohms $= 800$ ohms, and since the combined impedance of the five valves is $\frac{3500}{5} = 700$ ohms the impedance of the circuit is

$$Z_5 = \sqrt{(800)^2 + (700 + 200)^2} = 1200 \text{ ohms.}$$

The output current is increased from $\frac{V}{6000}$ to $\frac{V}{1200}$, *i.e.* an increase in the ampere turns from

$$\left(\frac{V}{6000} \times 1000\right) \text{ to } \left(\frac{V}{1200} \times 450\right).$$

Hence

$$P_1 = R_m\left(\frac{V}{6000} \times 1000\right)^2 \text{ and } P_5 = R_m\left(\frac{V}{1200} \times 450\right)^2.$$

From this P_5 is seen to be equal to $5P_1$, that is, the output power is increased five times. This contrasts strikingly with an increase of rather less than double which would result from using these five valves in conjunction with the original 1,000-turn coil.

[3] See *The Wireless World*, March 30th, 1927, p. 373.

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CURRENT TOPICS

Events of the Week

EDUCATIONAL WIRELESS AT B.A. MEETING.

At the British Association meeting at Glasgow in September next, Sir John Reith, Director-General of the B.B.C., will open a discussion entitled "Wireless in the Service of Education."

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BIG HOSPITAL SET.

Readers of two Sheffield newspapers have provided the Lodge Moor Hospital with a wireless installation capable of operating thirty-six loud-speakers and 600 pairs of headphones.

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CANADIAN BROADCASTING CONTROL.

A Royal Commission is to be set up by the Canadian Government to inquire into the conduct of broadcasting throughout the Dominion. It is public knowledge that the Government contemplates control based on the British system with public ownership of all stations.

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A PRUDENT PILOT.

Captain F. T. Courtney, who will shortly attempt an Atlantic flight from Lisbon, *via* the Azores to Newfoundland or Halifax, will make the fullest possible use of wireless. Transmitting and receiving sets will be carried on the Dornier Napier flying boat, and the crew will include a wireless operator. Special ground organisations have been established on both sides of the Atlantic to supply wireless weather reports while the flight is in progress.

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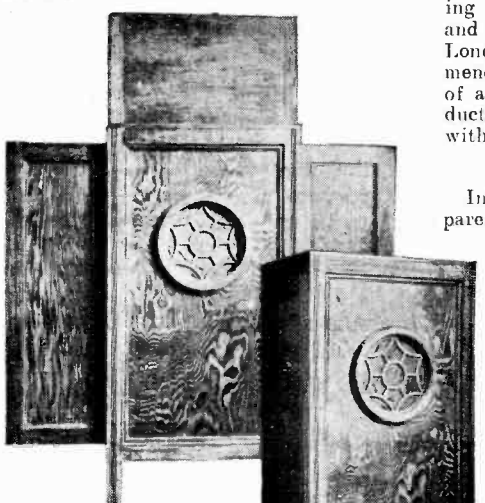
BROADCASTING ON A ROYAL TOUR.

During the voyage, begun yesterday, which their Majesties the King and Queen of the Belgians are making to the Belgian Congo on the steamship "Thysville," a special member of the staff of the *Journal Parlé de Radio-Belgique* will accompany them. Amplifiers are installed on the boat, and every day this announcer will broadcast for the benefit of the royal passengers a résumé of current events, edited from wireless telegrams received while at sea. In the same way he will send a daily wireless telegram to the Brussels station informing the Belgian people of the various activities on the voyage in which their King and Queen take part. This daily bulletin will be read every evening at 8 p.m., B.S.T., during the "Radio-Chronique," broadcast from Radio-Belgique. The Brussels station, it will be remembered, transmits on a wavelength of 508.5 metres.

WIRELESS AND FISH.

The fishing port of Fleetwood has discovered that the absence of a wireless station is a handicap to trade. Many of the fishing vessels carry wireless which the owners consider would be more useful than at present if communication could be maintained with the land. News of the night's catch could be wirelessed in advance of the fleet's arrival and would help to steady prices. It is expected that steps will shortly be taken to provide Fleetwood with a station.



HOME-MADE LOUD-SPEAKER CABINET. This attractive piece of furniture is the handiwork of two readers, Messrs. J. Boyd and W. Latimer, of Dublin. The baffle, which greatly improves reproduction, is incorporated in the cabinet, folding up when not in use.

INDIAN BROADCASTING DEFICIT.

The first annual report of the Indian Broadcasting Company, Ltd., discloses a loss of over £12,500.

The debit balance is attributed mainly to the inevitable expenses incurred during the early unproductive stages of the company's existence. "Piracy," says the report, "has affected the revenue."

in Brief Review.

SIGNIFICANT.

While police court investigations were being conducted in regard to three cases of wireless licence evasion at West Bridgford (Notts), 51 licences were taken out by local residents.

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FORESTALLING THE JUDGE.

At the Shoreditch County Court recently a defendant was explaining that his set would pick up only London and Morse, when a solicitor interrupted with the question: "Where is Morse?"

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M.C. LOUD-SPEAKER DEMONSTRATION.

Readers who desire an opportunity of hearing a moving coil loud-speaker demonstration under the most favourable conditions should make a point of visiting the new showrooms of Messrs. R. I. and Varley, Ltd., at 103, Kingsway, London, W.C.2, during the week commencing June 11th, when demonstrations of a moving coil instrument will be conducted by that company in collaboration with *The Wireless World*.

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THE LISTENERS.

Interesting figures have just been prepared showing the number of wireless listeners per thousand of the population in certain big towns. The highest numbers are those of Bournemouth and Aberdeen, with 154.5 and 116.5 per thousand respectively. Plymouth comes next with 83, closely followed by London with 78.8 per thousand. Apparently Glasgow has the smallest percentage of listeners with 51.1 per thousand.

The figures are based on the number of licences issued.

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CANADIAN PACIFIC SHIP WIRELESS.

Five newly built cargo ships of the "Beaver" class which have taken their place in the Canadian Pacific fleet are all equipped with Marconi apparatus for two-way wireless communication and direction finding.

The main installation is a 1½ kilowatt quenched spark transmitter and a two-valve receiver. This transmitter is sharply tuned to 600-, 706- and 800-metre wavelengths, covering all the requirements of ship to ship and ship to shore communication over distances of eight hundred miles.

The equipment is completed by the Marconi auto-alarm.

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Moving Coil Loud-speakers
COMMERCIAL TYPES

A Review of Manufactured Components and Complete Instruments.

THE construction of a moving coil loud-speaker presents comparatively few difficulties to the amateur, always provided that he can obtain ready-made pot magnet castings fitted with a diaphragm support. Fortunately, a large number of such components are now available commercially; these are briefly reviewed below, special mention being made of departures from conventional practice. Leading dimensions are given, together with what may be called an "exploded" sectional diagram, which will help to make clear the general method of assembly.

In almost every case field windings for either L.T. accumulators or D.C. main supplies are available. It will be observed that many manufacturers supply castings with both wide and narrow gaps, the former being more suitable when energising current is supplied from the mains. In this case, economy in consumption is not of vital importance, and the use of a wide gap simplifies construction.

Several firms are now marketing complete loud-speakers, as distinct from sets of parts; in such cases special attention is drawn to the fact.

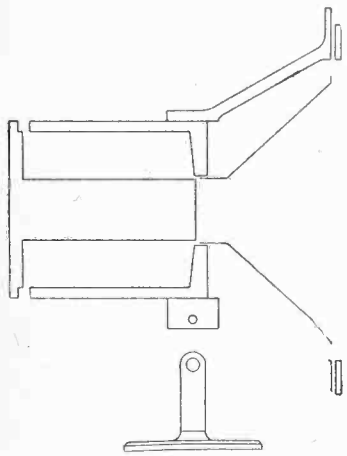
ARPO.

Dimensions. Outside and inside diameters: 5⅝in., 4½in. Length inside and overall: 4½in., 5⅛in. Core diameter: 1 25-32in. Gap width: 7-64in. Gap length: ⅜in. Diaphragm diameter: 7⅞in. Diaphragm angle: 90 degrees.

Moving Coil. High or low-resistance coils supplied as required.

Diaphragm. Mounted on leather.

Remarks. Pedestal mounting is provided, and the loud-speaker is adjustable as to angle. A model with a gap of 5-64in. is also available.

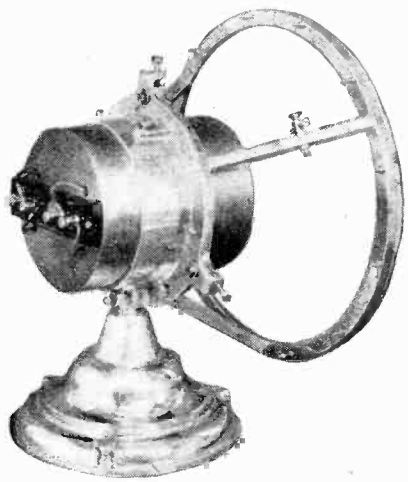


Price. Complete set of parts for high or low voltage, £5.

Maker's Name. E. Arnold Pochin and Bro., Trafford Park, Manchester.

BAKER'S "SELHURST."

Dimensions. Outside and inside diameters: 5in., 4⅜in. for 6-volt, and 4in. for high-voltage windings. Length inside and overall: 4⅜in., 5¼in. Core diameter, various. Gap width: 5-64in., or to order. Gap length: ⅜in. Diaphragm diameter: various. Diaphragm angle, 90 degrees.

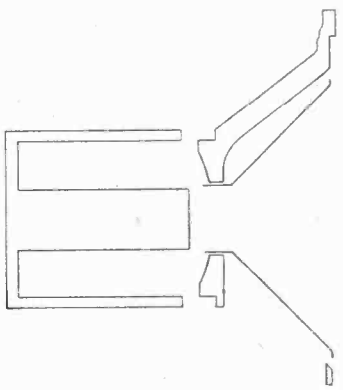


Baker's "Selhurst."

Moving Coil. Various patterns are supplied. Centring is effected by a two-thread adjustable suspension. A flanged celluloid ring on the coil former facilitates the attachment of the cone.

Diaphragm. Mounted on leather, silk or rubber as required, in diameters of 7in. or 9in. as ordered. Supported by an aluminium frame carrying a ring which slides over the magnet, to which it is secured by nipping screws.

Bygrave.



Remarks. This firm supplies a wide range of parts, including those with extremely small gaps, intended to operate on low field energising wattages. Standard "Wireless World" parts are also supplied.

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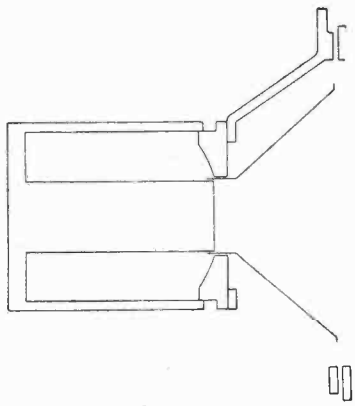
Moving Coil Loud-speakers.—

Price. Complete set of parts for low-voltage supply, £4 7s. For mains supply, £4 19s.

Maker's Name. A. Baker, 89, Selhurst Road, South Norwood, London, S.E.25.

BYGRAVE.

Dimensions. Outside and inside diameters: 5¼in., 4⅝in. Length inside and overall: 5in., 5½in. Core diameter: 1¾in. Gap width: 3/32in. Gap length: ⅜in. Diaphragm diameter: 7in. Diaphragm angle: 90 degrees.

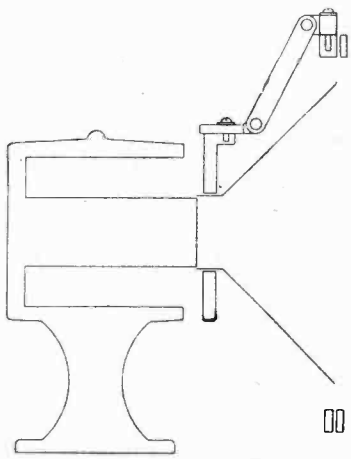


Diaphragm. Mounted on leather. The diaphragm frame is cast in one piece and is screwed to the cover plate of the magnet.

Maker's Name. W. Bygrave and Sons, Constitution Hill, Birmingham.

CLARK.

Dimensions. Outside and inside diameters: 5in., 4¼in. Length inside and overall: 4½in., 5in. Core diameter: 1⅝in. Gap width: ⅛in. Gap length: ⅜in. Diaphragm diameter: 8½in. Diaphragm angle: 90 degrees.



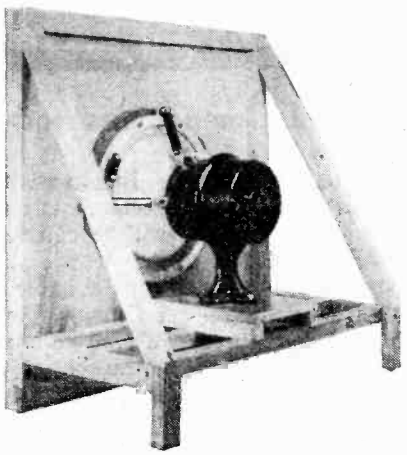
Moving Coil. High resistance type.

Diaphragm. Supported by rubber ring. The clamping rings are secured to the magnet by means of special link fittings which permit of adjustment in any direction.

Remarks. The field winding is connected to flush-mounted sockets on the magnet. Terminals for the moving coil leads are mounted on one of the diaphragm supports.

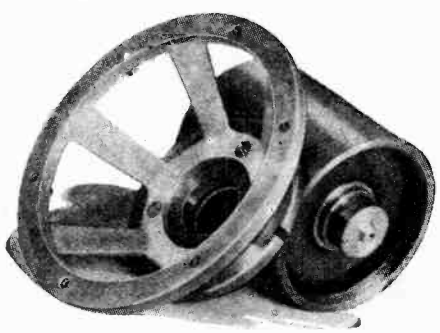
Price. Complete set of parts, without baffle board, £5 10s.

Maker's Name. L. V. Clark, 4, Compton Crescent, Chiswick, London, W.4.



Clark.

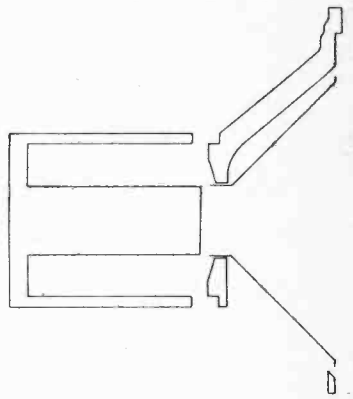
Colvern.



Cromwell Eng. Co.

COLVERN.

Dimensions. Outside and inside diameters: 5¼in., 4½in. Length inside and overall: 4⅞in., 5⅜in. Core diameter: 1⅜in. Gap width: 5/32in. or 5-64in. Diaphragm diameter: 7¼in. Diaphragm angle: 90 degrees.



Remarks. The set of parts, which are to *Wireless World* specification, comprise magnet pot with flanged cover plate cast integral with diaphragm supports, brass bobbin for field winding, plywood clamping ring and terminal strips.

Price. £3 7s. 6d.

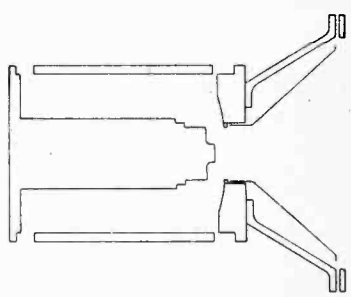
Maker's Name. Colvern, Ltd., Maunays Road, Romford, Essex.

CROMWELL.

Dimensions. Outside and inside diameters: 5in., 4½in. Length inside and overall: 5in., 5⅛in. Core diameter: 1½in. Gap width: 1/16in. Gap length: ⅜in. Diaphragm diameter: 6in. Diaphragm angle: 90 degrees.

Moving Coil. Of the high-resistance type (1,000 ohms). A tapped hole is provided in the centre of the pole for fitting a flexible centring disc if required.

Diaphragm. Carried on a cast aluminium frame screwed to the cover plate.



Remarks. All parts are of steel, being machined from drawn tube and rod. The front and back end plates screw into threads cut internally in the cover. A copper damping ring is pressed into the under face of the cover plate, and serves for centring the pole as well as for "loading" the moving coil.

Price. Complete set of parts, £5 15s. 6d.

Maker's Name. The Cromwell Engineering Co., 81, Oxford Avenue, Merton Park, London, S.W.20.

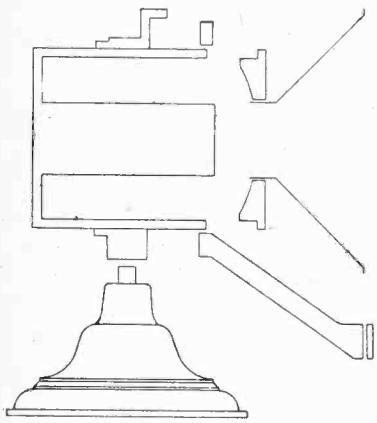
www.americanradiohistory.com

Moving Coil Loud-speakers.—

EPOCH.

Dimensions. Outside and inside diameters : 5in., 4½in. Length inside and overall : 5in., 5¼in. Core diameter : 2in. Gap width : ⅛in., 3/32in. or 5/64in. Gap length : ⅜in. Diaphragm diameter : 7in. or 9in. Diaphragm angle : 90 degrees.

Moving Coil. Former turned from ebonite of a quality specially chosen to pre-



vent warping ; it is flanged to give additional strength, and also grooved for the winding. The standard coil is wound to 2,000 ohms, but other resistances are supplied.

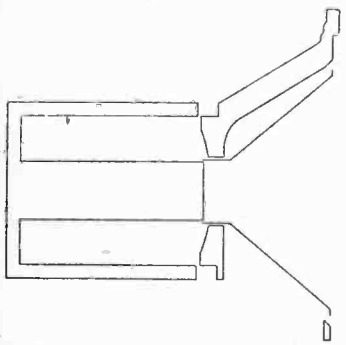
Remarks. Material for making the diaphragm and a blue print are included in the set of parts. Fittings with thread suspension holes are supplied to order at the same price. The standard field winding is for a 6-volt accumulator, and the consumption is 0.7 amp. Other windings are available, including one for D.C. mains at an extra cost of 12s.

Price. Complete set of parts, £3 10s.

Maker's Name. Epoch Radio Manufacturing Co., 53, Gracechurch Street, London, E.C.

ETA TOOL COMPANY.

Dimensions. Outside and inside diameters : 5⅛in., 4½in. Length inside and



overall : 5⅛in., 5½in. Core diameter : 1 3/16in. Gap width : 3/32in. Gap length : ½in. Diaphragm diameter : 7½in. Diaphragm angle : 90 degrees.

Moving Coil. The centring device consists of 3 threads, with special form of tensioning.

Diaphragm. Mounted on leather ring carried by aluminium supporting ring.

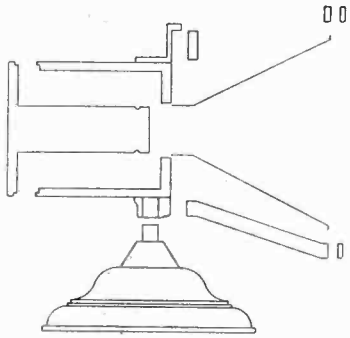
Remarks. The arms carrying the diaphragm ring are cast with the cover plate, and the ring is bolted to them in such a way that its distance from the gap is adjustable. The terminals for the field windings are mounted on an ebonite strip at the rear, and the coil terminals on one of the arms carrying the diaphragm mount.

Maker's Name. The Eta Tool Co., 70a-70c, Asylum Street, Leicester.

Eta Tool Co.

GODFREY.

Dimensions. Outside and inside diameters : 5⅛in., 4½in. Length inside and overall : 4¾in., 5⅛in. Core diameter :



1 3/16in. Gap width : 5/32in. Gap length : ⅜in. Diaphragm diameter : 7⅛in. Diaphragm angle : 55 degrees.

Maker's Name. F. E. Godfrey, 3, New End, Hampstead.

GOODMAN'S.

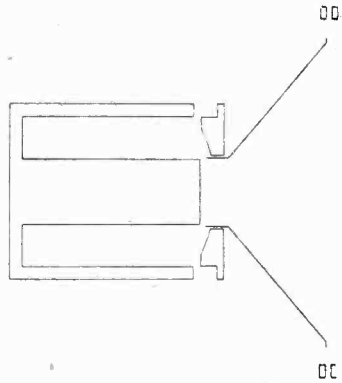
Dimensions. Outside and inside diameters : 5in., 4in. Length inside and overall : 5in., 5⅛in. Core diameter : 1 5/16in. Gap width : ⅛in., 3/32in., or any size to order.

Moving Coil. Standard high- or low-resistance coils can be supplied. Also coils wound to any particular specification. The former is turned from red fibre tube with a flange shaped for easy attachment of the cone.

Diaphragm. The cone paper supplied is marked with a circle on a radius of 6in., and instructions are given for making cones of various angles and consequently different diameters.

Remarks. The above remarks apply to the larger model. Another magnet casting of smaller size is also supplied, together with a full range of components.

Price. Magnet pot, with 6-volt field



winding, £3 5s. Junior model, £2 15s.

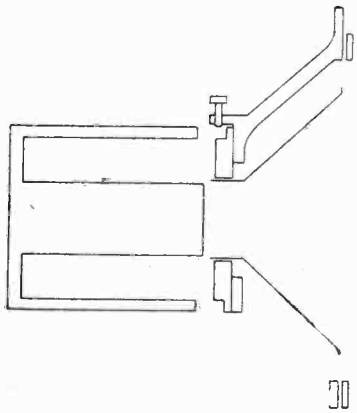
Maker's Name. Goodman's, 27, Farringdon Street, London, E.C.4.

GRIFFIN.

Dimensions. Outside and inside diameters : 5⅛in., 4½in. Length inside and overall : 4 7/8in., 5¼in. Core diameter : 1¾in. Gap width : 5/32in. Gap length : ½in. Diaphragm diameter : 7⅛in. Diaphragm angle : 90 degrees.

Moving Coil. On bakelised laminated paper former only 0.015in. thick. High resistance type.

Diaphragm. Mounted on leather, and carried in a one-piece frame secured to the magnet by nipping screws. Projecting lugs and a baize washer are provided to facilitate the fixing of a baffle plate.



Remarks. A new model with 3-thread suspension and narrower gap is being produced.

Maker's Name. A. W. Griffin and Co. Ltd., Old Factory, Redditch.

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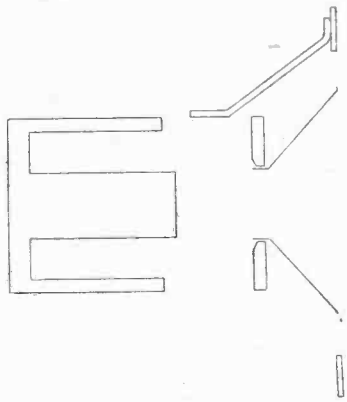
Moving Coil Loud-speakers.—

HILL.

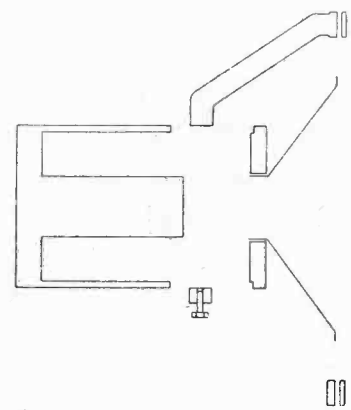
Dimensions. Outside and inside diameters: 5in., 4¼in. Length inside and overall: 3⅞in., 4½in. Core diameter: 1⅞in. Gap width: ⅛in. Gap length: ⅛in. Diaphragm diameter: 6½in. Diaphragm angle: 90 degrees.



Moving Coil. High resistance type with 1,000 turns of No. 44 S.S.C. wire.
Diaphragm. Mounted on washleather.
Remarks. A centring device in the form of a brass spider attached to the pin is supplied.
Price. As complete instrument, £5 10s. approximately, together with transformer.
Maker's Name. Fred C. Hill, Radio Engineer, 154, Compton Road, Wolverhampton.

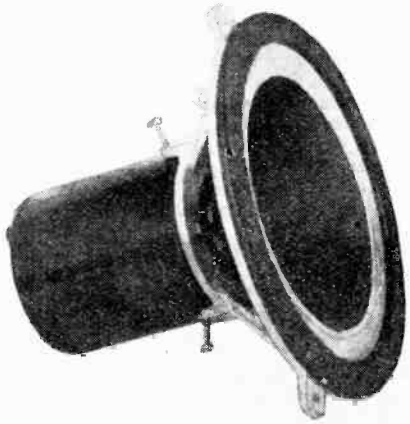
J.G.

Dimensions. Outside and inside diameters: 4¾in., 4¼in. Length inside and overall: 3¾in., 4½in. Core diameter: 1⅜in. Gap width: 1/16in. upwards according to requirements. Gap length: 7/16in. Diaphragm diameter: 7in. Diaphragm angle: 110 degrees.
Moving Coil. Provision for cut-out paper disc centring device
Diaphragm. Mounted on oiled silk.

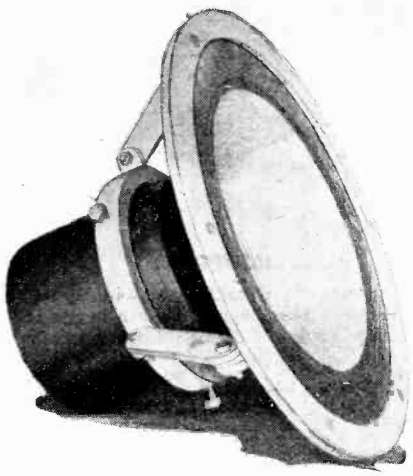


Remarks. The coil frame is a one-piece fitting with a ring sliding over the magnet; it may be secured in any desired position by means of nipping screws. The terminals are fitted on the diaphragm frame.

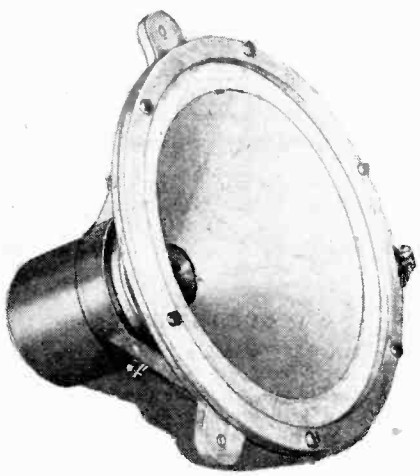
Price. £6 11s. 6d. as complete assembled instrument.
Makers' Name. J.G., Ltd., 49-51, Eastcheap, London, E.C.3.



Griffin.



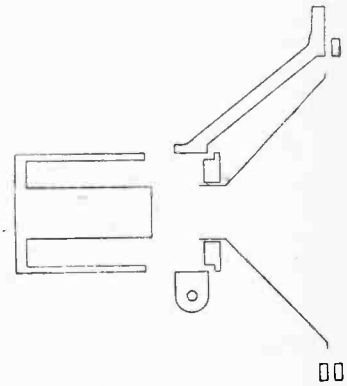
J. G.



Lang and Squire.

LANG AND SQUIRE.

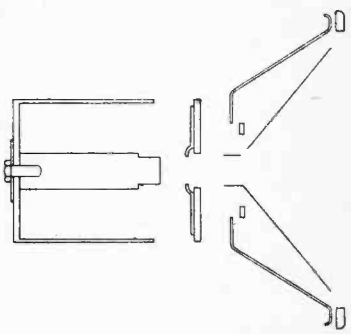
Dimensions. Outside and inside diameters: 3½in., 3⅛in. Length inside and overall: 3⅛in., 3⅞in. Core diameter: 1½in. Cap width: ⅛in. Gap length: ⅛in. Diaphragm diameter: 7⅝in. Diaphragm angle: 90 degrees.
Moving Coil. High or low resistance as required. Centring by 3-point thread suspension with tensioning screws; terminals on cone frame.
Diaphragm. Mounted on Empire cloth, and carried on aluminium supporting frame. This is secured (adjustably) to the magnet by means of a ring fitted with nipping screws.



Remarks. The field winding terminals are mounted at back of pot. The casting is of steel, and of comparatively small size.
Price. Complete set of parts, with low resistance moving coil, £4 3s. 6d.
Maker's Name. Lang and Squire, Ltd., Wales Farm Road, Acton, London, W.3.

MAGNAVOX.

Dimensions. Outside and inside diameters: 4in., 3 13-16in. Length inside and overall: 3¾in., 3 15-16in. Core diameter: ¾in. Gap width: 1/16in. Gap length: 3/16in. Diaphragm diameter: 6¾in. Diaphragm angle: 90 degrees.
Moving Coil. Low resistance, centred by bakelised fabric disc, cut away to leave three narrow curved strips.
Diaphragm. Mounted on leather.



Remarks. Sold only as a complete instrument. The centring device is unusual; the disc mentioned above is mounted in an annular metal frame which is screwed to the magnet cover plate. An

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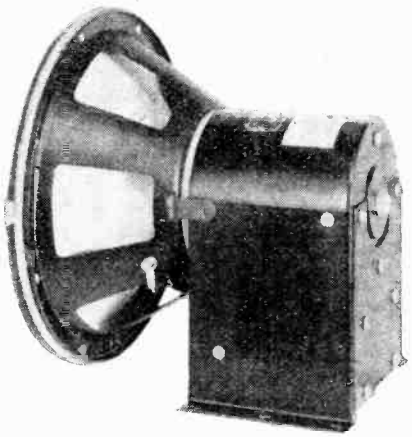
Moving Coil Loud-speakers.—

input transformer is housed in the bent metal base. The cone is rigidly secured to the moving coil by means of a thin pressed metal fitting.

Price. For A.C. (with metal rectifier unit), £11 11s.; for D.C., £10 10s.; for 6-volt accumulator (0.5 amp. consumption), £9 10s.

Agents. The Rothermel Corporation, Ltd., 24-26, Maddox Street, London, W.1.



Magnavox.

N.E.W.

Dimensions. Outside and inside diameters: 4⅜in., 4¼in. Length inside and overall: 4⅝in., 4⅞in. Core diameter: 1⅛in. Gap width: 3/32in. Gap length: ⅝in. Diaphragm diameter: 7½in. Diaphragm angle: 90 degrees.

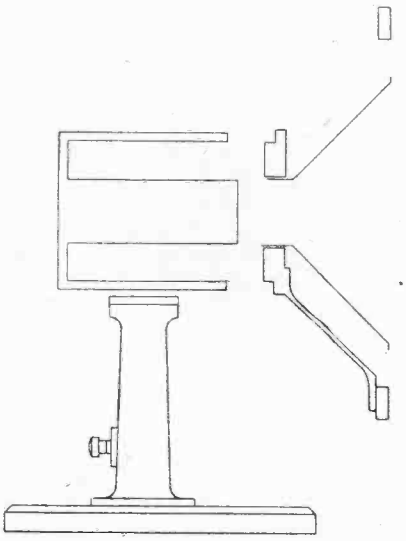
Moving Coil. A high-resistance coil is ordinarily supplied; it is centred by a 3-thread device with tension screws.

New Era "N.E.W."

Diaphragm. Mounted on leather ring, and fitted with re-entrant cone.

Remarks. The instrument is mounted on a wooden pedestal and a fabric washer is fitted to the supporting ring to provide a seating when a baffle board is added. The loud-speaker is supplied as a complete instrument, tested ready for use.

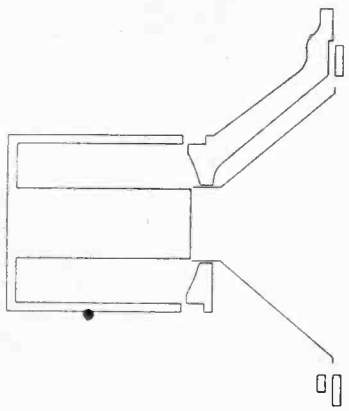
Price. For 200-220 volt supplies, £7. For 6-volt accumulators, £6 15s.



Maker's Name. New Era Wireless and Electrical Co., 3, Hobmoor Road, Small Heath, Birmingham.

PEARSON.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length inside and overall: 4¾in., 5⅛in. Core diameter: 1¾in. Gap width: 3/32in. Gap length: ⅜in. Diaphragm diameter: 7½in. Diaphragm angle: 90 degrees.

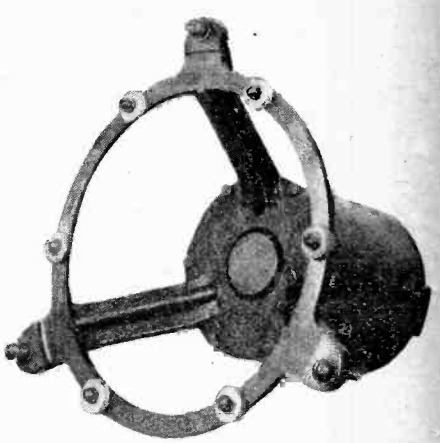


Remarks. The cover plate and diaphragm supporting ring are cast in one piece.

Maker's Name. Alfred Pearson, Newland Avenue, Hull.

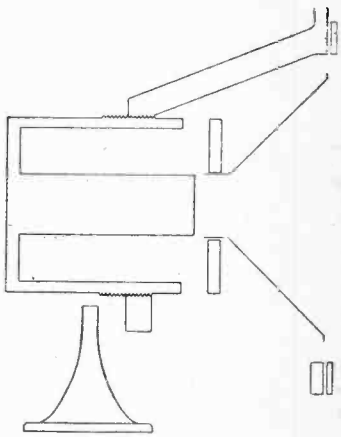
PEMBROKE.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length inside and overall: 4¾in., 5⅛in. Core diameter: 1 25-32in. Gap width: 5-64in. Gap length: ⅜in. Diaphragm diameter: 7½in. Diaphragm angle: 90 degrees.

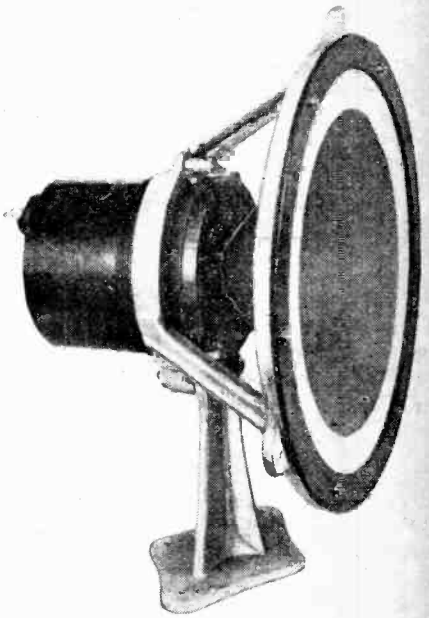


Pearson.

Moving Coil. High or low resistance as required. Centred by means of three



threads connected to the coil and anchored to phosphor-bronze springs.



Pembroke.

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Moving Coil Loud-speakers.—

the tension of which may be individually adjusted by set screws.

Diaphragm. Mounted on fabric.

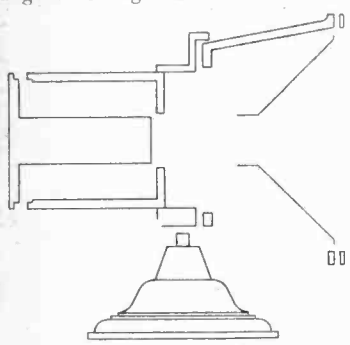
Remarks.—The cone frame is rigidly mounted to the base, which is secured to an internally threaded ring, engaging with an external thread on the magnet; thus the position of the latter with relation to the moving coil may be adjusted by rotating it to the position desired.

Price. Complete set of parts for D.C. mains or 6-volt L.T. supply, £6 10s.

Maker's Name. Cutters and Tools, Ltd., 43-45, Pembroke Place, Liverpool.

PERKS.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length and overall: 4¾in., 5¼in. Core diameter: 1¾in. Gap width: $\frac{3}{32}$in. Gap length: $\frac{5}{16}$in. Diaphragm diameter: 7½in. Diaphragm angle: 90 degrees.

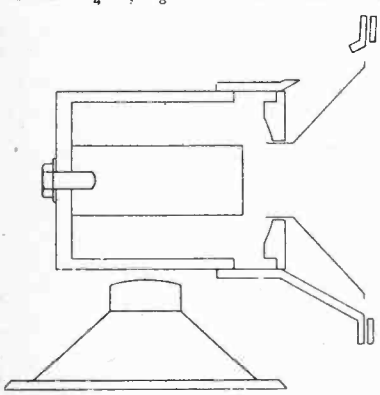


Remarks. The back cover plate and central pin are cast in one piece; thus the field coil may be permanently fixed in position.

Maker's Name. H. Perks and Co., The Foundry, Stanley Road, South Harrow, Middlesex.

PORTER.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length inside and overall: 4¾in., 5⅝in. Core diameter:



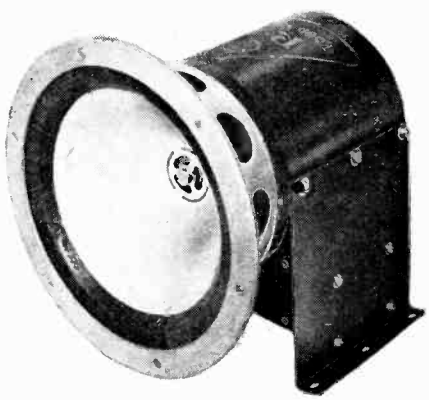
1¾in. Gap width: ⅛in. Gap length: $\frac{5}{16}$in. Diaphragm diameter: 6½in. Diaphragm angle: 90 degrees.

Diaphragm. Supported by one-piece cast aluminium frame with separate clamping ring. Its position with respect to the gap may be adjusted.

Remarks. An ingenious idea is incorporated in the pedestal stand for the loud-speaker. This is of the exact size and shape of the cone diaphragm, and

Perks.

Porter.



B. T. H. "R.K."

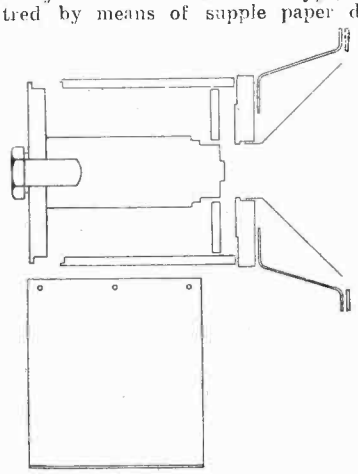
thus, prior to being used for its normal purpose, will serve as a former when constructing the cone.

Maker's Name. C. J. Porter, Wellowgate, Grimsby.

R.K.

Dimensions. Outside and inside diameters: 5¼in., 4½in. Length inside and overall: 4½in., 5in. Core diameter: 2in. Gap width: $\frac{1}{16}$in. Gap length: ⅜in. Diaphragm diameter: 6in. Diaphragm angle: 90 degrees.

Moving Coil. Low resistance type, centred by means of supple paper dise,



which is cut out to reduce its rigidity; the centre is screwed to the magnet pin.

Diaphragm. Mounted on leather and secured in position by perforated metal framework.

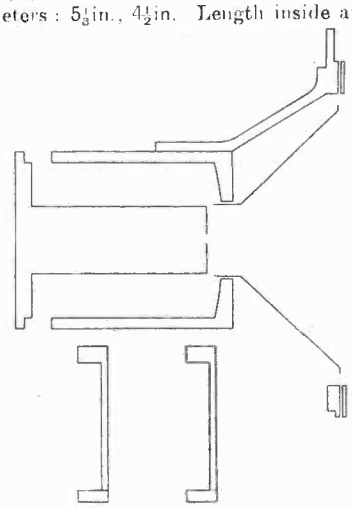
Remarks. Field windings suitable for high- or low-voltage D.C. supplies, or 6-volt accumulators are supplied. The consumption with the latter is 1 amp. A 20:1 ratio step-down transformer is housed in the bent metal supporting bracket: models are also sold without base or transformer. A copper damping ring is mounted immediately behind the moving coil. Supplied only as a complete instrument.

Price. £9 10s.: without base or transformer, £8 10s.

Maker's Name. The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

SCIENTIFIC DEVELOPMENT CO.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length inside and



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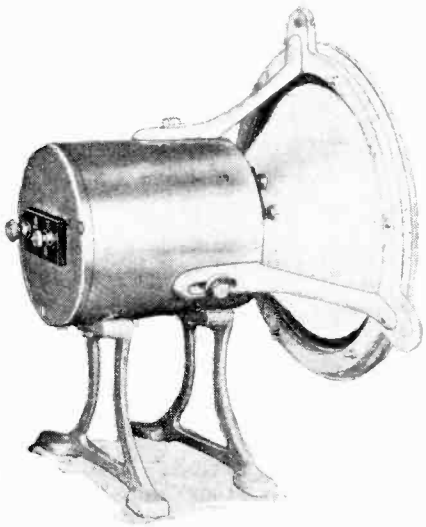
Moving Coil Loud-speakers.—

overall : 4⅜in., 5⅛in. Core diameter : 1⅞in. Gap width : ⅛in. Gap length : ⅜in. Diaphragm diameter : 7½in. Diaphragm angle : 90 degrees.

Diaphragm. Fitted with re-entrant cone and oiled silk supporting ring.



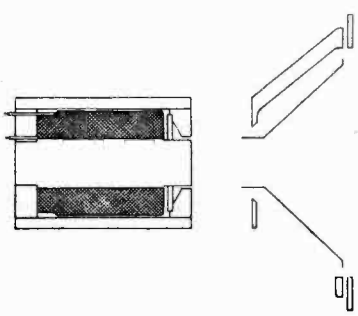
Scientific Development Co.

Remarks. Terminals for moving coil and field winding are provided, and a skeleton pedestal is fitted.

Maker's Name. Scientific Development Co., 51, Fishergate, Preston, Lancs.

SHEFFIELD MAGNET CO.

Dimensions. Outside and inside diameters : 4⅞in., 4in. Length inside and overall : 4 29-32in., 6 17-32in. Core diameter : 1¾in. Gap width : 5-64in.



Gap length : ⅜in. Diaphragm diameter : 7 3/16in. Diaphragm angle : 90 degrees.

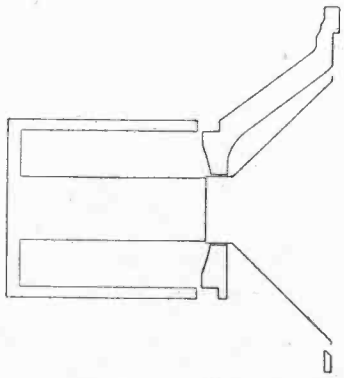
Remarks. A permanent magnet instrument constructed of special steel. The magnetising coil is left in position.

Maker's Name. The Sheffield Magnet Co., 116-126, Broad Lane, Sheffield.

SUN FOUNDRY.

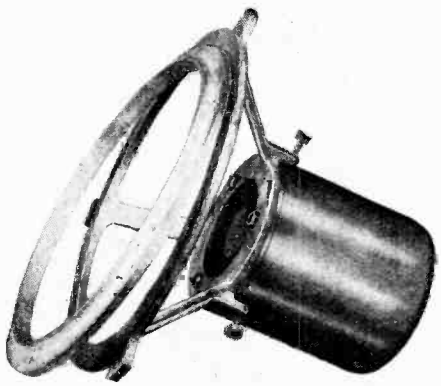
Dimensions. Outside and inside diameters : 5⅛in., 4 5/16in. Length inside and overall : 5⅛in., 5½in. Core diameter : 1¾in. Gap width : 5/32 or 3/32in. Diaphragm diameter : 6¾in. Diaphragm angle : 80 degrees.

Diaphragm. Mounted in a frame adjustably secured to the magnet by means of side nipping screws, and also by



screws passing through oversize clearance holes in the cover plate; thus the position of the cone with respect to the gap may be adjusted in any direction.

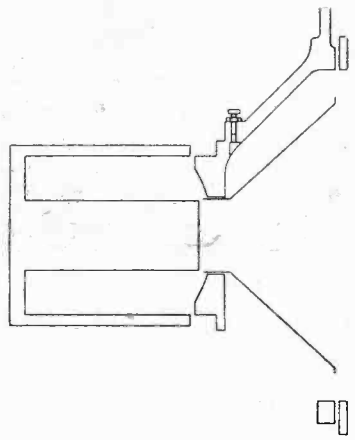
Maker's Name. Sun Foundry, Ltd., Newtown Row, Birmingham.



Sun Foundry.

TOFIELD "SIREN."

Dimensions. Outside and inside diameters : 5⅛in., 4½in. Length inside and overall : 4 13-16in., 5⅛in. Core diameter : 1¾in. Gap width : 5-64in. Gap length : 1/16in. Diaphragm diameter : 7½in. Diaphragm angle : 90 degrees.



Moving Coil. A 3-point thread suspension is fitted with tensioning screws.

Diaphragm. Mounted on leather. Supporting frame arms cast integral with cover plate. A plywood clamping ring is supplied.

Remarks. The field coil is wound on a brass bobbin.

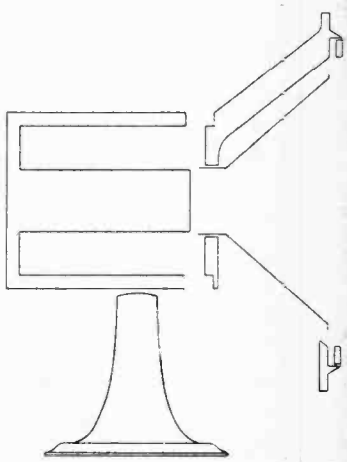
Tofield "Siren."

Price. Complete set of parts for 6-volt field supply, £6 5s.; for D.C. supply (any voltage), £6 15s.

Maker's Name. H. H. Tofield and Co., 99, Trafalgar Road, Moseley, Birmingham.

TURNOCK.

Dimensions. Outside and inside diameters : 5in., 4¼in. Length inside and overall : 5in., 5⅜in. Core diameter : 1 25-32in. Gap width : 7-64in. Gap length : ⅜in. Diaphragm diameter : 7in. Diaphragm angle : 90 degrees.



Moving Coil. High or low resistance.

Remarks. Field windings to suit all voltages are supplied. Various components are available.

Price. Magnet only, wound for 6 volts, £2 10s. Ditto for high voltages, £3. Frame, £1 5s.

Maker's Name. G. Turnock, Tunion Works, Six Ways, Aston, Birmingham.

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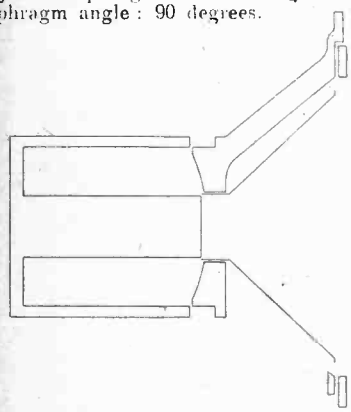
Moving Coil Loud-speakers.—

VAUGHTON.

Dimensions. Outside and inside diameters: 5⅛in., 4½in. Length inside and overall: 4⅞in., 5⅝in. Core diameter: 1⅝in. Gap width: 7-64in. Gap length: ⅝in. Diaphragm diameter: 7¼in. Diaphragm angle: 90 degrees.



Remarks. This firm supplies components for *Wireless World* designs, all parts being available.

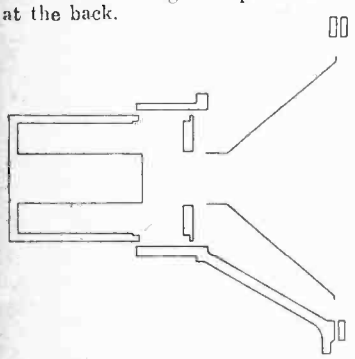
Price. Machined magnet casting and frame, £2.

Maker's Name. M. I. Vaughton, 88, Vyse Street, Birmingham.

WEBSON.

Dimensions. Outside and inside diameters: 4⅞in., 4 5-16in. Length inside and overall: 4⅝in., 4 15-16in. Core diameter: 1⅞in. Gap width: 1-16in. Gap length: ⅜in. Diaphragm diameter: 9in. Diaphragm angle: 90 degrees.

Moving Coil. High or low resistance as required. Its connections are taken to bushed terminals on the cover plate, and thence through the pot to terminals at the back.



Diaphragm. Supported on leather ring.

Remarks. The diaphragm frame is a one-piece casting, with separate clamping ring which may be secured to the pot magnet in any desired position by means of nipping screws.

Star Engineering Co.'s "Webson."

Price. Magnet unit with field winding from £2 to £3 15s., depending on voltage. Aluminium frame with micrometer adjustment, £1 15s. This firm supply a number of components for the construction of moving coil loud-speakers.

Maker's Name. Star Engineering Co., Albert Street, Didsbury, Manchester.

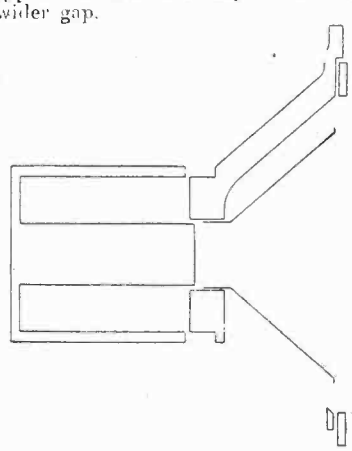
Mic Wireless Co.'s "Zampa."

W.M.C.

Dimensions. Outside and inside diameters: 5in., 4⅜in. Length inside and overall: 4⅜in., 5in. Core diameter: 1¾in. Gap width: 5/32in. or 5-64in. Gap length: 1in. Diaphragm diameter: 7in. Diaphragm angle: 90 degrees.

Moving Coil. High resistance type, with 2,000 turns of No. 47 enamelled wire.

Remarks. The 6-volt field winding takes a current of 0.7 ampere; the D.C. mains type consumes 0.2 amp., and has a wider gap.



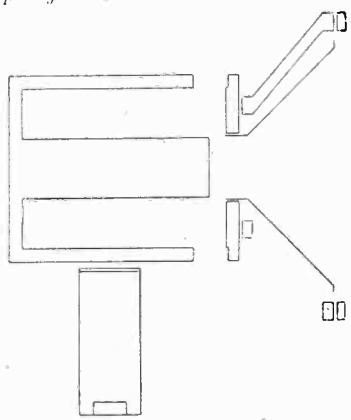
Maker's Name. W.M.C. Manufacturing Co., 4, Northampton Street, Birmingham.

ZAMPA.

Dimensions. Outside and inside diameters: 5¼in., 4½in. Length inside and overall: 4⅞in., 5¼in. Core diameter: 1 13-16in.

Moving Coil. 1,500 ohms resistance.

Diaphragm. Mounted on oiled silk



Remarks. The field current consumed is 0.5 amp. at 6 volts. Models are also supplied for D.C. mains. This loud-speaker is sold as a complete instrument.

Price. For 6-volt supply, £6 10s. For D.C. mains supply, £7.

Maker's Name. Mic Wireless Co., White Horse Yard, Market Street, Wellingborough.

IN NEXT WEEK'S ISSUE.

The All-wave Four Receiver which has proved to be a popular set among our readers will no doubt achieve a still greater following in the modified form in which it is to be described in the issue of this journal of 13th June. The wave range still embraces both the normal broadcast and longer wavelengths giving a high degree of H.F. amplification while other features which have recently been discussed including the prevention of parasitic oscillation at low frequency have been embodied.

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The LISTENER

WIRELESS LEAGUE NOTES AND NEWS

FUTURE WORK OF THE WIRELESS LEAGUE.

By the HON. SIR ARTHUR STANLEY, G.B.E., C.B., M.V.O. (*Chairman*).

FORMED at a time when the control of broadcasting had not been definitely fixed, and various phases of the service, which was still in an experimental stage, gave rise to dissatisfaction, the Wireless League can justly claim to have made a number of valuable contributions to the advancement of this great modern development. To mention only a few activities, the League has given evidence to the Crawford Committee (set up to advise the Government as to the control of broadcasting when the British Broadcasting Company's licence expired), organised a successful campaign to induce the Postmaster-General to grant a larger share of the licence fees to the B.B.C., made regular representations to the authorities through the Wireless Organisations' Advisory Committee, and, in conjunction with the R.S.G.B., has undertaken the certification of qualified wireless traders. The existing British Broadcasting Corporation and the powers given to it are largely based on the evidence and suggestions put forward by the Wireless League. This record alone is sufficient proof of the efficacy of the League, apart from the hundred and one minor ways in which help has been given to the individual listener.

Continuance of Representations.

Although it is felt that the broadcast service has now reached a stage when, except for representations on the programme and similar questions, the need for an organisation to protect listeners' interests is not so apparent as it was a few years ago, it has been decided, in response to many requests, to maintain the Wireless League in order that it may hold a watching brief on behalf of the listener. If and when occasion arises for action to be taken, the public will thus have at their disposal the necessary machinery. The League's numerous local representatives up and down the country have agreed to maintain their support, and in this way headquarters will be able to gauge public opinion.

Insurance.

With regard to benefits, it has become increasingly evident during the past year that most people are able to arrange to cover their wireless apparatus by the usual household insurance policy, so that a continuance of this benefit would not now appear necessary. Members will, of course, be able to enjoy the benefit until the expiry of their existing subscriptions, but subsequently the League will not include an insurance scheme in its benefits, unless the member makes a special request for such cover and sends a small extra fee with the usual minimum subscription of two shillings.

Technical Assistance.

The rapid improvement in the standard of service given by wireless dealers and the steady development of the Register of Qualified Agents and Dealers have been such that sufficient support has not been forthcoming for the Patrol Engineer Service, to which full members have been entitled. Consequently, this benefit will also be discontinued, but arrangements have been made to ensure that existing full members will be able to call upon the League for assistance of this nature until their subscriptions lapse. The League is retaining the services of an expert technical adviser, and all classes of members who are in difficulty will be able to claim assistance by correspondence.

"The Listener."

The League's arrangement with the proprietors of *The Wireless World* having now come to an end, this is the last occasion on which "The Listener" will appear as part of this journal. Before concluding our regular association with this popular publication, I should like to express, on behalf of the Committee, the League's very sincere appreciation of the support and assistance which has been freely given both by the proprietors and editorial staff of *The Wireless World*. Although the League's "Notes and News" will not be a regular monthly feature of *The Wireless World*, notices of our activities will continue to appear from time to time in its columns.

* * * *

I appeal to listeners to continue to give their support to the Wireless League in view of the desirability of having machinery ready at hand to press upon the B.B.C. or the Government such reforms or improvements of the existing wireless control and organisation as may from time to time seem to be necessary.

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PUSH-PULL PROBLEMS.

Some Practical Hints on How to Prevent Parasitic Oscillation and Instability.

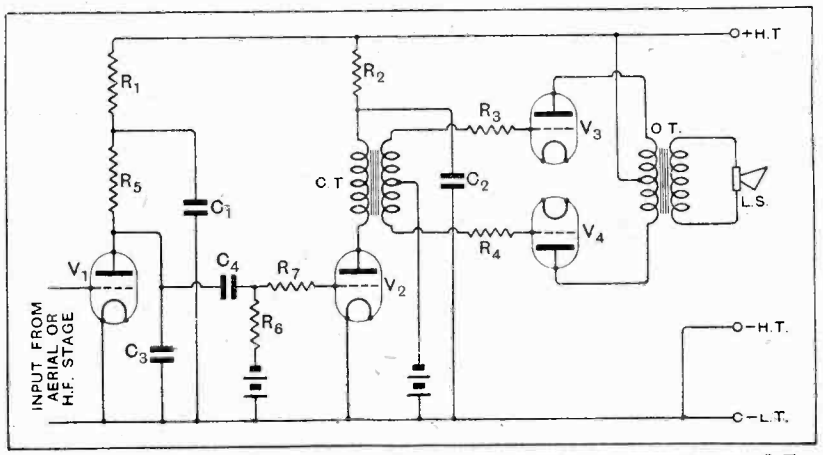
AMPLIFICATION by push-pull has obvious benefits which have prompted manufacturer and amateur alike to exploit this method of low-frequency coupling, especially where it is desired to handle large grid swings without employing excessively high anode potentials. It is possible to obtain adequately loud signals for reception in an ordinary house from a moving coil loud-speaker if the total grid swing applied to the double push-pull valve combination is in the order of 80 to 100 volts. It is the purpose of these notes to give a few hints on the design and operation of a push-pull amplifier which will handle such an input using two valves of the D.E.5A or P.M.256 class with not more than 175 volts H.T.

There are one or two troubles which may be encountered unless certain precautions be taken; in fact, a push-pull amplifier constructed with the best components and connected according to the conventional circuit may give rise to distorted signals, and, furthermore, a condition may arise in which it is possible to remove one of the two push-pull valves without decreasing volume and without changing the quality. It has been pointed out in this journal[1] that the ordinary push-pull circuit forms a bridge, the arms of which are balanced only when the components are matched; when the latter condition is fulfilled the signal potentials do not circulate through the source of H.T. supply, so that L.F. oscillation due to back-coupling is likely to be absent. By choosing valves (for V_3 and V_4 in the accompanying diagram) with a disparity of characteristic, thus unbalancing the bridge, it was found possible to cause distortion from incipient L.F. oscillation by adding a comparatively small resistance to the H.T. battery, but when valves with checked equality of characteristic were employed the addition of 1,500 ohms to the H.T. battery produced no ill effects. It is therefore evident that, owing to the chances of slight difference existing in valve constants, the anode feed resistance scheme to combat L.F. oscillation should be employed before a push-pull amplifier. Suitable values for the de-coupling resistances R_1 and R_2 are 20,000 ohms, and the condensers C_1 and C_2 can be 2 mfd.

Another likely cause of distortion is the self-oscillation at high-frequency of the two push-pull valves. This can be prevented by the interposition of series grid resistances having a value from 100,000 to 250,000 ohms as shown at R_3 and R_4 in the diagram (R_3 and R_4 must, of course, have the same value and be of the grid-leak type). It would appear difficult to predict the exact conditions which stimulate high-frequency oscillation in push-pull valves, but it is undoubtedly due to disparity of characteristic, and possibly to slight softness of one or both of the valves; it is, therefore, desirable always to employ stabilising series grid resistances.

The effect of residual gas in a valve formed the subject of an article in the issue of *The Wirless World* dated April 11th, 1928; the profound effect of reverse grid current on grid bias and the general properties of a circuit were pointed out, and a cheap efficient vacuum tester was described.

If the values of R_3 and R_4 be changed to 5 megohms and a milliammeter be inserted in the H.T.+ lead; then the short-circuiting of R_3 and R_4 in turn will give an indication on the meter if even a very small fraction of microampere of reverse grid current exists. Readers may prefer to test their valves for hardness separately from the receiver, but the fact still remains that a valve showing signs of softness should not be used in push-pull; moreover, the series grid resistances already advocated to prevent parasitic oscillation at high frequency would tend to accentuate the effect of reverse grid current.



A satisfactory push-pull circuit. C.T. is the coupling push-pull transformer; O.T., output transformer; V_1, anode bend detector, impedance about 25,000 ohms; V_2, impedance 17,000 ohms; V_3 and V_4, 4,000 ohms impedance; C_3, 0.0001 mfd.; C_1, 0.01 mfd. R_5, 150,000 ohms; R_6, 2 megohms; R_7, 0.25 megohms.

We must now pursue the question of checking valve characteristics. It is difficult to avoid using a small amount of curvature at the lower end of the curve, and should two valves be employed, the bottom bends of which are unequal, the harmonics created will not cancel out, which will result in distortion. Where readers have not facilities for careful checking of valve constants, it is important to note that certain valve manufacturers are now prepared to supply specially selected matched valves. In the diagram a circuit is given which gave good quality and signal strength with 175 volts H.T., and in which parasitic oscillations were absent, provided valves were used which had been chosen for similarity of constants and for hardness.

W. I. G. P.

[1] "Battery Resistance and Distortion," by W. I. G. Page. *The Wireless World*, April 25th, 1928, p. 440.

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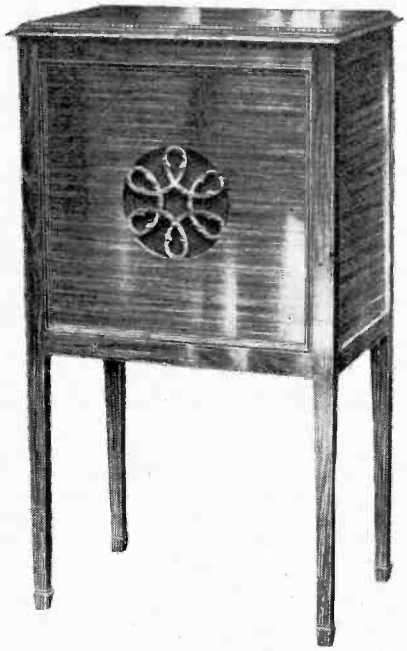
CABINETS FOR MOVING COIL LOUD-SPEAKERS.

Commercial Designs now Available.

IT is not only on the score of appearance that a cabinet is required for housing the moving coil loud-speaker. The cabinet serves as a baffle making the air leakage path between the two



The Peto Scott moving coil loud-speaker cabinet.

sides of the diaphragm as great as is conveniently possible. This can be done by adopting a shallow cabinet of liberal front dimensions or by creating a similar length path by reducing the use of the wooden front panel and making the cabinet somewhat deeper. The large cabinet may prove difficult to accommodate while the use of a smaller front panel elevated by means of suitable legs renders the cabinet less costly and yet attractive.

Compact Camco model.

A special cabinet for moving coil loud-speaker construction is available from Peto Scott Co., Ltd., 77, City Road, London, E.C.1, of reasonable front panel size yet not too deep to create marked "box" resonance. It is well finished, the panels and edges being suitably framed with beading. The interior provides sufficient space for including the output stage together with a mains rectifier for energising the field magnet.

As an inexpensive arrangement and one which is particularly effective in maintaining quality of reproduction the baffle board obtainable from the Carrington Manufacturing Co., Ltd., Camco Works, Sanderstead Road, South Croydon, is to be recommended. The baffle is a yard square and is made of substantial

A new idea in moving coil loud-speaker cabinets. The Adams patent folding sided cabinet entirely obviates the distortion effects sometimes arising when the back of the loud-speaker opens into a restricted space.

9-ply wood. It is supplied with the necessary struts for framing and attaching the loud-speaker supporting column. The outfit is complete in every way and closely follows the design given last September in the pages of this journal in connection with the first published designs of loud-speakers of this type.

The Carrington Manufacturing Co., Ltd., also produce Camco moving coil loud-speaker cabinets of attractive design. A small model is available either in oak or finished mahogany colour

The large size baffle board cabinet of W. & T. Lock in which the entire receiving equipment can be accommodated. It is a fine piece of furniture and in no way reveals the mechanical fitments associated with broadcast reception.

having outside dimensions of 17 by 16½ by 13¼ins. It is provided with an ornamental circular grille and beaded base and is suitable for standing on a table. The price is about £2 as compared with £1 10s. for the plain plywood board and mounting pieces. Another form of Camco cabinet is available, standing

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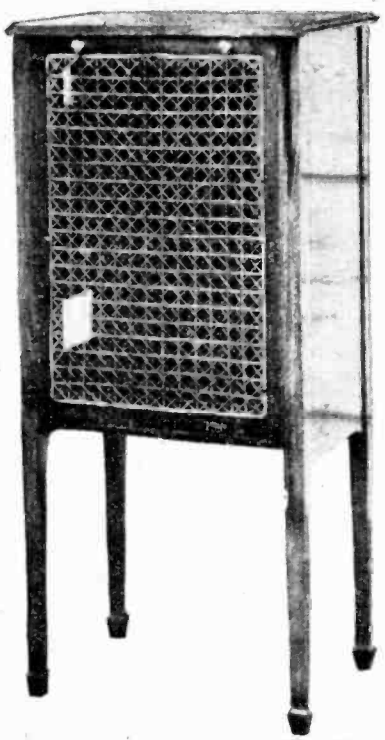
Cabinets for Moving Coil Loud-speakers.—39in. in height and fitted with a lower compartment and drop front for accommodating the batteries. Output amplifying stage, battery eliminator as well as an arc rectifier in the case of A.C. supply can be accommodated while the use of a separate compartment for the batteries prevents acid fumes from having a detrimental effect upon the apparatus. The price in oak is £4 17s. 6d.

The perfection of the results which are obtainable with the moving coil loud-speaker has brought about a demand for a first-class cabinet in which the entire outfit can be accommodated. Thus, with all the auxiliary apparatus enclosed in a single cabinet an on-and-off switch can provide a programme service brought into operation just as required without the complications of difficult maintenance. For this class of installation W. and T.

The Camco pedestal cabinet, a popular model with battery compartment.

Lock, Ltd., St. Peter's Works, Bath, have developed an attractive cabinet with large front baffle sufficiently deep to accommodate the associated apparatus and batteries. The cabinet is entirely free from box resonance. A feature of this cabinet is the provision of an open

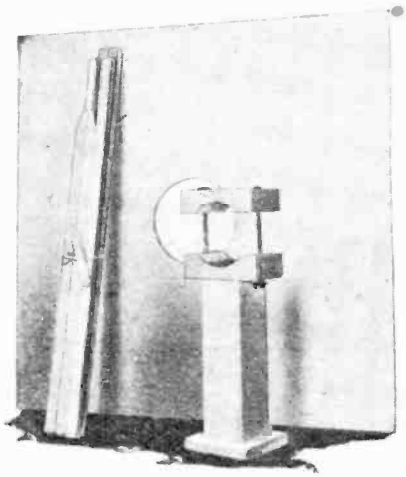


Another Lock cabinet with well ventilated back for the purpose of avoiding box resonance.

cane back so as to allow of good ventilation at the back of the diaphragm. A separate lower compartment is available for accumulator batteries which in the case of both A.C. and D.C. supply may be floated across the magnet winding or the L.T. terminals.

The artistic merit of this cabinet is best gleaned from the accompanying illustration. It is a good specimen of first-grade workmanship and excellence of finish. A smaller model is also available of sufficient size to produce the effect of the baffle and is fitted with a well-ventilated back for the purpose of avoiding box resonance.

Another cabinet of unique design is manufactured by F. Adams and Co., 66, Finsbury Pavement, London, E.C. The aim in the design is to avoid the modification of tone which results when the loud-speaker is accommodated in the front of a small enclosed cabinet. It possesses all the merits of the open baffle board



An inexpensive set of baffle parts is now available for the amateur and further simplifies the construction of the moving coil loud-speaker.

without being unsightly, for by the use of folding sides it can either be used as an enclosed cabinet or open baffle. Both sides and top are hinged to swing open while two additional panels hinge into position to complete the corners of the large size baffle board which is thus created with the moving coil loud-speaker grille at its centre. The specimen examined was made in oak, and well finished and provided with a lower cabinet for battery eliminator or accumulators. This design is an entirely new departure and is likely to become popular.

CLUB NEWS.

Eliminating Batteries.

The Tottenham Wireless Society's new high tension battery eliminator was recently demonstrated by its designer and constructor, Mr. F. Dyer, who is the Society's technical officer. The device incorporates a Rich and Bundy transformer and super choke, and is designed to give an output at any required voltage up to 400 volts. The choke is centre-tapped, and the main supply at 400 volts passes through one winding. Current at a lower voltage is supplied through the other winding.

The Society's transmitter (G5TT) was also on view during the evening. This instrument has received daylight reports up to 300 miles on 150 metres, and it is hoped that when the improvements suggested at the meeting have been incorporated even better results will be obtained. The Technical Committee has arranged an interesting series of demonstrations for the next few meetings.

Hon. Secretary, Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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Amateur Transmission.

Mr. D. G. Kennedy (14C) gave an informative lecture entitled "Some Systems of Amateur Radio Transmission" at the last meeting of the Wireless Society of Ireland, Dublin. The lecturer, who made use of a fine collection of lantern slides, pointed out certain valuable adjustments which make for transmitter efficiency, and also gave hints on the design of short-wave aerials and the stabilising of wavelength by means of oscillating crystals.

The Wireless Society of Ireland is organising a number of summer outings for the carrying out of experiments in the open air. Many successful Field Days were held last year.

Hon. Secretary, Mr. H. Hodgens, 12, Trinity Street, Dublin.

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Club Set Demonstrated.

Two interesting receivers, a two-valve set and a three-valve set, were demonstrated at a meeting of Queen's Park Wireless Club on May 16th. The former instrument, demonstrated by Mr. Biddle, had been constructed at the Society's previous meeting, and gave excellent results.

Hon. Secretary, Mr. F. Batho, 37, Enbrook Street, W.10.

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Modern Receiver Design.

The design of a modern receiver, with special reference to the use of screened grid valves and H.T. mains units, was the theme of a lecture given by Mr. F. W. Smurthwaite before the Croydon Wireless and Physical Society on May 14th. The lecturer dealt in detail with the causes and prevention of "motor-boating" when working off the mains, and, in dealing with the screened grid valve, explained its advantages and disadvantages.

The evening concluded with a demonstration of a new five-valve receiver incorporating two screened grid valves and working off a high voltage mains unit.

Hon. Secretary, Mr. H. T. P. Gee, Staple House, 51-52, Chancery Lane, W.C.2.

FORTHCOMING EVENTS.

WEDNESDAY, JUNE 6th.

Tottenham Wireless Society.—At 8 p.m. At the Institute, 10, Bruce Grove, N.17. Business Meeting. Arrangements for Summer Field Days.

Queen's Park Wireless Club.—At 8 p.m. At St. Jude's Hall, Lancefield Street, W.10. Demonstration by the Celestion Co.

THURSDAY, JUNE 7th.

Golders Green and Hendon Radio Society.—At 8 p.m. Reception by Mr. Handsley at 25, Woodlands, N.W.11. Wireless Demonstration.

Leyton and Leytonstone Radio Society.—Demonstration of the "R.C. Threesome" and R.K. Loud-speaker by Messrs. Ediswan's.

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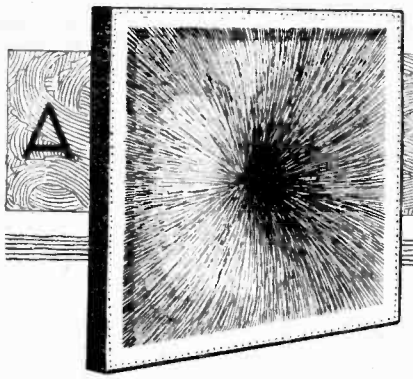


A NEW LOUDSPEAKER

Double Diaphragms with Balanced Armature Drive.

OF the many loud-speakers with claims to originality which have recently been placed on the market, few are so interesting as the instrument just introduced in America under the name of Air-Chrome. The principles governing its operation are somewhat similar to those of certain large reed-driven cones familiar in this country; but, instead of sound waves being radiated from a paper diaphragm, they are produced by vibration of a large stretched membrane, the tension of which is balanced by a smaller one mounted behind it.

The construction of the loud-speaker is quite simple, and will be made evident by a consideration of the sectional sketch. What may be called the working diaphragm, which is of special fabric treated in such a way that it is rendered air-tight without losing its suppleness, is stretched on a wooden frame measuring slightly over two feet square. Some three inches behind it is fitted the tensioning membrane, of the same material and similarly mounted on an 8-inch frame. The centres of these sheets are drawn together so that they actually form what almost amounts to two cones with apices joined; the driving rod of the energising unit, which is of the balanced armature type, is secured to the junction point.

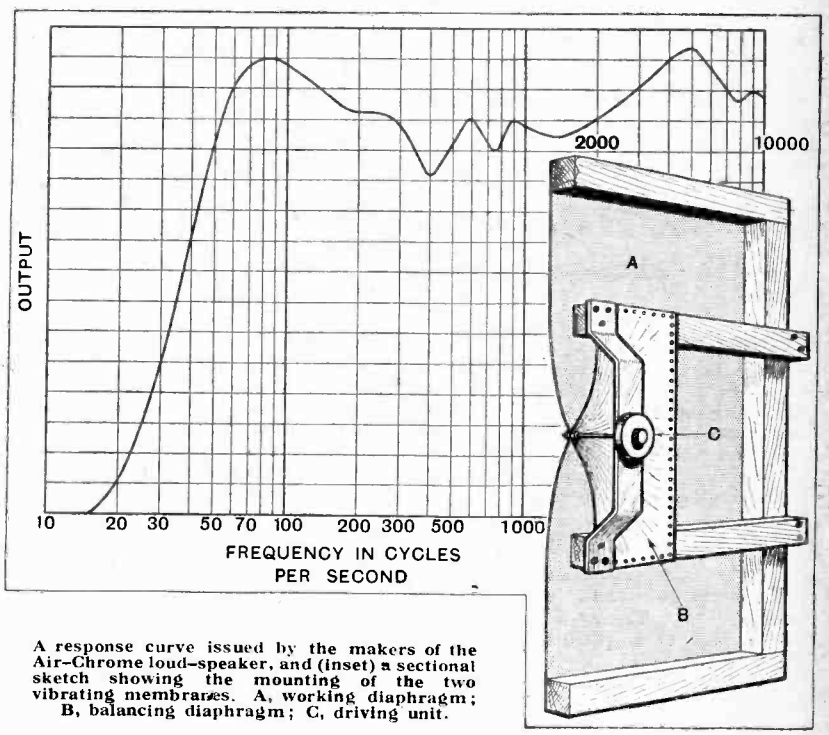
Method of Damping.

The tension of the large membrane is adjusted to give it a natural resonant frequency of about 60 cycles, while the smaller one tends to vibrate at a very much higher frequency—in the order of 5,000 cycles. When working together, this resonance of each vibrating member is partially damped out by the other. Naturally, the working diaphragm does not produce sound waves by moving as a whole, as does the cone of a coil-driven loud-speaker; concentric surface waves, starting at its centre, are set up by movements of the driving rod, which is actuated by the armature under the influence of signal currents.

It is claimed that the instrument is capable of handling a large input, and consequently its construction is massive; the battens of which the frame is constructed measure about 1½in. in cross section. Similarly, the driving unit is mounted by means of a heavy cast metal bracket in order to prevent the possibility of chattering.

The published response curve, if it can be taken as fairly representing the performance of the instrument under working conditions, is exceptionally good, as variations in proportional output between about 50 and 10,000 cycles are hardly sufficient to be perceptible to the ear. Resonances which seem to be due to the fact that the natural time periods of individual membranes are incompletely suppressed are not so marked as to be in any way objectionable.

The loud-speaker is sold either in skeleton form, as described, or mounted in a cabinet with its front covered in tapestry. Clearly its performance depends largely on the use of suitable material for the stretched diaphragms, and on the mounting of these in such a way that their tension is correct, and will remain so.



A response curve issued by the makers of the Air-Chrome loud-speaker, and (inset) a sectional sketch showing the mounting of the two vibrating membranes. A, working diaphragm; B, balancing diaphragm; C, driving unit.

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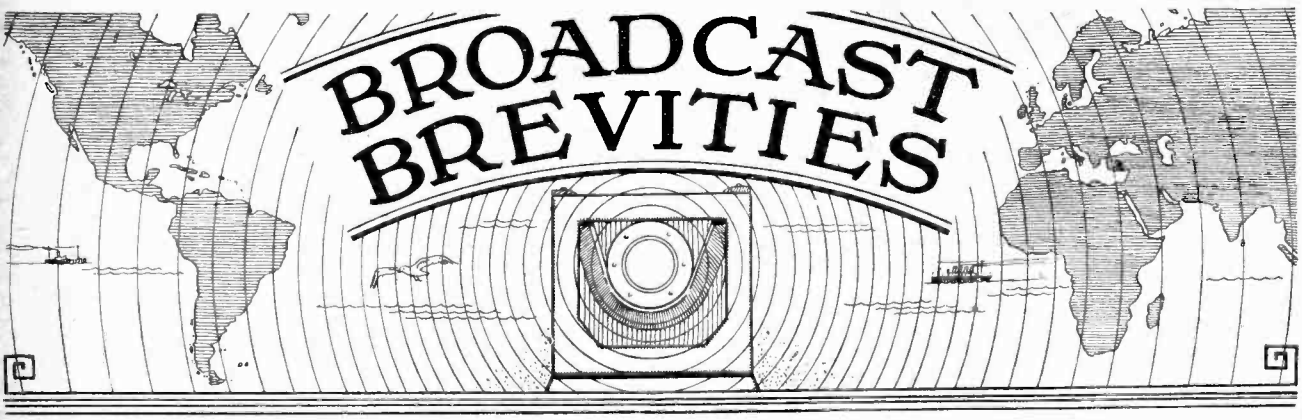

News from All Quarters: By Our Special Correspondent.

The Derby Broadcast.—A Licence Epoch.—Colour in the Studio.—What of the "Stunt"? The Searchlight Tattoo.—Programmes that Fizzle Out.

To-day's Derby Commentary.

Mr. C. C. Lyle, who will give the running commentary from Epsom this afternoon, is setting a precedent by undertaking to describe the race and the scenes on the course without the aid of a companion. Mr. Lyle will sit alone in a corner of the Press stand.

From 2.45 to 2.49 he will tell listeners what is happening on the course; he will then give the names of the runners and the result of the draw for places. The race description should begin at 3 o'clock, and will be all over within three minutes. A brief summary will conclude the broadcast.

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Unhonoured and Unsung.

Early in May only 5,089 additional receiving licences remained to be issued to bring the total up to the 2½ million mark, so it is just possible that at the exact moment these lines are being written some mute, inglorious Milton is assuming the honour of being the two and a half millionth licence holder.

Apparently the B.B.C. has overlooked this individual, although he marks quite an important milestone in broadcasting progress.

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A Laborious Climb.

The million mark was reached in November, 1924, and a whole year elapsed before another half-million was recorded. Then came a spurt, and the two-million figure was reached in March, 1926.

It has thus taken more than two years to add another half-million.

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Broadcasting Stars in the Flesh.

Listeners who wish to see broadcasting artists in the flesh should make a note of the date, June 12th, when the Theatrical Garden Party takes place in the grounds of Chelsea Hospital.

A B.B.C. tent is to be one of the features, and among the attractions are performances by Tommy Handley, Albert Sandler, Harry Hemsley, Clapham and Dwyer, Jean Melville, Leslie Sarony, Nick Adams, Julian Rose, Ernest Hastings, Mario de Pietro, and the B.B.C. Dance Orchestra, personally conducted by Jack Payne.

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"Brighter" Programmes?

If studio environment really exercises an influence on the quality of microphone performance, we may look forward to some "bright" evenings when the newest studio at Savoy Hill is in use. This interesting apartment, which occupies a position in the basement, once filled by a Turkish bath, has a colour scheme of red, black, and gold. The rustic scene adorning the walls includes a phœnix, though whether any symbolical meaning is implied must remain a subject for speculation.

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No Talks in the New Studio.

The new studio walls are covered by four layers of hessian cloth, each separated from its neighbour by wooden battens half an inch thick.

Talks will not be given in this studio, which is being reserved for instrumental solos and orchestral combinations not larger than octets.

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A Vanished Art?

The "stunt" phase in British broadcasting seems to have failed completely. Possibly this may be taken as a compliment to the intelligence of the British public, but it can also be regarded as an indication that in certain directions B.B.C. ideas have run dry.

A year or two ago we were listening to the gurglings of deep sea divers, and we even heard dinner noises at the Zoo. No public event seemed to escape the B.B.C., and the stunt department was justly regarded as a courageous and enterprising body, not afraid to poke its way into odd corners if only it could but get its teeth round a decent noise.

What has happened to the stunt department? Is the public really fed up with broadcast stunts?

Putting a Hustle into Sleep.

From the American "Blue Network" programme for May 24th:—

"Schubert's 'Marche Militaire' will open the program of Slumber Music."

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A Jewish Festival.

A Jewish musical festival will be relayed from the Kingsway Hall on June 6th. Singing by a Synagogue choir of male voices and mixed voices and by massed choirs, cantor, soprano, and contralto solos, with instrumental solos, will be included in the programme.

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Microphones at Aldershot.

Massed cavalry, Royal Artillery mounted bands, and pipes of the Seaforth Highlanders will assist in that part of the Aldershot Command Searchlight Tattoo which is to be relayed to 2LO from Rushmoor Arena, Aldershot, on June 19th. The broadcast will include the following items: Retrospect of War; Charge by Mounted Crusaders; Representation of Intensive Battle; "Abide with Me," and Finale.

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How to End a Programme.

Unfortunately, it often happens that one comes to the end of a perfect day feeling rather tired, and I cannot help thinking that the London broadcast programmes sometimes exhibit the same tendency. At all events, several listeners of my acquaintance confess that their attention lags towards the end of a perfectly good evening's entertainment.

What I would suggest to the B.B.C. is that they keep some of the plums to the last, reserving a special "turn" for, say, 11 p.m. This would keep listeners awake and avert that atmosphere of "where's-my-hat-better-get-a-taxi" which so often creeps into the theatre during the last act.

Each broadcasting programme should end with a flourish. Too often it just fizzles out.

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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

RECEPTION OF 5GB.

Sir,—I have watched with great interest the correspondence which has appeared recently in *The Wireless World* relative to the unsatisfactory reception of 5GB in certain parts of the United Kingdom, and perhaps your readers would be interested to learn that during the past fourteen months I have very often heard this station on a three-valve set (Det-2 L.F.) with wonderful clarity—at least, when reception has not been marred by atmospherics and Morse. As I am situated approximately 2,200 miles from the station, I think this speaks very well for its penetration in this direction at least. On occasion reception has been so good that every word announced has been audible.

Personally I think that one's relative situation has a great deal to do with reception. Here, Stamboul, the nearest station (800 miles direct north) is only a faint whisper now that the power has been reduced to 5 kW., while several of the German 4 kW. stations, more than double the distance away, come in with surprising strength and clarity. In fact, Breslau, after Budapest, is the best station received here at the present moment. Langenburg, in spite of its transmitting powers, is hardly audible here.

JAMES E. WOOLLEY.

Cairo, Egypt.
May 19th, 1928.

Sir,—Your correspondent, "Schoolmaster," complains of the lack of volume of 5GB in this district. My experience is the exact opposite. I should be sorry to have to listen on an efficient 5-valve set to 5GB or 5XX for many minutes unless the volume was heavily cut down. I use a 4-valve set and cannot listen to either of these stations in comfort without detuning, and my set, though selective, is not particularly powerful. I do not find that either of them is subject to fading, nor can I find any foreigner that night after night gives me the power and quality of 5XX and 5GB. Of course, as you travel round the dial you often find one particular station coming over exceptionally well, and if it happens to be a high-powered one, then perhaps the volume may equal or exceed that of Daventry; but, speaking generally, I have failed to discover that foreigners have much to teach us. For this reason I can't help thinking that there must be something other than faulty transmission to account for the fact that 2LO is a complete wash-out as far as this immediate neighbourhood is concerned. It is easy to abuse the B.B.C., but is it quite fair? One *has* heard of "dud" sets and faulty aerial circuits. The noble art of knob twiddling calls for a certain amount of manual dexterity and much patience; it is not every listener who has both. It seems to me a pity to exalt the foreigner at the expense of our own folk, unless we are very, very sure that we ourselves are quite without blame. In a science so new and consequently so unmastered it is a bold man who dares say "I know."

FOUR-VALVER.

King's Heath,
Birmingham.

GRAMOPHONE REPRODUCTION.

Sir,—I have been particularly interested in the point raised by Mr. H. R. Webb in your issue of April 18th regarding alignment of gramophone sound boxes and pick-ups.

A few years ago I examined critically numerous portable gramophones having short tone arms, and found that alignment was generally bad. On giving the matter further consideration I found that the following method of mounting the tone arm gave almost perfect tangential tracking of the needle for average 10in. and 12in. records. If the tone arm be pivoted 8in. from the turntable spindle, and the needle point be arranged to come $\frac{5}{8}$in. beyond the centre of the spindle, *i.e.*, if the distance of tone arm pivot is 8in. from the spindle, the distance of the needle point from the tone arm pivot must be $8\frac{5}{8}$in. approximately. If the distance from spindle to pivot can be arranged to be 12in., the distance from needle point to pivot should be $12\frac{1}{2}$in. The pick-up or sound box should now be inclined to the line from point to pivot, so that the needle tracks tangentially to the groove at the beginning of the record. If this be done it will be found that the needle will also be tracking correctly at the end of the record. As a matter of fact, the conditions are such that the angle between the centre of the record, the needle point, and tone arm pivot will be the same at the beginning and end of average records, and only a degree or two out somewhere near the middle of the run. It is advisable to fit a stop to prevent the needle running on to the label, as, if it does, the tone arm will suddenly swing right across the machine, gouging a deep groove in the record, as I know to my cost.

Perfect tracking at the beginning and end of records is important when a record is replayed with the same needle.

WALDO FERGUSSON.

Otford, near Sevenoaks,

THE "EVERYMAN PORTABLE."

Sir,—I wish to express my appreciation of *The Wireless World* "Everyman Portable," and to say that it far exceeded my expectations.

My young brother made the set up with my assistance—and although he has had no previous experience at all, is receiving the following stations at Weymouth: Bournemouth, both the Daventrys, Cardiff and Paris at good 'phone strength, and by using an outside aerial the same stations give ample volume from a Lissenola loud-speaker for a small room.

BM/CVO.

Hants.

STATION IDENTIFICATION.

Sir,—I suggest that the difficulty in identifying distant transmissions is solely the fault of the announcers, who, after all, are mainly concerned with their own immediate listeners and do not trouble much over someone perhaps 500 miles away. In addition, there is the difficulty of distinguishing foreign names *correctly* pronounced. This difficulty increases proportionately to the length of the word, so that anything more than two syllables is undesirable. Therefore, I suggest the following method to be reached by international agreement: (a) Every station to be called by a name of not *more* than two syllables; (b) The announcement to be made thus, e.g., one stroke of a gong—"Radio Lon-don—London," or—"Radio Tou-louse—Toulouse," repeated twice.

We should not then get such mouthfuls as "Konigswusterhausen" or "This is the London Station calling"—both probably unintelligible to listeners in other countries. It is largely a question of plain emphasis on the important word, and a warning signal to start with, say, a stroke of a small gong. It should only be necessary to announce in this manner after fairly lengthy items, and not after each separate song or such-like. There should be no difficulty in inventing two easy syllables for every station and publishing same, and the system could hardly be said to be inartistic or offensive to the sensitive listener.

C. BOOTH JONES.

Grantham.

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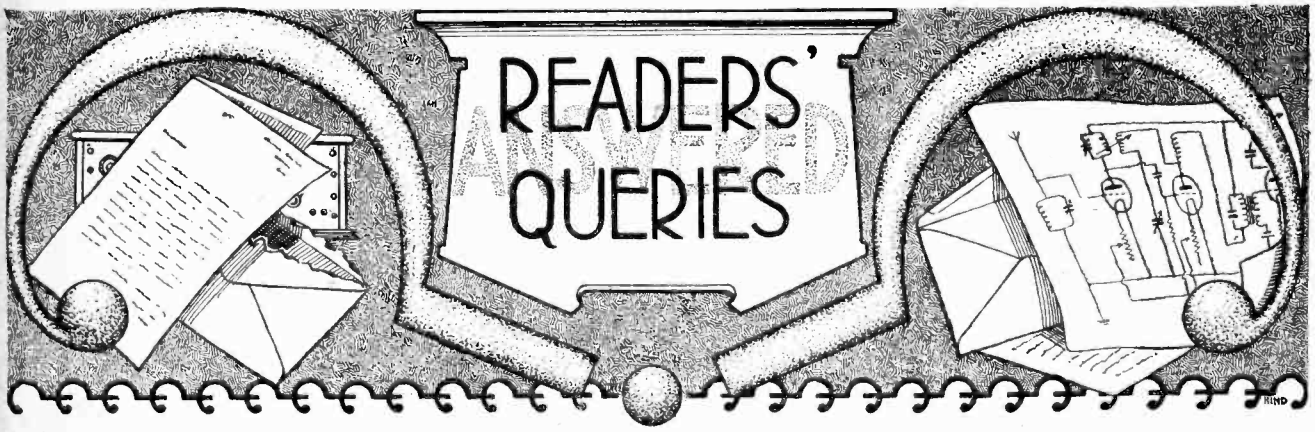

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interests of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

High Note Reproduction.

My receiver, with one H.F. stage, anode bend detector, and one resistance coupled L.F. amplifier constructed on the general lines recommended from time to time in your journal, has worked excellently for some months, but in view of articles which have recently appeared concerning the amplification of the higher audible frequencies, I should be glad of advice if you consider that it could be improved in this respect.

J. B. L.

We presume that you are using a high magnification detector valve with an anode resistance of about 250,000 ohms. It cannot be denied that such a combination does introduce a certain weakening of the higher frequencies, but in a single-stage amplifier it is doubtful if this is appreciable with the average loud-speaker.

In your locality you probably get signals which are of more than sufficient strength from 2LO and both the Daventry transmitters; we suggest that you might be able to sacrifice a little amplification by substituting for your present detector an efficient 20,000 ohm. valve with a coupling resistance of lower value than at present—say 100,000 ohms. or 150,000 ohms. At the same time, you will have to increase the grid bias applied to your detector valve. The alteration will reduce the sensitivity of the set, but will increase the proportional response to the higher frequencies.

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Shielded Valve Couplings.

I have a set of commercial plug-in H.F. transformers designed for ordinary valves. Can you tell me how they can be modified for use with screened grid valves?

H. F. H.

Without technical details of your transformers, it is impossible to give really helpful advice. If you wish to use them as transformers it may be possible to use the existing neutralising windings in series with the primary, particularly if this winding is wound as a continuation of it. Perhaps, however, the safest course is to remove those sections and to use the secondaries as tuned anode couplings.

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Frame Aerial Connections.

I am uncertain as to the correct method of winding the frame aerial of the "Everyman Portable" receiver, and also as to how to join up the four ends of the wire. Should the coils be wound clockwise or anti-clockwise?

D. C. E.

We think that you will experience no difficulty if you regard the two sections of the frame as a single winding broken at the centre, both halves being in the same direction.

The connections of the four ends will be made clear by the sectional sketch Fig. 1 (which is not drawn to scale). It is quite immaterial whether the windings are clockwise or anti-clockwise, provided

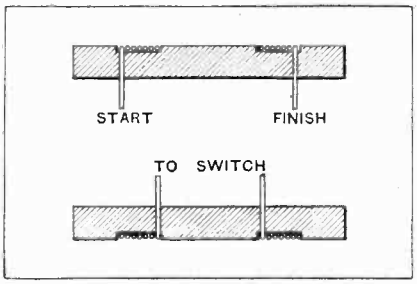

Fig. 1.—Sectional diagram showing windings of the "Everyman Portable" frame aerial.

they are in the same direction; it is also immaterial whether the "start" or "finish" is joined to the condenser C_1 or to the grid condenser.

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Aperiodic H.F. Amplification.

I propose to construct a self-contained transportable receiver for operating a loud-speaker at a distance of nearly twenty miles; as a single tuning control is essential, I am undecided whether to adopt a detector with reaction and two L.F. stages, or the same arrangement preceded by an aperiodic H.F. amplifier. Which do you recommend, taking into consideration the fact that extreme lightness is not of prime importance?

W. R.

With a detector-2 L.F. set, it is quite possible that you will find it necessary to use a good deal of reaction, which will tend to mar the quality of reproduction. Accordingly, we recommend you to include the aperiodic H.F. stage; even if it does not provide very much H.F. amplification, it will enable you to obtain sufficiently loud signals without making excessive use of reaction.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

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The Wireless World AND RADIO REVIEW

(16th Year of Publication)

No. 459. WEDNESDAY, JUNE 13TH, 1928. VOL. XXII. No. 24.

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Editorial Offices: 116-117, FLEET STREET, LONDON, E.C.4.

Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:

DORSET HOUSE, TUDOR STREET, LONDON, E.C.4.

Telephone: City 2847 (13 lines). Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.

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

BIRMINGHAM: Guildhall Buildings, Navigation Street

Telegrams "Autopress, Birmingham." *Telephone* 2970 and 2971 Midland.

MANCHESTER: 260, Deansgate.

Telegrams "Iliffe, Manchester." *Telephone* 8970 City (4 lines).

Subscription Rates: Home, 17s. 4d.; Canada, 17s. 4d.; other countries abroad, 19s. 6d. 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.

CONTENTS OF THIS ISSUE.

PATENT DEADLOCKS: A REMEDY.

IN our issue of May 23rd, under the title of "Patent Deadlocks," we discussed the unfortunate state of affairs which arises in the wireless industry when the patent position in regard to any piece of apparatus is obscure, and those firms which desire to manufacture a component are unable to ascertain to whom royalties are due in respect of patents, the situation being aggravated where a number of patents of different ownership relate to a particular component or circuit.

Our article has aroused so much interest, and is regarded in many quarters as touching upon a problem of such vital importance to the progress of the wireless industry, that we feel more than justified in returning to the subject. Incidentally, it has been pointed out to us that the idea of the desirability of setting up some machinery to act as an intermediary which would avoid the necessity of costly litigation is not entirely original, but that it has been pressed for in other industries from time to time. The fact that the proposal is not original does not, in our opinion, lessen its importance in any way; on the contrary, it only shows that a pressing need for some such machinery exists.

It would be out of place for *The Wireless World* to attempt to outline in any detail the character and scope of what we may describe as a Court of Summary Jurisdiction for patent cases which could be set up, for it would be necessary for such detail to be worked out by authorities conversant with all the intricacies of the law, and, in particular, patent law, who could so frame the new legislation required that it would conform to the established practices of law and not conflict with the prerogatives of the High Court. It is possible, however, to state very briefly certain guiding principles. The Patent Office is admittedly the most competent authority to investigate at least the facts of any patent position, and is staffed with technical experts for the purpose.

How the Scheme would Operate.

It should, therefore, be possible, when the Controller of the Patent Office can first be satisfied that there is a *prima facie* case, to convene a Court to enquire into any specific patent position in order that those wishing to manufacture apparatus may know where they stand and to whom royalties should be paid. The Court should have powers to call upon owners of any relative patents to appear to support or define their claims. Further, the necessary authority should be given for technical experts to be called to give evidence. In fact, the Court would be primarily a technical one dealing with the facts involved, and its findings should stand unless upset on appeal to the High Court, appeals being limited to points of law only, and should not traverse the technical findings of the lesser court.

In order that pressure may be brought to bear on this question, it would seem to us necessary that such pressure should originate from manufacturers in the industry who are able to show that the present patent position in wireless is detrimental to their interests, and that it definitely hampers the prosperity of the industry and limits its service to the public. The present procedure where the High Court alone can unravel obscure patent situations is, in our opinion, unfair to the manufacturer of limited capital, who cannot afford to face the expenditure involved, and consequently is more or less forced into paying royalties—sometimes on the most slender evidence of the validity of patent claims—by any patentee who is in a more fortunate financial position than himself.

This situation, in our opinion, invites abuse by those owners of patents who can, so to speak, shield themselves behind the threat of a High Court action, even to the extent of bluffing manufacturers into the payment of royalties to which in law there may be no title.

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THE NEW ALL-WAVE FOUR

A Modern Long-range Receiver using the New Anode Feed Scheme.

By N. P. VINCER-MINTER.

MORE than a year has passed and many electrons have flowed across from filament to plate of innumerable valves (not to mention those that have perched on the grid and slid down the leak or transformer secondary owing to insufficient grid bias) since the "All-wave Four" receiver was described in the pages of this journal. This set enjoyed a great measure of popularity among readers, and although the writer, being a part author, "ses it as shouldn't," such popularity was fully justified by the remarkably good results which it gave. It was the pioneer of the many receivers using a really efficient method of H.F. coupling *on both long and short wave-lengths*, which have appeared from time to time in this journal during the past year, just as the "Everyman-Four" receiver was the pioneer receiver employing a low capacity H.F. coupling on the 200- to 550-metre broadcasting band.

Viewed from present-day standards, it must regretfully be conceded that in certain aspects the "All-wave Four" is no longer in keeping with the best modern aspect, albeit it is still able to hold its own among many receivers of much greater pretensions. However, apart from other defects, it must be admitted that the receiver was of rather primitive appearance, and owing to the multiplicity of "knobs" on the panel, rather difficult to tune. The writer has, therefore, taken upon himself the task of bringing this once highly popular receiver entirely up to date, and causing it to rise phœnix-like from its ashes. We will, therefore, proceed at once to an examination of the theoretical considerations underlying the design of the receiver before passing on to constructional details.

Selectivity and Quality.

Upon examining Fig. 1 we see at a glance the fundamental circuit of the receiver minus all "trimmings" such as the filament circuit, etc. The receiver is absolutely straightforward and simple, and since experience teaches that the presence of these attributes in a wireless set postulates efficiency, it can safely be deduced that this instrument is *prima facie* a good one. Actual tests over a prolonged period fully bear this out. There are four main virtues in a wireless receiver, namely, sensitivity, selectivity, quality of reproduction, and ease of operation.

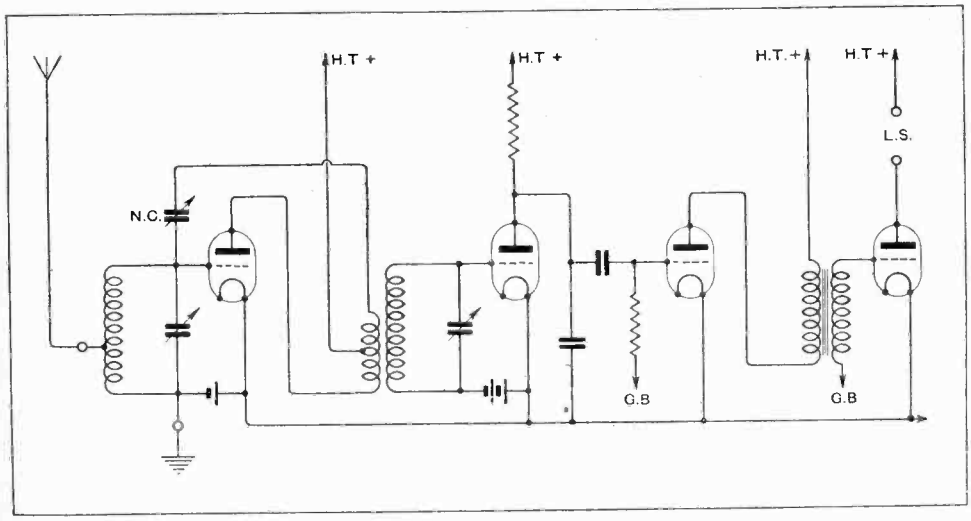

Fig. 1.—The fundamental circuit. As will be seen, the receiver is extremely simple and straightforward.

One school of thought is rather fond of emphasising the fact that the second mentioned attribute is diametrically opposed to the full development of the third. Whilst conceding that sharpness of tuning if

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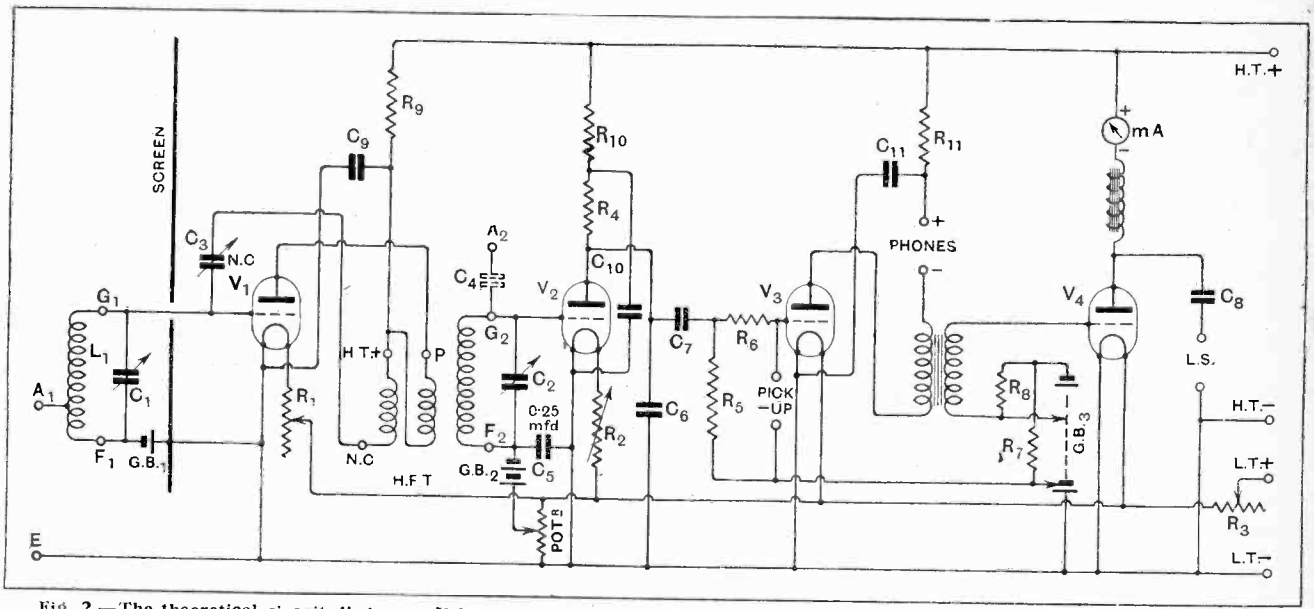


Fig. 2.—The theoretical circuit diagram. Values are as follows:—C_1 and C_2, 0.0005 mfd.; C_3, 0.00005 mfd.; C_4 and C_6, 0.0001 mfd.; C_5 and C_9, 0.25 mfd.; C_7, 0.01 mfd.; C_8, C_{10}, and C_{11}, 2 mfds.; R_1, 50 ohms; R_2, 30 ohms; R_3, 2 ohms; R_4, 250,000 ohms; R_5, 3 megohms; R_6, 0.25 megohm; R_7 and R_8, 5 megohms; R_9 and R_{11}, 20,000 ohms; R_{10}, 50,000 ohms.

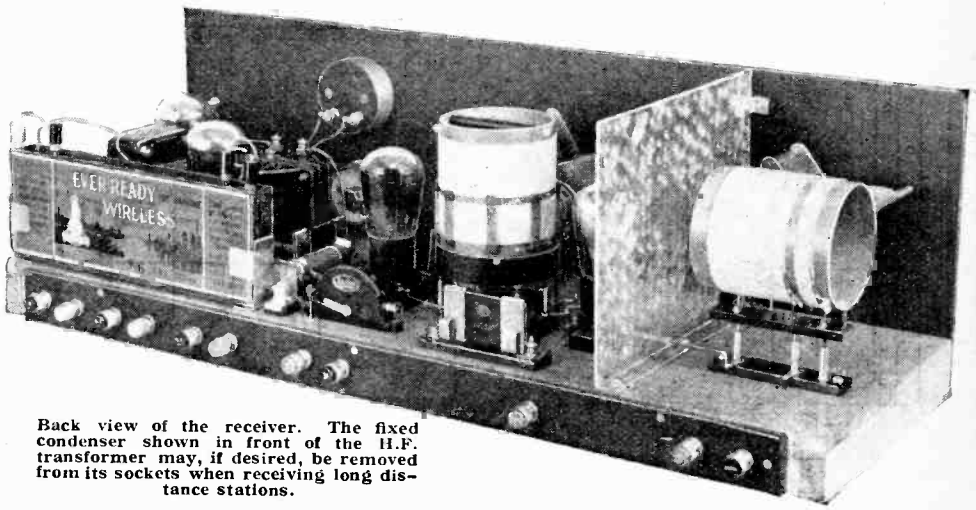
pushed to excessive limits will destroy quality, the writer would state definitely that, although the selectivity of the receiver is of no mean order owing to the low resistance of the tuned circuits and to the careful design of the whole instrument, yet the quality is such as to satisfy all but the hypercritical, whose needs have already been adequately met by other contributors to this journal. In brief, the quality given by this receiver can be improved upon by the man willing to undertake the necessary expense and trouble, but it is fully equal to that given by any modern commercial receiver the writer has had brought to his notice.

Intending constructors of the receiver, therefore, can rest assured that it is a sound proposition from the quality point of view. With regard to range, it definitely exceeds the original "All-wave Four" in this respect by a considerable margin. Theoretically, of course, range should be less than with the "Everyman Four" receiver, owing to losses in the coil mountings. In an aural test, however, in which a comparison was made between the two sets, the magnitude of these losses was not perceptible, although suitable instruments would doubtless detect its presence; since, however, the ear, rather than the valve voltmeter, is the medium through which the pleasure of broadcasting is conveyed to us, it is obvious that nobody need have any doubts concerning the range of this receiver, which is adequate on *both* the broadcast wavelengths.

In the matter of selectivity and ease of tuning, the receiver is all that could be desired. Tuning is sufficiently sharp to enable the instrument to be used for getting distant stations when situated in reasonably close proximity to a local station without impairing quality. In the matter of simplicity of operation, all that need be said is that there are two main "knobs" to match our two hands. The other two knobs seen on the front panel are for volume control and for switching off all batteries respectively. The L.F. amplifier has been designed with a view to getting the best possible quality coupled with a reasonably high degree of amplification, and its connections are simplicity itself.

L.F. Oscillation Prevented.

Turning to the actual theoretical circuit used in the receiver, beginners may at first be rather alarmed at the large number of extra resistances, fixed condensers, etc.,



Back view of the receiver. The fixed condenser shown in front of the H.F. transformer may, if desired, be removed from its sockets when receiving long distance stations.

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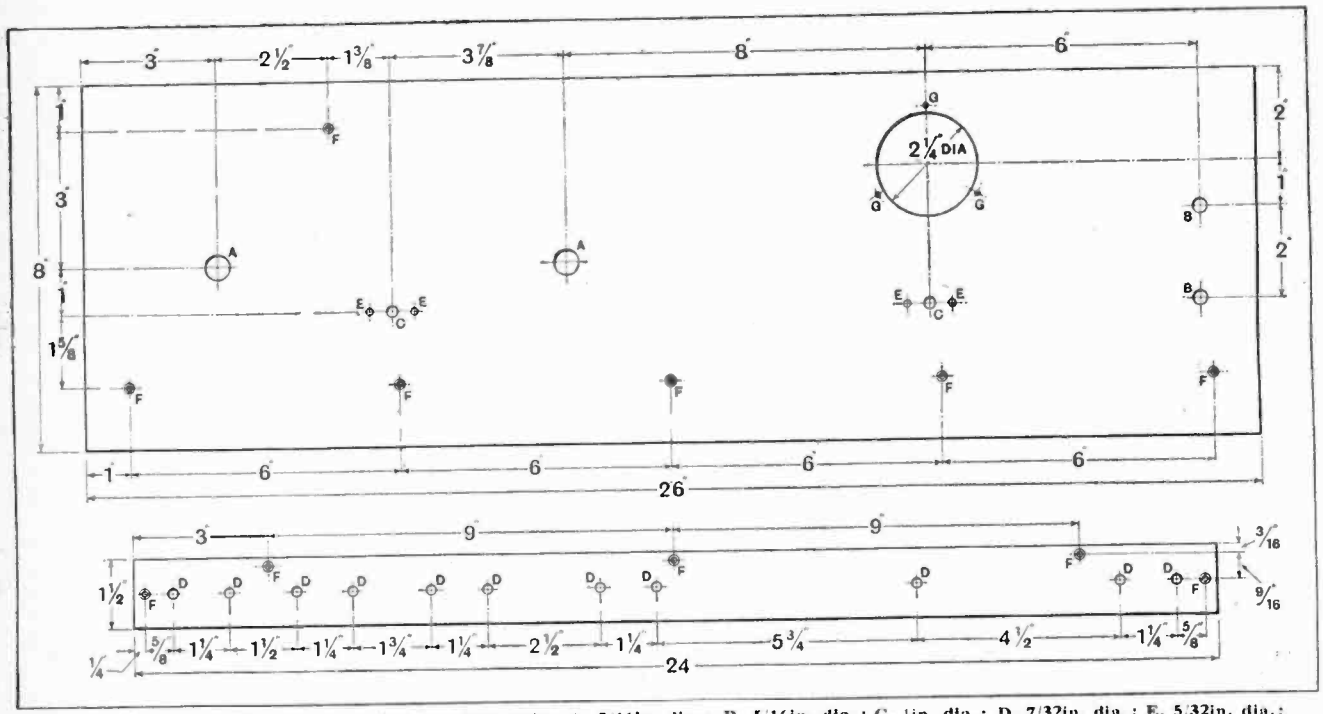

Fig. 3.—Data for drilling the panel and terminal strip: A, 9/16in. dia.; B, 5/16in. dia.; C, ¼in. dia.; D, 7/32in. dia.; E, 5/32in. dia.; F, ⅛in. dia., countersunk for No. 4 wood screws and No. 6 B.A. screws; G, drilled and tapped No. 6 B.A.

which appear to have crept into the circuit. The explanation is simple, however. The resistances and condensers mentioned are auxiliary and are part of the anode feed scheme developed last year by the makers of the well-known Ferranti transformer, for the purpose of combating L.F. oscillation, incipient and actual, due to the common resistance of the H.T. battery. Those who visited the Olympia Exhibition last year will doubtless remember that the "circuit" of this innovation was distributed to the public in pamphlet form. The whole scheme has, however, quite recently been dealt with in a lucid article published in this journal,[1] and those still in stygian darkness concerning it must refer to this article, since space forbids a further discussion here.

We now come to the constructional work, which is not nearly so formidable as might at first appear. All the stabilising apparatus has been included under the baseboard, together with the small grid batteries associated with the H.F. and detector valves. This leaves the top of the baseboard clear for the apparatus appertaining to the set proper. The panel is of ¼in. ebonite. Substances such as paxolin may be substituted if desired. If, however, a metal panel is used the condensers C_1 and C_2 will have to be bushed, or, alternatively, special condensers will have to be used, in which case neither

[1] "Battery Resistance and Distortion," by W. I. G. Page, *The Wireless World*, April 25th, 1928, p. 439.

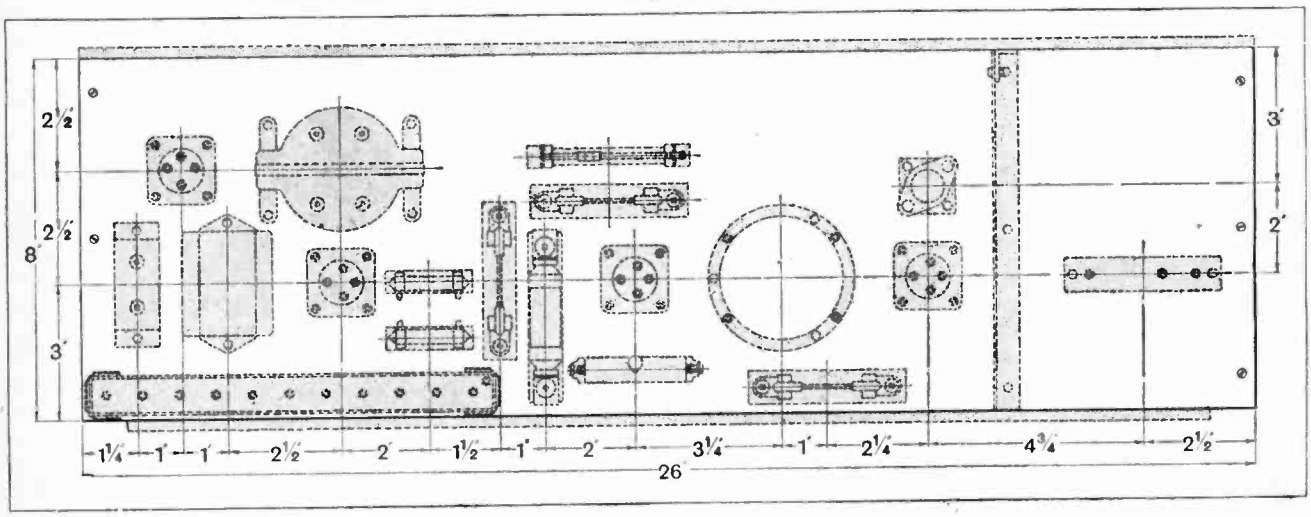

Fig. 4.—The baseboard layout.

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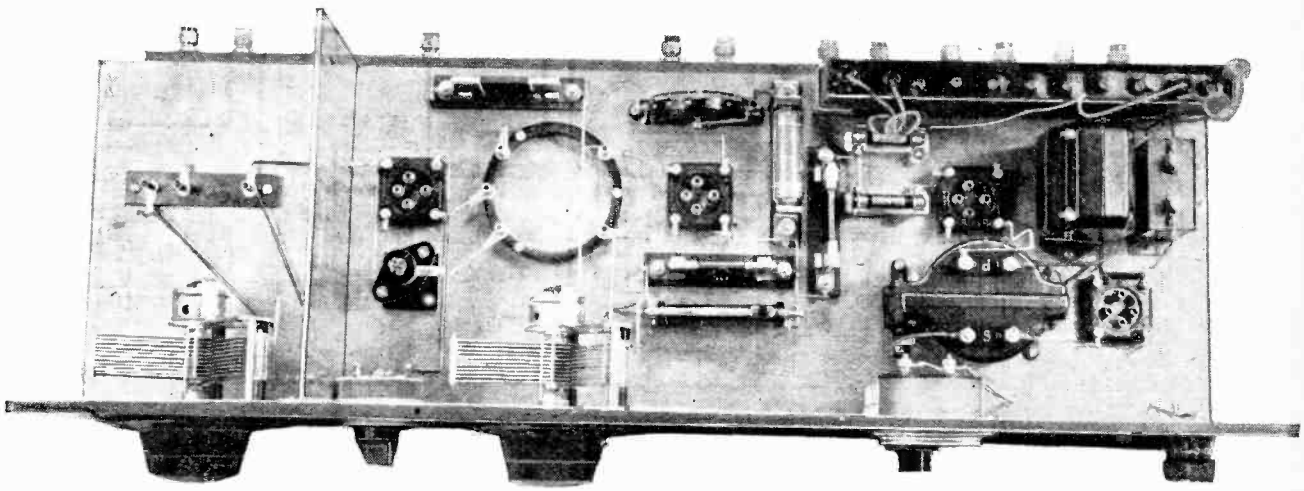
LIST OF PARTS.

2 Variable condensers with verniers, 0.0005 mfd. (Dubilier type K.C.).
1 Neutralising condenser (J.B.).
1 L.F. transformer (Marconi Ideal 4:1 ratio).
1 Output choke (Sterling).
1 Complete set of Standard coils with bases (Simmonds Bros.).
1 Filament rheostat, 50 ohms (Igranic).
1 Filament rheostat, 2 ohms (Igranic).
1 Variable fixed resistor, 30 ohms (Burton).
1 Wire-wound potentiometer ("Loriometer," 200 ohms, A. W. Stapleton).
1 Milliammeter with scale reading 0–20 mA (Sifam).
2 "Clip-in" fixed condensers with base, 0.0001 mfd. (McMichael).
1 "Clip-in" fixed condenser with base, 0.01 mfd. (McMichael).
4 Valve holders ("White Line," Bowyer Lowe).
2 Grid battery clips (Bulgin).
2 Dial indicators (Bulgin).
1 Ebonite terminal strip, 24in. × 1½in. × ¼in.
4 Wander plugs (Lisenin).
2 Terminals, ebonite shrouded, 'Phones +, 'Phones − ; (Belling Lee).
2 Mansbridge type condensers, 0.25 mfd. (Dubilier).
3 Mansbridge type condensers, 2 mfds. (Dubilier).
1 Wire-wound resistance, 250,000 ohms and holder (Dubilier).
2 Wire-wound resistances, 20,000 ohms and holder (Dubilier).
1 Wire-wound resistance, 50,000 ohms and holder (Dubilier).
2 Grid leaks, 5 megohms (Mullard).
1 Grid leak, 3 megohms (Mullard).
1 Grid leak, 0.25 megohm (Mullard).
4 Grid leak holders, porcelain type (Bulgin).
3 Dry cells, Type U9 (Ever-Ready).
1 Ebonite panel, 26in. × 8in. × ¼in.
1 Baseboard, 26in. × 8in. × ¾in.
1 Aluminium screen, 8in. × 7in., No. 18 gauge.
1 Grid battery, 16½ volts (Ever-Ready).
11 Terminals nickel-plated, A_1, A_2, E, L.T.+, L.T.−, H.T.+, H.T.−, L.S.+, L.S.−, P.+, P.− (Belling Lee).
Screws, Wire, Systoflex, etc.

Approximate cost of parts (less coils), £10 10 0.

In the "List of Parts" included in the description of *THE WIRELESS WORLD* receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

stator nor rotor is in electrical connection with the shaft and main framework of the condenser. Owing to the fact that the baseboard is mounted on battens to accommodate the stabilising components underneath, no brackets are needed to support the panel.



Plan view of the receiver. Note the simplicity of the layout and wiring.

In this article no constructional details of coils and H.F. transformers will be found, since standard *Wireless World* interchangeable coils and H.F. transformers obtainable from many firms are used. Readers who possess coils and H.F. transformers, together with their bases, made or purchased for the "*Wireless World* Regional" receiver, or for the "Standard Four" may use them with equal effect in this receiver, whilst those desiring to "roll their own" should refer to page 771 of the issue of this journal for December 7th, 1927, where they will find full details and drawings. The writer suggests these Bradshavian acrobatics with back numbers, as he is compelled to plead space restriction as an excuse. Before leaving the subject of transformers, it should be pointed out that the type of H.F. transformer having its pins arranged in the form of a latin cross is entirely unsuitable for this receiver. It will be remembered that the reasons for this were fully given in the article on the original "All-wave Four."[1]

The screen used in this receiver consists of a plain rectangular sheet of aluminium 7in. high and 8in. in length. The aluminium is bent at right angles at the bottom in order to form a foot for securing the screen to the baseboard. The amount bent over is exactly ½in., thus leaving an effective height of only 6½in. Owing to the disposition of the volume control rheostat R_1, the screen need not be cut away. The stout gauge of the screen renders it self-supporting, although a small rectangular piece of metal screwed to the panel at the upper end of the screen is used to give it additional support.

Care should be taken that no departure is made from the layout given, in so far as the "H.F." end of the receiver is concerned. This applies more particularly to the disposition of the aerial-grid coil and the H.F. transformer, since otherwise there is risk of magnetic linkage between the coils over the top of the screen, and consequent instability. Those who for any reason desire to

[1] *The Wireless World*, April 27th, 1927, p. 519.

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The New All-wave Four.—

make a slight change in layout to use coils of slightly larger dimensions, are advised to extend the screening by fixing a strip of aluminium at the top of the screen, and at right angles to it, so that it juts out over the H.F. transformer slightly, in the form of a roof. It can be affixed with the usual nuts and bolts. It should not, however, be necessary if specifications are adhered to.

On the underside of the baseboard the various condensers are screwed down to small battens which are attached by screws. It will be noticed that the terminal strip is so arranged that the shanks of all terminals project below the baseboard, this making for simple wiring.

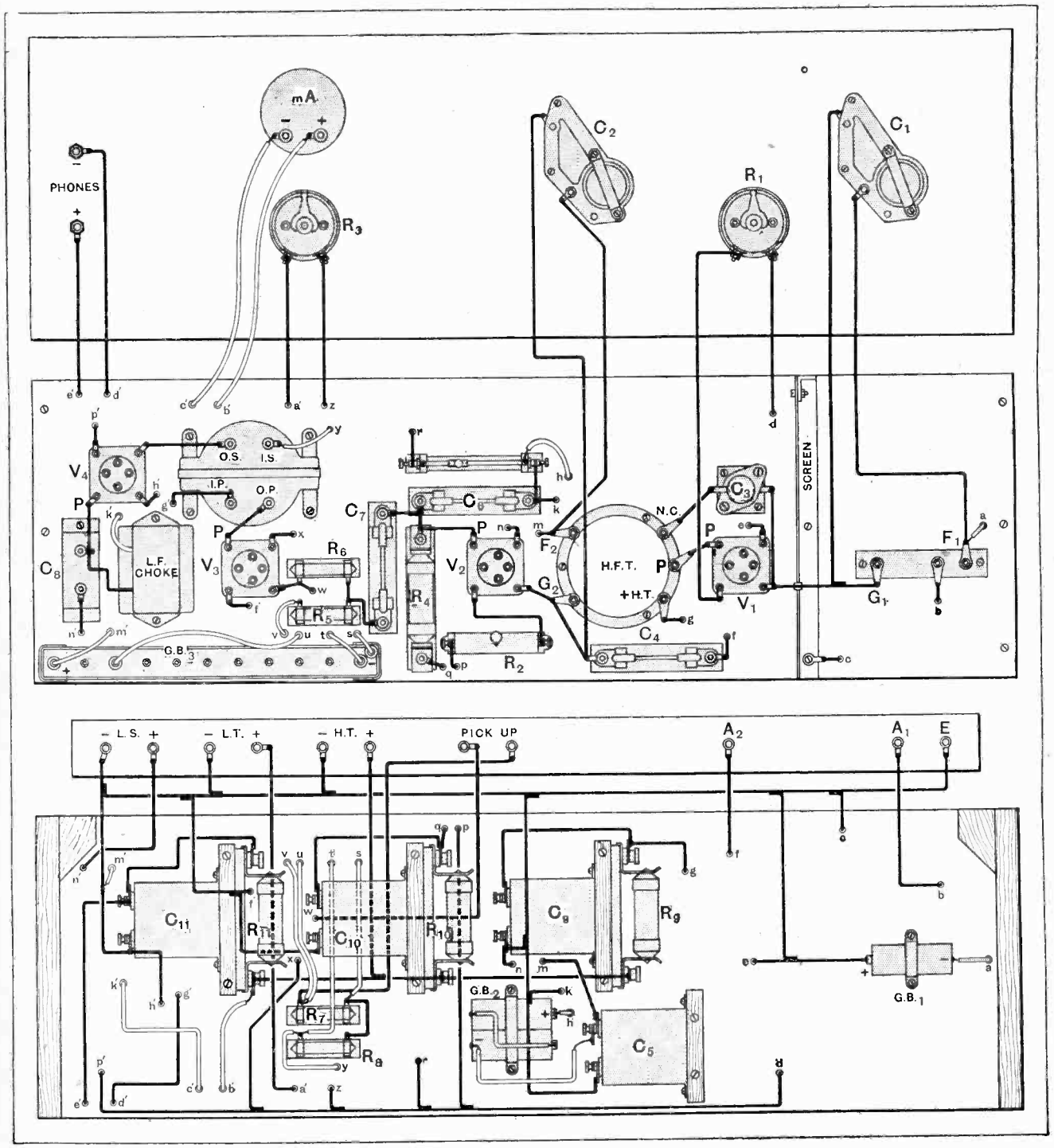

Fig. 5.—The practical wiring plan.

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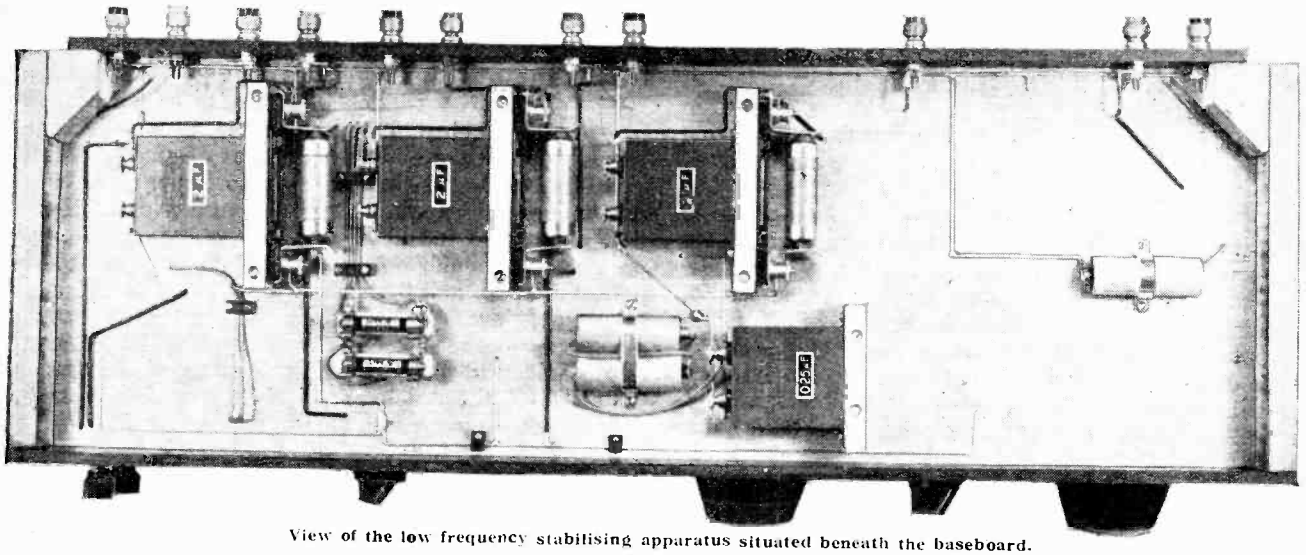
The New All-wave Four.—

The connections for the two 5-megohm protective resistances and the wander plugs attached to the large grid battery are made by rubber-covered wire, secured to the underside of the baseboard by small pieces of ebonite under which they are clamped.



View of the low frequency stabilising apparatus situated beneath the baseboard.

With regard to valves, we require in the H.F. position one having an A.C. resistance of roughly 20,000 to 30,000 ohms. A good example is the Mullard P.M.5.X, which gives us an amplification factor of 17.5, the A.C. resistance being 19,000 ohms. In the 2-volt range a suitable valve is the Mullard P.M.1.H.F. If desired, a valve of higher A.C. resistance may be used in order to gain increased selectivity. In the first L.F. position the same type of valve which has been mentioned as suitable in the H.F. stage should be used. In the detector position we require what is usually called an R.C. valve such as the P.M.1.A. and P.M.5.B., although better quality will be obtained with the P.M.5.X. class of valve, with some sacrifice of range. Needless to say, in the last stage a super-power valve of the P.M.256 or D.E.5.A. class is required.

This receiver is available for inspection by readers at the editorial offices of this journal, 116, Fleet Street, London, E.C.4.

BOOK REVIEW.

The Amateur's "Vade Mecum."

1928 *Annual and Log Book of the Incorporated Radio Society of Great Britain.* Published by the R.S.G.B., 53, Victoria Street, Westminster, S.W.1. Pp. 118. Price 4s., post free.

This eagerly awaited annual should undoubtedly be in the hands of all those interested in amateur transmission and reception. Owing to unforeseen delays in the preparation for press and in the printing, its appearance is somewhat later than was originally contemplated.

The book is printed in a more convenient form than last year's edition, and contains "Notes on Frequency Stabilisation by Quartz Crystals," by Mr. E. J. Simmonds; "Design of Short-wave Receivers," by Mr. F. G. Aughtie; "The Quartz Oscillator," by Mr. C. W. Goyder; a List of International Intermediates used by Amateur Transmitters; Useful Formulæ, Table of Wavelengths, Frequencies, and L.C. Values; Differences of Time in Various Parts of the World as Compared with G.M.T.; List of "Q" Signals, the much-abused "Ham" abbreviations, and, finally, a very comprehensive list of the call-signs, names, and addresses of all known amateur transmitters in all countries of the world with the exception of U.S.A., whose list is too long to be included in this publication without making it somewhat unwieldy. (The official list of amateur stations in U.S.A. is obtainable from the Government Printing Offices at Washington, D.C.) Modesty compels us to refrain from enlarging on the merits of this list of QRA's, but, knowing the trouble and care expended on it both by Mr. C. A. Jamblin, who was in charge of the QRA section of the R.S.G.B., and ourselves, we feel confident that it is the most complete list of its kind yet published. Incidentally, we may state that supplements and corrections appear both in our own columns and in the "T. and R. Bulletin," so that readers should have no difficulty in keeping their records up to date.

The final portion of this useful book is ruled up in the form of a convenient log for recording messages transmitted and received.

BOOKS RECEIVED.

Pitman's Technical Dictionary in Seven Languages. Parts 1 and 2. Introductory; abbreviations and orthography, alternatives, idioms and peculiar phrases; adopted words; common phrases used in technical language, engineering abbreviations and technical dictionary of engineering and industrial terms in English, French, Spanish, Italian, Portuguese, Russian and German. Published by Sir Isaac Pitman and Sons, Ltd., London. Complete in about 36 fortnightly parts, price 2s. 6d. net each part.

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Radio Association, Official Handbook, 1928, edited by C. M. R. Balbi, A.M.I.E.E. Including the constitution and rules of the Association and articles by well-known writers on the progress of Radio in 1927, television, a radio university, loud-speaker efficiency, multi-electrode valves, etc. Pp. 52, with numerous illustrations and diagrams. Published by the Radio Association, 22, Laurence Pountney Lane, E.C.4. Price 1s. 6d. net.

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An Investigation of a Rotating Radio Beacon, by R. L. Smith-Rose, D.Sc., Ph.D., A.M.I.E.E., and S. R. Chapman, M.Sc., A.M.I.E.E., issued by the Department of Scientific and Industrial Research, Radio Research, Special Report No. 6. An account of experiments carried out on a rotating loop beacon transmitter at Fort Monckton, near Gosport. Pp. 45, with 13 illustrations and diagrams, and 12 tables. Published by H.M. Stationery Office. Price 2s. 3d. net

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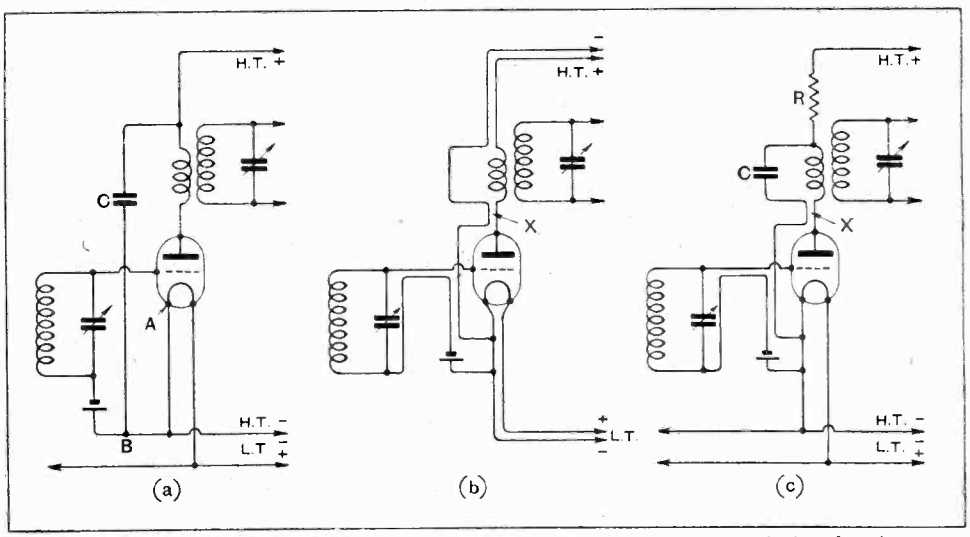
DE-COUPLING WIRING.

Hints on Applying Recent Developments.

By "RADIOPHARE."

ATTENTION has been directed to the need for a more scientific consideration of the question of receiver wiring by an article[1] which appeared in a recent issue of this journal, and in which an improved method of procedure was described. As far as is known, the subject was first treated seriously in *The Wireless World* of June 8th, 1927, and afterwards (as applied to short-wave work) in the issue of October 12th, 1927. The amateur is probably asking himself, "Are these unusual precautions really necessary, or is it a case of academic insistence on a refinement which will make no perceptible difference to the performance of my set?" Space does not permit of attempting to develop an argument in favour of de-coupling wiring, but it will be generally agreed that half our wireless troubles are due to unwanted couplings, and also that many of the more important advances in technique have been in the direction of overcoming the evil effects of such couplings.

Judging by results alone, it would appear to be worth while; the writer was recently asked for advice in connection with a receiver—admittedly not too well designed—having a screened grid H.F. amplifier, which was unstable over more than half the tuning scale. Rewiring in the manner suggested in the accompanying diagram (c) provided a complete cure; no other alteration was made. The fact that this was *not* due to the accidental introduction of damping was proved fairly conclusively by reverting to the original arrangement, when the same trouble made itself evident.



An H.F. stage wired in the conventional manner compared with methods which reduce inter-circuit coupling by eliminating leads common to several circuits.

How Interstage Coupling is Produced.

The underlying principle of the new system is the elimination of leads (and consequently of resistances) common to two or more circuits. As an example, the wire A-B in diagram (a) is common to both plate and grid circuits of the valve; in this particular case no harm would be done, but troubles often arise when magnified energy is fed back to earlier stages in this way.

Diagram (b) shows how this interaction may be avoided by running separate wires, preferably of twisted flex, for each valve directly to L.T. and H.T. batteries; provided the "return" connections are led to the negative filament terminals of individual valves, no lead is common to any other circuit, and interstage coupling can be caused only by internal battery resistance.

The production of inductive loops is avoided by running the high-potential grid and plate leads—which we have hitherto been told to keep clear of all other wires—parallel with and close to their corresponding return connections. Flex wire has indifferent dielectric properties, and would introduce too great a capacity in this part of the circuit; one of these "danger points" is indicated at X, and if the lead from anode to coil is of appreciable length it should be of bare wire with a small air spacing between it and the low-potential H.T. conductor joined to filament. If long connections between the coils and their tuning condensers become necessary, they should be made in a similar manner.

It will be realised that the application of this method to an existing receiver constructed on conventional lines will necessitate complete rewiring, however, a good deal may be done by adopting the modified method suggested in diagram (c) which involves fewer alterations. The complete de-coupling system, as already stated, in no way helps to overcome the effect of internal resistance in the H.T. battery, which, after all, is generally much more serious than that in the wiring, and which is overcome by the simpler scheme. It will be seen that the usual form of common battery wiring is retained, but grid return and anode by-pass circuits are joined directly to negative filament of the valve. As far as H.F. amplifiers are concerned, the de-coupling resistance R need not have the high value of some 20,000 ohms usually suggested for L.F. stages; a suitable resistor of a few hundred ohms can easily be made up by winding non-inductively two or three yards of No. 47 Eureka wire on a small bobbin.

1 "Scientific Wiring," *The Wireless World*, April 25th, 1928.

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The Theory of PUSH-PULL

A Comprehensive Discussion on the Merits of the System.

By N. W. McLACHLAN, D.Sc., M.I.E.E.

OWING to the increased output desired by many experimenters for operating loud speakers with moderate values of high tension, the above method is coming into vogue. But there are pitfalls, as doubtless many readers are aware. The idea looks so delightfully simple from the schematic diagram showing valves back to back, that one would naturally expect trouble in practice, for is it not the most complicated-looking circuits which work best? The object of this contribution is to review the position and to indicate those practical points which are so essential for the proper performance of the circuit using a push-pull combination. To probe the problem piquantly it is desirable for the reader to wade carefully through the elementary theory of the method. Should he fear boredom, he can readily turn to the end and find the answer beforehand, as one was wont to do at school with the arithmetic books.

The History of Push-pull.

First of all, let us survey the historical side of the subject. In British patent specification No. 275 of A.D. 1915, claim 1 reads:—

"Electric wave amplifying apparatus in which amplifying elements of the unidirectional type are employed, characterised in this, that divided input and output circuits are provided and an amplifying element is included in each branch of such circuits, whereby both the positive and negative portions of waves alternating in polarity may be amplified."

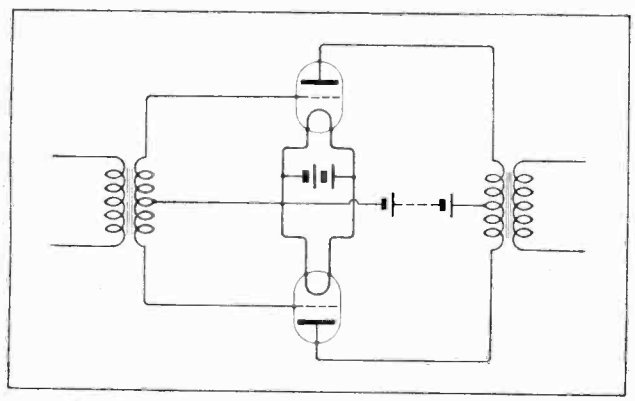

Fig. 1.—Circuit shown in a patent specification filed over thirteen years ago.

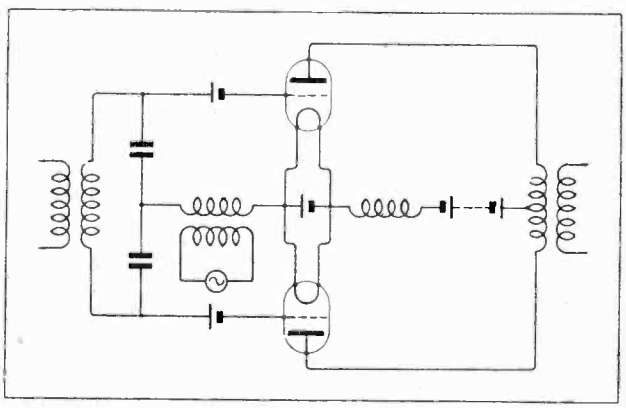

Fig. 2.—A push-pull circuit for which a patent specification was filed in 1918. Hard valves were contemplated since provision is made for grid bias.

The arrangement of the apparatus is shown in Fig. 1, this being taken from the above specification. Clearly this is the *now* well-known push-pull system 13 years old! Although the main claim of the patent definitely states that each half of the wave is to be used, no grid bias is applied to the valves. This is due to the fact that the valves[1] are of the low vacuum type which contain residual gas. Their characteristic curves and the physical conditions within the envelope during operation are quite different from the present-day thermionic valve.

In British specifications 102,503, 130,219, 130,432, 140,829, we find that high vacuum thermionic valves are contemplated, grid bias batteries being used, as shown in Fig. 2, this being taken from No. 130,219.

[1] Since valves of this nature are now only of historical interest, there is no necessity to deal with them here.

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The Theory of Push-pull.—

These specifications do not deal specifically with push-pull amplification, but it is used therein to attain certain results in radio and wire telephony. No guidance is given regarding valve characteristics, grid bias, types of transformer, and the like, so that we shall, in the course of this article, survey the subject in some of its ramifications. The complete analysis of the method would take us beyond the bounds of simplicity, but we may deal with it at a later date.

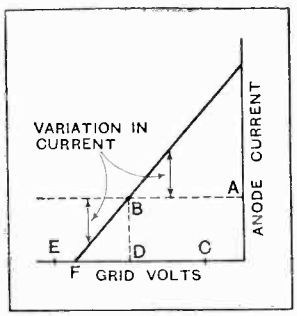

Fig. 3.—An ideal linear valve characteristic. C D equals D E and represents the grid swing for a case explained in the text.

To follow the procedure of working valves in push-pull fashion more readily, it is well to start with an ideal case. The reader can clearly understand that if valve characteristics were quite straight there would be no distortion. But as usual this only applies when the valves — assuming their characteristics to be straight —are worked with the correct value of grid bias. Fig. 3 shows a linear characteristic of the type mentioned above. Now in push-pull we have two valves and two characteristics. Again, we will for simplicity assume the characteristics of the two valves to be identical. The next procedure is to draw some form of diagram which indicates in a simple manner the operation of the back-to-back arrangement of the last stage in Fig. 4. The primary windings of the output transformer are both wound in the same sense, so that currents flowing in the direction of the arrow produce a magnetisation of the iron core, which is additive.

Analysis of the Push-pull Components.

For example, let P_1 and P_2 each have 3,000 turns. Assume at any instant that the current in P_1 is 10 milliamperes and in P_2 2 milliamperes. The total milliampere turns is $3{,}000 \times 10 + 3{,}000 \times 2 = 36{,}000$, or $3{,}000 \times 12$. Thus we can consider the ampere turn or

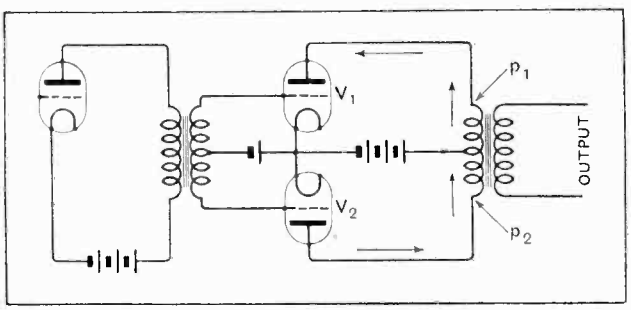

Fig. 4.—A simple push-pull arrangement. Observe that the currents are flowing in V_1 and V_2 in opposite directions. The magnetic effects, however, are clearly additive, i.e., V_1 pulls and V_2 pushes.

magnetisation effect as being equivalent to one-half of the transformer carrying 12 milliamperes. For this to occur it is clear that the current is flowing in *different* directions in the two-valve circuits, *i.e.*, one is pushing and the other is pulling, so to speak. At the instant under consideration, however, the push is only $\frac{1}{5}$ of the pull.

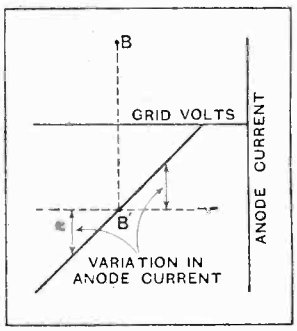

Fig. 5.—Ideal characteristic of V_2 of Fig. 4 corresponding to that for V_1 as shown in Fig. 3.

In Fig. 3, suppose the grid bias to be represented by A B, then B represents the condition when no signals are being received. When signals are applied to the grids of V_1 and V_2 of Fig. 4, there is a variation in the anode current of V_1; this variation taking place above and below point B. Suppose the maximum positive grid swing is C D. During the negative half of an alternation or swing, the grid potential will move back to the point E. From F to E there will be no anode current, *i.e.*, the valve will rectify. The value of the A.C. is given by vertical distances *above* (+) and *below* (−) the line A B, which passes through the grid bias point B. Now everything goes well so long as the grid swing does not exceed D F. This is where the valve V_2 enters the arena and lends its aid. To ascertain the action of V_2 we have to remember that the signal voltage applied to its grid is always *equal but opposite* in sign to that applied to the valve V_1. We therefore obtain for V_2 the diagram illustrated in Fig. 5. This is merely Fig. 3 inverted, since not only is the grid swing opposite, but the actual valve current is opposite also. We are now in a position to ascertain the combined action of the valves V_1 V_2 in push-pull action. In Fig. 6 the characteristics of V_1 V_2 are arranged so that they can readily be amalgamated. For example, when the grid of V_1 is + D P and that of V_2 is − D P, the change in anode current of V_1 is X Y and of V_2 is X^1 Y^1. To facilitate matters, the characteristics have been arranged in Fig. 7, so that the total current change is represented by R S, R^1 S^1, and this can be taken off immediately to a separate graph by means of a pair of dividers. In carrying out this construction, it must be borne in mind that quantities to the left of the grid bias point are to be considered as negative, this, of course, being merely a convention. The resultant characteristic is exhibited in Fig. 8. Here

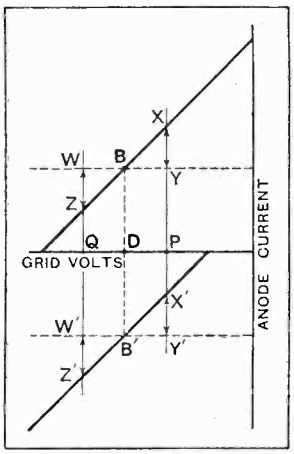

Fig. 6.—For a grid swing D P the total current variation is represented by X Y + X^1 Y^1.

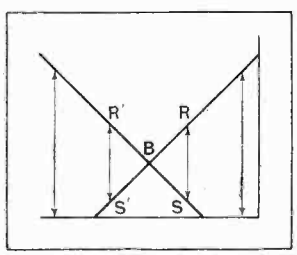

Fig. 7.—Arrangement of characteristics of Fig. 6, to facilitate plotting.

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we have three intersecting straight lines, W X, X O Y. and Y Z, two of which (W X and Y Z) are parallel. The slope of X Y is double that of the two others, as will be seen from the construction of Fig. 7. Since the characteristic is not a " single " straight line, it is clear that there will be distortion of the received signals. If, however, the grid is biased to the rectifying point F of Fig. 3, the complete push-pull characteristic is a straight

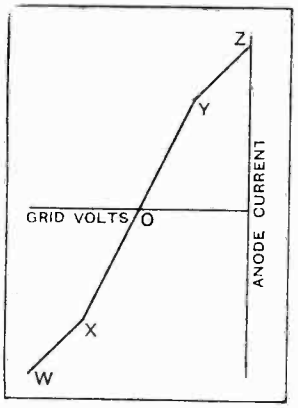

Fig. 8.—Complete push-pull characteristic of valves V_1 and V_2 of Fig. 4 with valves biased to point B of Fig. 3.

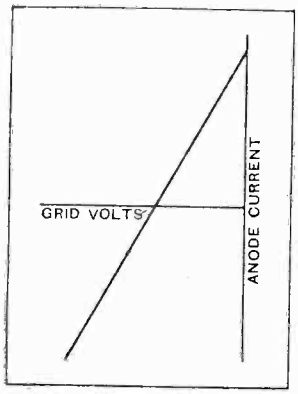

Fig. 9.—Characteristic of V_1 and V_2 of Fig. 4. When grid bias is point F in Fig. 3, the line has the same slope as that in Fig. 3.

line whose slope is identical with that of each separate valve characteristic. This is depicted in Fig. 9, and it is clear that within the limits of the characteristic where grid current does not flow no distortion will be encountered.

The Necessity for Matched Valves.

The case of too much grid bias is portrayed in Fig. 10, from which once more it is obvious that distortion will ensue, since there is no anode current whilst the signal sweeps from F to G. Thus our analysis using ideal characteristics shows that there *appears* to be only one value of grid bias for which distortion is absent. At a later stage we shall consider another aspect of the problem, where the push-pull combination is used under different conditions.

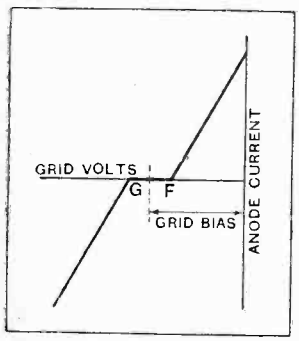

Fig. 10.—Characteristic of V_1 and V_2 when the grid bias exceeds the rectification point F in Fig. 3.

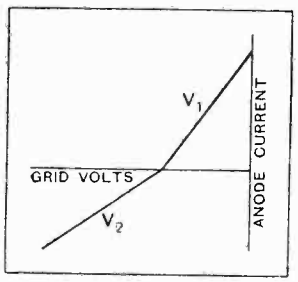

Fig. 11.—The combined characteristic is here shown when the separate characteristics have different slopes. The correct grid bias is applied.

Working with the correct value of grid bias we now proceed to the case where both characteristics are straight, but each has a different slope. This is a case which has a direct bearing on practice, since it does not always happen that two valves of a class are identical in behaviour. The effect is shown diagrammatically in Fig. 11. It is evident that the output due to V_1 is different from that of V_2. The resulting wave form is shown in Fig. 12. Each half wave is a sine curve, but owing to the difference in amplitude, the resulting wave is equivalent to a fundamental sine wave accompanied by a series of harmonics of 2, 4, 6, etc., times its frequency.

The second point which emerges from the analysis, therefore, is the necessity for " matched " valves, *i.e.*, the characteristics of two push-pull valves should be substantially identical.

When Valve Curves are Parabolic.

We now arrive at a stage where actual valve characteristics can be treated. Their shapes are now very familiar—in fact, as familiar as household gods. For practical purposes, a characteristic consists of a curved portion and a straight portion, as illustrated in Fig. 13. The curved portion is often assumed to be a well-known mathematical curve, namely, the " parabola." Its use in engineering and physics is prolific. Common examples are found in bridge construction and in the trajectories of heavenly bodies. The theory of the

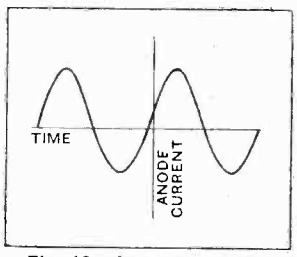

Fig. 12.—The effect of disparity of characteristic (see Fig. 11) on a simple sine wave. The + ve maximum is greater than the − ve maximum.

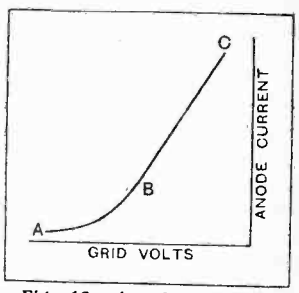

Fig. 13.—A valve characteristic is assumed to consist of two parts: (1) a curved portion A B; (2) a straight portion B C.

parabola was studied by the ancient Greeks 1,500 years before it found any practical application. The parabola is characterised by the fact that the square of the base line is proportional to or equal to the vertical distance from the base line to the curve. This is illustrated in Fig. 14, which shows one-half of the curve, the other being dotted. Now, if we proceed with two identical parabolic curves, and deal with them after the manner of Fig. 7, we get the result shown at the top of Fig. 14. This is obviously a straight line, which is precisely what is required for zero distortion. Furthermore, any length of the parabolic portion can be used in the manner shown, and the result will always be a straight line. If now we continue the line Y O V by the two straight lines X Y and V Z, we get the desired straight characteristic. This will occur if the valve characteristic consists of a parabolic portion followed by a straight portion, as shown in Fig. 13. To make this clearer, two characteristics identical with Fig. 13, consisting of a parabolic and a straight portion, have been treated as shown in Fig. 15. The correct grid bias is given to the valves.

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The Theory of Push-pull.—

From Fig. 15 the correct bias is seen to be a point on the horizontal axis *half-way* along the curved portion of the characteristic. Any other value of bias yields a

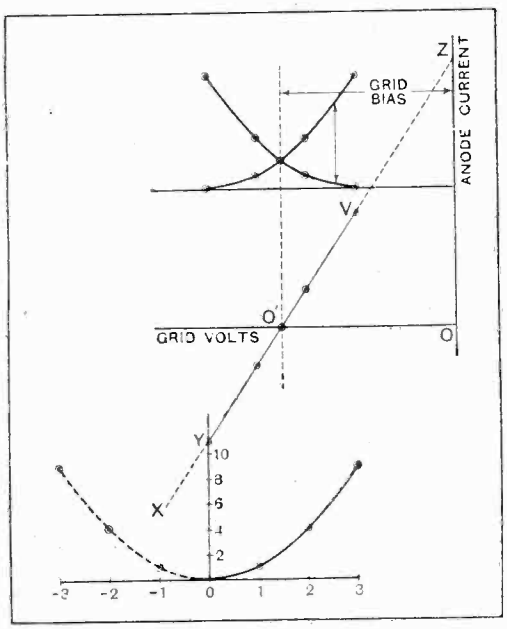

Fig. 14.—It is here shown that the combination of parabolic characteristics in push-pull fashion yields a straight line.

non-linear characteristic, thereby introducing distortion, except in a special case yet to be discussed. The reader should plot push-pull diagrams, using actual curves and various values of grid bias. Also, as a matter of interest, he should alter the shape of the curved portion of the valve characteristic and note the results. As with ideal straight-line characteristics, so with actual valve curves, the "pairs" for push and pull must be substantially alike for zero distortion.

Some curves for D.E.5A valves are plotted in Fig. 16. These show the effect of various values of grid bias. In particular, Fig. 16(c) is interesting, since the result is substantially a straight line, although the grid

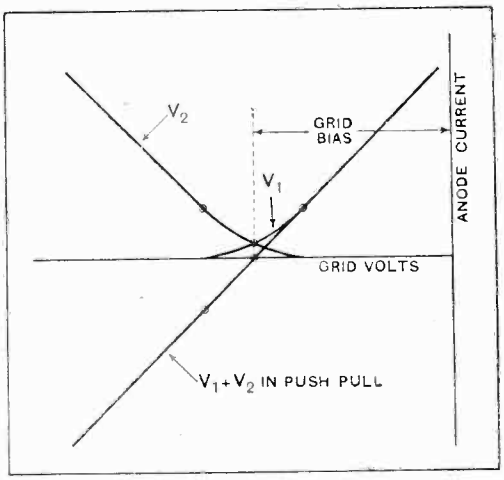

Fig. 15.—Two valves with parabolic-linear curves when used in a push-pull amplifier present a complete characteristic as above.

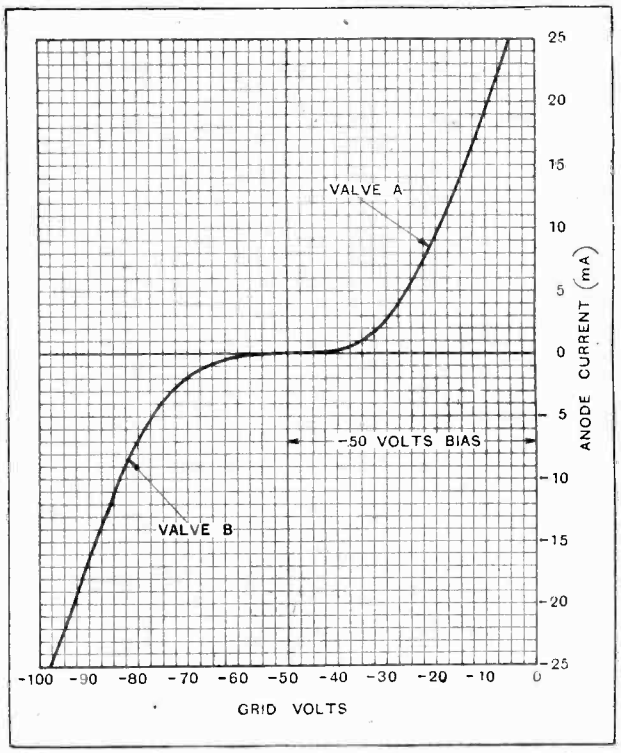

Fig. 16(a).—Push-pull characteristic of two average D.E.5A valves. Anode voltage 120. Grid bias 50 volts, which is too large and yields a non-linear characteristic. Note that the characteristics of A and B are different. The characteristics treated herein are "static." In practice a family of curves is used owing to the variation in anode voltage due to the impedance of the load. This introduces a larger problem than is contemplated at present. For zero distortion the combined characteristics should be equally spaced parallel lines for equal variations in anode voltage.

potential is not taken half-way along the curved portion. We shall now investigate this alternative value of

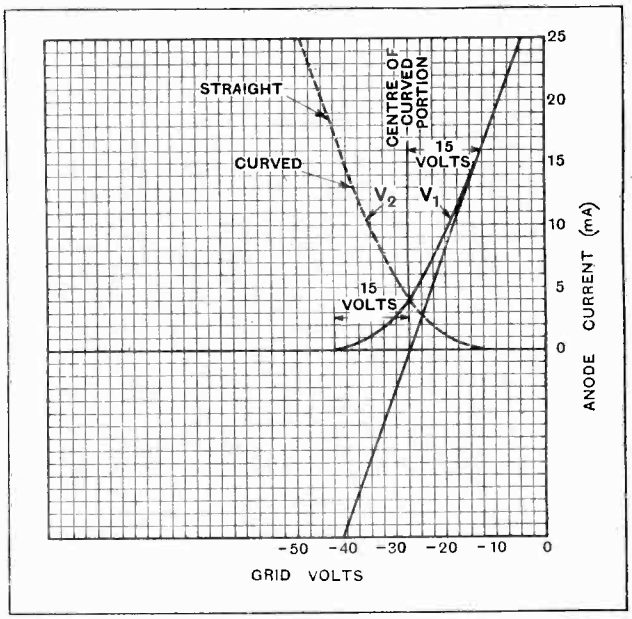

Fig. 16(b).—Push-pull characteristic of two identical D.E.5A valves. Anode voltage 120. The proper bias was found by plotting until the resultant was a straight line. It is difficult to estimate the terminations of the curved portion by eye.

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The Theory of Push-pull.—

bias, which yields a suitable linear characteristic for push-pull amplification. For simplicity, the working parts of the characteristic when the valves are used in the ordinary manner will be treated. In Fig. 16(c) this consists of the straight portion only, the grid swing due to the signal not being allowed to reach the curved portion. The result is a straight line as shown. An important point is that the combined characteristic will be linear even if the slopes of the two individual characteristics are different, as can readily be proved by adding two straight lines of different slopes. When the straight portions of the characteristics do not fall within the same values of grid swing, it is possible to bias the push and the pull valves unequally. This means that two bias batteries have to be used, one next to each grid, or the secondary windings of the transformer has to be split to accommodate a tapping on the bias battery. Neither of these is particularly commendable.

Summary.

We can summarise our results[2] as follows:—

1. There are two methods of obtaining linear characteristics from two valves operating in push-pull manner, (*a*) with a grid bias which sets the valves almost to their

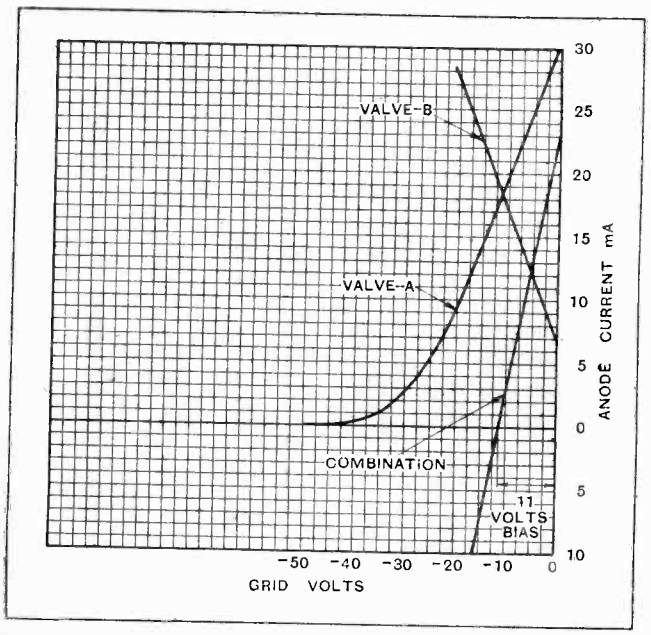

Fig. 16(c).—Push-pull characteristic of valves A and B (dissimilar) with grids biassed equally to approximate centre of linear portion. Resultant is linear, but the grid swing is half that of Fig. 16(b). Anode voltage 120.

rectifying points, (*b*) with a grid bias which sets the valves at the mid-points of the linear portions of their characteristics.

2. If the curved portion of a valve characteristic is parabolic, the proper grid bias for case (*a*) above, is half-way along the base line of the curved portion.

[2] It is assumed that there is no load in the valve circuit, and it is important that the reader should bear this in mind.

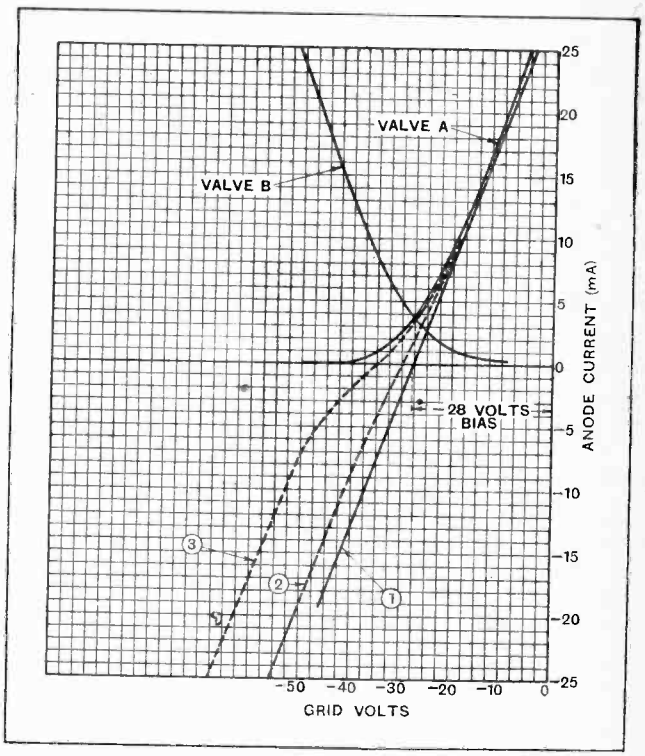

Fig. 16(d).—Push-pull characteristics of two average D.E.5A valves. Anode voltage 120. In curve 1 the bias is −28 volts; in curve 2 it is −30 volts; while in curve 3 it is −35 volts. Curve 1 is substantially linear. The bias, which is the same for both valves, must be accurately adjusted, using a graphical construction.

3. In case (*a*) the permissible grid swing is substantially double that in case (*b*).

4. In case (*b*) the permissible grid swing is half that of case (*a*).

5. In case (*a*) the push and pull valves should have substantially identical characteristics.

6. In case (*b*) the two valve characteristics should be linear over the same values of grid swing. The slopes of the characteristics need not be identical to give a combined linear effect. In practice, however, it is desirable that they should be equal.

In the present article space has been allotted to neither load impedances nor output transformers. These we hope to treat in a future article. Meanwhile, if the reader assimilates the above material and plots back-to-back characteristics as indicated in Fig. 15 he will be in a much better position to deal with the practical side of the problem.

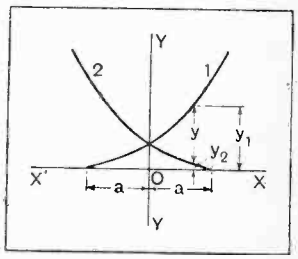

Fig. 17.—The necessary data are given in this diagram for the equations set out and solved in the appendix.

In view of the unique properties of the parabola in yielding a straight line when two identical curves are laterally inverted and added, the following appendix has been given for the mathematical reader.

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The Theory of Push-pull.—

APPENDIX.

The equation to curve (1) of Fig. 17 is

$$Y_1 = A(x + a)^2 \quad \ldots\ldots (1)$$

where A is an arbitrary constant; and the equation to curve (2) is

$$Y_2 = A(a - x)^2 \quad \ldots\ldots (2)$$

Now, the result we require is the difference $(Y_1 - Y_2) = Y$, between $x = o$ and $x = a$.

Expanding equations (1) and (2) for Y_1 and Y_2, we get

$$Y_1 = A(x^2 + 2ax + a^2) \quad \ldots\ldots (3)$$

$$Y_2 = A(x^2 - 2ax + a^2) \quad \ldots\ldots (4)$$

Subtracting (3) and (4) we have

$$Y = (Y_1 - Y_2) = 4Aax \quad \ldots\ldots (5)$$

which is the equation to a straight line of slope $4Aa$.

The slope of parabola (1)

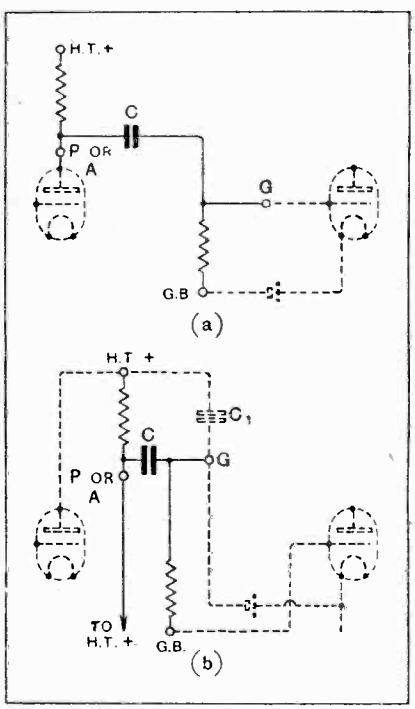
$$\text{is } \frac{dY_1}{dx} = A(2x + 2a) \quad \ldots\ldots (6)$$

When $x = a$, the parabola joins the straight line in Fig 13 at the point B. By substituting this value for x in (6), the slope of the parabola is $A(2a + 2a) = 4Aa$. But this is also the slope of the straight line obtained by combining the two parabolic portions. Hence, if a characteristic consists of a parabolic-linear curve, the combined push-pull characteristic is a straight line, provided the bias is set halfway along the base line of the parabolic portion.

NOVELTIES FROM OUR READERS.

EXPERIMENTING WITH R.C. UNITS.

There are a large number of commercial R.C. units upon the market having interchangeable anode resistances and grid leaks; in most cases the anode resistance in these units is of the non-wire wound type. The experimenter can thus change at will either the anode resistance or the grid leak, but is unable to experiment with other values of coupling condenser.



(a) Conventional method of lettering R.C.C. commercial units. (b) Rearrangement of terminals to allow the insertion of any value of condenser.

Anybody possessing an R.C. unit of this type in which the condenser is not interchangeable can easily arrange to use it with condensers of varying capacities by slightly altering the external connections to the R.C. unit as follows:—

In Fig. (*a*) the ordinary connections of an R.C. unit are given, and the terminals of the unit are marked with the usual symbols. Sometimes, as is well known, the anode terminal is marked "A" and sometimes it is marked "P," indicating that a particular manufacturer prefers the word "plate" to that of "anode." By altering the external connections of the unit to those given in Fig. (*b*), experiments may be made with various values of condenser, this experimental condenser being marked C_1. It must not be forgotten, however, that C, the actual condenser of the unit, will still be in circuit, but its position will actually be across the H.T. and G.B. batteries where it will do no harm. It must, however, be capable of withstanding the normal H.T. voltage, but in all good makes of R.C. unit a mica condenser is used which is capable of withstanding a very high voltage without risk of breakdown. If the condenser actually did break down, no harm would occur to the valve, but the H.T. and G.B. batteries would be short-circuited.

J. M.

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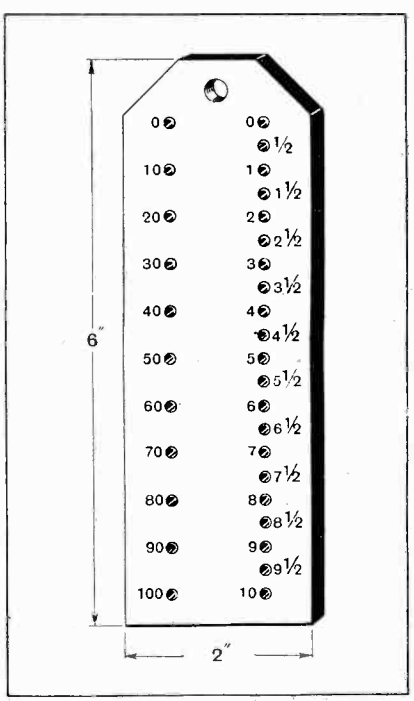
CHECKING L.T. CONSUMPTION.

The average set owner can easily find out by simple calculation exactly how many hours' service his L.T. accumulator should give him on one charge. The receiver, however, is not often used for exactly the same period every day, and it becomes rather annoying to write down every day the number of hours' use to which an accumulator has been subjected.

It is important to keep this check on the accumulator in order to make sure that it is fulfilling its proper duties. The simple device shown will enable this to be done without any use of pencil and paper. It is very simply constructed of wood having suitable dimensions, suggested ones being 6in. × 2in. × ¼in., $\frac{1}{16}$in holes



A match stick recorder of L.T. consumption.

being drilled, and it will be found that these will accommodate ordinary match-sticks. Naturally, the neat workman will prefer to make special pegs. The method of using the device is completely self-explanatory.

F. H.

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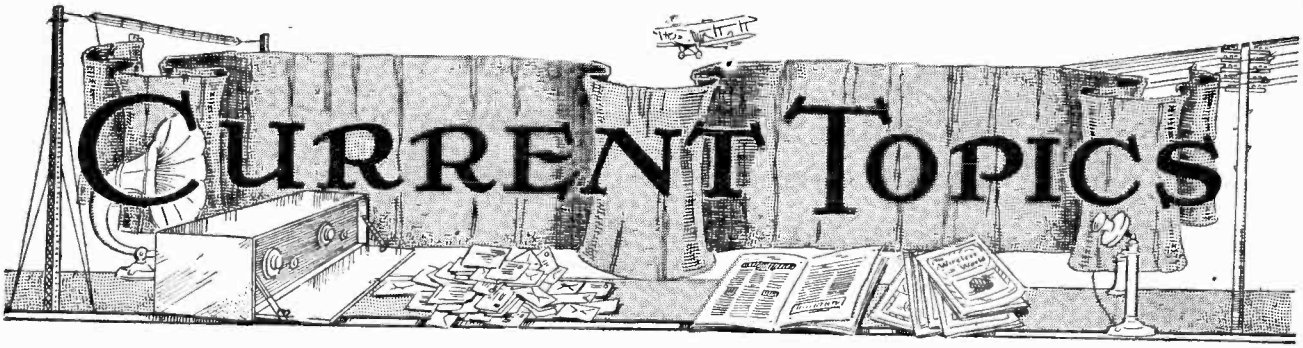

Events of the Week in Brief Review.

HEALTHY DAVENTRY

Wireless has so often been blamed for the minor troubles of life, such as wet weather or thunderstorms, that it is refreshing to read that the increasing good health of the inhabitants of Daventry is, by some, ascribed to the benign influence of 5XX and 5GB.

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IN RETURN FOR THE NIGHTINGALE.

We hear that our New Zealand brethren were delighted with the notes of the nightingale recently broadcast from Pangbourne, and it is rumoured that a movement is on foot to send us in return the song of the New Zealand moki-moki or bell-bird, if this elusive songster can be persuaded to face the microphone with the same good grace as its English rival.

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A DOG STORY FROM HOLLAND.

Educational talks are not usually associated with the recovery of lost pets, but we hear the story of a Dutch professor whose favourite dog had been stolen, escaped from captivity, been adopted by a kindly doctor, and was eventually recovered by a wireless coincidence.

The dog's adopted master was listening to the professor's discourse broadcast from Hilversum when he noticed the unusual excitement shown by the canine foundling at the sounds of the voice from the loud speaker. Guessing that it might be his master's voice that aroused the dog's interest he got into touch with the professor and was soon able to return the lost one to his rightful owner.

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ANOTHER DOG STORY.

A listener summoned at Bradford for installing and working a wireless set without taking out a licence pleaded in defence that the set would not work a loud speaker, and contended that if a dog licence need not be taken out for a puppy until it was six months old and had become useful instead of destructive, the same argument should apply to a receiving licence. The magistrates, however, were unconvinced—presumably taking the view that even a dumb dog (if such there be) should be licensed—and fined him £5 and costs.

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RECEIVERS FOR THE BLIND.

The Derbyshire Association for the Blind is about to provide 100 receiving sets for the use of their hospitals and homes, and we understand that they have accepted the tender of Messrs. Burne-Jones and Co., Ltd.

DERBY RESULTS HEARD ALL OVER ENGLAND.

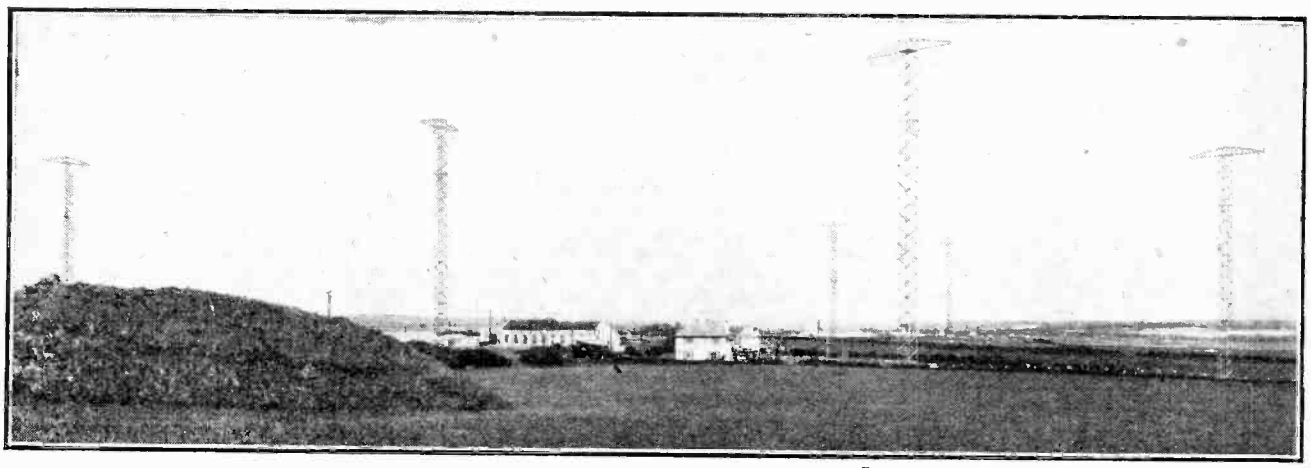
The vivid description of the Derby was picked up all over the country, and probably distant listeners were more in touch with the rapid progress of events than many of the actual spectators. Even travellers by the "Scotsman" were able to keep in touch with Epsom while speeding northwards.

oooo

ALASKA'S APPRECIATION.

Of all countries in the world, it is probable that desolate Alaska feels most the benefit of wireless communication. Twenty-five years ago the interior of the country was linked up with the rest of the world by land line only. Let us not seem to belittle the wonderful work of the Army Signal Corps, who carried wires over mountains and passes almost inaccessible to man, but it must be candidly admitted that wire telegraphy was a somewhat precarious means of keeping in touch with the outside world.

To-day there are twenty-six army stations, three of which are also for cable work, and in addition there are six cable stations. In the interior the wireless stations are rapidly increasing, so that at no very distant time the whole of that difficult country may be in constant touch with Canada and the United States.



(By courtesy of Marconi's Wireless Telegraph Co., Ltd.)

DORCHESTER BEAM STATION. A first photograph of the completed Dorchester station. The two masts on the left are part of the American and Egyptian aerial system. Those on the right carry the South American aerial and reflector systems, and the two masts in the background are for the Far East services.

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AMERICAN TELEVISION SERVICE.

WGY (Schenectady) is now transmitting a regular television programme on three days each week, between 1.30 and 2 p.m. (Eastern Daylight Time), says *The Manchester Guardian*. The service is intended for the benefit of experimenters and amateurs who have constructed television sets, and it will, it is expected, assist engineers in the development of a reliable and complete system of television.

No elaborate effects are to be attempted for some time. On the first day faces of men talking, laughing, and smoking were broadcast. The signal is an intermittent, high-pitched whirr, the pitch varying with the action before the transmitter.

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PICTURE TRANSMISSION FROM DENMARK.

Our esteemed contemporaries *Radiolytteren* and *Populær Radio* began a regular schedule of picture transmission from their short-wave station ED 7RL in Copenhagen on May 29th and intend to continue this programme twice a week on a wavelength of 42.12 metres. We understand that, owing to changes in the Danish broadcasting programmes, some of their earlier picture transmission had to be deferred, but we hope to give our readers regular notice of the times in future. The next transmission will be on Friday, June 15th, from 2330 to 0100.

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THE ITALIAN WAY.

The Italian Ministry of Communications will not stand any refusal to broadcast on the part of singers and other artists or their managers. A Decree has been signed in Rome to oblige artists to perform, if required, for programmes broadcast from Rome, Milan and Naples. On the other hand, the chiefs of these stations are equally under an obligation to provide a satisfactory technical rendering of these programmes.

The Ministry is determined to popularise broadcasting, as it is estimated that there are less than 200,000 listeners in the whole of Italy.

oooo

CHAOS IN RUSSIA.

According to a Russian radio specialist, the situation in Russia is far worse even than in the most chaotic days of uncontrolled broadcasting in America. The Government, he states, is spending more time in building broadcasting stations than in widening the net of receiving sets. There are now fifty-seven broadcasting stations in European Russia and ten in Siberia, whereas the number of registered receivers in the whole of Siberia is only 200,000, mostly primitive crystal sets; there are 280,500 registered sets in Russian cities and only 21,000 in the villages. Instead of "one man one vote" they may reach the state of "one transmitter one receiver."

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LOST AND FOUND.

The loud speakers at Stamford Bridge on Whit-Monday did more than proclaim the results of the events in the sports held in these popular grounds. In many instances they were used to identify children who had got lost in the crowd, and in two instances the missing ones were restored to their anxious parents within a few minutes of their description being broadcast.

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FOOTBALL LEAGUE'S BROADCAST BAN.

At the annual meeting of the Football League in London on June 4th the Management Committee recommended clubs to discourage in future the broadcasting of descriptions of League matches. A number of the clubs had complained of a falling-off in the gate-money as an increasing number of those who might otherwise have been spectators were content to listen to descriptions of the matches in comfort rather than take their chance in a seething crowd.

FORTHCOMING EVENTS.

THURSDAY, JUNE 14th.

Leyton and Leytonstone Radio Society.—At 8 p.m., at Grove House, High Road, Leyton, E.10. Paper on "The Output Stage."

SATURDAY, JUNE 16th.

Wigan and District Technical College Radio Society.—Visit to Messrs. Metropolitan Vickers, Manchester. Members should communicate with the Hon. Secretary, Mr. M. M. Das, B.Sc., Library Street, Wigan.

SUNDAY, JUNE 17th.

Golders Green and Hendon Radio Society.—First Direction-finding Field Day.

MONDAY, JUNE 18th.

Croydon Wireless and Physical Society.—Informal meeting, "Questions and Answers."

WEDNESDAY, JUNE 20th.

Golders Green and Hendon Radio Society.—Reception by Mr. Van Zwanenberg, at 619, Finchley Road, N.W.3.

INDUCTIVE MUSIC.

M. Maurice Martenot has recently given a demonstration at the London Coliseum of his apparatus for producing "Music from the Ether." This is said to be somewhat similar in principle to that invented and shown by Prof. Theremin a few months ago, but M. Martenot is able to play staccato notes and has a chart or keyboard plan whereby he can "sight" the pitch and avoid "feeling for the note."

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LAUSANNE CONFERENCE.

At a meeting of the Council of the Union Internationale de Radiophonie and of the European Broadcasting Engineers held recently in Lausanne it was recommended that the identity of broadcasting stations should be stated as clearly as possible and that all propaganda should be avoided which might give offence to neighbouring countries.

Discussion among the engineers included the best means of eliminating interference from trains, lifts and other electrical apparatus, the latest development of short-wave experiments, and the technical problems involved in relaying programmes over long distance by land line and cable.

A WORLD'S MASTER CLOCK.

Professor Arthur Korn, the well-known German professor who has devoted so much work towards the transmission of pictures, proposes that a master clock of extreme accuracy and a synchroniser shall be installed at some central station and that corresponding synchronising apparatus, such as is now used in picture transmission, should be installed throughout the world. He estimates that a degree of accuracy of one hundred-thousandth of a second could thereby be maintained.

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A CORRECTION.

It is regretted that owing to a typographical error the amplification factor of the new Marconi valve type H.L.210 was incorrectly stated in the advertisement of the Marconiphone Co., Ltd., which appeared on the back cover of last week's issue. It was given as 6.15 instead of 15.

Club News.

Screened Grid Valves Explained.

A lantern lecture and demonstration on "Screened Grid Valves" was given by Mr. F. Youle, of the Marconiphone Co., at the 4th open meeting of the Association of British Radio Societies on May 17th at the Y.M.C.A., Manchester. By means of slides the lecturer gave a clear exposition of the early difficulties in wireless circuit design due to the capacity between the plate and grid and the attempts made to overcome the trouble by neutralisation. He demonstrated how the screened grid valve overcame the difficulty. A characteristic curve of the DES 625 was shown and explained. Mr. Youle gave the efficient amplification factor for this valve at one stage 50-60; two stages 45-50; and three stages 30 per stage (without reaction).

Hon. Secretary, Mr. L. A. Gill, Hope House, South Reddish, Stockport.

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Power Transformers.

A lively discussion followed the reading of a paper on "Power Transformers" by Mr. Smith at a meeting of the Leyton and Leytonstone Radio Society on May 17th. This proved a subject of exceptional interest to the members, as the power supply of the district is now being converted to A.C.

Hon. secretary, Mr. E. Boatright, 265, Murchison Road, Leyton, E.10.

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A Wireless Excursion.

A very enjoyable time was spent on Saturday, May 19th, by all who participated in the highly successful South-Western Area Conventionette organised by the Radio Society of Great Britain in co-operation with the Bristol and District Radio Society. The visitors, among whom were many well-known amateurs, including Mr. Gerald Marcuse (2NM), were met on arrival during the morning by members of the Society, and after lunch the party set off in charabancs and private cars to visit the recently-opened Post Office wireless station at Portishead. The apparatus was inspected and described by the engineer in charge, and then the return journey to Bristol commenced, where tea was partaken of at the Merchant Venturer's Technical College. After tea the president of the Bristol Society, Prof. David Robertson, D.Sc., delivered a lecture entitled "Sound and Sound Waves," which was illustrated by lantern slides and a number of most interesting experiments. This was followed by an informal dinner at St. Stephen's Restaurant, which concluded one of the happiest and most enjoyable days in the history of the Society.

Hon. secretary, Mr. S. J. Hurley, Arno's Vale, Bristol.

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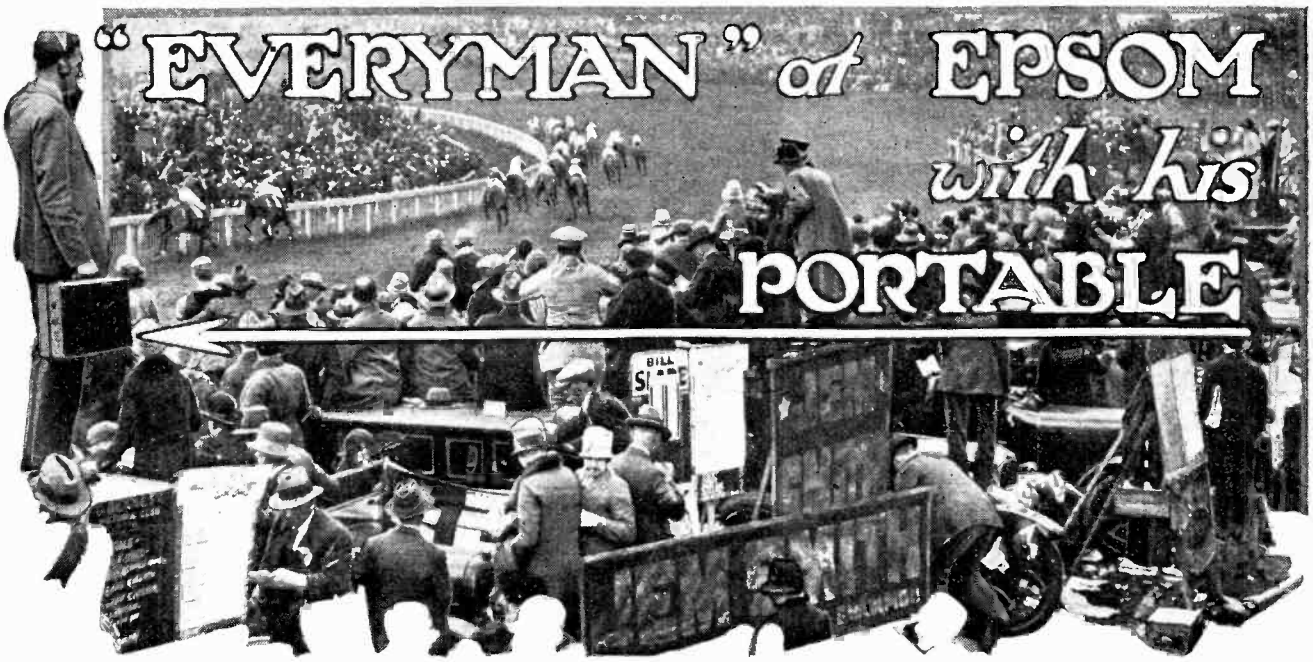

How Broadcasting Helps the Racegoer.

UNTIL we overcome that particularly British form of shyness which deters us from doing anything unusual, and therefore conspicuous, we cannot obtain the full benefit from our portable receivers. So, at least, thinks the writer, and he speaks feelingly; when his offer was accepted by the Editor, did he not regret his rashness in suggesting that he should be commissioned to go to Epsom with a portable, and record his impressions as to the usefulness of the running commentary to a spectator at the Derby?

At first sight, the broadcast of any sporting event as an aid to the enjoyment of the man on the spot may seem superfluous, but is this actually so? Surely not; the commentator is, or should be, better situated for obtaining a good view than all but the specially favoured few, and, equally important, he is an expert at his subject. Be his eyesight ever so keen, the ordinary man cannot pick out colours at a glance, as can the racecourse habitué.

The Value of a Portable Set.

For the trip to last Wednesday's classic race, an "Everyman Portable," as described in *The Wireless World* for April 18th, was chosen; as most readers are aware, this is a small self-contained attaché case receiver weighing some 12 lb. As the set is designed for operation with the lid closed, it is ideal for use on the crowded top of a 'bus; this form of combined conveyance and grandstand was decided upon as likely to afford a fair opportunity of carrying out the experiment under reasonably good conditions. As the distance from 2LO to Epsom Downs is only slightly over a dozen miles as the crow flies, the receiver is more than sufficiently sensitive; and it was decided to substitute, for the usual pair of phones, a single earpiece, which is more convenient for listening under the conditions already described.

Of the preliminaries little need be said, beyond mentioning the fact that the set was tested during the lunch-hour programme and found to be perfectly satisfactory, delivering signals of sufficient intensity to be audible over the noises of the course. The opening remarks of the commentator, though admirably suited for conveying "atmosphere" to the home listener, were of but slight interest to an actual onlooker, and it was not until the horses lined up for the start that the advantage of having, so to speak, an expert at one's elbow was fully appreciated.

The Situation of the Commentator.

Perhaps the writer was affected by mass psychology (the victory of an outsider and the complete failure of a much-fancied favourite must have meant disappointment for the majority of the vast assembly), but he admits frankly that the broadcast of the race did not fully come up to expectations. This is no reflection on the excellent work of the very able commentator; it is entirely due to the fact that he was so situated as to be unable to see properly how matters were progressing over the first two-thirds of the course. Had the B.B.C. been able to set up one or two extra "points," the results could not have failed to be more gratifying.

Perhaps it is hardly fair to convey the impression that the experiment was not a success; there is no doubt that, with the help of the receiver, it was possible to form a better idea of the progress of the race than could those in the immediate vicinity who were not so equipped. Indeed, the writer found that his fellow-racegoers on the 'bus were by no means certain of the result until he himself repeated the commentator's announcement.

H. F. S.

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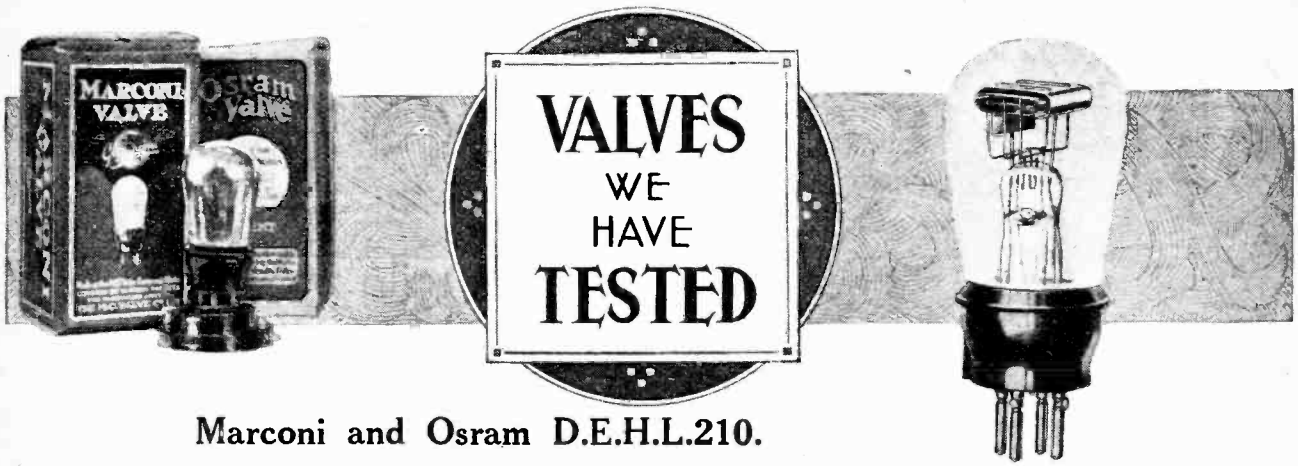


Marconi and Osram D.E.H.L.210.

A General-purpose Valve Suitable for Portable Sets.

AS the title of this valve implies, it is designed for both high- and low-frequency amplification. It has a two-volt filament, which takes 0.1 amp. Actually, this current is attained with 1.8 volts, and excellent results are obtained at this voltage; there is no need to work the valve at 2.0 volts, which is the maximum permissible filament voltage.

Working Data.

The H.T. voltages recommended by the makers for various purposes are as follows:—

H.F. amplification	50-150 volts.
Grid leak detection	50- 90 volts.
Anode bend detection	70-150 volts.
L.F. amplification	90-150 volts.

Normally, the H.T. voltage should not exceed 150. The amplification factor and A.C. resistance are given as 15 and 25,000 ohms respectively. This figure agrees very well with the results of the tests, which gave an average amplification factor under working conditions of 14.5 and an A.C. resistance of 24,600 ohms. The mutual conductance obtained from these figures is 0.59 milliamp. per volt.

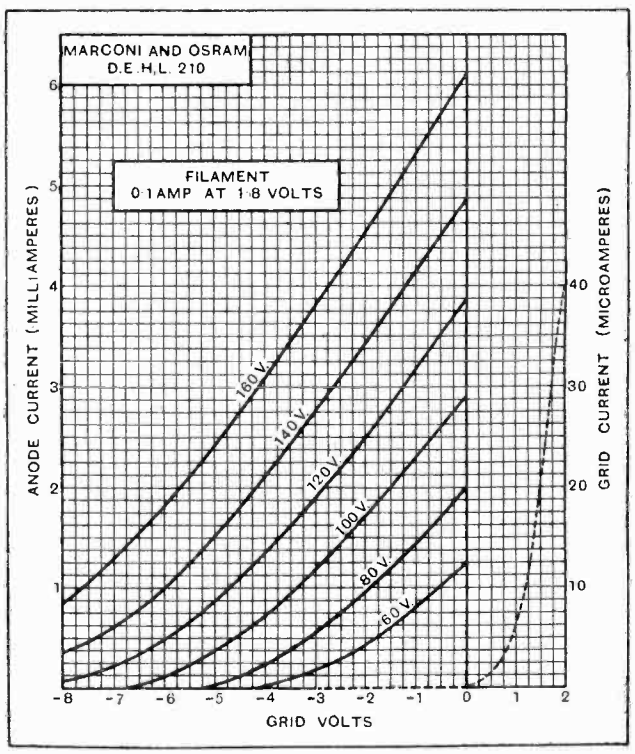
Grid Bias Values.

The following values of grid bias are recommended for the H.T. voltages indicated when the valve is used as an L.F. amplifier:

H.T.	Grid Bias.	Anode Current (mA.)
60	$-1\frac{1}{2}$	0.6
100	-3	1.2
140	$-4\frac{1}{2}$	1.8

When the valve is used as a leaky grid detector the grid return should be connected to L.T.+.

The D.E.H.L.210 is suitable for use in all stages of a portable set, excepting the last or output stage, in which a valve such as the D.E.P.215 or D.E.P.240 should be used. The amplification factor and A.C. resistance are well suited to the untuned H.F. couplings at present in vogue in portable sets, the valve functions well as a detector, and the resistance is not too high for transformer coupling, provided a transformer with a moderately high primary inductance is used after the valve.



(Average values.)
A.C. Resistance = 24,600.
Amplification factor 14.5.
Mutual conductance = 0.59.

The overall dimensions are a further recommendation for service in portable sets, for the height is only $2\frac{3}{4}$in. from the bottom of the base to the top of the bulb, and the greatest diameter is $1\frac{1}{2}$in.

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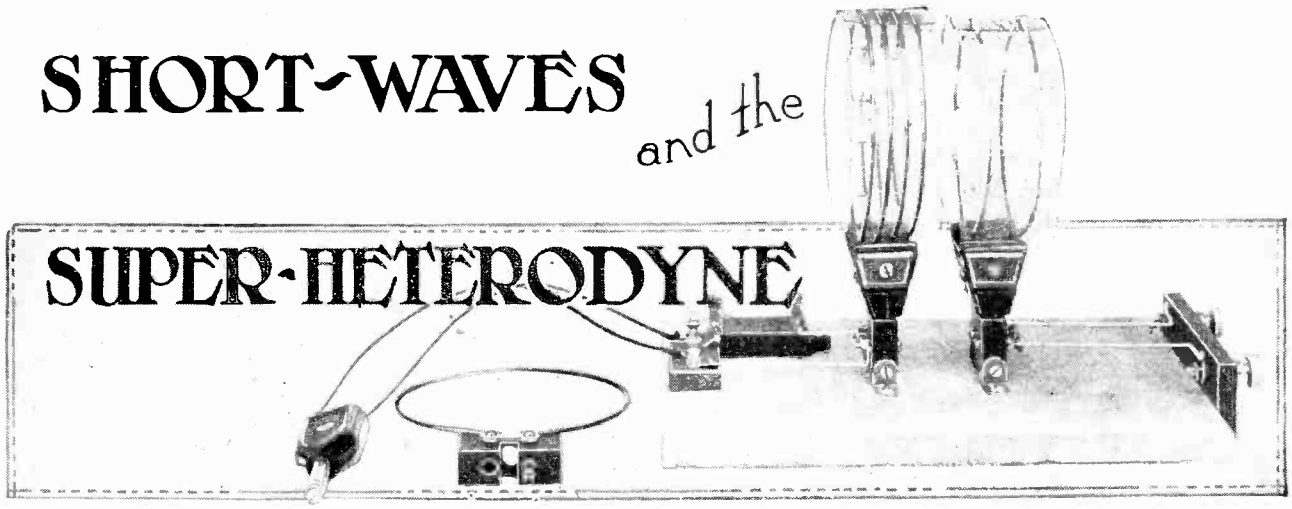
SHORT-WAVES and the SUPER-HETERODYNE



Constructional Details for a Short-wave Unit for "The Wireless World Super-Seven."

By H. B. DENT.

THE day is not far distant when listeners in this country will cease to be thrilled by the statement, "London calling the British Empire," in place of the orthodox announcement prefacing an S.B. broadcast, "London calling the British Isles." How this will be achieved is yet to be seen, but undoubtedly the messages will be flashed to the far corners of the earth *via* the medium of the ultra short waves. Even to-day more and more broadcast stations are adopting these high frequencies for linking up isolated outposts in distant parts with the home country, and regular transmissions are now "on tap" to the possessor of a really good short-wave set. What actually constitutes a good set is a matter of considerable controversy among designers, and many still pin their faith to the regenerative detector followed by one or more L.F. amplifiers. While it is admitted that these simple circuits have achieved surprising results over great distances, the lessons learned from the use of H.F. amplification on the ordinary broadcast wavelengths must not be overlooked, and, moreover, it has been pointed out in a previous issue of this journal that H.F. amplification has many advantages when applied to very short wavelengths.[1] Great care is necessary in the disposition of the components, and certain precautions must be taken in wiring the amplifier, but the results obtained will more than compensate for this. However, there are many who would look with less suspicion on the suggestion if a receiver of standard design could be easily and quickly adapted to the new requirements.

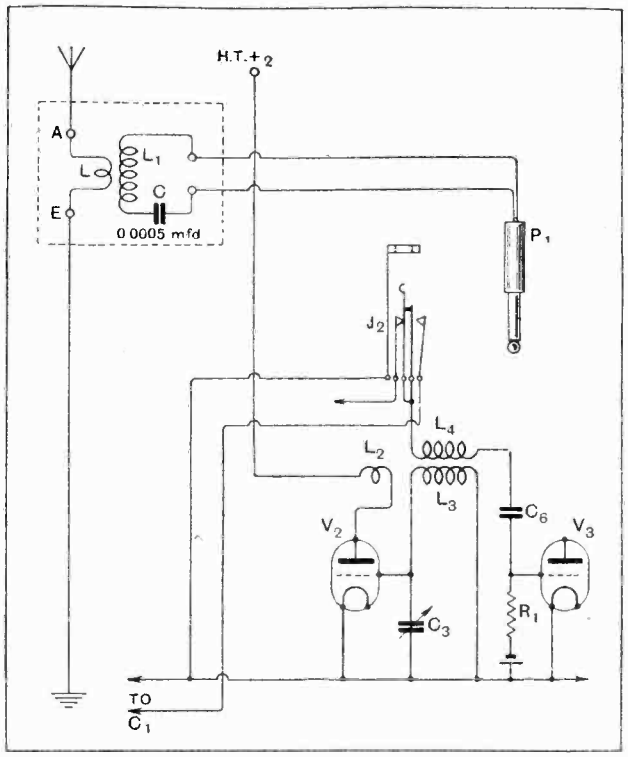


Fig. 1.—The theoretical diagram of the oscillator and first detector in the Super-Seven. The additional short-wave unit is shown within the dotted lines.

It is not generally realised that a certain type of receiver extensively used on the normal broadcast wavelengths lends itself admirably to easy conversion into a highly efficient short-wave receiver. When making this statement the writer has in mind those sets employing the supersonic-heterodyne principle. Readers who are conversant with these sets know that the H.F. amplification is carried out on a long wavelength, and this remains fixed irrespective of the wavelength of the transmission being received. It would appear, therefore,

[1] "H.F. Amplification on Short Waves," *The Wireless World*, October 12th, 1927.

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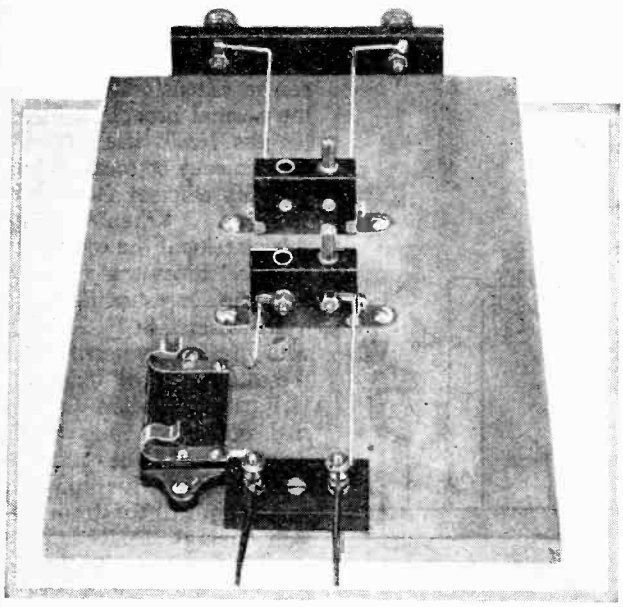
that as far as the intermediate amplifier is concerned, it is quite immaterial whether the received signal is on a wavelength of 600 metres or 60 metres, provided the frequency conversion circuits can be made to function equally well in both cases.

This question was investigated carefully, using *The Wireless World* "Super-Seven" as the main portion of the apparatus, and it was found that, without altering the receiver in any way, but by merely adding an external aerial-coupling unit, exceptionally good results could be obtained. Needless to say, special coils were required in the oscillator and pick-up positions, but with the exception of the pick-up coil, which consisted of one turn only, commercial short-wave coils were used throughout. The single-turn coil can be constructed by attaching a loop of stout gauge wire to an ordinary coil plug in the manner shown in the illustration.

The Aerial Unit.

The aerial coupling unit consisted of a pair of Igranic short-wave coils, a two-turn coil being used as an aerial coil, and coupled to this was a four-turn coil of the same type, the tuning being carried out with the variable condenser fitted in the receiver. The arrangement adopted is shown theoretically in the circuit diagram, Fig. 1, the aerial coupling unit being enclosed within dotted lines. L and L_1 represent the two- and four-turn coils respectively, and the fixed condenser C of 0.0005 mfd. is included in the tuned circuit for the purpose of reducing the effective maximum capacity of the variable condenser C_1, so that the tuning of this circuit shall not be too critical.

The expedient of connecting two condensers in series to reduce the total capacity has been advocated on many occasions, but the procedure to follow when it is required to determine the value of the series condenser



A plan view of the short-wave unit; the coil holder in the foreground carries the tuned coil.

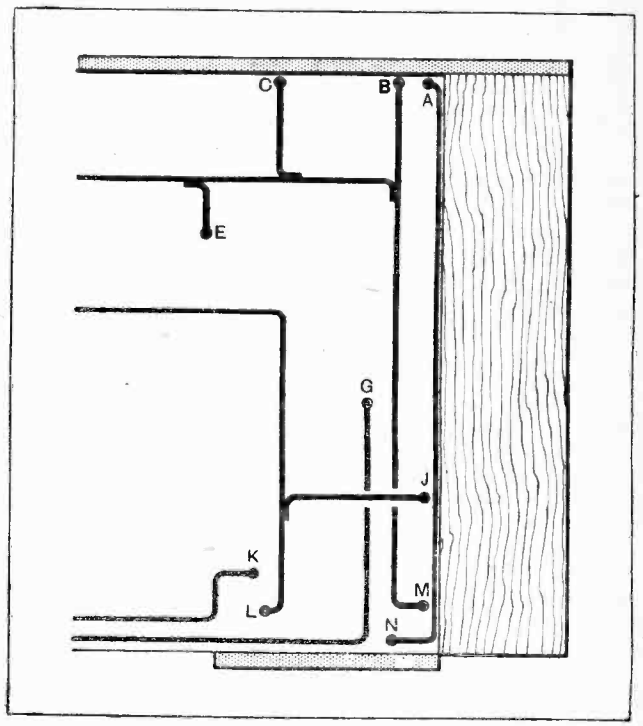


Fig. 2.—The corrected under-deck wiring of the output end of the Super-Seven.

necessary to reduce a known capacity to a predetermined smaller value is not too well understood. The resultant capacity when two condensers are connected in series is given by the formula $\frac{C}{C_1} + \frac{C}{C_2} = 1$, where C_1 and C_2 are the individual capacities in mfds. of the two condensers, and C the effective capacity obtained by connecting the condensers in this manner.

This arrangement is applicable in simple form only to the input circuit, as the grid of the valve V_3 obtains its bias through a grid leak R_1, whereas the grid of V_2 depends upon a continuous D.C. path in the coil L_3 to enable the accumulated charge to leak away. This prohibits the use of a coil and condenser mounted on a plug attachment to replace the coil L_3; however, those who are not averse to making a slight modification to the oscillator circuit could include a fixed condenser of 0.0005 mfd. in series with the variable condenser C_3, and fit a switch, so that the fixed condenser can be short-circuited for normal broadcast reception. This need not be considered an essential feature, as by the exercise of a little care there will be no difficulty in tuning, in spite of the large capacity of the variable condenser.

Stray Capacities.

In all short-wave work stray capacities must be kept down to a minimum, and although a slight loss may result due to the jack switch J_2 and its associated wiring, this can be ignored in view of the large H.F. amplification available. However, it would not be wise to introduce unavoidable capacities. This would be the case if twisted flex was used to link the aerial-coupling unit with the plug P_1, but as a flexible conductor is desir-

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Short Waves and Super-heterodyne.

able, it should consist of two separate wires spaced by means of small insulating strips.

Although the foregoing deals exclusively with short waves and the "Super-Seven," those possessing receivers of other design but functioning on the super-heterodyne principle should have no difficulty in adapting their sets for this purpose, as only minor differences in detail will exist. Some designers favour an oscillator in which both plate and grid coils are tuned by the variable condenser; in this case half the number of turns specified for the grid coil should be used in the plate and grid circuits, and these coils must be tightly coupled, otherwise some difficulty may be encountered with the local oscillator. The tendency would be to oscillate violently at the lower settings of the condenser, and very weakly, or perhaps not at all, at the readings corresponding to the higher wavelengths.

The opportunity will be taken here to correct two minor errors which occurred in the practical wiring diagrams in the constructional article of the "Super-Seven" receiver. In the wiring plan, Fig. 4, page 635, of *The Wireless World*, of November 9th, 1927, the letters K and M have been applied incorrectly. K should refer to the lead joined to the O.P. tag of the left-hand transformer and M to the leads joined to the I.S. tags of the two other transformers shown. The second error occurred in Fig. 12, on page 701, in *The Wireless World* of November 23rd, 1927, where the leads marked AM and BN have been drawn in the wrong positions. The lead from the point A should travel direct to the point marked N, and not connect to M. That marked M should not be joined to A, but connected to the common negative conductor BCDE, etc. This correction will be more readily followed by referring to the revised practical wiring sketch of this portion of the under-deck wiring given in Fig. 2, which should be compared with Fig. 12 in the original "Super-Seven" article.

General Notes.

The American amateur stations NU 2ET, H. W. Hollister, 26, Plainfield Avenue, Lynbrook, N.Y., and 4EY, W. F. Gamble, 524½, West Fifth Street, Chattanooga, Tenn., will be grateful for reports on their signals.

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NU 1BBN, the Headquarters Co., 3rd Battalion, 182nd Infantry, Massachusetts National Guard, is transmitting on 41.5 and 38 metres, raw A.C., with 150-watt input, and is anxious to get into touch with a British amateur station. Communications may be sent *via* Mr. A. Lambourne, 43, Bramshaw Road, Norcot, Reading, who informs us that he is willing to stand by at any time on any wavelength from 15 to 440 metres and report.

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Mr. L. H. Thomas, 6QB, "Conway," 66, Ingram Road, Thornton Heath, Surrey, is now operating regularly on a wavelength of 23 metres between 0600 and 0800 B.S.T., and would be glad of reports on his signals from the British Isles. An attempt is being made to compare local weather conditions with "DX" conditions, and also with the strength of signals locally, if they are heard at all in this country.

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American 10-metre Signals.

With reference to the note on page 584 of our issue of May 30th, we understand from Mr. D. W. Heightman (2BRJ) that he cannot claim to be the first English amateur to receive U.S.A. signals on 10 metres, as he believes that G 2NH, Mr. E. A. Dedman, forestalled him when he received NU 2JN. He did, however, pick up signals from a station he was unable to identify on March 22nd, and thinks that he was the first to pick up the 8th district of U.S.A. on 10 metres when he heard NU 8ALY, calling at 1410 G.M.T. on April 13th. Mr. Heightman was using an indoor aerial 25 ft. long and 30 ft. above the ground with an 0-v-1 receiver.

TRANSMITTERS' NOTES AND QUERIES.

Japanese Stations.

A correspondent in Japan informs us that the stations JOAK, JOHK, JOBK, and JOIK are testing on 10 kW. and that there are now nine amateur transmitting stations with the call-signs JXAX to JXIX. The names and addresses of the owners of these stations may be found in the recently published Annual and Log Book of the R.S.G.B.

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Programme from PCJJ.

The transmissions from PCJJ, the well-known station of the Philips Lamp Works at Eindhoven, are now at the following times.—

Tuesdays, 1600-2000 and 2300-0200 (Wed.) G.M.T.
Thursdays, 1600-2000 G.M.T.
Saturdays, 0400-0700 and 1400-1700 G.M.T.

Although the actual transmitter is at Hilversum, the station is controlled from Eindhoven, and we understand that Messrs. Philips prefer to have the station called "PCJJ, Eindhoven" to avoid the possibility of confusion with the Hilversum long-wave station.

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Rumania and Bulgaria.

Mr. M. W. Pilpel (G 6PP) tells us that on Sunday, May 27th, he heard a station calling CQ and signing EQ 2AB. He succeeded in getting into touch, and found that the station was in Rumania. 6PP pointed out to him that he was using the wrong prefix—Q being generally used for Bulgaria and R for Rumania—and thinks this will be of interest to other readers who may be disappointed to find that they have really worked with Rumania while thinking the station with which they were in communication was in Bulgaria.

Forwarding Agents. (Addition to list on page 584 of our issue of May 30th).

Russia—c/o "Radioliubitel," Ohotni Riad 9, Moscow-Central.

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New Call-signs and Stations Identified.

2HD (ex 2ADC), C. A. Harper, Cropwell Bishop, Nottingham.
5DV R. F. Bracewell, 2, Hereford St., Sale, Cheshire.
6DQ H. Drury, 3, St. Albans Rd., Bestwood, nr. Nottingham. (Change of address.)
6IZ E. G. Ingram, 20, Cairnfield Place, Aberdeen. (Change of address.)
CQB L. H. Thomas, "Conway," 66, Ingram Rd., Thornton Heath, Surrey. (Also operates 6LT, Portable Station.) (Change of address.)
6UH (ex 2BZW), H. E. Smith, 31, Wandle Rd., Hackbridge, Surrey.
2BXD H. J. Horsley, Tenby House, High St., Ramsgate.
ED 7CG C. C. Gravesen, Roskilde, Denmark.
EI 1XW F. S. Salimei, Piazza S. Salvatore in Lauro 15, Rome II.
EP 1BM F. C. de Medeiros, Rua Renato Baptista 13, 2°, Lisbon.
EP 1BV A. Telles, Junr., Rua Sonza Martins 15, 1°, Lisbon.
ETP CJ R. Kitzner, Stalowa 60, Warsaw, Poland.
NQ 5CX J. A y Velis, Calle Diago 73, Colon, Cuba.

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Spanish Amateurs.

We are indebted to our Spanish contemporary "E. A. R." for the following QRA's which supplement the lists already published in our pages and in the R.S.G.B. Annual.

E 078 A. Barbuzano, La Naval, 189, Puerto de la Luz.
EAR 96 J. M. Cordova, Jorge Juan, 22, Valencia.
EAR 97 J. Enriquez de Salamanca, Real, 59, Almeria.
EAR 98 J. Tejeiro, Plaza Nicolas Salmeron, 12, Madrid.
EAR 99 V. Albors, Aracil, 27, Alcoy.
EAR 100 J. Colvee, Plaza Principe Alfonso 16, Valencia.
EAR 101 J. Figuls, Lacy 53, Sabadell.
EAR 102 J. Pastor, Oficinas de Telegrafos, Santiago de Compostela.
EAR 103 F. Galvez, Espartero 4, Valencia.
EAR 104 R. Elizalde, Valencia 302, Barcelona.
EAR 105 S. Mainu, Vilanova 12, Barcelona.
EAR 106 L. Cirera, Lauria 108, Barcelona.

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A Correction.

In our note on page 584 of our issue of May 30th Mr. A. G. Livesey's address should have read: 15, rue d'Orléans *Pau*, B.P. We regret the error.

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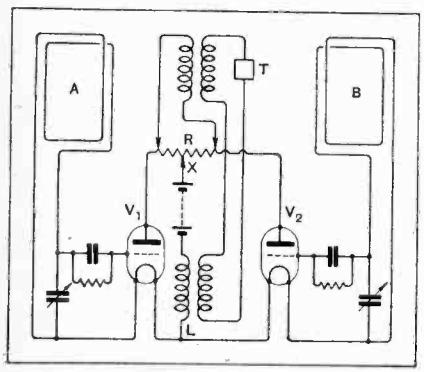
The following abstracts are prepared, with the permission of the Comptroller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London W.C.2, price 1s. each.

Eliminating Interference. (No. 273,479.)

Application date: August 13th, 1926.

Instead of transmitting the signal on one wavelength two carrier frequencies are used, together with two receiving circuits. An interfering signal on a third frequency will then affect one of the two receivers to a greater extent than the other, and it can, in fact, be arranged that it shall affect one receiver only. After rectification there will accordingly be two low-frequency components, one containing the desired signal only, and the other containing a mixture of desired and undesired signals. If these two components are opposed, the resultant will be due to the interference alone. If at the same time the two components are added cumulatively, the resultant will be a double strength of the desired signal plus the undesired signal component. Finally by balancing the result of the first and second operations the ultimate response will be a signal of double strength free from any trace of interference.



Method of minimising interference by the use of two aerials to receive two carrier frequencies, which are suitably combined in the double receiver. (No. 278,479.)

In the diagrammatic arrangement shown in the figure, the two carrier frequencies are received separately on the aerials, A, B, and, after passing through suitable amplifying and detecting stages V_1 and V_2 are applied in opposition across the resistance or inductance R and in series, or cumulatively across the inductance L. These two effects are then combined in the correct magnitude and sense in a third circuit comprising the final receiver T. By adjusting the tapping X, it is possible to find a point at which disturbance due to atmospherics as well as to tuned interference can be balanced out in the receiver T. Patent issued to J. Robinson.

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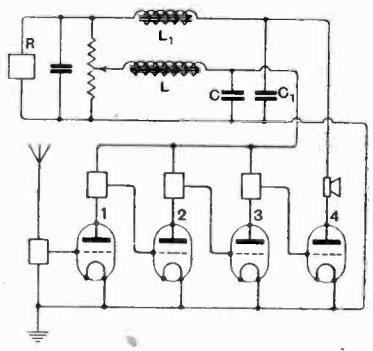
Mains-supply Units. (No. 281,776.)

Application date: September 10th, 1926.

It is well known that, in a multivalve set, the total plate-current consumption of the earlier stages is much smaller than the individual current taken by the final



Mains-supply unit in which a separate feed is taken from the rectifier to the plate of the last valve. (No. 281,776.)

stage or power amplifier. In the typical case of a four-valve set, the total plate current of the H.F. detector, and first L.F. valves, will be of the order 3 to 6 milliamps, whilst the power amplifier alone may take as much as 20-25 milliamps.

The object of the invention is to minimise the cost of manufacture of the filter circuits between the rectifier and the set by providing a separate channel for the current taken by the last valve. As shown, the valves 1, 2, 3, are supplied from the rectifier R through a filter comprising a choke L, consisting of a very large number of turns of fine wire shunted by a condenser C. The supply to the last valve (4) passes separately through a choke L_1 having fewer turns of thicker wire, shunted by a second condenser C_1. Any voltage fluctuations that may persist at the output end of the choke L_1 will have no appreciable effect on the plate of the last valve. Patent issued to W. J. Brown and the Metropolitan Vickers Co.

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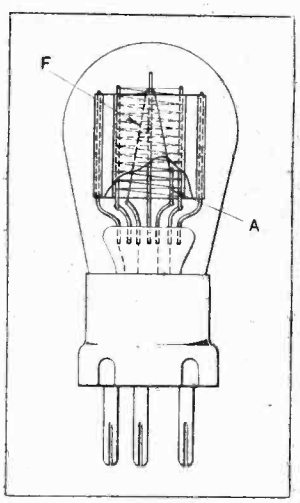
Reducing Space-charge. (No. 280,617.)

Application date: July 19th, 1926.

In order to reduce the blanketing effect of the "space-charge" or aggregation of free electrons normally surrounding the filament of a thermionic valve, a substance which has the property of emitting positive ions is located near to, or may form part of, the filament wire. The free positive ions counterbalance the effect of the negative mass of electrons, and so reduce the effective internal impedance of the valve.

As shown in the figure, a part A of the hairpin filament F is coated with a fused mixture of iron oxide containing a small percentage of an alkali or alkaline earth



Space-charge neutralisation by arrangement of a suitable electrode which emits positive ions. (No. 280,617.)

metal. As the filament is heated, positive ions are liberated from this coating. The coated leg is connected to the positive terminal of the battery, so that the free ions tend to drift towards the negative portion of the filament, and thus automatically reduce the normal space-charge. Patent issued to L. J. Davies and British Thomson-Houston Co.

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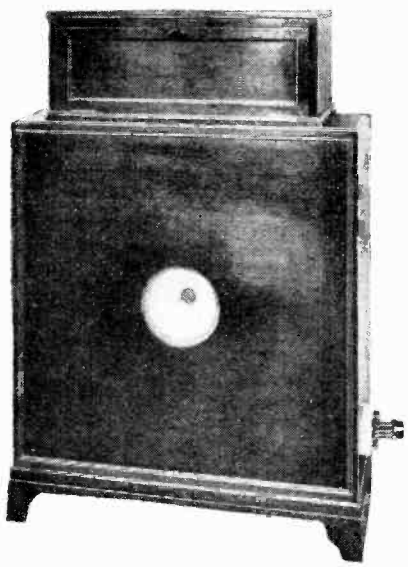
By Our Special Correspondent.

The B.B.C. Pronunciation.—Wanted: A Bright Idea.—Choral Societies and the National Chorus.—Reading and Writing.—Luxurious Debating.

The Truth About Bannockburn.

The broadcast talk which is to mark the anniversary of the Battle of Bannockburn (June 23rd, 1314) for all Scottish listeners promises to tell "The Truth About Bannockburn." No startling theory of an English victory or anything like that need be expected, for the "truth" merely refers to the tactical aspect of the battle, about which the historians have all been in error for years and years. The man who discovered that



THE HOME CONSTRUCTED SET OF TO-DAY. Self-contained and entirely mains operated, the outfit embodies the Everyman Four receiver with modified output stage, moving coil loud speaker, high voltage H.T. battery eliminator, an Arc rectifying valve for field current supply as well as battery charging.—

the conventional explanation of the strategy of the battle was wrong, Mr. W. Mackay Mackenzie, Secretary of the Ancient Monuments Commission for Scotland, is to give this broadcast talk himself on June 23rd.

Complaints from an Unexpected Source.

It was bound to come! The B.B.C. recently announced that the afternoon programmes would start at 4 p.m. on and after July 2nd as it was not intended to fill the time normally occupied with school transmissions, which will then have ceased. This decision has produced a crop of complaints from listeners who describe it as a "retrograde step." In fact, the B.B.C. has, probably for the first time, learnt that whole households of grown-up persons have come to regard it as a daily rite to listen to the school talks. And yet there are those who scoff at the idea of education by broadcasting.

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The Trials of an Announcer.

The daily Press is indulging in one of its periodical spasms of criticism of B.B.C. pronunciation. Announcers are but human after all, and if they are occasionally caught napping it is not always a sign of ignorance or affectation. One announcer tells me that the word "cupola" occurred several times in the manuscript from which he was lately reading, and some demon of fancy absolutely compelled him to pronounce the word as if its first syllable rhymed with "cup." Another with a contrary mental aberration found himself speaking of the famous Northamptonshire cricketer as "Joop," although he was fully aware that his name should rhyme with "up."

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Is Reading Obsolescent?

In his presidential address to the Scottish Library Association, Mr. Frank C. Nicholson stated that reading for recreation, as distinct from professional and intellectual reading, was in danger of being superseded by broadcasting, but prophesied a future linking of the old and new order of things which, however, would depend largely upon what was preserved of the old culture.

I wonder if "best sellers" really find a serious rival in wireless. Judging by the speed with which popular authors seem to bring out new works of fiction, I do not think this branch of literature can as yet be seriously affected. On the other hand, reading aloud may suffer, and the family man possibly welcomes the relief afforded by the Children's Hour. Instead of being greeted on his return home after a day's work with imperious cries of "Daddy, Daddy, come and read to me!" he probably finds the small tyrant engrossed with the loud speaker, and, perhaps regretfully, settles down to an hour's peace while the official Uncles and Aunts take over the task of keeping his offspring amused until bedtime.

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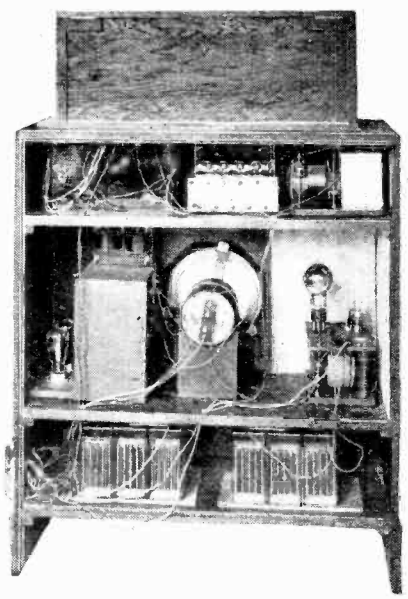
Broadcasting from Windsor Castle.

The service in St. George's Chapel, Windsor, will be broadcast for the first time at 8 p.m. on June 17th, when an address will be given by the Dean of Windsor and the music will be under the direction of Sir Walford Davies.



—Each of the component instruments is built in accordance with details given in the pages of this journal. A suitable circuit system for wiring an outfit such as this appeared on page 597 of last week's issue. (*Built by Mr. H. B. Andrews of Southgate.*)

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Fruitless Referendums.

From time to time the B.B.C. has attempted to obtain a referendum in regard both to programmes and to signal strength, but the results have invariably been disappointing.

More than once it has been declared that the licence figures offer a reliable indication of programme popularity. The fallacy here needs little explanation. People who renew their licences are rarely actuated by a passion for the B.B.C. programmes, which to many people are the only programmes available; moreover, the listening habit is not easily broken off. The newcomers are not prejudiced one way or the other in the matter of programmes, but have bought their sets through the enterprise, not of the B.B.C., but of the wireless trade.

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Are Listeners Less Critical?

I have had an opportunity of studying the monthly report of progress which is circulated for the guidance of the staff at Savoy Hill. According to the report, "All goes well." A noteworthy point is the absence of criticism. This can, however, be interpreted in several ways. Public indifference would quite likely result in an absence of criticism, just as it would account for lack of praise, which is also to be noted in the report.

Still, it would be unfair to jump to conclusions, and the real truth may be that the listening public is abundantly satisfied with the general trend of programmes.

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Applause Cards.

This uncertainty regarding the real mind of the listening public has always been a bugbear to all who are concerned with the preparation of broadcast programmes, whether in this country or abroad. For some unknown reason, the "applause card," which used to be favoured in America, but is less popular nowadays, has never been seized upon by the British public. This may be due to the traditionally phlegmatic nature of the average Britisher, who hates "gush" of any description.

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Wanted: A Bright Idea.

It remains for some bright person to invent a new and infallible method of feeling the public pulse. No reliable means has yet been found, and it seems likely that we shall wait a long time for anything better than the "hit or miss" policy which Savoy Hill follows at the present time.

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No "Droll Legends of His Infancy."

John Kirby, who is broadcasting on June 22nd in George Graves' programme, has appeared in many shows, such as "O.K." with Gertrude Lawrence, "Tip-Toes" with Dorothy Dickson and Laddie Cliff, "Shake Your Feet," etc. On being asked to relate some interesting reminiscences, he replied sadly, "Nothing interesting has ever happened to me in all my life." This reply is very similar to that of A. J. Allen when asked to discard for once his *nom de plume* and reveal his identity so that listeners might visualise as well as hear him. His answer was to send a photo of himself as a year-old baby.

FUTURE FEATURES.

London and Daventry

JUNE 17TH.—Civic and Military Service from York Minster. Address by the Archbishop of York.

JUNE 18TH.—"Up the River," an aqueous entertainment for Broadcasting by L. du G.

JUNE 19TH.—Aldershot Command Searchlight Tattoo.

JUNE 20TH.—"Paolo and Francesca" (Stephen Phillips).

JUNE 21ST.—"Cavalleria Rusticana," from Covent Garden.

JUNE 22ND.—Vaudeville Programme.

JUNE 23RD.—A Military Band Concert.

Daventry Experimental (5GB).

JUNE 18TH.—"The Marchioness," a comedy operetta—a chapter from Charles Dickens, arranged and amplified by B. W. Finden.

JUNE 20TH.—A Military Band Concert.

JUNE 21ST.—"She Was No Lady," a play by St. John G. Irvine.

JUNE 22ND.—Light Orchestral Concert.

JUNE 23RD.—Symphony Concert.

Cardiff.

JUNE 18TH.—"Romance Unlimited," a match-making medley by Dorothy Eaves.

JUNE 20TH.—The Bristol Orchestra.

JUNE 22ND.—"Joie de Vivre," a medley of Music-Hall Favourites both Old and New.

Manchester.

JUNE 19TH.—"Tired," a comedy in one act by Juliet Wilbor Tompkins.

JUNE 23RD.—Vaudeville Programme.

Newcastle.

JUNE 23RD.—Revue—"Our Hour."

Glasgow.

JUNE 19TH.—Scottish Songs and Dances.

JUNE 22ND.—Midsummer Programme.

Aberdeen.

JUNE 18TH.—A Scottish Variety Programme.

JUNE 19TH.—A Schubert Programme.

Belfast.

JUNE 18TH.—A Choral and Orchestral Concert.

JUNE 20TH.—"Love in a Village," a comic opera in three acts by Isaac Bickerstaff, music by Dr. Arne.

Controversial Broadcasting de Luxe.

Although controversial broadcasting seems rather to have hung fire since the Maxton debate, I understand that plans are projected for a series of discussions which will not be limited to political or economic subjects, but will include sporting and literary topics. For these debates the dignified restraint of the studio may be relaxed. I hear that the antagonists will be provided with armchairs, each speaker having a microphone in front of him, and the general atmosphere of good fellowship will be further heightened by the introduction of—coffee and cigars!

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Comfort for the Prime Minister

The Prime Minister will note this with considerable envy, remembering the occasion, some two years ago, when, on entering the studio, he was confronted with the uncompromising admonition, "No Smoking." Promptly removing a cherished briar from between his teeth, he stuck it into his pocket, alight! He will certainly approve of the new concession when the three political parties eventually make up their minds to enter the broadcasting lists together.

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Choral Societies Will Not be Losers.

I understand that, in furtherance of their plan for the reorganisation of the National Chorus on a permanent amateur basis, the B.B.C. invites the co-operation of choral societies in and around London in persuading their members to take part. No danger of competition—or, to use a Cornish expression, "slocking away"—need be feared, as a condition of engagement by the B.B.C. is that members of the National Chorus must not forsake the older organisation to which they already belong, and if at any time a member should relinquish his position in the Choral Society with which he is associated he will automatically sever his connection with the National Chorus. The plans for the latter body will involve rehearsals once a week at a convenient time in the evening at some place near Savoy Hill. A minimum of 250 singers are wanted. Choral societies relieved of the fear of losing membership should no longer hesitate to give their best singers to the National Chorus, where they may have opportunities for practising works that may possibly be beyond the financial or even executive reach of smaller societies.

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A New but Appropriate Name.

A Midland daily paper, in recalling one of the first Zeppelin raids, states that the spot where considerable havoc was caused by bombs during the war is now occupied by the new B.B.C. studio in "Sunny Hill," Strand. The well-known aspirations of the B.B.C. to give us a brighter London are universally appreciated, but I did not know that they had gone so far as to change the name of the quiet by-way where their offices and studios are situated. However, the new address, if correct, seems applicable.

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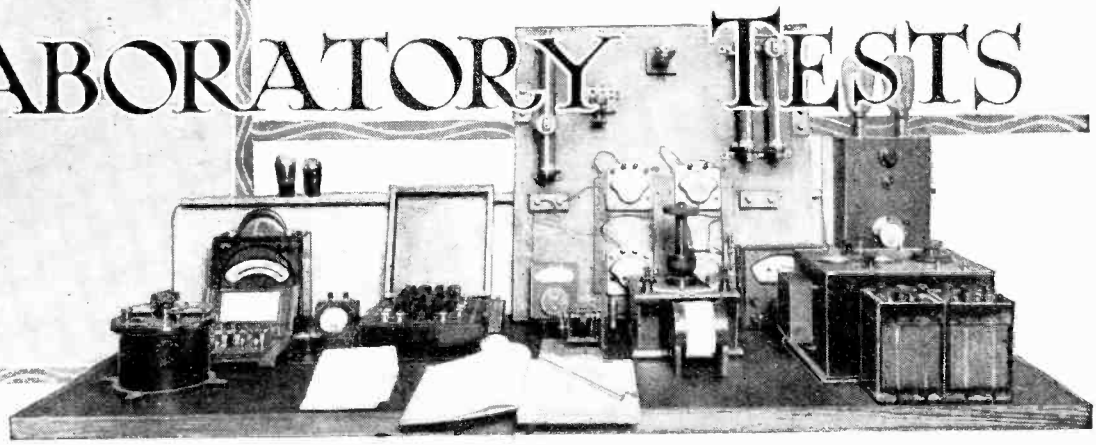
WIRELESS WORLD LABORATORY TESTS

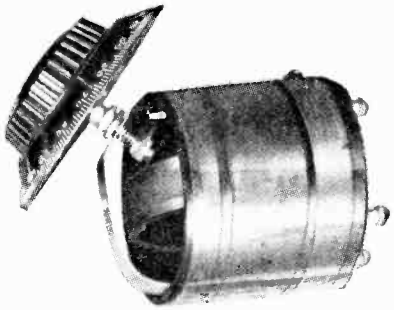


A Review of Manufacturers' Recent Products.

N.S.I. MULTI-TUNER.

Complete tuning units are of great assistance to home constructors with limited workshop facilities, and the N.S.I. tuner made by the Northern Scientific Industries, 91, Victory Road, Blackpool, is particularly convenient in this respect, inasmuch as there is only one hole to be drilled for fixing to the panel. Terminals are provided for all external connections, thus eliminating the necessity of soldering.

The unit is designed for use with a 0.0005 mfd. tuning condenser, and covers the high and low B.B.C. wavelengths. The single knob reaction control rotates through 360 degrees and the scale is divided into two halves, one for short and one for long waves. When in the short-wave region of the scale, a fibre cam on the reaction coil spindle depresses a short-circuiting switch across the 5XX loading coil. The arrangement of the various sections of the aerial tuning coil is such that, although the same reaction coil is used for long and short wavelengths the co-efficient of coupling is increased when the loading coil is in circuit, thus ensuring sufficient reaction on the long waves. The aerial is tapped part of the way down the tuning coil with a consequent increase in selectivity.



The N.S.I. multi-tuner unit.

The price is 21s., and full instructions, including a blue print of a typical 3-valve circuit are given. Only best ebonite is used for the coil formers, and the windings are protected by a covering of celluloid.

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"CHEMICO" WIRELESS SPECIALITIES.

The County Chemical Co., Ltd., Bradford Street, Birmingham, have prepared a useful series of solutions and fluxes for use in wireless work.

"Chemico" shellac varnish, celluloid cement and solidified flux.

That most useful commodity shellac varnish is sold in sixpenny bottles and is of exceptionally high quality, being pale in colour and free from sediment.

Celluloid cement is made up in tubes which also sell at 6d., and is also obtainable in 1lb. tins at 7s. 6d. A complete accumulator repair outfit, including celluloid patches and angle pieces, is also made.

Another useful substance is the solidified soldering flux. This is made up in the form of a stick and is covered in silver paper so that it may be held in the left hand while the iron is held in the right and much time is saved. We have tested the flux, which is a brown wax-like substance, and find it entirely satisfactory if the parts to be tinned were previously cleaned.

Other products carrying the well-known "Chemico" trade mark include a soldering and tinning fluid, soldering flux in the form of paste, acid-resisting varnish, and insulating tape. A leaflet describing all these substances in detail is obtainable from the manufacturers.

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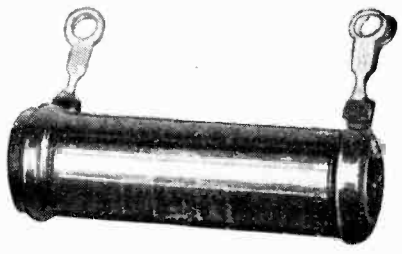
"KROBLAK" RESISTANCES.

These resistances are of American origin and are obtainable in this country through Messrs. Wholesale Wireless, Ltd., 103, Farringdon Road, London, E.C.1. They are wire-wound and embedded in vitreous heat-resisting material with copper terminal lugs. On test the resistances were in no case more than 4 per cent. different from the rated values and in the majority of instances the divergence was less than 1 per cent. It was found that within the current rating of the resistances the temperature coefficient was negligible.



"Kroblak" wire-wound resistance elements.

Resistance values from 500 to 50,000 are available in capacities of 10 and 20 watts respectively, and the method of winding makes them well suited for the construction of battery eliminators.

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THE LOMETER.

The number and diameter of turns and the tuning capacity required to cover the waveband from 200 to 500 are well-known to every wireless experimenter. After a time one comes to think automatically of the number of turns required for any given wavelength, but on first descending to the 15-50 metre region one is apt to be a little at sea until a certain amount of experience has been acquired.

The Lometer, an absorption wavemeter covering wavelengths from 22 to 70 metres.

At all times useful, an absorption wavemeter is indispensable when commencing experimental work on the reception of short waves, not only for checking the wavelength of circuits but for identifying the more important transmissions which constitute the landmarks in the short-wave field. The "Lometer" is admirable for this purpose. It consists simply of a coil and condenser connected to form a closed circuit which when placed in proximity to the oscillating receiver gives a double click in the phones as the wavemeter condenser passes the point of resonance with the receiver. Alternatively a milliammeter in the anode circuit of the detector valve may be used to give visual indication of resonance.

The "Lometer" is completely enclosed in a neat mahogany box with ebonite front panel and a calibration chart is supplied with each instrument. By carefully adjusting the coupling between the wavemeter and the set, the wavelength can be read off to the nearest degree on the dial; one degree on the dial is equivalent to about 0.5 metre over the range from 25 to 55 metres. The actual range covered by the Lometer is 22 to 70 metres. The price is 35s., and the makers are Messrs. Deepees, 22, Ganton Street, London, W.1.

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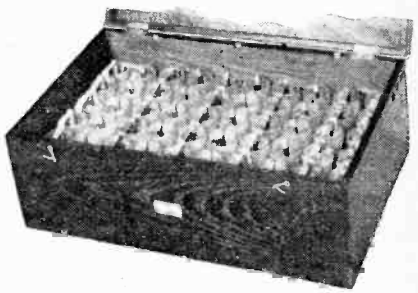
"STANDARD" WET H.T. BATTERY.

The wet type Leclanché H.T. battery is well worth the extra trouble required to keep it in order, though in the case of the "Standard" battery the amount of extra time involved is negligible. A special grade of oil is supplied with the battery and a small quantity of this is floated on the surface of the electrolyte to stop evaporation. As a matter of fact this oil was omitted in the actual test, yet the level of the electrolyte had to be adjusted only three times with the special syringe supplied—a job easily accomplished in ten minutes.

A 60-cell battery having a nominal terminal voltage of 90 was submitted for test and a section of this battery consisting of 12 cells was filled and discharged for three-hour periods with three hours for recovery between each discharge period. The results are shown in the curve; it will be seen that an initial terminal voltage of 1.59 per cell was given under a load of 13.2 mA. Over the first 300 working hours the current and voltage per cell fell progressively to 8.2 and 1.0 respectively and these values were maintained for a further 200 hours before the output became erratic. A consistent performance of 500 working hours may, therefore, be expected when the battery is used to operate a normal three- or four-valve set. Of course, this period can in actual practice be considerably increased by adding fresh cells to make up the required voltage and running the original cells right down. It will be found that this can be done with a wet cell without introducing crackling noises.

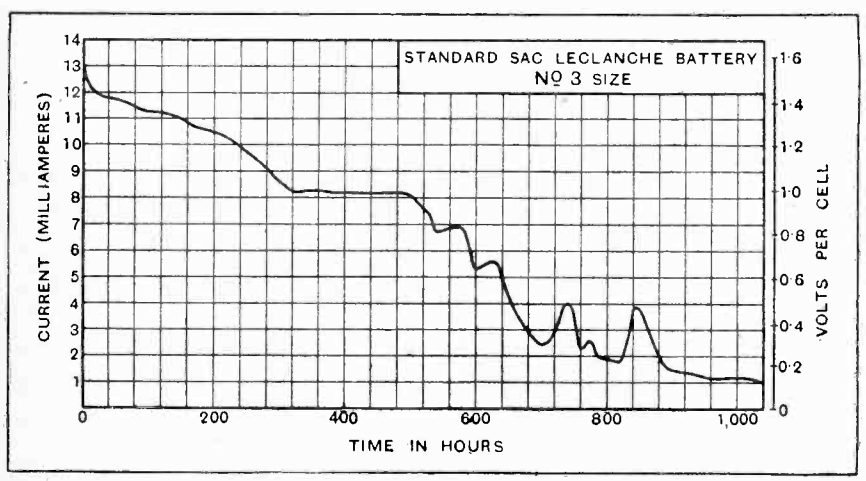
The dimensions of the glass container of the No. 3 size cell used in this battery are 1⅞ in. square × 4 in. high, and the makers put the maximum discharge current for this size at 30 mA. Even if so high a current is not required it is preferable to use the No. 3 type cell which is most economical in the long run. The component parts may be purchased or the cells may be supplied assembled, full particulars of prices being contained in an interesting booklet obtainable from the makers, The Wet H.T. Battery Co., 12/13, Brownlow-st., London, W.C.1.

The workmanship and design of the cells are above criticism; the zincs and their connecting straps are cut from the sheet in one piece; there are no soldered joints. All parts above the level of the electrolyte are coated in paraffin wax which effectively prevents creeping even in the absence of an oil film.



"Standard" 90-volt battery in dust-proof cabinet.

The wet H.T. battery can be confidently recommended as a substitute for the dry cell battery where portability is not required, and it has this great advantage that the standing life is indefinite; no deterioration can take place while the chemicals are dry and the battery makes a fresh start as soon as the solution is made up. With a dry battery there is always an element of uncertainty as to how long it has been in stock.



Discharge of the "Standard" No. 3 size wet H.T. battery. The time is for working hours.

TRADE NOTES.

Securite Wire.

Messrs. Brasse, Ltd., Manor Works, High Street, Hornsey, London, N.8, are the manufacturers of this glazed cotton covered connecting wire. We regret that this information was omitted from the note which appeared on page 530 of our May 16th issue.

Changes of Address.

Eric J. Lever (Trix), Ltd., to 8-9, Clerkenwell, London, E.C.1.

Sifam Electrical Instrument Co., Ltd., to Bush House, Aldwych, London, W.C.2.

Wilkins & Wright, Ltd., to Utility Works, Holyhead Road, Birmingham.

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

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

MORSE INTERFERENCE.

Sir,—In the last paragraph of "A Listener's" letter in *The Wireless World* of May 9th he suggests "that commercial working between ship and shore, and shore and shore, is rather more important than a listeners' entertainment, and until a more satisfactory method of communication is introduced we must 'grin and bear it.'" Although he refers mainly to ultra short waves, he raises the whole question of Morse interference with broadcasting programmes on the ordinary wavebands of 300/550 and 1000/2000, and frankly I do not grin and bear it, nor do I see any reason why one should. That communications between ship and ship, or ship and shore are necessary and important I do not deny for a moment, but I used to be under the impression that ships' wireless and commercial wireless were allotted certain specified wavebands on which to operate. Apparently I am suffering from a gross delusion, as I have obtained excellent specimens of Morse on every possible wavelength. I am just listening to a fine programme from Kalundborg with a twittering background of Morse, which I also get daily on Radio-Paris. I refrain from speaking of my results on the 300/550 waveband except to mention that it is mere waste of time to try for distant stations, which are nearly always blotted out by a deafening fusillade of Morse, so broadly tuned that it is impossible to cut it out. For weeks now I have not changed the long wavelength coils in my set

Now, I ask, is this necessary, and must I grin and bear it? If it is not necessary, then why are no steps taken to compel ships and others to keep to their proper waveband? If it is necessary, then I consider it a waste of money to pay £30 or £40 for a powerful set, when, for a third of that amount, one can buy a set good enough for getting news and weather reports. I have two sets: a super-het, and a 5-valve with two screened-grid H.F.s, but I am gradually losing all interest in searching with them, and am devoting my spare time and spare cash to experimenting with a gramophone pick-up and 3-valve amplifier. With this I choose my own programmes, which I can always be certain of enjoying without interference of any kind. My next wireless set will have to wait till the Morse question has been settled.

Atmospherics we have to put up with; they appear to be beyond human control, but Morse, NO, decidedly not; there are surely regulations laid down for its use, but apparently they are not enforced and the authorities do not care. Is this not a most extraordinary situation, and one which is grossly unfair to the listener-in, who duly pays his 10s. yearly for a licence to listen to programmes punctuated with Morse "obbligatos"?

Moffat, W. R. YOUNGER.
Dumfriesshire.

STATION IDENTIFICATION.

Sir,—A station identification signal must be such that it is easily recognisable by listeners of all ages and all shades of mentality, and of such a nature that it does not strike a jarring note when following any kind of broadcast item. To the technically minded listener with a calibrated receiver, station identification is a simple matter, but such listeners are in the vast minority.

Any form of signal composed of dots, musical chords, etc., is almost certain to strike an unpleasant note when following certain broadcast items. Imagine a beautiful solo item, which has stirred us to the depths, followed by the ear-splitting 5.30 tuning whistle! The most agreeable form of station signal is the human voice of a "good" announcer.

My contribution to the suggestions is that each station be allotted a number, and all numbers announced in some international or universal language, preferably "Esperanto." It would not be difficult for the meanest intelligence to become familiar with the numbers, say, 1 to 40 in Esperanto, or any other language. I am not an Esperanto enthusiast, but I suggest its use simply because it avoids national rivalry, and because I am of the opinion that it will come into universal use in years to come.

You will notice that I refer to a "good" announcer. This is necessary. Many announcements from British stations, giving names of foreign compositions and composers, are often painful. D. W. HUGHES, A.M.I.R.E.

Thornton Heath.

FAULTY SETS IN HOSPITALS.

Sir,—Having been engaged on hospital installations for some time, I am very interested in your Editorial concerning the bad reproduction in some hospitals. One of the main causes of this, I believe, is the number of unauthorised persons having access to the receiver. Many of these know nothing whatever about wireless beyond the fact that they have a receiver of their own, which they would never think of using in the same manner that they use the hospital equipment. Even the best receiver will not stand having its inside pulled about by six or seven people without some kind of protest.

Again, some hospital receivers have never been touched by a competent engineer since they were installed, and no receiver will give satisfactory service for three years without some attention beyond the charging of accumulators; even these require more attention than just charging and topping up.

The best preventive of these things is, I think, to lock the receiver in a room, or even a cupboard, and let one person have sole charge of it. Some firm can then be paid a small annual sum to make periodical visits to keep the set in good order and give advice on the best methods of using it. Many London hospitals do this, and, I believe, have never regretted it. There is one firm in London, specialising in hospital set maintenance, who always request the authorities to keep their receiver under lock and key. BM/BB3A.

London, W.C.1.

GRAMOPHONE REPRODUCTION.

Sir,—I was extremely interested to read the letter from "C.H.S." included in the correspondence of the May 30th issue. Unfortunately, my experience entirely coincides with his. My pick-up, selected to give best quality and freedom from resonance, has practically ruined what used to be a good set of modern records. As a result, I have abandoned the use of the pick-up all together, and, as the gramophone alone sounds very thin after the reproduction *via* L.S.5A. and "Kone" (+ 300 volts!), I have lost interest in the whole affair and ceased to purchase records.

I believe our only hope now remains with the few well-known firms who have yet to bring out a pick-up, but who are, I understand, still working on the subject.

The first firm to offer a pick-up covered by a real, full-blooded money-back guarantee not to cause more record wear on a modern full-volume, electrically cut record than a standard sound-box will find in me a ready purchaser; but at present, after reading the article in your March 14th issue, I should not consider it a good policy to replace my present pick-up with any other now being marketed at a reasonable price. A. M. R.

Kingston Hill, Surrey.

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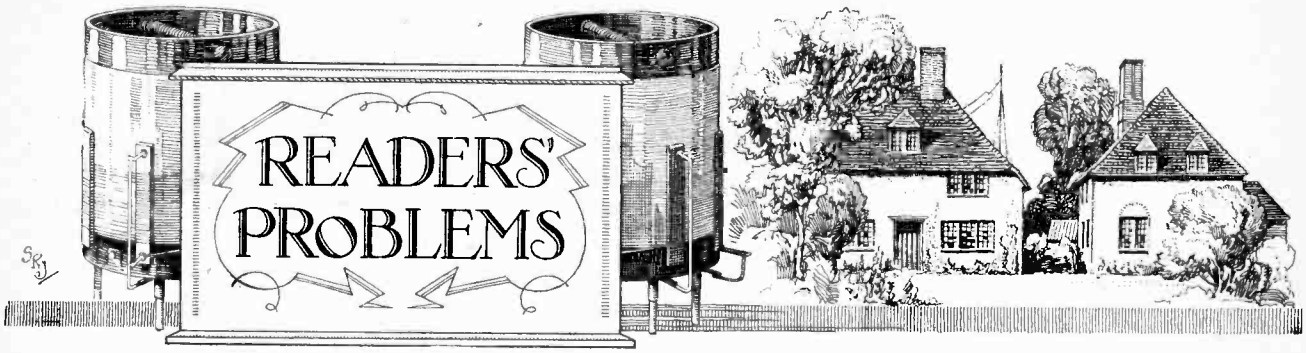

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Detuning.

I have read that there is danger of introducing distortion by detuning in order to reduce volume, unless this detuning is "thorough." For receiving the two Daventry transmissions I use a Det.-2 L.F. combination, which overloads the output valve when the aerial circuit is exactly in tune, and I habitually control intensity by detuning. By how much is it necessary to vary the wavelength of the tuned circuit to ensure that no distortion will be introduced?

C. T.

There should be no fear of causing distortion if you detune the circuit by 30 kilocycles or more; on the middle broadcast band this means by a wavelength change of from 10 to 15 metres. We would refer you to our reply to "H. L. S.," which is given elsewhere.

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Adjusting a Relay.

My receiver has recently been modified for remote control of filament switching and volume on the lines suggested in several recent articles. The relay consists of a cheap electric bell altered in the manner suggested.

On the whole, the scheme works extremely well, but I have difficulty in adjusting the relay contacts: if the movement of the armature is sufficient to ensure that the Det.-L.F. filament circuits are broken, the armature is not always held over by the magnets unless the H.F. valve is passing its full rated current. I should be obliged if you would give me any hints for carrying out adjustments.—

W. P.

The average bell magnet is wound to some 3 ohms, and it is certain that you can improve the sensitivity of your home-made relay by rewinding it to at least double that value; the increase in resistance would probably not be excessive unless your extension leads are exceptionally long. However, it has been found that the ordinary 3-ohm electro-magnets exert a sufficient force to hold the armature when a current of about 50 milliamps is passing; this means that the average valve is consuming only half its normal current, and the reduction in signal strength will generally be sufficient when it is dimmed to this extent.

In the first place you should examine your relay carefully, and if small insets of insulating material are fitted to the armature or pole pieces to prevent their making contact, you should file away the projections and replace them by a piece of very thin paper. Referring to the accompanying diagram, Fig. 1, the back stop should be adjusted with the contact X withdrawn until there is a clearance of under 1/32in. between the armature and the magnet poles. The next step is to screw in the contact X until it is spaced from Y by about 1/64in. After this the tension screw A, which bears against the spring S_1, should be adjusted until the contacts X and Y open properly when the current is switched off. If this adjusting spring is not fitted it may be necessary for you to bend the spring plate S, which carries the armature.

With a little patience it is possible to find an adjustment which will work perfectly satisfactorily for months on end without attention.

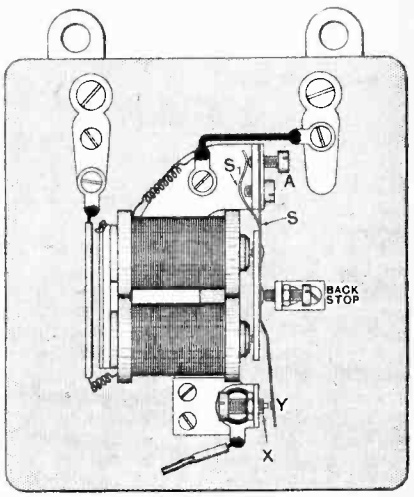

Fig. 1.—An improvised relay; adjustment of the armature is discussed.

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Adjusting Detector Bias.

Will you inform me of simple methods of ascertaining that a valve functioning as an anode bend detector is being operated quite correctly? Is an audible indication sufficiently reliable? A. F. J.

The adjustment of an anode bend detector by observing the strength of signals corresponding to various negative voltages is quite satisfactory, particularly if you use a potentiometer, with the help of which it is possible to make smooth and rapid changes.

We cannot think of any really simple method of ascertaining more accurately the correct setting. The usual procedure was described on page 88 of our issue for January 25th.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

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The Wireless World AND RADIO REVIEW

(16th Year of Publication)

No. 460. WEDNESDAY, JUNE 20TH, 1928. VOL. XXII. No. 25.

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Editorial Offices: 116-117, FLEET STREET, LONDON, E.C.4.

Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:

DORSET HOUSE, TUDOR STREET, LONDON, E.C.4.

Telephone: City 2847 (13 lines). Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.

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

BIRMINGHAM: Guildhall Buildings, Navigation Street.

Telegrams: "Autopress, Birmingham." Telephone: 2970 and 2971 Midland.

MANCHESTER: 260, Deansgate.

Telegrams: "Iliffe, Manchester." Telephone: 8970 City (4 lines).

Subscription Rates: Home, 17s. 4d.; Canada, 17s. 4d.; other countries abroad, 19s. 6d. 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.

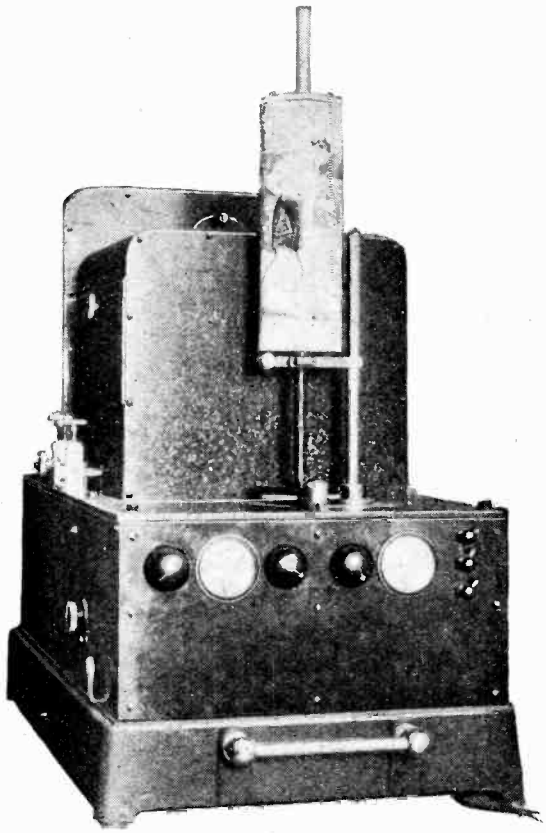
CONTENTS OF THIS ISSUE.

TELEVISION AND PICTURE BROADCASTS.

IN spite of the many technical articles which have appeared describing the theoretical principles of television and the practical results achieved in "still life" picture broadcasting, there still seems to be considerable confusion of these two distinct lines of picture transmission in the minds of lay writers who contribute to the general Press. Only a few days ago a daily paper announced that illustrated wireless is to be the new fireside recreation of thousands of British homes next September, when, we are told, Mr. Baird will make his first broadcasting of pictures in conjunction with a wireless programme, this achievement to be followed in October by the first broadcast of "still" photographs by the Fulton system.

On inquiry at the British Broadcast Corporation we learn officially that no undertaking of any nature has been made by the B.B.C., which would commit them to conduct broadcasting of this nature, but that they are, of course, watching with interest any development which may occur in connection with the technique of picture transmission generally.

In the light of this statement it would seem premature to announce that broadcasting of either still life or television pictures is to commence at any definite date, and, moreover, while still life picture transmission is acknowledged to be a practical achievement, necessitating only the installation of the proper receiving apparatus as the



The Cooley picture receiver, of American design, in the form that is stated to be shortly available for experimental use.

counterpart of the picture transmitter, yet we must assume, in the absence of evidence to the contrary, that television has by no means reached such a stage of practicability.

Elsewhere in the daily Press we recently came across a letter under the title "Broadcast Television," from which we quote as follows:—"It is amazing to learn that although British television is apparently treated with indifference by the authorities here, an American syndicate . . . . . within a matter of weeks will be operating a television broadcast service throughout the U.S.A., Canada, and Mexico, and will market home

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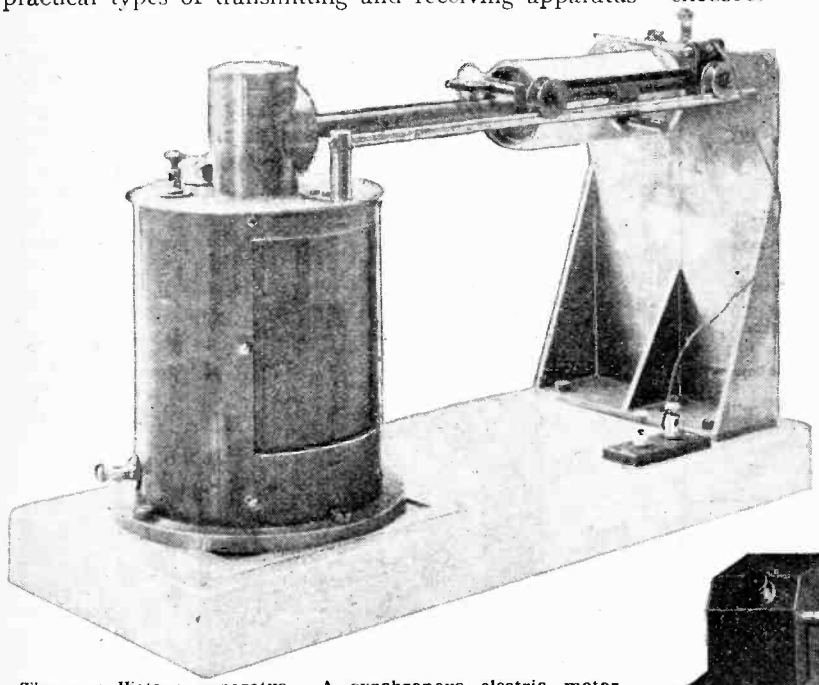
receivers. At the same time there is no sign of any similar service being started in this country." We entirely agree with the contributor of that letter in stating that "it is amazing," but then many amazing things happen or are announced as about to happen in the States, and we must leave it at that. But, whatever the state of development of television may be, still life picture broadcasting is now undoubtedly a practical proposition. Both here and in the States there are several practical types of transmitting and receiving apparatus



The new Watson apparatus. A synchronous electric motor, consuming a battery current about equal to that of a valve, removes the principal difficulty in the design of picture-receiving gear. The image is recorded electrolytically.

for the reproduction of still life pictures available on the market, and we give credit to the apparatus now controlled by Capt. Otho Fulton and known as the "Fultograph" as being one of the simplest and most convenient of the several systems. If the B.B.C. should decide to broadcast pictures with this or some other system for the benefit of those who purchased receiving sets, such broadcasts could be carried out almost immediately.

Is it Worth While?

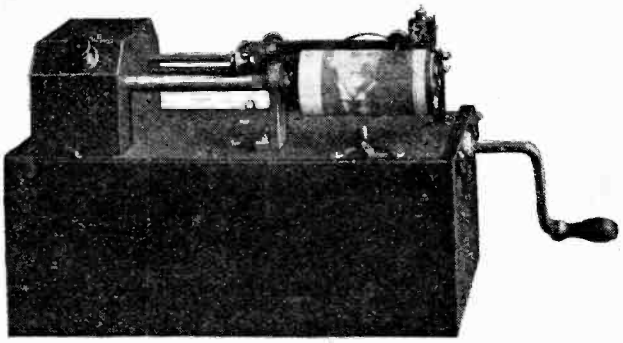
We ourselves doubt whether broadcasting is the proper channel through which to develop this service. The big newspapers are daily extending the use of picture transmitting apparatus between their offices for the purpose of obtaining by wire or wireless pictures for reproduction in their various editions which could not be obtained so expeditiously by any other means. When, however, it comes to the question of a broadcasting station sending out a picture to be received by a limited number of their listeners who may have equipped themselves with picture receiving apparatus, the price of which would at present be in the neighbourhood of £30, we doubt very seriously whether the experiment would be worth while.

There are few occasions when the opportunity would arise for a picture to be broadcast of such very special interest that the listener could not wait to see it in his newspaper. In America we see that an example of the possibilities of the system as applied to broadcasting is given in transmitting a picture of the conclusion of a prize fight, so that the public may see for themselves how the fight ended without waiting for their morning newspaper, but this, it would seem, is one of the very few instances where sufficient excuse for monopolising broadcast time for the convenience of a limited few might be excused.

The Obligations Incurred.

One has to consider that once entered upon by the broadcasting authorities it would be very difficult for them to discontinue the transmission of pictures, for there are, perhaps, quite a large number of people prepared to pay £30 or so for picture receiving equipment, but those people would at least expect that, having bought the apparatus, the broadcasting authorities would continue to provide a constant and regular service of picture transmission, and it is very doubtful whether the broadcasting authorities would be justified in continuing a regular transmission.

These comments may read as expressing a very pessimistic view upon what our readers may consider should



The Fultograph. A new home picture receiver of public interest.

be heralded as a radio development of great potentialities, but let us make it quite clear that it is only the proposal to link up this system with broadcasting to the public at large that makes us sceptical as to its future. The transmission of pictures by means of apparatus so simple as that now developed is a big achievement and we should be sorry to see this invention applied in a direction in which we believe it can have little future. If it could be shown that the news picture material for broadcasting was available in sufficient quantity and quality to interest even a small percentage of the listeners, then it might be worth while to extend broadcasting perhaps for an additional quarter of an hour daily expressly for this purpose. But we cannot help feeling that if the public is induced to believe that they can buy apparatus of this character and anticipate a regular broadcasting service of pictures, they will be sadly disappointed.

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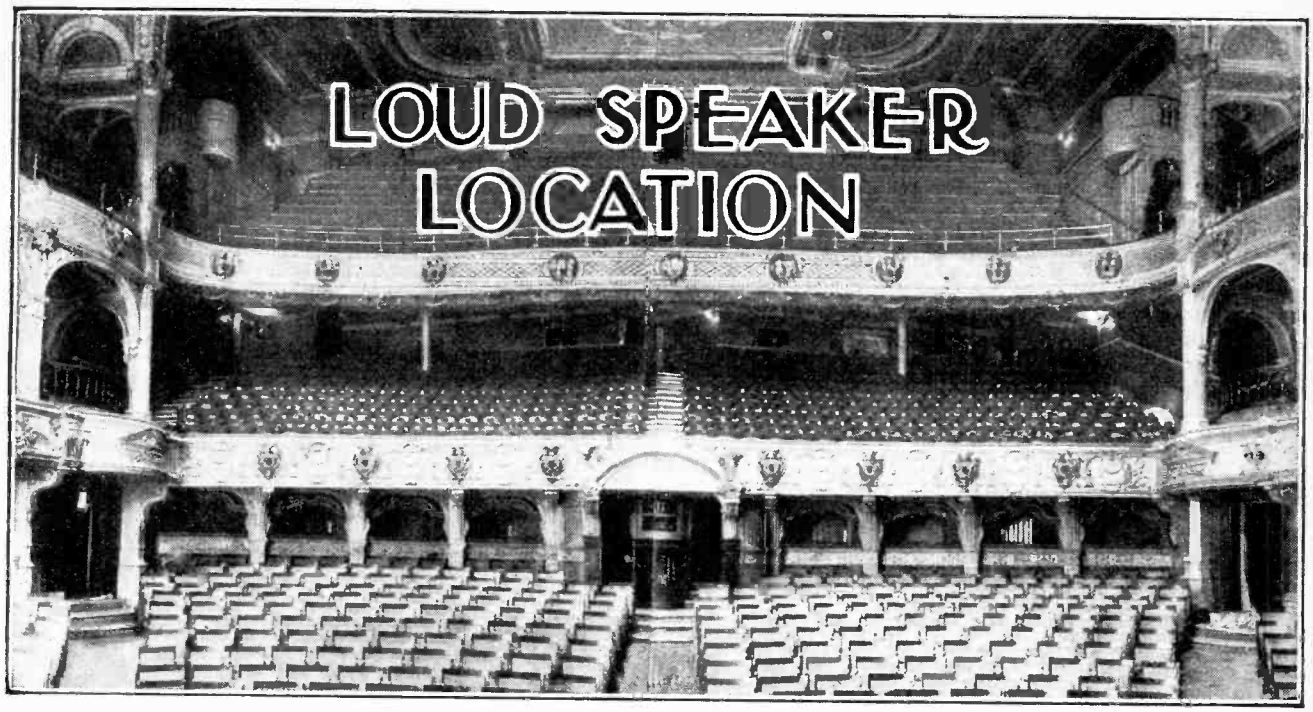

Tracing Sound Pulses by Photography in the Auditorium.

By A. H. DAVIS, D.Sc., Physics Department, National Physical Laboratory.

THROUGH the advent of broadcasting, conditions for good hearing of speech and of music have recently become intimately related to everyday life. In the past, after an evening's entertainment in a concert hall or theatre, the average man has perhaps thought that he has not heard very well, without being very clear as to what was to blame. Nowadays, however, a listener may hear within the space of an hour or so broadcasts from a " dead " studio, a reverberant one, and from, say, an actual cathedral. With the acoustical differences thus thrust upon his notice, he wonders as to the cause, and has ample opportunity to make comparisons. It becomes abundantly clear to him that good acoustics will not necessarily be ensured when microphones, loud speakers, and associated electrical apparatus are themselves perfect, and he learns that even a comparatively small room may have poor acoustics when an audience is absent, a frequent state of affairs when the audience is represented only by the microphone of the broadcasting station. Broadcasting has, in fact, brought questions of acoustics prominently before a large number who would normally take little or no real interest in them.

The Problem of Reverberation.

While records show that, a century ago, or even two thousand years ago, there were persons who had fairly clear ideas as to certain general acoustical requirements for good hearing of speech and of music, the factors involved are somewhat varied, and it is only necessary to look back into architectural journals for the last half century to find that there has been much confusion of thought on the question even up to very recent years. The last twenty years or so, however, have seen a marked advance in systematic knowledge of the subject, and writers generally are now able to disentangle the various factors concerned and to assess their importance in a given case. Much of this advance is due to the late Prof. W. C. Sabine, who laid the foundations of the measurement, study, and cure of that most prevalent defect of all—excessive prolongation of sound by reverberation, and who set his face definitely against some of the superstitions, such as the universal efficacy of wires as a cure for poor acoustics, which had grown up around the subject and obscured the vital facts.

Public Address Systems.

With the principles of good hearing now definitely established, it is interesting that the development of telephony and broadcasting has not only assisted acoustics by bringing conditions for good hearing prominently before all listeners—a very wide audience—but also it has recently provided electrical amplifying equipment for assisting the address of large audiences in open air, or in cathedrals and halls too spacious to be filled by an ordinary speaker. This apparatus, with its microphone, valve amplifiers, and its powerful loud speaker, constitutes one of the most striking recent advances in the subject.

Whilst referring to loud-speaking equipment, however, it would perhaps be well to say that it is not a universal remedy for acoustical shortcomings; indeed it is not a remedy for the most prevalent defect—excessive reverberation. It can promote loudness and it

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has a number of other advantages, but it does not relieve an architect from the necessity of studying acoustical requirements when designing an auditorium. Indeed, in the design of any very large hall where a public address system likely to be installed, consideration might well be given to the particular requirements of the apparatus.

It is symptomatic of the increased interest in acoustics and the increased tendency for architects to have the acoustics of a proposed hall tested before construction, that in the last few years appropriate steps have been taken at the National Physical Laboratory to meet the demand for this work, and examination into the acoustics of buildings is now included among the various classes of test work undertaken in the Sound Division.

The following paragraphs give a description of the experimental methods by which the acoustic characteristics of sections of proposed or existing buildings are studied in detail.

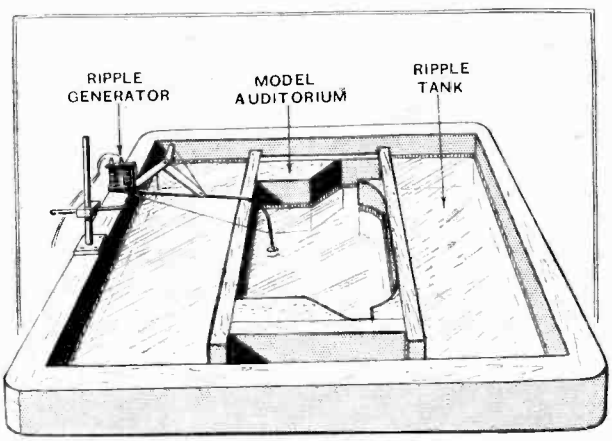

Fig. 1.—Ripple tank for studying acoustic features of model sections of auditoriums.

We may first remark, however, that in interpreting results of experiments and arriving at full conclusions, there are other points to consider besides the shape of the auditorium. For instance, a quiet situation is desirable and extraneous sounds should be entirely excluded.

Distortion due to Draping of Room.

Loudness must be adequate for hearing, and, if necessary, amplifiers must be employed. There must be a sufficient amount of sound-absorbing material in the hall to ensure that each sound shall die away quickly enough to be inappreciable by the time the next is uttered, for otherwise confusion will result. Moreover, the character of this absorbent must be, in the aggregate, such as to ensure that sounds of all pitches die away at approximately the same rate, or distortion will occur. If the room is small, resonances may occur within the musical range—say, in the air column between opposite walls or between the platform and the ceiling. It is not proposed, however, to discuss these points here, in spite of their importance, for the considerations and formulæ involved are somewhat specialised and fall rather outside the scope of this journal. They are fully discussed in books recently written on the subject, for example, in "Acoustics of Buildings," by Davis and Kaye (published by Bell).

Ripple Analogy.

One method of tracing sound reflections within sections of model auditoriums which has been employed at the National Physical Laboratory uses the analogy between ripples and sound waves. Ripples travel comparatively slowly so that it is readily possible to observe their progress without elaborate arrangements, and indeed an ordinary camera is all that is needed for photographing them. The general arrangement is shown in Fig. 1. A model outline of a section of a hall, made in wood on a suitable scale, is laid flat upon the glass bottom of a shallow tank of water in such a manner that it encloses a small "pond," the boundaries of which have the same shape as the section of the building under test. A plunger is dipped into the water at a point corresponding to that of a speaker, and it sends out a train of waves which spreads outwards in circles. Observation then shows in which directions these waves are reflected at the boundaries and thus reveals the reflections of sound waves which would occur in the actual building, for there is a close correspondence between the reflections in the two cases. The progress of the waves may be seen most clearly if light from an arc lamp is passed upwards through the glass bottom of the tank and received upon a screen suitably mounted above. For the ripples then act as a long curved cylindrical lens, and focus a brilliant image of the ripples upon the screen. The progress of the waves may be observed visually. Their

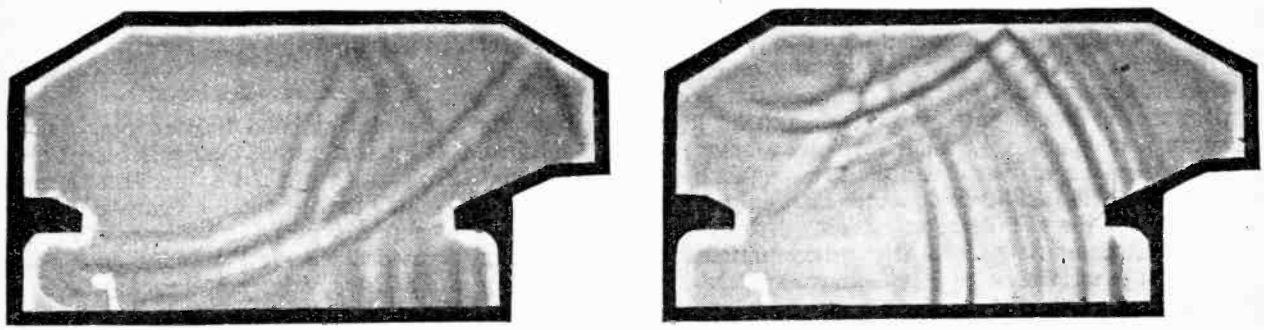

Fig. 2.—Ripple photographs showing successive stages in the progress of ripples within a model section of an auditorium.

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complete history may be recorded by kinematography, or selected features may be recorded by taking snapshots with an ordinary camera.

Fig. 2 shows two such photographs taken with the apparatus set up at the National Physical Laboratory, using a model of a longitudinal section of a typical auditorium. The position of a speaker is represented by the round-headed object within the section, this being actually the silhouette of the plunger which generates the waves. The first photograph, taken after a time interval corresponding to an interval of 0.045 second in the actual auditorium, shows the outgoing wave spreading equally in all directions. In the second photograph, representing an interval of 0.07 second, the sound is returning after reflection from the ceiling and walls, etc. No reflections take place at the floor since this was made totally absorbent, to correspond to actual conditions when a full audience occupies this surface. A point to notice is that in the first photograph the sound is just reaching the right-hand gallery; in the second photograph, 1-40th second later, reflections from the horizontal and splayed surfaces of the ceiling are just sweeping down.

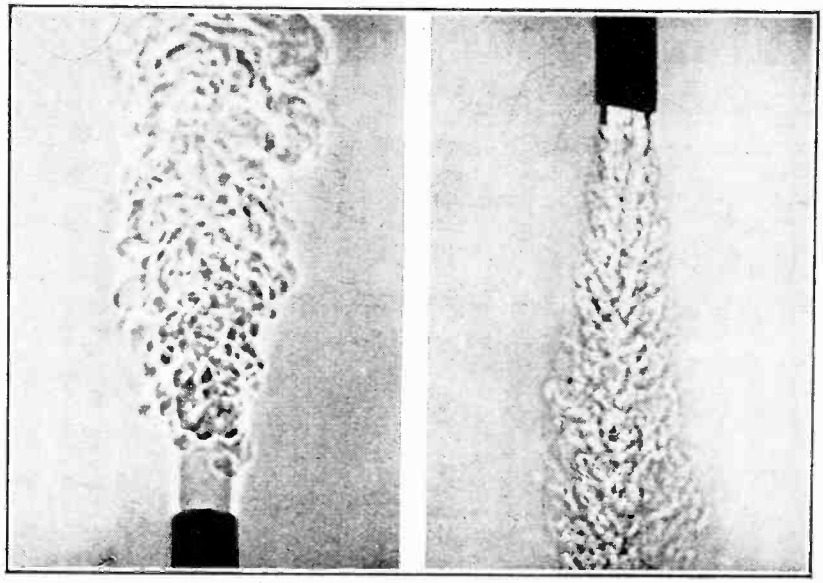

Fig. 3.—On the left is shown a shadow cast by a jet of invisible hydrogen gas. On the right is a photograph of the shadow of a descending stream of carbon dioxide.

Shadows Cast by Invisible Gases.

It is clear that this reflection follows too soon upon the original sound to be perceptible as an echo, and it helps to compensate hearers in the gallery for any weakening of sound due to remoteness from the speaker.

The criterion in these matters is that the time interval between the arrival of direct and reflected sounds shall not exceed about one-fifteenth of a second. Within this interval reflections contribute usefully in raising the level of loudness, but later arrivals should be suppressed by applying sound absorbents to the surface which gives rise to them, for otherwise they would be perceptible as echoes. Clearly the ceiling illustrated is useful in appropriate cases, for it is low enough to reflect sound to practically all hearers in the hall within the approved interval, and the slight splay of the ceiling is sufficient to send to hearers sound which would otherwise graze the walls, but not so pronounced as to focus sound to the centre of the hall to the detriment of remoter parts. Also the gallery, being under the main ceiling, benefits from the enhancement available.

In a more elaborate method of studying the manner in which sounds are reflected within an auditorium, photographs are taken of the behaviour of actual impulsive sounds in model sections having open sides, a procedure first adopted by Sabine, who used the technique of sound photography which had been developed previously by a number of physicists, including Prof. C. V. Boys, F.R.S., in England (1891), and A. L. Foley in America (1912). The two difficulties to be overcome before one can obtain a photographic picture of the pressure wave due to an impulsive sound are: first, to render the wave visible; and, secondly, to take a photograph with not more than about a millionth of a second exposure so that the rapidly moving pulse may not

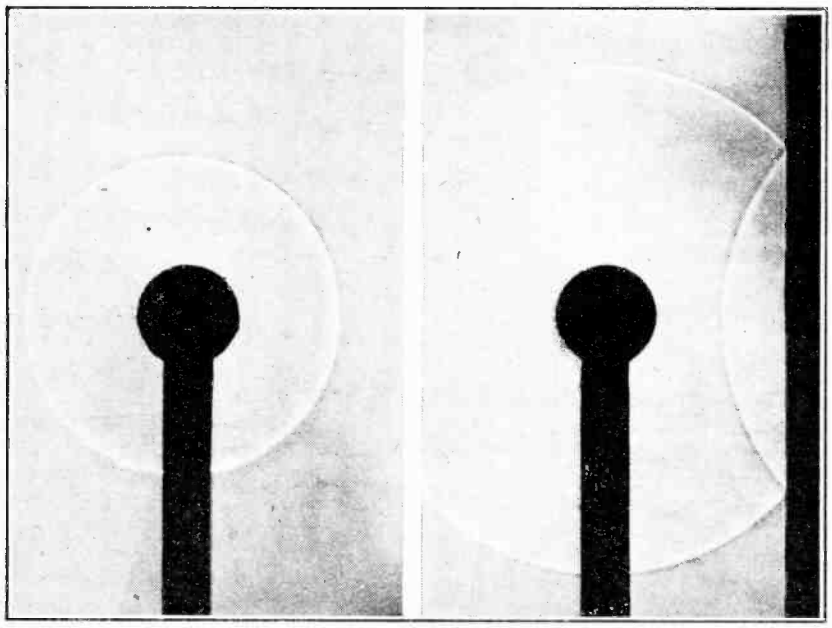

Fig. 4.—Instantaneous photographs of the shadows cast by a sound pulse as it spreads outwards in a continually expanding circle. The reflection of sound by a hard wooden board is shown in the right hand illustration.

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move appreciably while the plate is exposed.

To reveal the pulse, advantage is taken of the refraction which takes place when light passes through a region in which the density of a gas changes, even although the gas may be perfectly transparent. It is on account of this phenomenon that sunlight frequently casts upon a wall behind a hot radiator a " shadow " of the hot air streams rising in its vicinity. Such " shadows " are moving at only moderate speed and may be photographed without difficulty. To give a further example, Fig. 3 shows the " shadows " cast by jets of perfectly transparent gases. On the left is a rising jet of hydrogen, which has a density less than that of the air into which the jet issues, and on the right is of a falling jet of carbon dioxide, which has a density greater than air. Now a sound pulse consists of a region of compressed air followed by a region of rarefaction, but the shadow it casts is moving too rapidly to be visible or photographed in the ordinary way.

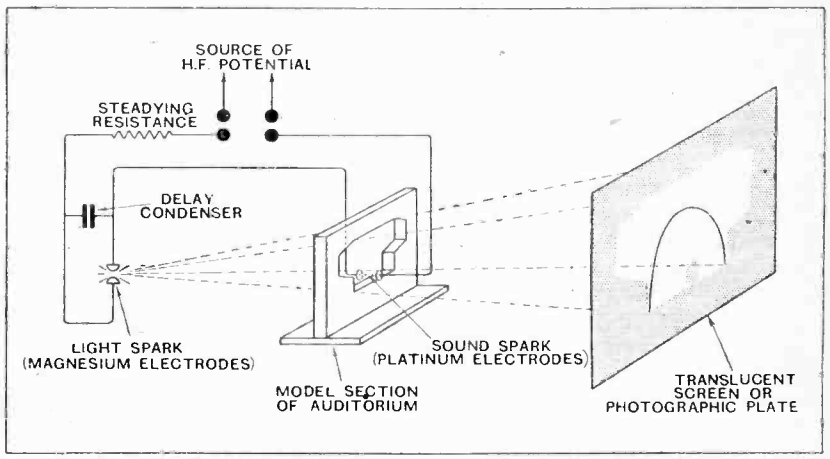

Fig. 5.—Arrangement of apparatus for sound pulse photography. The light spark occurs at a fraction of a second after the sound spark.

Photographing Sound Pulses.

In photographing a sound pulse, therefore, an " instantaneous " exposure is obtained by special means—namely, by using an electric spark as the shadow-casting source of light, for the duration of the spark is so short that the sound is practically stationary during exposure, and the shadow can be perceived by the eye. The most convenient photographic arrangement in such work is to receive the shadow direct upon a photographic plate. In actual fact, the photographs of gas jets already referred to were obtained in this manner, and are the instantaneous images of the jet as cast upon a photographic plate by a distant electric spark. Fig. 4, obtained with similar apparatus, is a photograph of a sound pulse, spreading equally in all directions from a source which is revealed on the photograph by the dark shadow. On the right of Fig. 4 is another sound pulse being reflected as the arc of a circle from a wooden reflecting surface. The centre of the reflected arc is the acoustical image of the source and, as with optical images, is situated as far behind the reflector as the original source is in front of it.

The actual arrangement used at the National Physical Laboratory in studying auditoriums was developed by Mr. N. Fleming, M.A., working in collaboration with the writer, and is illustrated in Fig. 5. A sound pulse is produced within a model section of an auditorium by making use of the snap of an electric spark indicated on the drawing as the " sound spark." A few hundred thousandths of a second later it is illuminated from a point several feet away by means of the light from another electric spark—the " light spark." The electrodes of the latter are of magnesium, so that a brilliant flash of high actinic value is produced. The light emitted casts upon the screen not only a shadow silhouette of the model, but also a shadow of the instantaneous position of the sound pulse within it. Obviously the timing of the moment of discharge at the light spark is of paramount importance, for if it goes off before the sound spark, there will be no sound pulse to reveal, and if it is delayed by as little as one-hundredth of a second the sound will have completely disappeared. The method adopted to control the interval is to put the two spark gaps in series as shown, and to connect a small condenser across the electrodes of the light spark.

When a photograph is required, a condenser charged to a high potential is discharged through the circuit. The two sparks then go off practically simultaneously, but the light spark is delayed momentarily by the action of the delay condenser across its terminals. The magnitude of the delay, which depends upon the size

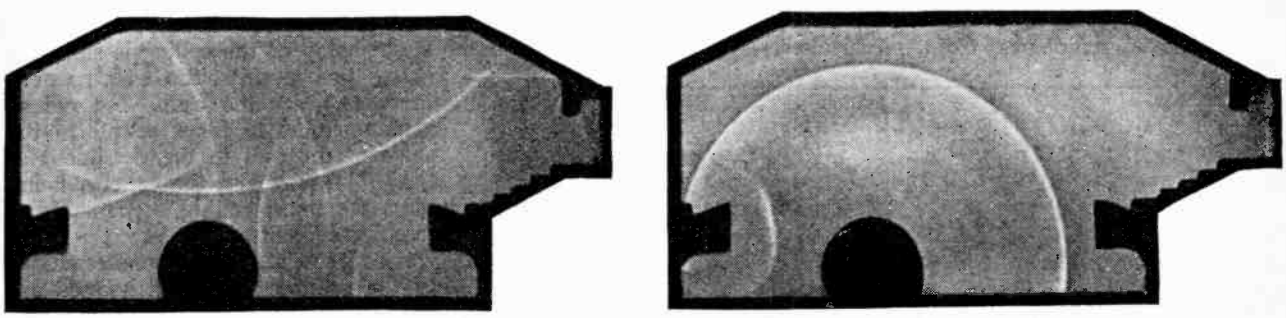

Fig. 6.—Sound pulse photographs showing progress of sound within a model section of an auditorium.

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of the condenser and upon the length of the spark gap, can be adjusted as desired within certain limits. To prevent light from the sound spark from falling upon the screen or photographic plate a small button is placed as shown upon the right-hand electrode to act as a screen. Fogging of the plate by scattered light is prevented by enclosing the whole in a long wooden "light-tight" box with blackened interior fitted with a number of suitable diaphragms.

Fig. 6 shows a pair of photographs taken by Mr. Fleming corresponding, to a certain extent, to the ripple photographs already given. It would be superfluous to point out that the sound pulse pictures are by far the clearer since the pulse is not accompanied by the subsidiary wavelets which travel with the water ripples. Nevertheless, the ripple method has a value on account of its simple technique when the other apparatus is not available, and the ease with which a complete series of photographs may be obtained.

(In the concluding instalment of this article in next week's issue the question of small room resonance and the best location of the loud speaker will be investigated.)

TRANSMITTERS' NOTES AND QUERIES

Mid-Britain Conventionette.

Mr. G. A. Jeapes (2XV), 117, Victoria Road, Cambridge, has been appointed sub-area manager of the R.S.G.B. for the Mid-Britain (Eastern) district, and is arranging for another "conventionette" for members both of his special area and from other localities. The meeting place will be the Cock Hotel, Kingsthorpe, Northampton, and a visit to the Daventry experimental station, 5GB, is projected. The inclusive cost of tickets will be 5s. each, and application should be made at once to Mr. Jeapes.

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Short-wave Stations.

NU 2XE, the short-wave station of the Atlantic Broadcasting Corporation at Richmond Hill, New York, is now transmitting, on 58.5 metres (5121.6 kC), the programmes from WABC or WBOQ every week-day from 6 p.m. to midnight E.S.T. (0000 to 0600 B.S.T.), and on Sundays from 10.50 to 12.30 E.S.T. (1650-1830 B.S.T.).

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French Mystery Station.

A correspondent is anxious to identify a French station working on 24 to 25 metres. So many stations are now experimenting with this waveband that it is difficult to identify them, but we shall welcome information on the subject from any of our readers.

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Radio Jargon.

Continuing our campaign against the misuse of the "Ham Language," we give a typical instance furnished by one of our readers: "Ur QSB FB." Now QSB means "Your note is bad," so the horrible abbreviation "Ur" is superfluous; also how can anything bad be FB ("Fine Business"), unless the report was intended to be sarcastic?

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PCJJ Calls the "Italia."

PCJJ, the powerful Philips short-wave station, made an attempt to call the airship "Italia" on Friday evening, June 8th, between 5 p.m. and 7 p.m. A wavelength of 31 metres was used, and messages were sent every three minutes in French and Italian, but no reply was received. North Cape, Spitzbergen, reported good reception of the signals.

Any listeners who may have heard these signals are requested to communicate with Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

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Danish Short-wave Stations.

Experimental transmissions from the short-wave station ED 7RL, operated by "Radiolytteren" and "Populær Radio," Copenhagen, on a wavelength of 84.25 metres, will be broadcast on Friday, June 22nd, at 2300-0100 (picture transmission). All listeners are requested to forward reports to "Radiolytteren," Raadhusplads 55, Copenhagen V, on how the transmissions have been received.

General Notes.

Stations G 6XN and G 2OW are carrying out a series of tests on 45 metres, using various aerial systems, daily at 0900-1000 and 1900-2000 B.S.T. during alternate ten-minute periods. Tests from 2OW will be denoted by letters A, C, G, J, L, and P; and from 6XN by Q, R, W, X, Y, and Z.

Reports on signal strength, fading, etc., will be appreciated and will be acknowledged. They may be sent to Mr. L. A. Moxon (6XN), 5, Pembroke Mansions, Canfield Gardens, Hampstead, N.W.6, and Mr. E. L. Owen (2OW), 43, Mount Park Road, W.5.

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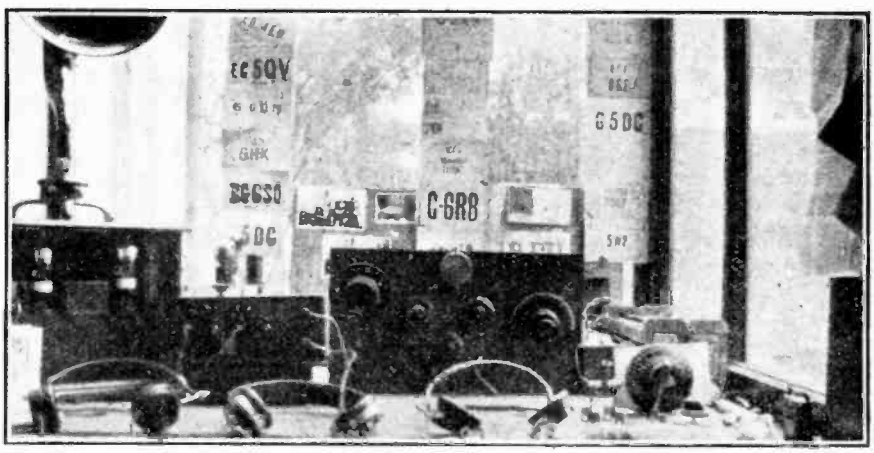
New Call-signs and Stations Identified.

G 5TJ	(ex 2AMN), E. T. James, Pitwood Yard House, Abercanaid, Merthyr Tydvil, Glam.
G 6DH	(ex 2BRJ), D. W. Heightman, Belowda, Park Way, Clacton-on-Sea.
2AGT	R. Walker, St. Ives, Lytton Rd., New Barnet, Herts (experimenting in Duplex Telephony and will welcome advice from other experimenters).
2AGX	F. Appleton, St. Muir, Leicester Rd., New Barnet, is also experimenting in Duplex Telephony in conjunction with 2AGT.
EW AA	Fabian István, Abony, Hungary.



A short-wave receiver built by Mr. G. E. Webster, Junr., at Darwen, Lancs, from directions given in our constructional articles.

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TAKING THE PORTABLE ABROAD

Customs Regulations of Interest to the Tourist.

TO-DAY there are far fewer restrictions upon the importation of wireless sets in foreign countries than there were a few years ago, when it was less trouble to take a grand piano on a Continental tour than to attempt to take a wireless set.

Frontier officials no longer regard the radio tourist as a suspect. Definite regulations affecting portable sets have now been framed by most European countries, and even if some of the regulations are occasionally irksome, the portable set owner has the satisfaction of knowing that, provided he complies with them, he is within the law and not liable to be arraigned for high treason or transported as an undesirable alien.

The following information has been obtained in most cases from the respective consuls-general in this country, whose kindness and courtesy are hereby acknowledged.

France.

There is no restriction on the importation of wireless sets in France. A small amount of duty is payable on sets imported among personal luggage, but this is recoverable when the traveller is leaving the country if his stay is a short one. The fact must, however, be mentioned on entering the country and the requisite form must be filled up.

Before the set can be used the owner must make a declaration at the Post Office in the area in which he will reside.

The use of wireless sets in motor cars is strictly prohibited.

Belgium.

Belgium offers no restrictions on the importation of wireless sets. The Customs duty amounts to 12 francs per kilogram.

As in the case of France, the duty is refundable provided that the Customs authorities are informed at the time of entry into the country.

Holland.

Under a Royal Decree of 1925 "goods to be used by travelling persons for personal use during the journey can be imported free of duty in so far as they are obviously destined for the profession, comfort or pleasure of the traveller, and this must be proved to the Customs at the port of entrance if so demanded."

If it should be decided by the Customs that duty must be paid on a wireless set this will amount to 8 per cent. ad valorem; the amount is, however, refundable when the instrument is taken out of Holland provided that the necessary notification is given to the authorities when entering the country.

Germany.

There is no objection to the temporary importation of wireless sets into Germany. On entering the country a deposit amounting to 120 marks per 100 kilograms must be left at the Customs office and is recoverable when the set is re-exported.

Switzerland.

The Swiss regulations concerning imported wireless sets are rather more complex than those of the countries already dealt with. Before taking a wireless set to Switzerland the intending traveller should make application for a permit to the "Direction Generale des Telegraphes et Telephones" at Berne. The application must contain these particulars:—

Full Name. Exact Address. Date of Birth. Nationality. Date of arrival in Switzerland. If possible, route and place of residence in Switzerland.

The permit must be presented at the frontier. If no permit has been obtained the tourist must deposit a certain sum (20 francs if place of residence can be given, 50 francs if otherwise). This is recoverable provided that the requisite form is filled up on entry into the country. In addition there is a Customs duty of 60 francs per 100 kilograms, also recoverable.

Before the wireless set can be used a licence must be obtained from the local Post Office. When the set has been imported without a permit and a deposit has accordingly been left at the frontier this sum will be refunded by the Post Office when the receiving licence is granted.

A fixed licence fee of 3 francs is levied in addition to an annual fee of 15 francs expiring on December 31st of each year regardless of the length of sojourn in Switzerland. When, however, the tourist is able to state beforehand the duration of his stay he can obtain a special licence for a period of three months at least.

Italy.

The duty on wireless sets temporarily imported into Italy is recoverable if the set is taken out of the country within three months. The duty is 240 gold lire for 100 kilograms.

Before operating the set licence fees and taxes must be paid but further information is not at present available.

Spain.

There are no restrictions on portable wireless sets in Spain but there is a duty of two pesetas gold per kilogram. Information is at present lacking as to whether the duty is recoverable or not. The radio tourist must sign a special form on entering the country.

Portugal.

No licence is required for the use of wireless sets in Portugal but a small import duty is payable.

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In whatever country he travels the tourist with a wireless set would be well advised to visit a post office to ascertain what fee, if any, is payable before the set may be used. It is better to buy a licence than to pay a fine.

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SAFETY AND THE MAINS.

Precautions to be Taken when Using Battery Eliminators.

By PHILIP R. COURSEY, B.Sc., M.I.E.E.

TO many people, radio to-day does not mean what it did only a year or so ago. It stands for better reproduction obtained by the use of better valves and better means of using them. In many cases the old set has been replaced by a new one using newer types of valves, which in turn often require the use of more H.T. voltage, particularly when used with resistance-capacity coupling methods. These changes and many other factors have contributed to the desire to use the electric lighting supply mains, whenever available, for feeding the wireless set, either by the application of a "battery eliminator" to an existing radio receiver, or by the use of a complete "mains-driven" apparatus. All users of such equipment, however, would do well to remember that their radio set is no longer connected to a small isolated battery, but can draw energy in very considerable quantities from a large power network.

Certain precautions are consequently necessary in the installation and use of such apparatus—necessary, not only to add to the safety and convenience of the apparatus from the user's point of view, but desirable also as a duty to other users of the same electric supply mains. Without wishing to take up or express in any way an alarmist attitude in this connection, it is as well to remember that it is unwise to play with fire—unless in a well-constructed grate.

In order to clear up any indefiniteness in connection with the safety of operation of apparatus of the type just mentioned, it may be well to consider the chief features of the apparatus which have a bearing on the matter, and also points which need care in the design and installation of the entire wireless receiving equipment.

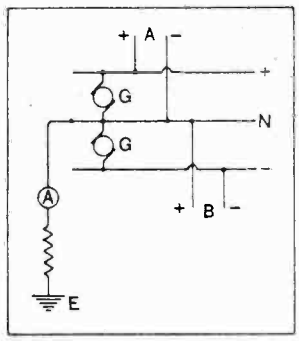

Fig. 1.—D.C. supply mains on the 3-wire system. The diagram shows that in some houses the positive main may be earthed and in others the negative.

D.C. Difficulties.

The first, and probably the most important matter arises in connection with earthing the radio set. Most receivers, excepting portable sets operating with a frame aerial, require an earth connection as well as an aerial connection, the earth lead completing the aerial circuit through the receiver. If a complete "mains-driven" receiver is purchased from a reputable manufacturer, it may be assumed with reasonable certainty that this question of the earth connection has been taken care of in the design of the apparatus, but if a battery eliminator is purchased, or constructed, for use with an existing receiver, then care is needed to ensure that the earth connection is made in such a way as will not cause any troubles. When the supply is taken from direct current mains it is unavoidable that there shall be a direct electrical connection through from the valves, etc., of the receiver back to the supply mains. In all such cases *no direct earth connection must ever be made to the radio apparatus which would make an earth connection to the valve circuits themselves.*

Earth Connecting the Mains.

If such a connection were made it would mean that an earth connection would also be made to the electric supply circuit. Not only is this expressly forbidden by all electric supply companies, but in many instances it would also cause a short circuit of the supply which would blow the circuit fuses and might damage the radio apparatus as well. The reason for this is that all D.C. supply circuits have an earth connection made to them at some definite point, by the supply company, usually at the generating station, so that another earth connection elsewhere on the system would upset the electrical conditions very considerably. Suppose that GG, Fig. 1, represents part of the generating system of a D.C. supply network arranged in what is known as the "three-wire" system of distribution, with a positive, a negative, and a "neutral" cable. When a service connection to a house is taken from the positive and neutral conductors as at A, the direct connection of a radio receiver to this service point using some form of battery eliminator will present no special difficulty, since the negative main which becomes connected to the valve filaments of the receiver is normally approximately at earth potential. Care must be taken, however, even in this case, that the normal earth connection of the receiver is not used, but that either a condenser is connected in series with it, or that a loose coupling is used to the aerial-earth circuit, so that no direct earth connection is made to the valve filaments.

It should be remembered that although the neutral cable is nominally at earth potential, its actual potential at any place will depend upon the load current flowing along the cable back to the power station, and will therefore vary from time to time. The neutral cable at a service point may be several volts different from earth potential, so that quite heavy currents might on occasion flow to earth if an earth connection were not made. These currents would still be able to flow even when the set is switched off, since usually only a single-pole switch connected in the live main (in this case the positive) is employed. These currents may easily be sufficient to burn out and damage part of the receiver unless they are prevented from flowing.

At places where the service point is connected between the negative and neutral cables, as at B, the negative

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lead which will necessarily be joined to the filament circuits of the valves, will be the full line voltage, say, 200 to 240 volts, different from earth potential. Even more necessary, therefore, in this case, is the use of the condenser as mentioned above, connected in the earth lead, Fig. 2.

In this diagram the essential elements of a simple two-valve circuit are indicated merely to represent a typical receiver, which is fed from the L.T. accumulator B, and

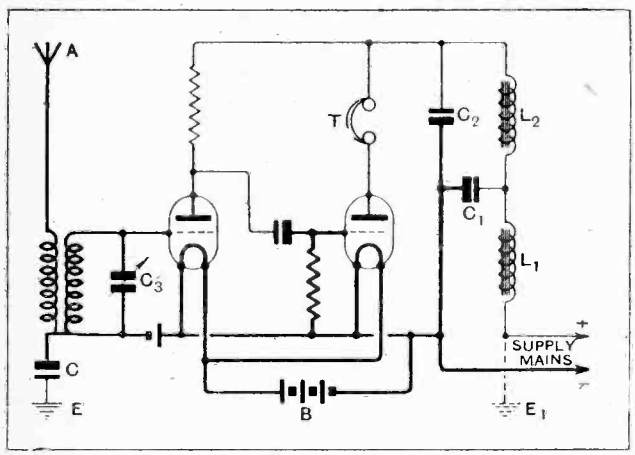

Fig. 2.—A receiver deriving its H.T. from D.C. mains where the positive is earthed. The heavy lines show the circuits which are "live" to earth.

the H.T. battery eliminator represented by the condensers C_1 C_2, and chokes L_1 L_2. The condenser referred to above is shown at C, in series with the earth connection of the receiver. Provided that it is not too small, the capacity of this condenser is not very material, and various values between about 0.01 mfd. and 0.5 mfd. are commonly employed. When such a receiver and eliminator are connected to the neutral and negative cables of a three-wire D.C. supply system, the whole of the L.T. filament circuit and other parts of the receiver metallically connected thereto will be alive to earth at the full voltage of the supply mains—*i.e.*, say, 220 or 240 volts.

Apparatus Above Earth Potential.

The condenser C in the earth lead will, therefore, be subjected to this voltage, and for safety the condenser should be of a quality capable of withstanding this voltage indefinitely with an adequate factor of safety. A condenser capable of withstanding a test voltage of not less than 600 volts (with naturally a breakdown voltage of much higher value) should be employed if reliability is desired. The parts of the receiver which are "live" to earth with such an arrangement are marked in with heavy lines, and it will be noted that the whole of the aerial circuit, the coupling coils, the tuning condenser C_3, and the L.T. battery B are all included.

Care is therefore essential in handling such parts, particularly if there is any liability to touching any earthed object at the same time, or if standing on a damp floor where leakage to earth is likely to occur. The accumulator battery should also be particularly watched in such cases, since, owing to the presence of the acid, which is liable to spray over and moisten the container of the battery, leakage to earth may easily occur. With celluloid-cased batteries, too, there is a certain fire risk from such leakage currents, so that in all such cases the batteries should be well insulated from earth, such, for example, as by standing them on glass or porcelain insulators. Owing to the risk of shock when touching such batteries, it is also desirable to enclose them in some box or other container, so that the terminals and connections cannot easily be accidentally touched when the set is switched on.

With the newer types of receiving sets, most of the terminals are screened or mounted at the back of the set, so that they are not too easily accessible, so that the risk of shock from exposed terminals is small in such instances. With many of the older types of receivers, however, exposed terminals on the front panel of the set were used, and with such sets care should be exercised when using the set connected to the mains. Strictly speaking, it would be advisable, particularly if the set is liable to be touched or used by people unused or unskilled in handling it, to cover those terminals which are affected with some form of insulating box or screen to prevent contact with them.

A.C. Precautions.

With the majority of alternating current supply circuits similar situations may arise, since generally also one of the supply cables is at or near earth potential. With alternating current, however, it is possible to derive the energy for feeding the radio set through a transformer, which, when of the "double-wound" type with completely separate primary and secondary windings, provides a means of isolating the radio receiver from the mains, and thus removes the possibility of the occurrence of a dangerous short-circuit to earth.

When a double wound transformer is not used, however, but the supply to the rectifying valve is derived

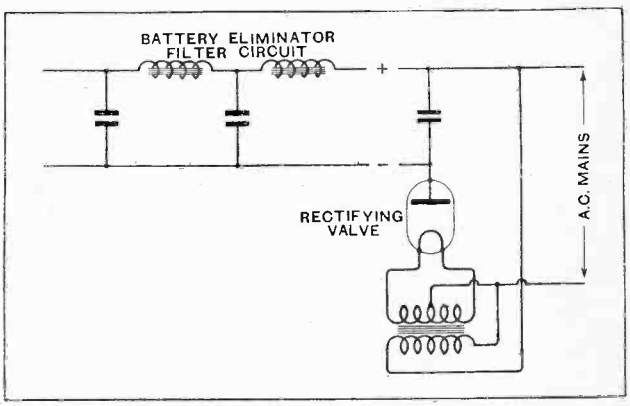

Fig. 3.—An A.C. eliminator with single-wave rectifying valve. In this case most of the connections in the receiver may be at more than twice the voltage of the supply mains to earth.

direct from the mains, very similar precautions should be taken to those necessary in the D.C. case. If a single-wave rectifying scheme, such as Fig. 3, were used, the whole L.T. circuit of the receiver would be live to earth at a potential equal to the potential differ-

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ence across the rectifying valve. This may easily be more than double the r.m.s. voltage of the supply mains, so that the necessity for the precautions referred to in connection with Fig. 2 becomes intensified. With reversed connections for the rectifying valve, the situation becomes more similar to that of the D.C. case connected to the positive and neutral cables of the supply network.

Avoiding a "Live" Aerial.

Reverting again to Fig. 2, it should also be noted that the aerial conductors are also live to earth. In most installations this will cause no trouble, unless the aerial wires be accidentally broken and fall to the ground, when the supply mains might be earthed and damage might occur. If the wires can be touched at any place there is considerable risk of dangerous shock, particularly outdoors, where a person may be standing on damp soil. Even indoor aerials are dangerous in this respect, since they may be close to or come into contact with gas pipes, water pipes, etc., and cause a short circuit. The obvious remedy is to use a series condenser in the aerial lead as well, and thus to isolate the aerial wires from connection to the mains, putting it as close to the receiver as possible, so that no live wire is exposed.

An obvious essential requirement for all radio apparatus used connected to electric supply mains—whether a "mains-driven" receiver, or other type of receiver or apparatus operated through a "battery eliminator"—is that all terminals and other exposed metal parts which are readily accessible or liable to be touched when connected to the mains, shall be so mounted or covered that accidental contact with them is prevented. This is particularly necessary to prevent risk of shock to the user, and is necessary also to make the apparatus comply with the existing Wiring Regulations of the Institution of Electrical Engineers as applicable to a current-consuming device connected to the mains.[1] All apparatus connected to the mains, whether radio or otherwise, should, strictly speaking, comply with the requirements of these Regulations, but, unfortunately, it is not every electrical appliance that does so, with the result that some additional precautions are desirable with radio apparatus, since this is, perhaps, more directly handled while in use than many other electrical appliances. Headphones, for example, should be isolated entirely both from the mains, if used with "mains-driven" radio apparatus, and also from earth. The wearer of the phones may touch or be standing on some earthed object, so that he would get a shock if the phones were "live" on the mains, or he might handle a live lampholder, pedestal, or table lamp-stand, or switch, for example, and so get a shock if the phones were earthed. Complete electrical isolation of the windings and headbands of the phones is thus very desirable not only for mains-driven receivers but also for all receivers which may be used near to other existing electrical apparatus, lamps, etc. This latter is perhaps a point which is rather apt to be overlooked, but is a situation which may quite easily occur in the event of a fault occurring to the insulation of any electrical device used adjacent to the radio apparatus. Live lampholders are, unfortunately, not nearly so rare as one would wish.

This desirable isolation of the circuit of headphones may be achieved in two ways: (*a*) by the use of an output transformer or (*b*) by an output filter comprising a choke and two condensers—Fig. 4 (a) and (b).

If an output transformer is used, it must necessarily, in order to be effective as a protection, be of the double-wound type with two separate windings adequately insulated from each other. This insulation should be such

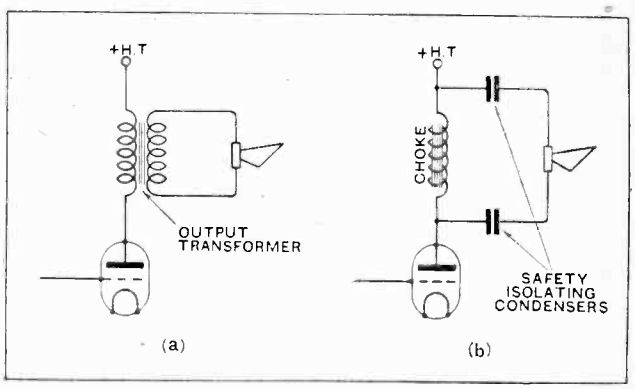

Fig. 4.—(a) An output transformer isolates the loud speaker or phones. (b) If a choke filter output is used, complete isolation is obtained by using two condensers.

that it will stand up to the full line voltage of the supply mains without any liability to breakdown. This implies that the insulation should be able to stand up to a test of at least 500 to 600 volts A.C. in order to provide an adequate degree of safety. Alternatively, a choke coil connected in the anode circuit of the last valve of the receiver may be used to form an output filter by connecting a condenser of, say, 1 microfarad capacity to each end of it, so that the two condensers are in series with the loud speaker or headphones circuit. These condensers need also to have an adequate factor of safety—say, a rating of not less than 600 volts test—if they are to be trusted to give proper protection from the mains.

The Importance of Fuses.

Many battery eliminators are mounted in metal cases or boxes, and, in common with other electrical apparatus enclosed in metal, these cases should be connected to earth, so that, if any failure of insulation of the parts inside the case should occur, the user of the apparatus would be protected from risk of shock. The fire risk is also lessened by this earthing, since it implies usually that, if a fault occurs, a short circuit will immediately result, and the circuit fuses will be blown. The fusing of the circuit to which the eliminator or radio apparatus is connected should also be looked to when connecting

[1] Additional regulations forming part of the I.E.E. Wiring Regulations, and relating particularly to radio apparatus, battery eliminators, etc., have been in preparation for some considerable time past. With the co-operation of the Radio Manufacturers' Association and other interested bodies, further additions to these have recently been made, and it is probable that the complete new regulations will shortly be issued officially.

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up such apparatus, so as to ensure that the circuit is not fused too heavily. An ordinary H.T. eliminator should not be connected to a heater circuit plug which is provided with a fuse to blow at 20-25 amps., as, for example, for a 3 kW. electric fire, unless a subsidiary fuse is added which does not blow at more than 2 to 3 amps. The heavy fuse does not provide adequate protection for the flexible wires and other parts of the apparatus in the event of a short circuit taking place. Metal panels of receiving sets operating off the mains should also be earthed for the same reasons. With eliminators or other apparatus operating on A.C. supply mains, it is possible to isolate the radio apparatus entirely from the mains by the use of a double-wound transformer with adequate insulation between the primary winding connected to the mains and the other windings which are connected to the valves and other parts of the radio apparatus. If the insulation of the transformer is adequate, all risk of shock and leakage from the mains through the radio apparatus is avoided, but the fact should not be overlooked that many A.C. battery eliminators are often capable of delivering fairly high voltages, often in excess of the mains voltage, so that quite nasty shocks are possible from the apparatus unless the terminals and connections are properly insulated or protected. A loud speaker or headphones used on such apparatus may be at a potential of 200 volts or so above earth potential, and, as the windings of such instruments are often not insulated for such voltages, it is still desirable to employ an output transformer or filter circuit with condensers of the types mentioned above.

Usually with such apparatus the aerial and earth connections will be quite safe from risk of shock, so that no further insulation with condensers would then be necessary.

Danger of Shock Negligible.

While the risk of shock is increased by the use of higher voltages, such as are obtainable from mains-driven apparatus, it should not be overlooked that ordinary H.T. batteries, when of 150 volts or more, can give quite an objectionable shock, the danger or otherwise of which depends greatly upon the state of health of the recipient and the moistness of his skin. This being the case, such apparatus should always be treated with reasonable care and respect; and if similar and common-sense treatment is accorded to all radio apparatus when operated from the supply mains and the above simple precautions are observed, there should be little fear of serious danger arising even in unskilled hands. Careless and improper treatment of any electrical apparatus is, on the other hand, liable to be troublesome and dangerous in all cases, whether or not it is applied to radio uses.

VALVE CURVES.

Figures and Characteristics that Count.

THE reason why one make of valve is bought in preference to another varies with the purchaser. In many cases the results obtained by a friend is the deciding factor. In the case of the wireless experimenter, published figures and curves count most.

Let us consider, then, what relation the usual particulars given in the test reports of a valve bear to the service which will be required of it. We can dismiss at once the question of filament voltage and current, since there are now complete series of valves available at all the usual L.T. voltages, and the current has been reduced to almost negligible limits.

The generally accepted efficiency figure of a valve is that known as the mutual conductance, which is obtained by multiplying the voltage amplification factor by 1,000 and dividing the result by the A.C. resistance of the anode circuit (also called the anode impedance). In modern valves this figure is approaching unity in all models; in fact, in a few cases a mutual conductance considerably greater than unity is to be found.

The Importance of Mutual Conductance.

The mutual conductance figure is not quite the best criterion of performance in all cases, as the following will show: To take first L.F. transformer amplification, the most suitable valve is generally agreed to be the one having the maximum voltage amplification that can be obtained without increasing the A.C. resistance to more than 20,000, or at the most 30,000 ohms.

As regards L.F. resistance coupling, as the working capacity of the valve is a direct function of its magnification factor, the high note loss will be appreciable unless a compromise be struck and valves having an amplification factor of not more than 20 or 30 be used. In tuned anode coupling a high impedance valve is desirable.

H.F. transformers of the "Everyman Four" type can be modified by the addition or removal of a few primary turns to match the A.C. resistance of the valve to which it is connected, and since this adjustment of primary turns alters the step-up ratio it can be shown that the overall amplification is proportional to the *square* of the voltage amplification factor of the valve divided by the A.C. resistance, or, in other words, proportional to the mutual conductance multiplied by the amplification factor. Practical considerations such as even response over a wide range of frequencies tend to modify the design of the H.F. transformers somewhat, but in general one can expect a greater overall amplification from a valve with a voltage factor of 20 for an A.C. resistance of 20,000 ohms with an appropriate H.F. transformer than from one with the corresponding figures of 6 and 6,000.

One of the few cases in which mutual conductance is a sure guide to performance is in the operation of a loud speaker, though even here the valve and the loud speaker winding should bear a definite relation to one another to obtain the most musical result; this relation may not be that most suitable for the production of maximum power.

The usually published characteristic curve of a valve is that showing the relationship between anode current and grid volts at a definite anode voltage. Three or four of such curves for different anode voltages may be included on one sheet, and are generally known as a family of curves. We expect the major portion of such curves to show little departure from a straight line, and what is really just as important, but not usually realised, we should find that the straight portions of each of the curves are parallel to one another. A way of ascertaining this last point is to examine the anode volts-anode current characteristic curve if available. This should be straight over a wide range if the valve is to be considered good.

The quality indicated by straightness of the anode volts-anode current curve is that of constancy of A.C. resistance over a range of anode voltage. Under working conditions the actual anode voltage varies from instant to instant, and a type of distortion known as amplitude distortion would be introduced if the A.C. resistance varied greatly.

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Hints on Judging Receiver Performance.

By "RADIOPHARE."

EXCEPT for the fortunate few whose testing equipment includes such apparatus as a valve voltmeter, it is the hardest thing in the world for the home constructor of a receiver intended for long-distance reception definitely to answer a self-imposed question as to whether his set is really as sensitive as it should be; few of us are ever completely satisfied, and there is generally a lurking suspicion that some minor and undiscovered imperfection is responsible for a range of reception less than the maximum attainable. As a rule, no definite answer is ever forthcoming, although with a preconceived standard acquired as the result of experience with other circuits on the same aerial and by a judicious comparison of notes with other amateurs, it should be possible to form a good idea as to the efficiency of the set.

Unfortunately, the object of this brief note is not to describe a simple rule of thumb method whereby this harassing feeling of uncertainty may be removed—such a rule does not exist—but merely to point out an all-too-common cause of erroneous conclusions: namely, the effect of darkness on wireless transmissions.

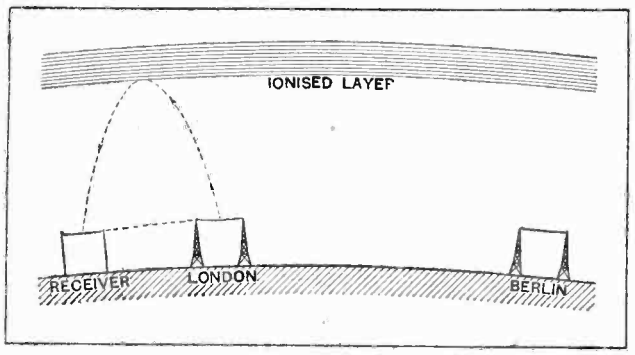

Fig. 1.—Direct and "reflected" rays at short range.

Have we not all heard the over-confident enthusiast say: "There isn't much wrong with my set; Vienna is nearly as strong as 2LO"—or whatever his local transmitter may be? When pressed, he will admit that this result is attained only at night-time, but will be rather hurt when it is suggested that the daylight reception at a distance of two or three hundred miles would be a much more convincing proof of the excellence of his receiver. The fact is that wireless waves travelling over long distances are inherently liable to behave in an erratic manner during the hours of darkness, and it is best to carry out all comparative tests, whether they involve measurement or not, between sunrise and sunset.

As a result of the formulation of theoretical assumptions and subsequent confirmatory experimental work, the causes and nature of these night-time irregularities are now fairly well understood. Indeed, many readers of this journal will be familiar with the subject, but to the others no apology is necessary for a brief repetition of information which will be helpful to them in arriving at a proper appreciation of the performance of their receivers under varying conditions.

Uncertainty of Night-time Reception.

Waves from a transmitter reach our receiving aerials by two different paths: First, there is the direct ray, or ground wave, which follows the contour of the earth, and which is subject to rapid attenuation due to absorption. The second form of radiation is an indirect ray, reflected downwards by a layer of ionised and conduct-

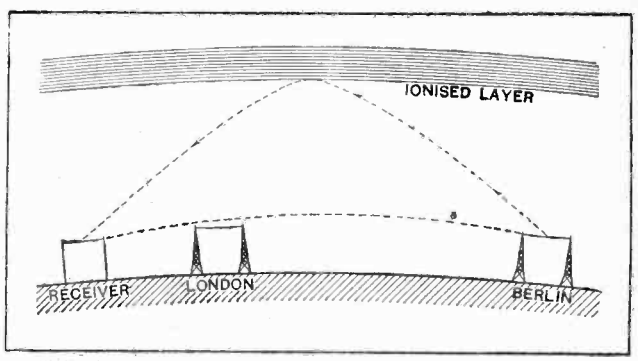

Fig. 2.—Interaction between direct and indirect waves.

ing atmosphere which is assumed to exist some 50 miles above the earth's surface. During the hours of sunlight this layer is ill-defined; consequently its influence is not present and we depend entirely on the direct ray. Even at night-time its condition is seldom stable for long periods, and its assistance in helping signals towards our aerials is not always forthcoming. These variations are not subject to any known law, and the phenomenon

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Day and Night Range.—of irregular fading is produced, either by a temporary failure of the reflected ray or by out-of-step interaction between it and the direct ray (when the distance is short enough for this latter to be received at all).

The Reflecting Layer as Friend or Enemy.

Let us take the case of a listener situated some 20 or 30 miles west of London, and see how these different forms of radiation are likely to affect him. The direct ray from his local station (Fig. 1) will be so strong as compared to the indirect that the latter may be ignored; true, at night there will be some slight increase of signal strength when the reflected wave is in step, with a corresponding decrease as the conditions for reflection change to give an out-of-step effect, but these variations will not be of sufficient magnitude to be aurally appreciable. For practical purposes, he will receive from 2LO a constant intensity both during the day and night; any changes which he may erroneously ascribe to fading will be due, in fact, to a faulty receiver, a variation of the transmission, or possibly to re-radiation from a neighbouring aerial, very possibly attached to a receiver oscillating "on the silent point."

Now consider what happens when he tunes to, let us say, a German station (Fig. 2) four or five hundred miles away. In daylight, the direct wave, attenuated as it is, will be received if his set is sensitive enough, and signals, though possibly subject to interference, will be of constant strength. After dark, however, the reflected wave will come into play; if momentarily of the same amplitude as the other, and completely out of step, it will cause a total "fade out"; if in step, or of much greater strength, signals will be louder than during the day. It should be emphasised that the indirect ray is less subject to absorption, and, given favourable conditions in the ionised layer for its reflection, signals may be more than sufficiently strong to be detected by a receiver which in daylight would be found hopelessly insensitive; in other words, the *average* night-time range is greater.

It would be base ingratitude for any wireless man to belittle the help he receives from the reflecting layer which makes possible—but only after dark—the reception of distant stations with simple apparatus. Everyone knows that such transmissions are sometimes heard for a considerable time without serious fading, but it must be emphasised that conditions are never really stable for long; indeed, they often vary from minute to minute.

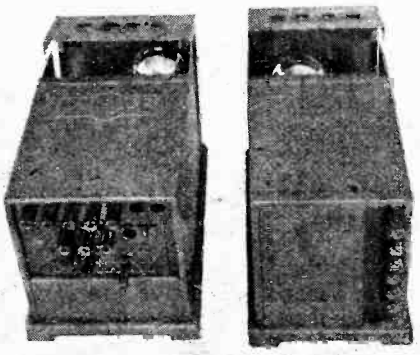
The foregoing remarks apply particularly to the medium broadcast waveband; very short waves are affected in a slightly different way, and the longer waves suffer less attenuation of the direct ray; consequently they are received even at considerable distances with less serious variations of signal strength. The truth of this may be proved by making a critical comparison of the two Daventry transmissions in the more remote parts of the country.

Finally, a small point of some importance should be noted; night conditions are sometimes in force a little before the actual time of sunset and after sunrise, particularly when receiving, respectively, from an easterly or a westerly direction. To be absolutely certain that his comparisons are being made under stable day conditions, the experimenter should assure himself that the sun has not set over any part of the signal path.

NEW ELIMINATOR FOR H.T. & GRID BIASING POTENTIALS.

IMMEDIATELY following the recommendations drafted by the Institution of Electrical Engineers governing the design of mains connected receiving gear, is the introduction of two new types of battery eliminators by Philips (Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, London, W.C.2), designed to afford complete protection against the dangers of fire and electric shock. Two points of merit are at once obvious—the extreme simplicity of operation, and the complete protection which has been provided. The entire rectifying equipment is totally enclosed in a well-finished metal container, while the connecting plugs are protected with insulated sleeves and engage in sockets located in recessed holes, so that it is quite impossible to touch a "live" metal part. Before a plug engages in a socket, the metal part has disappeared.

The Model 3002 is a full-wave thermionic rectifier using the Philips valve, Type 506. A maximum anode potential of about 220 is permissible with this valve, so that on open circuit a potential approaching this value is delivered at the output terminals. On a 15 mA. load the output potential was found to be 200 volts. When loaded to 30 mA. the potential did not fall to below 150 volts, indicating the suitability of the rectifier for operating a multivalve receiver fitted with a moderate power output valve. A range of five H.T. potentials is obtainable, produced in each case by a voltage dropping resistance. The resistances are wire-wound and of new design, being assembled on insulating



The new Philips A.C. battery eliminators.

glass stems some 4in. in length by ½in. in diameter, and supported on brass rods. It is unnecessary to describe the exact nature of the smoothing apparatus, and it will suffice to state that in operation ripple arising from the A.C. source is in no way discernible. Connected to an "Everyman-Four" receiver, the eliminator behaved precisely like an H.T. battery of liberal output, and there was neither hum nor oscillation.

Another model is available, Type 3003, which, as well as being a substitute for the high tension battery, provides grid biasing potentials up to a value of approximately 40 volts. Three biasing potentials are simultaneously available, voltage variation being obtained by means of plug switches. A critical control of voltage is obtained varying in about two volt steps up to ten volts, and then advancing in steps of five volts. The combining of H.T. and grid biasing potentials in a single unit is a feature which has long been sought. All danger of coupling between grid and anode circuits is avoided by the use of a separate rectifying valve for producing the grid biasing potentials. On test it was found that there was no interaction between the grid and anode circuits, and the behaviour of the grid biasing section corresponded to that of a battery, and was found to be entirely reliable.

The H.T. eliminator alone, Type 3002, costs £8 10s., whilst the complete H.T. and grid bias battery eliminator, Type 3003, is priced at £10 10s.

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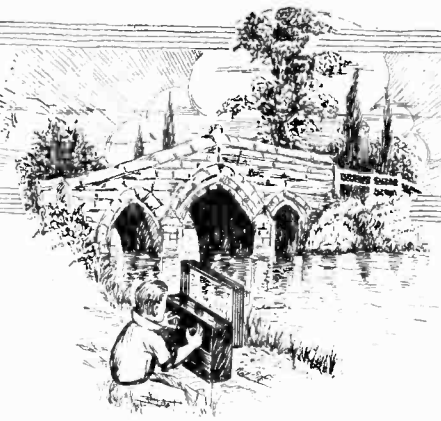
CURRENT TOPICS



Events of the Week in Brief Review.

COMMUNAL RECEPTION.

A broadcast distributing service has been started at Clacton-on-Sea. From a central receiving station wires are run to the subscribers' houses and the listener has only to instal a loud speaker. We understand that there are already 300 subscribers, who pay 1s. 6d. a week in addition, of course, to the 10s. licence. It is uncertain, according to our present information, whether these subscribers have a choice of programmes or if they are limited by the tastes of the engineers at the central receiving station.

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RADIO EXHIBITION POSTERS.

A record number of designs for the poster of the Radio Exhibition has been sent in this year and the judges appointed by the Radio Manufacturers' Association had to consider over 600 entries before finally awarding the first prize of £50 to Mr. C. Scott, of the Leeds College of Arts. The general standard of the designs was excellent, and we look forward to seeing Mr. Scott's poster next autumn.

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THE CRADLE OF THE HUMAN RACE.

An expedition into the vast desert between the Orange and Zambesi rivers in Bechuanaland is being conducted by Dr. C. E Cadle, of the Colorado Museum of Natural History, and Prof. R. L. Mannen, of Texas University. They believe that the bushmen who inhabit the Kalaharri Desert are the direct and almost unmixed descendants of primitive man, and expect to discover ethnological facts of the greatest interest. The party is taking out two two-ton tractors and a complete transmitting and receiving set so that they may keep in touch with civilisation and report progress.

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BROADCASTING IN RUMANIA.

A new broadcasting transmitter is to be erected near Bucharest by the Marconi Company, which will be operated by a national company, to whom the broadcasting rights in Rumania have been granted. The transmitter will have an output of 12 kW to the aerial, and has been designed to work on any wavelength that may be allotted to the station between 200 and 545 metres.

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WIRELESS BEACONS.

The end of the present year should find our coasts well protected with wireless beacons. Those at the Caskets and Start Point will be working in about four months' time and will quickly be followed by one on Lundy Island. Further beacons at Dungeness, Cromer, Sale Skerry, and Kinnaird Head will probably be erected during the present financial year.

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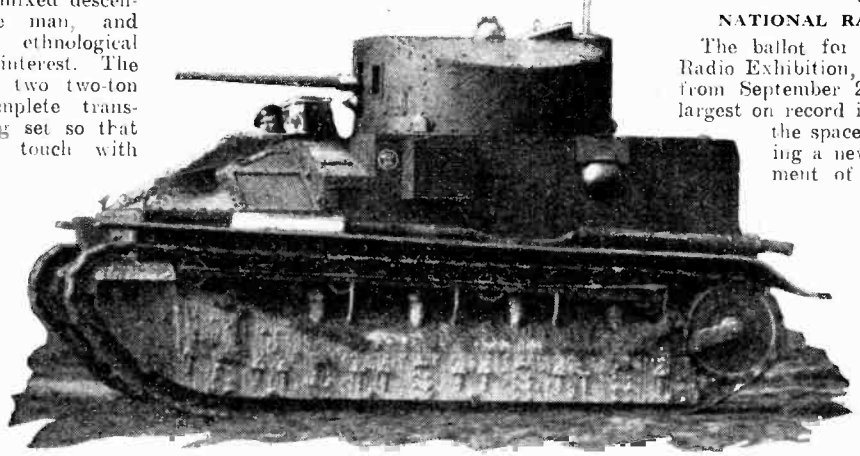
THE PRESIDENTIAL ELECTION.

The broadcasting companies in the United States expect to reap a rich harvest at the forthcoming Presidential Election as the rival candidates will doubtless make large use of their services, at the usual rates, for furthering their respective claims. Mr. Hoover is also said to have prepared a number of talking films illustrating his past achievements.



ONE OF THE LATEST TANKS. This tank equipped with wireless apparatus and having a short metal mast which constitutes the aerial was photographed on the common at the Woolwich Experimental station while undergoing its trials.

INCREASED POWER FROM ICELAND.

The broadcasting station at Reykjavik will shortly increase its power to 5 kW., when we shall be able to get information about those elusive "secondary depressions" with even greater ease and persistency than at present.

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THE FLIGHT OF THE "SOUTHERN CROSS."

Apart from the enormous distance covered, the flight of the aeroplane "Southern Cross" from San Francisco to Sydney, New South Wales, is notable as an outstanding achievement of wireless communication. During the first stage of the journey the petrol supply nearly ran out, and but for the assistance received from his wireless set, which enabled him to keep in touch with the radio beacon at Honolulu, Capt. Kingsford Smith might easily have met with disaster. Again when approaching Sydney the flyers thought they had lost their way and sent an urgent message, "Guess we are lost. Battery went down; please get ship with receiver to get our bearings on my 740 wave." As a result the aeroplane received its position from the U.S. destroyer *Richmond*, and soon after was able to state that land was in sight.

The "Southern Cross" was equipped with a standard A.D.6 set supplied by the Marconi Co., to whom we are indebted for particulars of the incidents recorded above.

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NATIONAL RADIO EXHIBITION.

The ballot for space in the National Radio Exhibition, to be held at Olympia from September 22nd to 29th, was the largest on record in the British industry, the space applied for necessitating a new plan for the arrangement of stands, of which 262 have been allotted as compared with 229 last year.

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THE "BABY" PANOTROPE.

At a luncheon given by Sir Alan Burgoyne, of the British Brunswick, Ltd., at the Savoy Hotel on Tuesday, June 12th, he stated that the Panotrope had been installed

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in over a thousand cinema theatres, and that his company was now perfecting a smaller type suitable for home use which would be sold for £35 to £40. This "baby" Panotrope includes a modified R.K. moving-coil loud speaker, fed by a two-stage L.F. amplifier, transformer-coupled with a L.S.5A. power valve in the last stage. Provision will be made for working off either A.C. or D.C. mains, so that no batteries are needed. The whole apparatus will be contained in a handsomely designed pedestal cabinet and is operated by the Panotrope pick-up.

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INDIAN SUMMER AFFECTS BROADCASTING.

Every country has its own peculiar troubles, and what is one man's drink is another man's poison. In India we hear one of the troubles of the Indian Broadcasting Company is to find European artists during the summer months to fill the programmes. All Europeans who can possibly do so escape to the hills to avoid the heat. At the time of writing we feel that we would gladly sacrifice a large portion of our own broadcast programmes if, in return, we might have a fair share of summer weather.

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WIRELESS SERVICE TO KENYA.

A direct wireless service between this country and Kenya was opened last week.

During the initial stages of the service it will be worked only during limited periods each day; and in these circumstances ordinary (full-rate) telegrams will not be accepted until further experience has been obtained and the hours of working have been extended. It is hoped at a later stage to introduce a service of ordinary telegrams.

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THE BROADCASTING PROBLEM IN U.S.A.

The Federal Radio Commission of the United States is still pursuing its endeavours to reduce the number of broadcasting stations in operation. The last licences expired on June 1st, and only temporary licences, usually for sixty days, have been granted in extension. Meanwhile two hundred stations have received notices inviting them to satisfy the Commission that they are operating "in the public interest," in which case they will have their licences renewed after August 1st.

FORTHCOMING EVENTS.

THURSDAY, JUNE 21st.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Grove House, High Road, Leyton, E.10. Paper on Loud Speakers, with Demonstration.

SUNDAY, JUNE 24th.

Tottenham Wireless Society, 10, Bruce Grove, Tottenham, N.17.—Annual Social Outing to Hastings, leaving Bruce Grove Station at 9 a.m.

MONDAY, June 25th.

Institution of Electrical Engineers.—Summer Meeting in Glasgow, ending on Saturday, June 30th.

CYCLING AND WIRELESS INTERLUDES.

Spectators at the principal "dirt tracks," where motor cycle racing is proving an ever-increasing attraction, have no lack of entertainment. Between the events the announcer's microphone is replaced by a gramophone pick-up and the intervals filled in with popular music transmitted through the various loud speakers placed in convenient positions around the track.

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DR. FLEMING JOINS THE DISCUSSION.

We note with satisfaction that Prof. J. A. Fleming has contributed his quota to the discussion raging in a section of the Daily Press on the subject of human immortality. It would obviously be out of place for a technical journal, such as *The Wireless World*, to express any opinion on this subject, but we welcome Dr. Fleming's remarks as a refutation of the common idea that science and religion must necessarily be antagonistic.

WIRELESS AT WESTMINSTER.

(From Our Parliamentary Correspondent.)

Danger to Pedestrians.

Mr. Albery asked the Minister of Transport whether he proposed to take any further steps to safeguard pedestrians, especially in rural areas, by making more widely known any existing rules of the road; and whether he would consider obtaining the co-operation of the British Broadcasting Corporation towards this end.

Col. Arnley said he was always glad to receive any suggestions for minimising dangers arising from road traffic, but so far as he was aware accidents to pedestrians were not commonly caused by a lack of knowledge of the rules of the road either on their part or on the part of drivers of vehicles.

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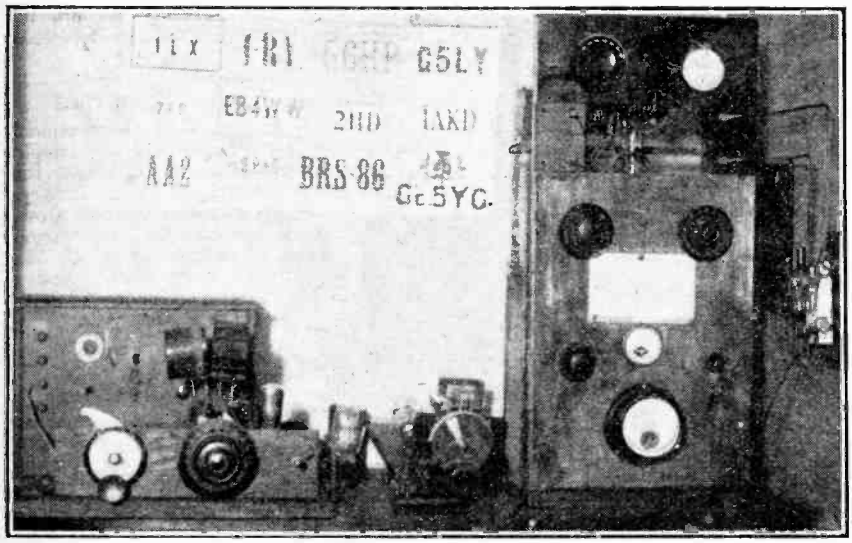
The Television Position.

Sir W. Mitchell-Thomson, in reply to Mr. Malone, said that technical officers of his department had witnessed four demonstrations of television—three in this country and the fourth in the United States a few weeks ago. The company most active in the matter in this country agreed in September last to give his officers a further demonstration, but so far this promise had not been fulfilled. He had seen a statement in the Press that television tests were recently conducted by an American broadcasting station, but that after a week of tests not one had reported reception of the moving images.



G 6WO. The transmitting station of Mr. M. S. Woodhams at Rugby. The T-P T-G circuit is crystal-controlled and the input 10 watts rectified A.C.

Club News.

Arms and Excursions.

The last meeting of the Tottenham Wireless Society, held last Wednesday at the Institute, 10, Bruce Grove, was devoted to the consideration of arrangements for the summer field days and other items of business.

The handsome new shield, presented by the President, Prof. A. M. Low, D.Sc., was on view for the first time and was admired by all the members present. Of conventional shape, there is a scroll bearing the name of the Society at the top, and another with the name of the donor at the bottom. The central figure is symbolic of radio research. The whole of the metal work is in oxidised silver. This shield will be presented to the member each year who gives the best lecture combined with a relevant demonstration on some subject connected with radio transmission or reception.

The first field day will be held on July 15th. Messrs. Smith and Holness will be in charge of a station at Bayford and will use the call-sign 6YX. Messrs. Milner and Dyer will operate the Society's transmitter 5TT in the neighbourhood of Broxbourne. It is hoped to arrange for another station to operate near Woodridden Farm, Epping.

Hon. Secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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THE DESIGN OF THE FIELD MAGNET.

Field Strength and Leakage Flux in Moving Coil Loud Speakers.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

MUCH controversy exists among users of moving coil loud speakers as to the amount of power it is necessary to consume to produce an adequate field strength. The problem of the design of the magnet system such that the highest field strength may be obtained in an air gap of given dimensions with the minimum expenditure of energy is the problem here discussed. With the type of moving coil used up to the present the gap dimensions are such as practically to preclude the use of permanent magnets for large volume output since the flux density obtainable in the gap with even the best type now available will be less—and probably decidedly less—than the flux density obtainable with an electromagnet.

Field Strength and Flux Density.

When a current I is passed round a coil of wire a certain number of lines of magnetic force will thread the coil, giving a certain number of lines per unit area (or field strength) on the axis of the coil. If the coil is wound on a non-magnetic material and there is no magnetic material in the neighbourhood of the coil, then the field strength (H) at a given point on the axis of the coil will vary directly as the current I. On the other hand, if the coil is wound on magnetic material which is so shaped as to occupy the whole of the field, so that all the lines of force thread the magnetic material, then the field strength will be increased by a greater or lesser degree, depending on the material used, and also will not vary directly with the current. The field strength in the magnetic material is usually referred to as the flux density B, so that for a non-magnetic material, such as air, $B=H$ or $\frac{B}{H}=1$, while for a magnetic material $\frac{B}{H}$ is greater than unity. Thus for a given air core coil H varies as the current I. Also for a given current H varies as the number of turns in the coil, so that the field strength H must vary as the product of the current and the turns in the coil. For this reason H may be denoted by units of current turns, or ampere-turns to employ the more usual nomenclature.

When it comes to magnetic materials such as iron and steel the relation between B and H must be determined by experiment for the particular material under consideration. Such relations for cast iron, sheet steel, and cast steel are shown in Fig. 1.

This shows that the flux density B increases with increasing number of ampere turns up to a certain limit, after which the increase is very slow indeed. What is happening here is that B can increase until all the available paths in the iron are being used, after which further lines must occupy space outside the magnetic material. When this occurs the magnetic material is said to be saturated, and it is obviously no good increasing the number of ampere turns beyond this point. In the magnet system required for the moving coil cone loud speaker part of the magnetic path is of magnetic material (iron or steel) and part of air, so that we must find the ampere turns required for each part and add them up to find the total ampere turns. As

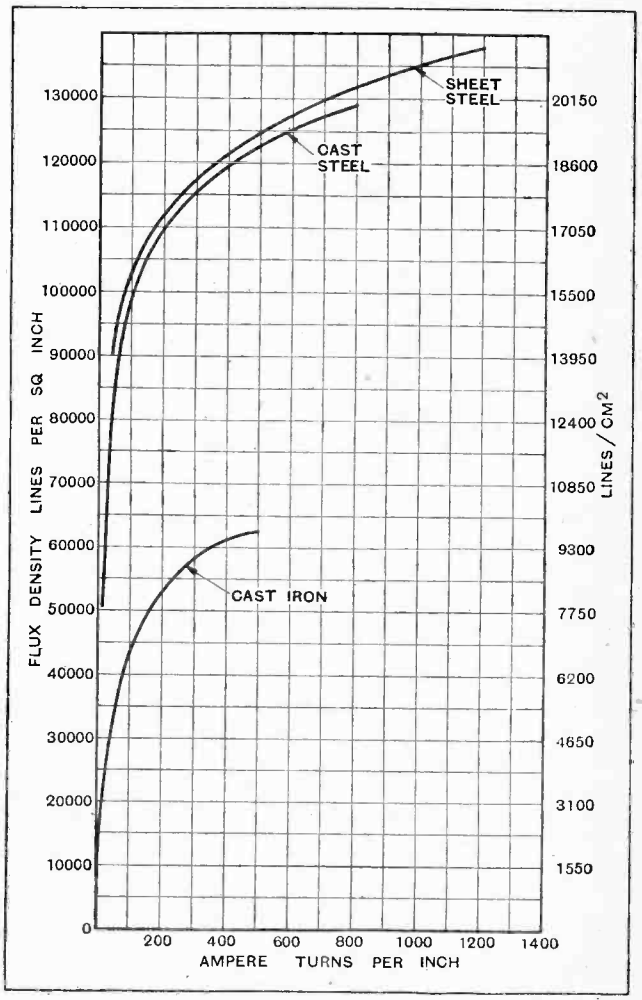

Fig. 1.—Magnetisation curves for cast iron, cast steel and sheet steel.

will be seen from the B-H curves of Fig. 1, each part of the iron or steel where a change of cross-section occurs much be dealt with separately as the flux density in each part will be different.

A further consideration, and perhaps the most important, is what allowance must be made for leakage, for obviously if we want a certain number of ampere

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turns to produce a given flux density in the gap with no leakage we must add on further ampere turns to get the same flux density in the gap if there is leakage of flux. The definition of leakage for the purpose of this design is the amount of lines of force which do not stretch across the air gap in the required manner—*i.e.*, those lines which do not take the shortest distance across the gap—see Fig. 2, where the unbroken lines represent useful flux and the dotted lines leakage flux. From what has already been said it would appear that

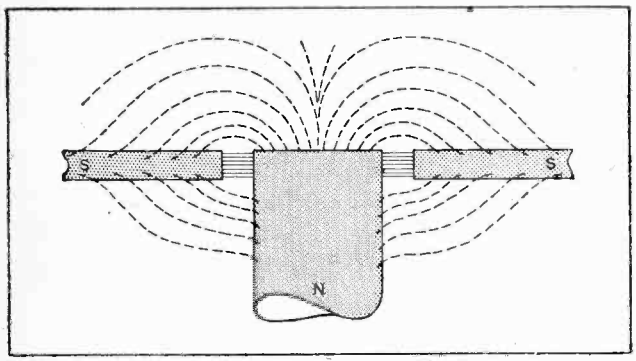

Fig. 2.—The lines across the gap represent useful flux, while the dotted lines are leakage flux.

if any part of the iron or steel—especially in the neighbourhood of the air gap—is saturated then leakage is likely to be bad. It would also seem probable that the shape of the iron or steel in the neighbourhood could be made to influence leakage quite considerably—for instance, provided always that the iron was not saturated at the narrowest cross-section, the shape shown in Fig. 3 (*a*) should give less leakage than that shown in Fig. 2, and probably that in 3 (*b*) would be less still under the same conditions. The wider the air gap the more the leakage is likely to be, so that it is desirable to use a relatively small gap.

Measurement of Flux Density.

It is a very difficult matter to calculate or even to estimate the leakage for a given shape of metal and a given width and shape of gap without a large amount of previous design experience, and probably the most satisfactory way is to measure the flux densities in various parts of actual magnet systems to try to obtain some reasonable figure for the leakage. It would perhaps not be too much of a digression to describe briefly how these measurements are made.

The instrument used is a Grassot fluxmeter, which is essentially a moving coil instrument so arranged that

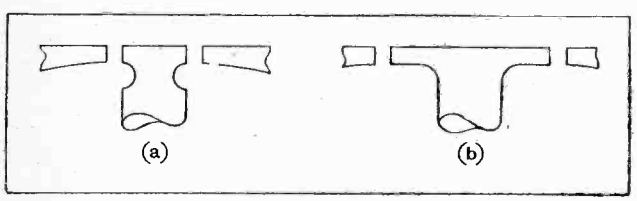

Fig. 3—(a) Centre pole with grooved end. (b) Another pole shape, designed to reduce magnetic leakage.

the method of suspension of the moving coil exerts no controlling force on it—*i.e.*, the coil will "stay put" in any position. Attached to the coil is a pointer moving over a graduated scale, and the instrument is calibrated in Maxwells—*i.e.*, line-turns. A search coil of a known number (N) of turns and a known area (A) is placed in the position in which the flux density is required. If the flux is present the whole time the act of placing the search coil in position effectively cuts the flux lines and so gives an indication on the fluxmeter. If it may be assumed that the flux is constant over the whole cross-section of the search coil, then the flux density is simply found as follows: The meter indicates line-turns = M; number of turns = N, so that number of lines (or flux) $= \frac{M}{N}$, and these lines occupy a cross-sectional area A, so that the flux density $B = \frac{M}{N \times A}$. The search coil for each position must be so constructed as to shape and size that the flux density will be sensibly uniform over its cross-section, but since the reading of the fluxmeter is practically independent of the resistance of the search coil up to about twenty times the meter resistance the construction of suitable search coils is not a difficult matter.

Actual Measurements of Leakage.

Several coils were made up for this investigation, some for the gap and some for the central cores of several specimens of field magnets. The leads from the coils must be carefully twisted together to ensure that there is no area to enclose lines from parts of the field not under investigation. The results of one series of measurements on a field magnet is shown in Fig. 4, the coil used in the air gap having an area of almost exactly 1 sq. cm. and twenty turns, while the other search coil was wound directly on the central core and in the centre before the field bobbin was slipped on. The field magnet was made of cast iron and the shape of the poles was approximately as shown in Fig. 2 with a gap of approximately 4 mm.

Fig. 4 shows several interesting points; first, that with the particular winding used it would not pay to use a greater field current than 9 amperes; secondly, that the flux density in the air gap is only 4,000 lines per square centimetre; thirdly, that under these conditions the flux density in the core is over 9,000 lines/cm.^{2}; and, fourthly, that leakage seems to increase after 9 amperes field current, suggesting that saturation is occurring in some part of the iron circuit other than the core itself—probably at the edge of the outer ring. Taking the field current of 9 amperes as being the most economical, it will be seen that over 60 per cent. of the total ampere turns go to produce leakage lines and that only about 40 per cent. are producing useful lines in the gap.

Since we are concerned with the flux density in the gap, we must fix that as high as would be thought practicable and design the rest accordingly. It would be desirable to obtain a flux density of 10,000 lines/cm.^{2} in the gap if possible, as this figure can certainly be obtained in dynamo work. If only 40 per

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cent. represents the useful proportion of ampere turns, it follows that with the design of magnet for which the curves of Fig. 4 were obtained the flux density in the core will have to be 23,000 lines/cm.^{2}—rather a high figure for even good steel, and quite impossible for cast iron (see Fig. 1).

On a basis of taking the *gap flux density* as our start, with the above-mentioned design we must add on 130 per cent. to allow for leakage. A test on another type of field magnet constructed of good steel with a 3 mm. gap gave the figure for the leakage as 60 per cent. approximately. This magnet had poles of the shape shown in Fig. 2. A type with poles shaped as in Fig. 3(a) of

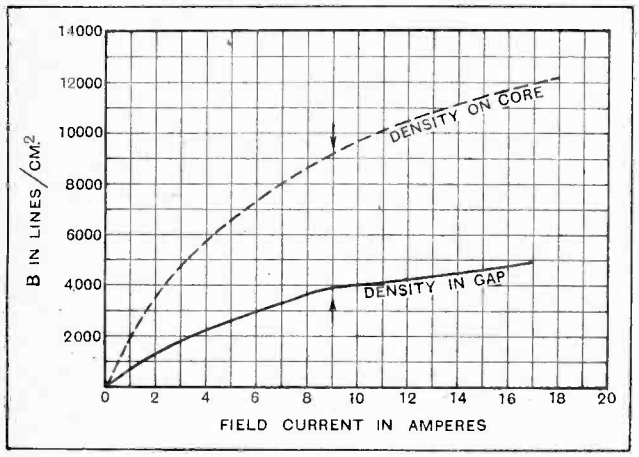

Fig. 4.—Relative flux densities across the gap and in the iron circuit thus revealing leakage.

steel gave a figure of 50 per cent. for leakage with a 3.2 mm. gap. When using a magnet system of the usual pot type we must therefore allow at least 50 per cent. for leakage flux, and preferably shape the poles as shown in Fig. 3(a), otherwise we must allow at least 60 per cent.

The procedure is now as follows. The dimensions of the air gap are given—say 3 mm. wide and 1 cm. deep with a *mean* diameter of 5 cms. and a mean flux density of 10,000 lines to the square centimetre is required.

The mean area of cross-section of the gap is $\pi \times 5 \times 1$ sq. cm., therefore the total flux in the gap equals flux density $\times$ area $= 10{,}000 \times 5\pi$ or 1.57×10^5 lines.

Allowing 60 per cent. for leakage, the flux in the metal part will be $1.6 \times 1.57 \times 10^5 = 2.5 \times 10^5$ lines.

Diameter of central core $= 5 - 0.3$ cm. $= 4.7$ cm.

$$\therefore \text{ Area of central core } = \frac{\pi}{4} \times 4.7^2 = 17 \text{ sq. cm.}$$

$$\therefore B \text{ in main part of core} = \frac{2.5 \times 10^5}{17} = 15{,}000 \text{ lines}$$

to the square centimetre.

With the ordinary field magnet construction the only other part where the flux density is likely to be unduly high is round the tip of the outer pole. The worst possible case is where the greater part of the leakage lines have returned quite close to the tip. Suppose 90 per cent. of the total flux is carried by a cross-section of 6 cm. diameter, and suppose the depth here is the same as the gap—1 cm.

Area $= \pi \times 6 \times 1$ sq. cm. Flux $= 0.9 \times 2.5 \times 10^5$ lines. $B = 12{,}000$ lines/cm.^{2}

If suitable thickness of metal is used, the rest of the field magnet will run at lower flux densities than these.

On regarding Fig. 1 it would appear desirable to use steel for the central core at any rate, even for the comparatively narrow gap of 3 mm., and even if the core is cut back and the outer pole shaped as in Fig. 3(a) it would be necessary to use steel for the central core and at least the outer pole tip (by pressing in a ring of steel) if not for the whole field magnet when a larger gap is desired.

Gap Width and Ampere Turns.

We are not yet in a position to determine accurately the ampere turns required for the complete magnet system, but we can now find a close approximation. We cannot do it accurately because we do not yet know the size of the casting; however, we can allow for a probable size of field magnet, find the number of ampere turns, and then see if a suitable winding will fit in the space provided. If we start with a casting rather larger than we are likely to require, we get an oversize figure for the ampere turns, but as the number for the metal part will be considerably less than the number required for the air gap, we can use this total number as a working basis.

For the air gap we have $B = H = \frac{4\pi}{10} \times$ amp. turns/cm.

$$\therefore \text{ Amp. turns} = \frac{10 \times B}{4\pi} \times \text{length of air gap}$$

$$= \frac{10 \times 10^4 \times 0.3}{4\pi} = 2{,}400 \text{ amp. turns.}$$

Suppose the central core requires	900
and the rest of the circuit	200
Total ampere turns	3,500

Having obtained the total number of ampere turns, it now remains to decide how to arrange them. This essentially depends, of course, on the type of power supply available for the field. If 240-volt D.C. mains are available, then a large number of turns and a small current are necessary, while if a 6-volt accumulator only is available fewer turns and larger current will be desirable. A point arises here which perhaps is not generally realised, and that is that the power consumed in maintaining the current is entirely dissipated as heat, and that energy is only stored up in the magnetic field at the moment of switching on while the current is growing to its full value.

In other words, the less the *resistance* of the field winding, the smaller the *power* consumed to maintain the required current. Further, the smaller the resistance of the winding the greater must be the cross-section of the wire, and hence the larger the pot to contain a given number of turns. The limit in smallness of power consumed (*i.e.*, efficiency of the magnet system) is obviously one of economics, but it is perhaps justifiable to say that where only a 6-volt accumulator is avail-

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able the power taken should not exceed about 12 watts, while with D.C. mains two or three times this power would not be objected to.

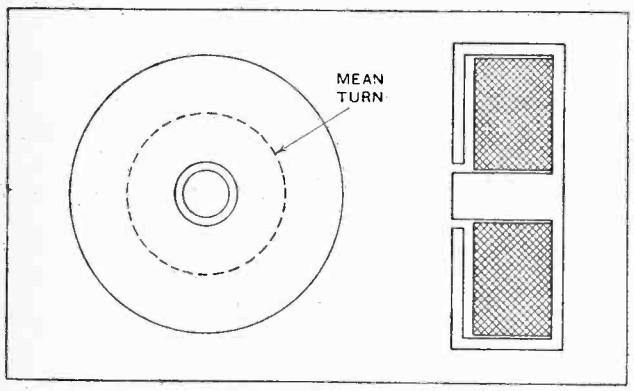

Fig. 5(a).—Here the mean turn diameter is necessarily large, producing a winding of higher resistance than that shown in 5(b).

Taking the case of the 6-volt winding, with a current limit of about 2 amperes, we must construct a winding of 1,750 turns to give us 3,500 ampere turns. The length of wire required depends on the length of the mean turn, since it equals this length times the number of turns.

Therefore it follows that for an efficient field magnet we must make the length of the mean turn as short as possible. If we do this by winding only a single layer of wire on the core, then the pot will have to be so long that the iron circuit will be very large indeed, so that the total resistance of the winding will probably be actually increased to make up for the extra ampere turns needed for the extra iron. What we must do, however, is to use a long, narrow winding as shown in Fig. 5(b) in preference to a short and fat winding (Fig. 5(a), an appropriate mean turn being about $2\frac{3}{4}$in. diameter.

In conclusion, then, for the pot type of electromagnet it is advisable to use cast or mild steel for at least the centre core, and preferably for the outer edge of the air gap as well; to use a long, thin, rather than a short

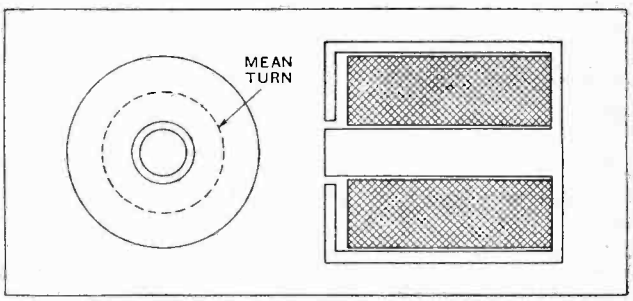

Fig. 5(b).—The turns in this case are accommodated around a core of reasonable length, thus producing a minimum mean turn resistance.

and fat, field winding; to shape the poles as shown in Fig. 3(a); to allow at least 50 per cent. for leakage flux, and if field watts are a consideration to employ the two- or three-thread method of suspension so as to be able to use a small gap.

MODES OF APPLYING REACTION.

The Advantages of the Modified Reinartz System.

DESPITE recent advances in high-frequency amplification, it is probably true to say that the vast majority of receivers in use to-day employ reaction as the chief aid to long-distance reception, for it is still quite common for the H.F. valve to be little better than a passenger. The consideration of the most convenient mode of applying reaction is therefore a matter of interest to a very large number of listeners.

The favourite method a year or two ago, when plug-in coils were in vogue, was to connect a reaction coil, which could be variably coupled to the aerial coil, directly in the plate circuit of the detector valve. Even though a geared coil-holder was employed, this method was never very satisfactory, the chief reason for this being that the proximity of the reaction coil upset the tuning to such a degree that extensive retuning was necessary after every alteration in reaction coupling. The interdependence of the two controls made the tuning-in of a distant station an unnecessarily troublesome process.

The Reinartz circuit offered an improvement in this direction, but in its original form in which the reaction coil was wound as a continuation of the tuning coil and the reaction condenser was connected between the end of this coil and the plate of the valve, another difficulty made its appearance. This was due to the fact that both sides of the reaction condenser were at a high-frequency potential relative to earth, so that hand-capacity effects were liable to be very marked. Metal panels and other forms of screening are not very helpful in this connection, because in any normal case the spindle of the condenser is metallically connected to the moving plates, and as the spindle has to project through the panel for control purposes the screening is necessarily imperfect. An exception must, of course, be made in favour of cases in which the spindle is made of insulating material or is insulated from the moving plates of the condenser, but the majority of condensers are not built in this way.

Later modifications of the Reinartz circuit have done away with this difficulty by connecting the reaction coil direct to the plate of the valve, and interposing the reaction condenser between this coil and earth, so that provided the moving plates of the latter are joined to earth, a metal-lined panel can be used to remove any lingering traces of hand-capacity effects.

If this type of circuit, which is perhaps the most satisfactory of all, be adopted, it is found that the tuning can be made sufficiently independent of the reaction control to make adjustment of the receiver easy, though it is usual for the setting of the reaction condenser to vary widely over the different parts of the tuning range. This, however, is not found to make tuning difficult, and so is of but little practical importance.

It is found in practice that the greatest degree of independence between the controls is attained when the reaction condenser is not too small. It is therefore easier to handle a receiver in which the reaction coil is small, or loosely coupled to the tuned circuit, but is fed through a condenser of maximum capacity, perhaps 0.0003 or 0.0005 mfd., than one in which the same degree of reaction is obtained by the use of quite a small condenser in conjunction with a large coil.

The remarks here made are equally applicable to receivers in which a stage of high-frequency amplification precedes the detector, even although in this case critical reaction should be required less frequently.

A. L. M. S.

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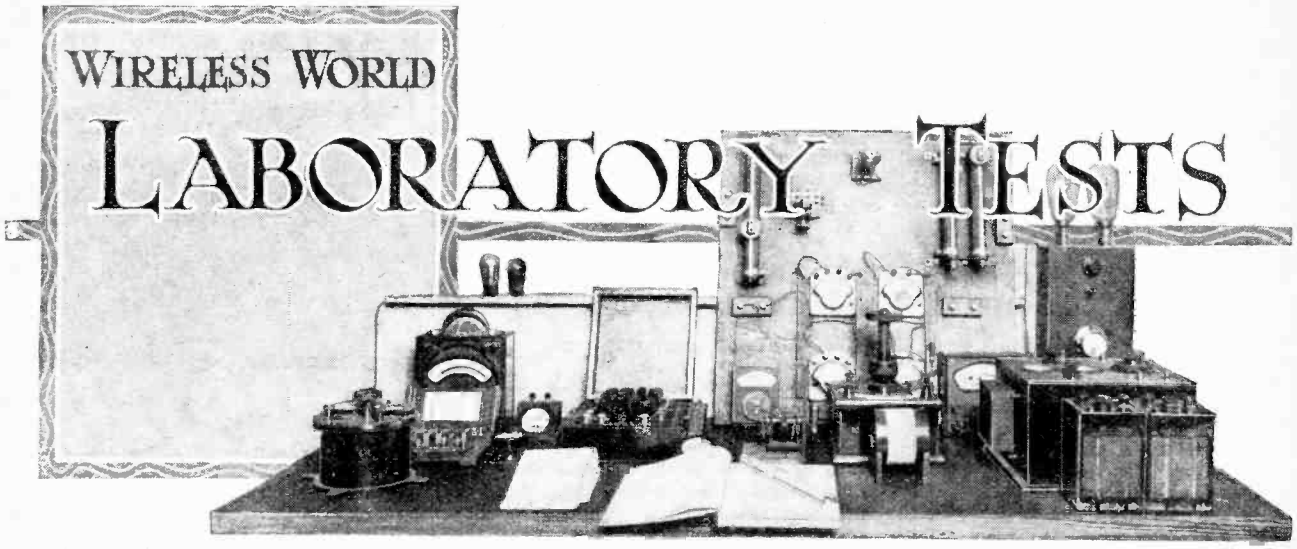

A Review of Recent Products of the Manufacturers.

H.T. L.T. BATTERY ELIMINATOR.

For use with A.C. mains, Electrical Units, Ltd., 104, North Street, Edgware Road, London, N.W.8, have now introduced a complete battery eliminator for supplying both H.T. and filament heating current. Although no new principle is involved in the design of the apparatus it has been constructed in a manner which effectively permits of its successful use by removing the difficulties associated with maintaining H.T. and L.T. batteries.

For the purpose of supply a totally enclosed full-wave rectifying valve gives

A new type of A.C. eliminator giving L.T. as well as H.T. supply.

a maximum of 120 volts, though the provision of three terminals provides a range of anode voltages to suit the several valves of a receiving set. These potentials are obtained in a manner which arrests incipient oscillation by preventing the load taken by one of the valves reacting on another. The output is liberal and there is no appreciable falling off of potential when operating a moderate power valve such as a DE5A or PM256.

As regards L.T. supply a small full-wave arc rectifying valve is shunted with an accumulator to maintain a constant output voltage. Access could not be readily gained to the interior of the apparatus though it is assumed that some auxiliary equipment is used in connection with the L.T. supply for the purpose of modifying the voltage rise created in the process of rectification.

The convenience of this outfit as a battery substitute recommends it although a very slight hum may be produced with certain circuit system, arising from small fluctuations in the L.T. supply reaching the grid circuits.

A double section 4-volt unspillable accumulator is included in the outfit and suitably protected so that acid fumes cannot pass to the rectifying smoothing equipment. A good feature is the provision of a voltmeter for verifying the output potentials developed on both H.T. and L.T. portions of the eliminator.

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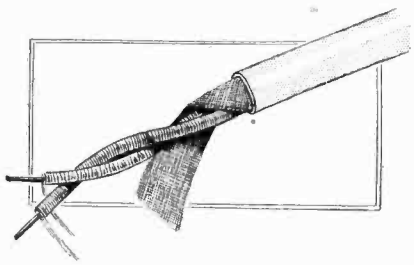
EXTENSION WIRE.

Messrs. A. Taylor & Son, Saltgate, Beccles, supply a grade of twin lead-covered cable which is intended for loud-speaker extension leads. The wires are of No. 22 S.W.G., and are enamelled and double-cotton covered. After treating with paraffin wax they are wrapped with cloth tape and lead-covered, the overall finished diameter being $\frac{3}{16}$ in. The cable may therefore be regarded as high-grade twin bell wire with a protective lead sheath, and should be quite impervious to moisture.



Lead-covered twin extension cable supplied by Messrs. A. Taylor & Son.

Measurement shows the capacity to be 23 micro-mfd. per foot, with the sheath free, and 37 micro-mfd. with the sheath earthed and joined to one wire.

The price per yard is 4½d., and a 110 yard coil costs £1 13s.

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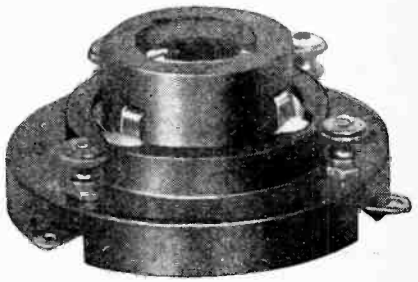
WEARITE VALVEHOLDER.

The latest Wearite valveholder combines the advantages both of the spring mounted and rubber-mounted anti-microphonic types; the holder is spring-



Wearite anti-microphonic valveholder.

mounted, but the movement is damped by a ring of sponge rubber inserted between the movable part of the moulding and the fixed base ring. Each valve socket with its coil spring and soldering lug is cut from one piece of spring metal, and there is thus no possibility of discontinuity. Terminals are provided as an alternative to the soldered connections.

This component should be ideal for port-

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able sets, for without being too rigid the movement is restricted and the valve is not allowed enough lateral movement to suffer damage by impact with adjacent components. The price is 2s. 6d.

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CONDENSER EXTENSION HANDLE.

If hand-capacity in a short-wave set cannot be eliminated by correct layout and connection of the tuning condensers an

Bulgin short-wave condenser extension handle.

extension handle must be used to space the condenser some distance away from the slow motion dial. Such an extension rod is made by Messrs. A. F. Bulgin & Co., 9, 10, 11, Cursitor Street, London, E.C.4, and costs 2s. 3d.

It is 6in. in length and is designed to fit ¼in. dials and spindles. Each extension rod is supplied with a ¼in. bush and one hole fixing nut and special sleeves may be obtained for fitting to $\frac{3}{16}$in. or 2BA condenser spindles.

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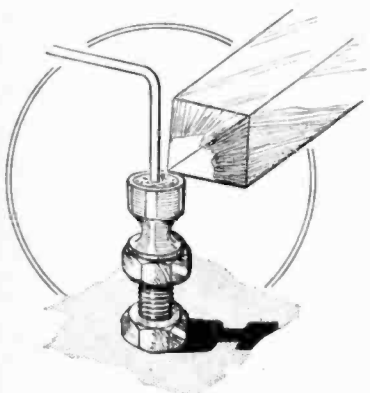
SOLDERCUPS.

To the home constructor who feels that his ability with the soldering iron is not all that it might be, these specially prepared soldering cups should be of the greatest assistance. They are made to fit 2, 4, 5 and 6 B.A. screws, and although primarily intended for fixing to terminal screws behind the panel they are easily adaptable for other purposes. It will be seen from the sketch that the cup is



Soldercup fitted to terminal at back of panel.

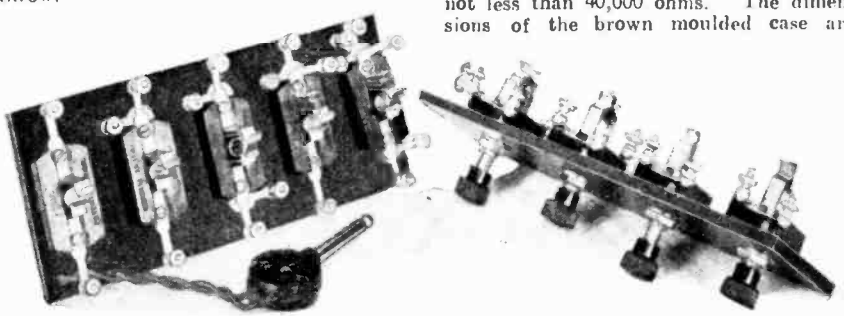
turned in one piece with the nut out of solid hexagon brass rod. Each cup is filled with solder and all that is required when fixing the wire is to press the end of the wire on top of the solder and apply heat from the iron simultaneously to the cup and the wire. A little flux may be added if desired, but this is not really necessary if tinned copper wire is used.

The Soldercups cost 1s. 6d. per dozen, and are obtainable from Messrs. F. W. Lumb, 28, Wilson Street, Monkwearmouth, Sunderland.

"LOTUS" JACKS AND SWITCHES.

All "Lotus" jacks and switches made by Messrs. Garnett, Whiteley & Co., Ltd., Broadgreen Road, Liverpool, are now fitted with terminals in place of the conventional soldering tags. The springs are of nickel silver and the contacts themselves are pure silver. Five types of jacks are available as follows: Single circuit open, single circuit closed, double circuit, filament single control, and filament double control. A special plug is made to fit these jacks, and is provided with a special device for gripping the terminal tags or flex leads. This takes the form of a cam terminal which grips the lead after insertion merely by giving the terminal screw head half a turn with the screw driver.

Four switches of the jack type are made as follows: Single-pole—single-throw; single-pole—double-throw: double-pole—single-throw, and double-pole—double-throw.



"Lotus" jacks and switches.

Both jacks and switches are fitted with paxolin spacers, and the terminals are arranged with fantail spacing to facilitate the connection of leads. The space occupied behind the panel does not exceed 1½ in.

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"TIME SAVER" STATION LOG.

A station log working on the roller blind principle is something of a novelty and is certain to appeal to those listeners who take pride in the possession of unusual gadgets and accessories. Known as the "Time Saver," it is made by Messrs. Adsigns, Ltd., 265, Strand, London, W.C.2, and costs 2s. 6d. The spring roller carries a flexible linen chart 3in. wide and 10in. in length, upon which is printed a list of 60 important broadcasting stations in ascending order of wavelengths from 225 to 2,650 metres. The present powers and wavelengths of these stations are indicated, and space is allowed on the right-hand side for three dial readings for each station. At the top of the list nine blank spaces are left for the insertion of additional stations.

The chart and roller are contained in a neat black metal box which may be attached to the wall or even the receiver itself. The "Time Saver" is decidedly neater and more convenient than the

"Time Saver" station log.

usual calibration chart and is not so easily lost.

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TRIX R.C.C. UNIT.

This neat and compact unit is made in two types, "A" for use after medium impedance valves, and "B" for use after special R.C. valves having impedances not less than 40,000 ohms. The dimensions of the brown moulded case are $1\frac{5}{8}$in. × $1\frac{1}{4}$in. × $\frac{7}{8}$in.; it would be difficult to design a more compact unit than this or one better suited for incorporation in a portable receiver.

Anode resistance, grid leak and coupling condenser values were measured in each case, and worked out as follows:—

The Trix R.C.C. unit occupies the minimum of space.

	Anode resistance.	Grid lead.	Condenser.
Type A	120,000 ohms	1 megohm.	0.008 mfd.
Type B	1 megohm.	5 megohms.	0.001 mfd.

Best ruby mica is used in the coupling condensers, and the resistances and condensers are embedded in paraffin wax.

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By Our Special Correspondent.

Football Commentaries.—A Flourishing Finish.—The Air Pageant.—Unnoticed Failures.—The Educational Conference.

The Football "Ban."

Any mention of the word "ban" arouses instant publicity, but I understand that the recommendation of some of the clubs in the Football League that broadcast commentaries on their matches should be stopped will have only a limited application. The League, as a corporate body, has not banned broadcasting. Some minor clubs have undoubtedly found that when a big match is being played in another part of the country the fact that it is being broadcast may affect their gate money, as a certain percentage of possible spectators of the minor event may prefer to listen to the description of the more important match. This was the complaint lodged particularly against broadcasting in connection with the semi-finals and Cup final last season, where persons who might otherwise have been spectators at matches in the north were listening to the progress of events in the south and *vice versâ*.

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How to End a Programme.

The suggestion made in these notes on June 6th that programmes should end with a flourish is, I hear, to be adopted on certain evenings. Starting on the second Friday of next month, a weekly "surprise feature" will constitute an innovation as a wind-up to the Friday evening programmes. It will last only a quarter of an hour, finishing at 11 p.m., and may consist of a turn by a star artist or the last-minute insertion of a talk. It is probable that in many cases the arrangements will not be made until about an hour before the time fixed, so that there will be no opportunity for a preliminary announcement. Hence the intention of Savoy Hill to call it a "surprise feature."

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American Programmes Given a Rest.

The B.B.C. will not attempt to relay any further American programmes, at all events until next winter, and I am inclined to echo the words of an esteemed contemporary, "For this relief, much thanks!" he continues, "American programmes are of nothing like the quality listeners to British and Continental programmes are in the habit of receiving, and atmospherics, fading and other evils serve to make them, as a rule, wholly vile when served up on this side."

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5SW Perseveres.

5SW will still go plugging along, and the B.B.C. gets reports of this station from all parts of the world, but nothing done by 5SW will constitute a regular service this side of Christmas. There is also no immediate prospect of this short-wave station adopting a regular wavelength other than 24 metres, but it is contemplated that experimental variations may be necessary in accordance with the plan to be adopted by the National Broadcasting Co. on the American side of trying different wavelengths at different periods in order to ascertain whether there is any guarantee of successful and dependable reception with constant changes in atmospheric conditions.

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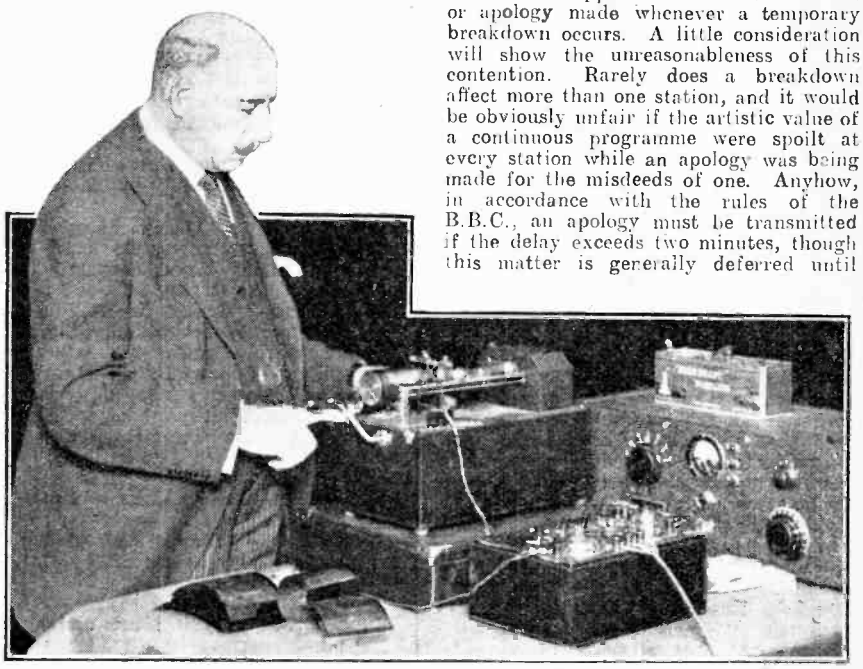
Breakdowns and Stoppages.

Noticeable breakdowns are comparatively rare, but when these do occur complaints are made that the programme is continued, artists and orchestra go on, and listeners have to pick them up afresh when their station comes into action again. Many urge that the programme should be stopped and an announcement or apology made whenever a temporary breakdown occurs. A little consideration will show the unreasonableness of this contention. Rarely does a breakdown affect more than one station, and it would be obviously unfair if the artistic value of a continuous programme were spoilt at every station while an apology was being made for the misdeeds of one. Anyhow, in accordance with the rules of the B.B.C., an apology must be transmitted if the delay exceeds two minutes, though this matter is generally deferred until



PICTURE BROADCASTING. Otho Fulton who promises a picture transmitting service by October next, demonstrating his complete picture receiving equipment.

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the end of a separate item. Daventry Experimental comes under a different category. Being experimental, it suffers more than other stations from breakdowns and apologies, if given, might possibly, take up more time than they would be worth.

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A Quick Change.

Many of the breakdowns pass unnoticed by listeners owing to the efficiency of the engineering staff. I learn that while the description of the Amateur Athletic sports was being broadcast from Cambridge the transmitter in Oxford Street was put out of action for 40 minutes by the failure of the power supply from the mains, but the programme was at once switched over to the emergency transmitter in Marconi House almost without a break.

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The Education Scheme.

Despite the strong differences of opinion which exist anent the B.B.C.'s Educational Scheme, the subject of adult education is being taken very seriously at Savoy Hill. A remarkable response is noticeable, we are told, as the result of the endeavour of Mr. Lambert to awaken the interest of educational bodies in the Hadow recommendations. The issue of "New Ventures in Broadcasting," in which the report is summarised, is largely responsible for the fact that over 100 different organisations whose interests are concerned with education will be represented at the London Conference to be held at the Friends' Meeting House, Euston Road, on Friday, June 22nd. Subjects so widely diverse as eugenics, architecture and the co-operative movement will be discussed, and it is expected that representatives of the Railway Clerks' Union, the Transport and General Workers and the Union of Post Office Workers will be represented, all showing an eagerness for real education as distinct from a mere mechanical absorption of facts. The B.B.C. seems to have a finger ready for every pie!

This London conference is one of a series being held to call attention to broadcasting's part in education. The first and second were held in Edinburgh and Southampton respectively, and at least twelve others will be held in different parts of the country.

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Martial Music.

A B.B.C. engineer recently underwent a test in identifying certain instruments heard through the loud speaker. He insisted that a particular instrument was either a large concertina or a harmonium. This instrument will be heard by Glasgow listeners on June 30th, and it is extremely unlikely that their guesses as to what it is that William Thomson is playing will be any more accurate than the engineer's.

To help listeners a little, it may be stated that it is neither a concertina nor a harmonium, but a small instrument played with the mouth. No other instrument grows so much in power when heard by wireless.

And More Ancient Instruments.

The Société des Instruments Anciens (Consort of Ancient Instruments) will give a novel entertainment from 5GB on July 1st and from 2LO on July 2nd.

Their instruments include a treble viol, which is not unlike the modern violin in shape, though somewhat larger; a viola d'amore, which has from seven to fourteen metal strings; the viola da gamba, a viol closely resembling the modern 'cello in compass; a bass viol, which was used throughout Europe as early as the 11th century; and a harpsichord, which is rather like the modern grand piano.

FUTURE FEATURES.

London and Daventry (5XX).

JUNE 24TH.—Orchestral Concert.

JUNE 25TH.—The British Women's Symphony Orchestra, conducted by Dr. Malcolm Sargent, with an introductory talk by Dame Ethel Smythe.

JUNE 26TH.—A Military Band Concert.

JUNE 27TH.—"Widow Engaging," a play by Lady Forbes-Robertson.

JUNE 29TH.—An Open-air Programme.

JUNE 30TH.—Light Orchestral Concert.

Daventry Experimental (5GB).

JUNE 24TH.—Chamber Music.

JUNE 25TH.—"Progress and the Builder," a play by Edwin Lewis.

JUNE 27TH. — Orchestral Programme.

JUNE 28TH.—A Military Band Concert.

JUNE 29TH.—Symphony Concert.

JUNE 30TH.—Variety Programme.

Cardiff.

JUNE 26TH.—String Orchestral Programme by the National Orchestra of Wales.

Manchester.

JUNE 25TH.—Folk Songs of Yorkshire.

JUNE 28TH.—"The True History of Henry VIII," by L. du Garde Peach.

JUNE 30TH.—On with the Show of 1928, a concert party entertainment by Ernest Longstaffe.

Newcastle.

JUNE 25TH.—"Canny Cracks," a summery revuesical entertainment in five gusts.

JUNE 29TH.—Concert by the Municipal Orchestra relayed from the Spa, Whitby.

JUNE 30TH.—An Anniversary Programme.

Glasgow.

JUNE 25TH.—Irish Variety Programme.

JUNE 29TH.—"Stewart of Ardbeg," a play in one act by C. Stewart Black.

Aberdeen.

JUNE 28TH.—Scottish Music and a play.

Belfast.

JUNE 25TH.—An Irish Programme.

Of Interest to Journalists.

Gertrude Elliott (Lady Forbes-Robertson) will broadcast from 2LO and 5XX on June 27th in a one-act comedy by Beatrice Forbes-Robertson, the well-known actress. Miss Elliott will take the part of Bessie Chilcote, the widow in the play, which is entitled "Widow Engaging," and might equally well have been called "The Sub-Editor's Revenge."

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Air Force Display.

A description of the events in the Air Force Display at Hendon on June 30th will be given by Colonel the Master of Sempill and Flight-Lieutenant W. Helmore, starting at about 4.55 p.m. The items to be described will include a low bombing attack, individual aerobatics, an air battle, night bombers in flight, and an attack on an oil refinery. Flight-Lieut. Amery and his bandsmen will be absent for the first time since the Air Pageant was started, as he is setting out on a three months' tour of Canada and the United States and gave his parting broadcast performance last Saturday.

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"Uncle Mac" Returns Thanks.

Mr. Derek McCulloch, who, it will be remembered, so ably described the Air Pageant last year, is making good progress after his 21st operation, which the staff of St. Thomas's Hospital hope will prove eminently successful. He was very badly wounded in the war, but flatly refused to succumb to his injuries. It was considered almost necessary to amputate his left arm, but Mr. Max Page, the chief consulting surgeon, undertook the task of grafting fresh muscles on his shoulder, as there was a "sporting chance" of giving him back the use of the arm. I am delighted to learn that the operation is considered successful in every way, and the patient wishes to express his gratitude to the many friends and readers of *The Wireless World* who have practically kept his room filled with flowers and fruit during his six weeks' painful sojourn in St. Thomas's Nursing Home.

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The Inseparables.

Arthur Prince—"prince of ventriloquists"—and Jim are broadcasting from 2LO and 5XX on July 3rd and 7th. Some listeners asked, after the last broadcast by these artists, if Arthur Prince actually took Jim to the studio with him for their turns. "It didn't seem necessary," said one enquirer, "as the audience would not be able to see if Jim was there or not." The sceptics are, however, assured that Arthur Prince and Jim gave their joint act before the "mike" exactly as they do on the stage.

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League of Nations Service.

The League of Nations service in York Minster on July 1st will be relayed to 2LO. The service commemorates the signing of the League Covenant. The Bishop of Winchester will give the address.

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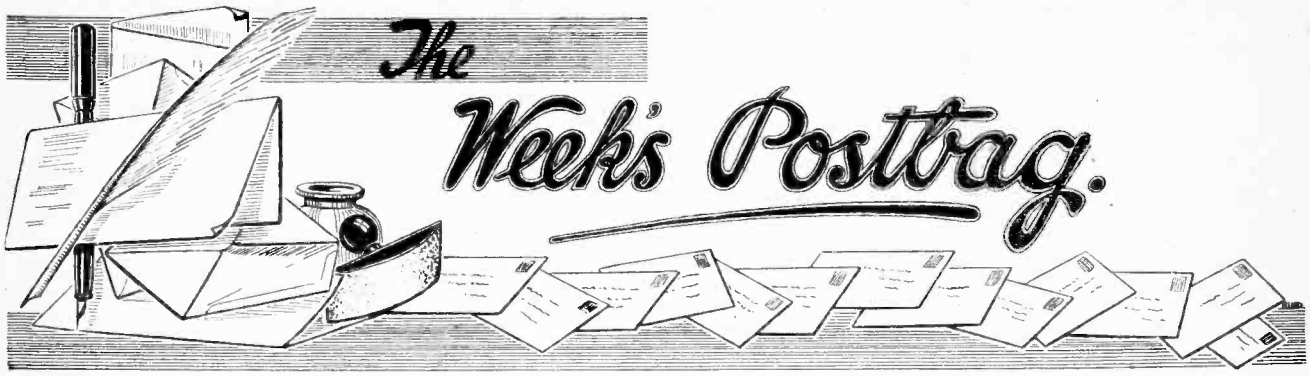


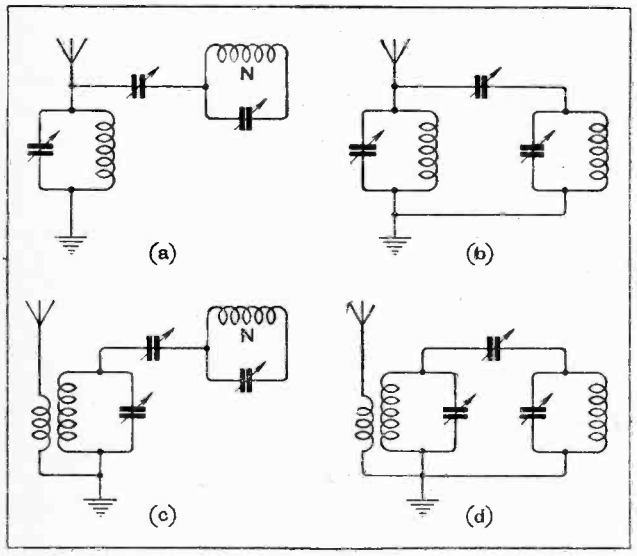
The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

CAPACITY-CONTROLLED LOOSE-COUPLING.

Sir,—I have read H. J. W.'s article on "Capacity-controlled Loose-coupling" [1] with great interest, but I have been left with a doubt in my mind as to whether he has considered true electrostatic coupling or Sir Oliver Lodge's "N" circuit principle.

H. J. W.'s preliminary discourse on direct and loose magnetic coupling is perfectly sound, but I would like to point out that, in Figs. 8a and 8b, he has indicated "N" circuits with an extremely weak electrostatic *connection*. Not unless filament or phones, respectively, are earthed, will he get electrostatic *coupling*. The following diagrams should make my point clear, *a* and *c* being "N" coupled circuits and *b* and *d* electrostatic.

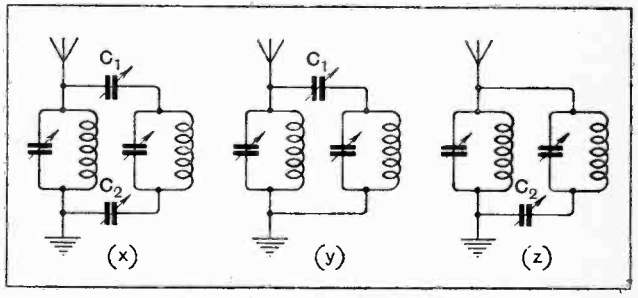


It is assumed, of course, that the coils are so arranged that there is no magnetic coupling, an assumption made in the article itself.

Sir Oliver Lodge patented electrostatic coupling in 1912, and three of his fundamental circuits are given at *x*, *y*, and *z*.

Considering *x*, it will be seen that, as either one of the condensers C_1 or C_2 is reduced in value, the coupling between the circuits is reduced. The amount of "connection" depends on both condensers, but the amount of coupling depends on the smaller. In *y* and *z* there is direct "connection" in one arm, and C_1 or C_2 respectively, as the case may be, regulates the coupling.

Later Sir Oliver found that a single "connection" only was sufficient for the transference of energy from the "collector" circuit to the "secondary" or "N" circuit, thus effecting a marked advance by *eliminating coupling*. H. J. W.'s main



point seems to be to leave the oscillatory circuit controlling the grid as free as possible, corroborating the theory of the "N" circuit principle The amount of energy transferred can be regulated by a condenser in the single connection, and H. J. W. uses a micro-condenser to achieve extreme selectivity.

The "N" circuits I have given must not be confused with the choke aerial "N" circuit. In the latter the aerial circuit is untuned, but the "N" circuit principle remains unchanged

Croydon. M. M. MELINSKY.

THE "CONTROL" ROOM.

Sir,—It seems to me to be time to make a vigorous protest against a feature of the present engineering policy of the B.B.C. I refer to "control." On the occasions (all too seldom) when we are given some decent orchestral music it is nearly always so mangled before it leaves the control room as to take all real pleasure out of listening. On *pp.* passages the wick is turned up and one has the feeling of being seated in the midst of the orchestra; then as a climax approaches it is as though one were taken up and whisked away right to the back of an extremely large hall. The result would be laughable were it not so exasperating. The excuse for this mutilation of the composer's and conductor's intentions is that it enables the purists on the engineering side to say that the transmission is always perfect (i.e., free from overloading). But how can a transmission claim any approach to perfection when musical balance is utterly lost?

There would appear to be two remedies. Either (*a*) let the average modulation remain as at present and let us have some overloading on the peaks, or (*b*) drop the general level of modulation. Either would be preferable to the present method. I am quite aware that our theorists will be after

[1] *The Wireless World*, May 9th, 1928.

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my blood with regard to (*a*) but I venture to say that not many of our receivers are capable of dealing with peak values without some overload. Certainly mine is not, in spite of 200 volts on the anodes of two 2,500 ohm valves in parallel. All the same, I would prefer to see (*b*) adopted. Why not? After all, if we can get the right stuff from the transmitting aerial it is easy enough to supply the amplification. In the days of crystal reception and wretched loud speakers the only thing that mattered in the transmission was plenty of power. But nowadays it should be a secondary consideration.

The ideal would appear to be an absolutely constant amplification from microphone to aerial. We should then be spared the "talk" that comes out of the cone at about the strength of a brass band. I daresay this would be very difficult to achieve, but the B.B.C. does not seem to *aim* at it. After all, a man goes about with a pair of ears of roughly constant sensitivity, and, provided he can choose his own place, can listen very successfully to any sound that is worth his attention. Certainly he would seldom appreciate being moved rapidly towards or away from the source of sound in bewildering succession.

I feel very strongly on this subject and that must be my excuse for the length of this letter. It would be interesting to hear your readers' views. G. B. HARGREAVES.

Hull.

GRAMOPHONE PICK-UPS.

Sir,—Being very much interested in the electrical reproduction of gramophone records by means of a pick-up, I feel that I must say a few words upon the subject.

Having obtained poor results, so far (as compared with broadcast reception) using one of the best makes of pick-up, I agree with "C. H. S." in the issue of May 30th.

With reference to the rigidity of pick-ups, also the mention of the H.M.V. Co.'s test with their reproducer, do they (the H.M.V. Co.) refer to their electrical pick-up described in *The Wireless World* some weeks ago? Perhaps "C. H. S." would inform us. If so can they be purchased? Ordinary soundboxes can. Also the Brunswick Co.'s "Panotrope" was described in *The Wireless World* for January 26th, 1927. This was spoken of very highly. If apparatus manufactured by such experienced companies could be purchased separately, then I think there would be little to complain of.

The whole subject is one which has, I think, a very great future before it, and the sooner there are components available on the market the better. Other wireless components have been improved wonderfully during the last two years or so, therefore it is not beyond the makers, surely. W. KEYLOCK.

New Cross, S.E.14.

"THE MAINS DANGER."

Sir,—I would like to correct an error which has crept into your editorial of May 30th. You say "Inconvenience will be caused by stipulating that metal frames shall be earth-connected for the prevention of shock, *particularly as such a precaution is not demanded in respect of other household electric fittings.*" Home Office regulations state that, where an electrical fitting or consuming device *is used within reach of* any water pipe, gas pipe, or any metal fitting which is at earth potential the fittings must be insulated against shock, or if not possible as in heating devices they must then have the case or frame connected to earth. This is the general practice amongst electrical engineers and contractors. E. BURNS.

Manchester.

TELEVISION.

Sir,—I do not often read Editorials, but your remarks in your issue of February 29th I read with great interest. I think you have sounded a note which should have its effect in the better enlightenment of thousands of people who have read the Press reports upon the development of television. Briefly summed up, what you have written is sound common sense, and I commend it to all who read it. A. W. WATT,

Sydney. Editor, "Wireless Weekly" and "Radio."

DISTORTION ON DISTANT RECEPTION.

Sir,—The curious form of distortion accompanying the London transmission after dark when received at a distance exceeding fifty miles or so was very widely commented on in this district as far back as September, 1927.

As a result of the numerous letters which reached us on the subject we wrote to the chief engineer who, through one of his assistants, replied as follows:—

"We agree with the remarks which you make to the effect that a station working on an exclusive frequency should be free from heterodyne interference, even at long ranges. As far as possible we endeavour to keep all our stations which are on exclusive frequencies free from heterodyne interference, and any complaints which we receive are investigated, and if necessary reported to the International Bureau.

"We have, however, found in practice that at ranges of over 30 miles the signal strength from our present main stations, with the exception, of course, of 5XX and 5GB, is so weak that it is at the mercy of a heavy background such as atmospherics, interference by electrical machinery, morse and in some instances background from a neighbouring powerful foreign transmitter which is working on the adjacent frequency. It is for this reason that we do not advise listeners to listen to our medium frequency main stations if they lie outside the radius of 30 miles.

"We believe this policy to be the fairest one, as in some instances it saves listeners the expense of purchasing a sensitive receiver which will be of little real musical value to them . . ."

This letter is dated September 27th, 1927, and, as listeners know, conditions remain unchanged.

LEONARD L. ADCOCK,
Deputy Editor, "Leicester Mercury."

SPARK INTERFERENCE

Sir,—As an enthusiast and one who realises what potentialities the marvel of up-to-date radio holds in store as an incomparable source of healthy entertainment as well as serving more useful and beneficial interests in other spheres of life, I heartily associate myself with the "Unsatisfied" writer of the letter in your issue of May 9th.

It always puzzles me how matters are allowed to drift in this respect, and the only explanation is probably that the various commercial interests are so powerful and the authorities, through the Post Office and Board of Trade, so much associated with the nuisance, that it is hard for the opposition, although of an immense weight, to have its only too legitimate rights defended.

Of course, we all agree and recognise the vital necessity of spark transmissions in case of distress, but it seems that with the present-day achievements of our engineers' apparatus for dual purposes, viz., for spark in exceptional cases and more harmless signals for ordinary use, may be installed.

To this end, and in order to argue in a more constructional manner, it would be suggested, for instance, that a proportion of the licence money might be applied to help shipping companies enjoying a lesser degree of prosperity to bring their apparatus up to the present-day standard of transmission.[1]

Anyhow, such a procedure does not seem to be so unreasonable if one considers that occasionally even programmes from 5GB may absolutely be spoiled in London by a powerful spark transmission, so that the money paid in such instances to artists, etc., is sheer waste. The French Marine Minister promised some time ago that it would be only a matter of a few months until the French coastal wireless stations would be equipped with the continuous wave system, which in my experience has taken place mostly in the vicinity of 200-300 metres. But this improvement appears now to have encouraged them and others to make more and more use of this modern means of communication and to look upon the encroachment into the waveband of 200-600 as harmless. The consequences may be judged any evening. ERNEST FREEDLEY.

Hampstead, N.W.3.

[1] [Such a suggestion would probably meet with the approval of listeners, who would prefer that the balance of their licence fees should be applied to this rather than an unknown purpose.—ED.]

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READERS' PROBLEMS

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

An Overloaded Detector.

I should be glad of your help with regard to the following difficulty encountered in the operation of my "Regional Receiver."

When using the optional aperiodic aerial coupling the two dials are almost exactly in step over the major part of the tuning scale, and distant stations are received without any unusual effect. However, when I tune to the local transmitter (about 1½ miles away) the station is only received free of distortion at points on the grid tuning condenser on either side of the position corresponding to resonance; when both circuits are in tune signals are weak and badly distorted. The difficulty is overcome by increasing the H.F. grid bias to 6 volts, but this destroys sensitivity on distant transmissions. F. W. W.

If you have a moderately effective aerial-earth system it is quite understandable that your detector valve would be completely overloaded when both circuits are tuned to the wavelength of the local station. The set in question gives a high degree of H.F. magnification, and it is not unlikely that the voltage between the detector grid and filament is three or four times greater than that with which the valve can deal adequately.

You might use a valve of much lower magnification factor and impedance than that usually recommended for this circuit; if you do so the bias supplied to its grid may be suitably increased, with the result that the permissible H.F. input will be much greater. However, this change will reduce sensitivity, and perhaps your best course is to detune the grid circuit of the H.F. valve.

○○○○

A Self-starter.

I have a relay which experiment shows is sufficiently sensitive to operate on the anode current passed by the detector valve of my receiver (Det.-2 L.F. with anode bend rectification). It occurs to me that this could be arranged to switch on the receiver automatically when broadcasting from the local station commences. If you think the idea is sound, will you please give me the connections? R. L. V.

Your scheme should be quite practicable, assuming that the relay is to close its contacts on the detector anode current which is normally passed *when no signals are being received*, or that it could be made to comply with this condition by suitable adjustment; at the same time, it should operate on the current which will flow when signals are being received. As you are probably aware, the effect of signal voltages on the detector grid is to reduce its mean negative voltage, and thus to increase anode current.

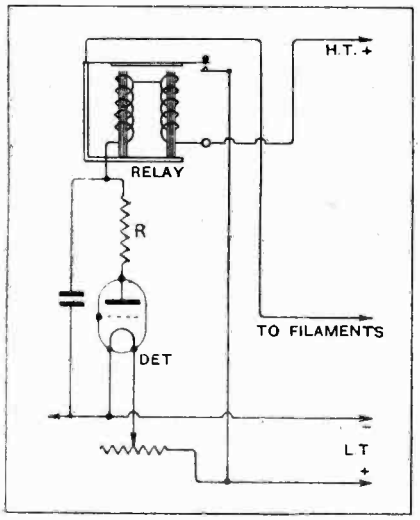

Fig. 1.—A sensitive relay arranged to switch on the receiver when the local station commences to operate.

The connections to the relay are given in Fig. 1, in which R is the resistance which couples the detector to the L.F. amplifier. The lead marked "to filaments" is joined to the positive filament terminals of the L.F. valve holders, the negative sides of which will be connected to the common negative bus bar.

The effect of an incoming signal will, of course, be to close the relay and to switch on the set. If the relay shows signs of sticking, you must interpose a second, of a less sensitive pattern.

You will no doubt realise that the detector valve filament must be glowing continuously.

○○○○

Connecting a Double Choke.

Is it possible to use a double-wound L.F. choke in a circuit in which a centre tapping is called for? If so, will you advise me as to the correct connections? The particular choke in question has four terminals, in order that the two sections may be connected either in series or in parallel. T. W. R.

Yes, chokes of this type are quite suitable for your purpose; as the separate windings of these components are usually similar. You should adopt the series connection as given by the makers; the junction between the sections will be the centre point.

○○○○

Adding H.F. Amplification.

Do you recommend me to attempt to add a second H.F. amplifying stage to the B.B.C. "Quality Four" which you described some time ago? If the idea is practicable, I should welcome some hints as to how it may be put into practice. V. J. N.

We seldom recommend the addition of an extra H.F. stage to any receiver unless it is specifically designed with this object in view. It is certainly not applicable with advantage to the receiver in question, as its present H.F. stage is unneutralised

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RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

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"1-v-2."

I am a new recruit to wireless, and am puzzled by what are to me mystic symbols, such as "1-v-2" and "0-v-1" applied to wireless receivers. I gather that these refer to some method of circuit classification, and should be glad if you would explain it. T. B.

As you surmise, these symbols relate to a method of classification, which was published in *The Wireless World* at the time when receiving valves came into general use. The initial figure refers to the number of high frequency amplifiers, and the letter to the detector; v for valve, and c for crystal. The last figure refers to the number of L.F. stages. Thus a set with two stages of H.F. amplification, a valve detector, and one L.F. magnifier, would be referred to as 2-v-1, and an H.F.-crystal combination as 1-c-0.

The system, which is reminiscent of the method of classifying locomotive engines, has never been universally adopted, possibly because it is not easily applicable to reflex or superheterodyne receivers.

o o o o

Reversed Anode Current.

While conducting insulation tests of my receiver I encountered a curious effect which perhaps you can elucidate. By accident the H.T. battery connections were reversed when a sensitive galvanometer was connected in series with the anode circuit of one of the valves, the filament of which was glowing, and I noticed that a small current in the reverse direction was indicated. I have always understood that no current could flow in a valve with a negative plate, and should be glad to know if the fact that this current was actually observed would indicate that anything was wrong. F. W. R.

Assuming that insulation throughout is not at fault, it seems quite possible that your valve is soft, as under certain operating conditions it is quite possible that a reversed anode current would flow in very much the same manner as a reversed grid current, which is the indication of softness.

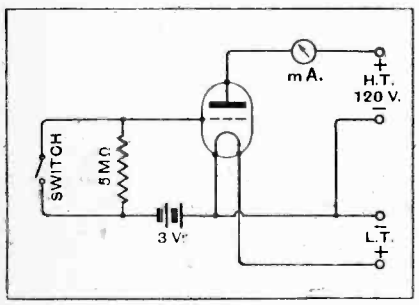

Fig. 2.—Testing valves for "softness."

We suggest that you apply the test described in the issue of April 11th. To do this, the valve should be connected in the circuit shown in Fig. 2. The anode current shown by the galvanometer should be read with the switch across the grid leak in the closed position; then open the switch and observe if there is an appreciable change in anode current. If there is you can rest assured that the valve is soft.

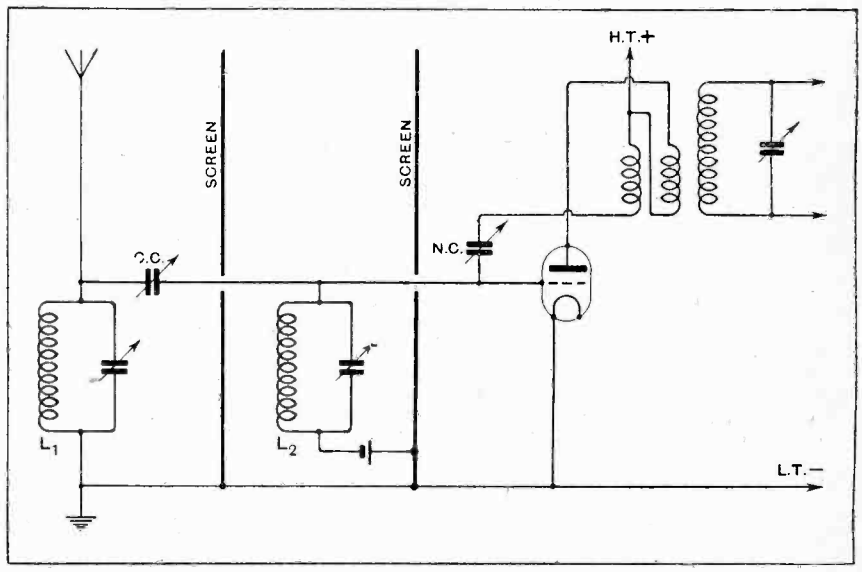

Fig. 3.—A capacity-coupled aerial circuit.

A Capacity Coupled Aerial.

Is it possible to apply the general idea of "The Wireless World Selectivity Unit" to a coupled aerial receiver using ordinary plug-in coils? If so, I propose to include it in an ordinary H.F.-det.-2L.F. receiver which I am building, and should be obliged if you would give me a circuit diagram. J. S.

Yes, the arrangement will work quite well, but will be hardly as effective as an ordinary magnetically-coupled and separately-tuned aerial circuit, although construction may be simpler, as there is no need to make provision for swinging either the aerial or secondary coils; these may be permanently fixed in position.

The circuit diagram is given in Fig. 3, in which L_1 and L_2 are, respectively, aerial and secondary coils, and C.C. is a coupling condenser, which should have a capacity of not greater than 0.0001 mfd. with a low minimum. Inductive coupling between these coils should be avoided as far as possible, so their axes should be at right angles. It is also recommended that screens should be fitted in the position shown, particularly if a high degree of selectivity is required.

o o o o

Volts on the Plate.

Will you tell me how to calculate the actual voltage under working conditions on the anode of a bottom bend detector which is resistance-coupled to the next stage? D. H. H.

It is not possible to give a definite reply to your query, as we understand it. If you wish to know the voltage on the plate existing when no signals are coming in, you can ascertain it easily in the ordinary manner by measuring the current and calculating the voltage drop across the coupling resistance. We presume, however, that you refer to the conditions existing when a signal is coming in. Here, again, you can apply the same methods, but you must realise that the current will vary with the high frequency voltage applied to the detector grid; strong signals will tend to reduce the negative value of its mean voltage, and consequently the current flowing in the anode circuit will be increased.

o o o o

Strengthening the High Notes.

From a perusal of recent articles I have come to the conclusion that there must be an appreciable cut-off of the higher audible frequencies in the three tuned circuits of my "2 H.F." receiver. The coils included in it are of the low resistance type. I understand that this loss may, up to a point, be made good by suitably detuning some of the circuits, but my information on this point is vague, and I should like some definite advice as to how my nearest station (80 miles away) may be received to the best advantage. There is ample volume to spare. H. L. S.

It is quite possible to improve quality by judiciously detuning the receiver. The aerial-grid circuit should be exactly in tune, while the first and second H.F. couplings should be respectively detuned by about 3 kilocycles above and below the frequency of the transmitting station. If your condensers are of the "straight-line-frequency" type, and if the circuits are of conventional design, it is probable that each division of the 180-degree dials will represent a frequency value of nearly 3 kilocycles. This will be a useful guide to you in making adjustments.

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The Wireless World AND RADIO REVIEW

(16th Year of Publication)

No. 461. WEDNESDAY, JUNE 27TH, 1928. VOL. XXII. No. 26.

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DORSET HOUSE, TUDOR STREET, LONDON, E.C.4.
Telephone City 2847 (13 lines). Telegrams: "Ethaworld, Fleet, London."

COVENTRY Hertford Street
Telegrams "Cyclist, Coventry." *Telephone* 5210 Coventry.

BIRMINGHAM: Guildhall Buildings, Navigation Street
Telegrams "Autopress, Birmingham." *Telephone* 2970 and 2971 Midland.

MANCHESTER 260, Deansgate.
Telegrams "Iliffe, Manchester." *Telephone* 1970 City (4 lines).

Subscription Rates: Home, 17s. 4d.; Canada, 17s. 4d.; other countries abroad, 19s. 6d. 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.

CONTENTS OF THIS ISSUE.

THE B.B.C. FIRST ANNUAL REPORT.

THE first annual report of the Governors of the British Broadcasting Corporation presented to the Postmaster-General has just been published. The report is in two parts, the first recording the year's activities generally, and the second the year's finance.

An Out-of-date Document.

Those who might have anticipated that the report would contain anything of startling interest will be disappointed, for it is merely a statement in very general and brief form describing the nature of the work carried on during 1927, with which, of course, we are most of us fully familiar, and the report, issued as it is some six months after the close of the year, seems a very out-of-date document. There are, however, one or two points in connection with the report which invite comment.

It is disappointing that a report of this kind should have been confined to a mere record of what has been done and should not include even a hint as to what may be in store for us in the future, beyond the strong indication from the tone of the report that the Governors attach first importance to the development of the educational side of broadcasting in the programmes. There is, in our opinion, too self-satisfied a tone about the report, and here and there the text departs from being an accurate chronicle of the activities of the B.B.C. in order to make comment, which suggests that the present programme policy meets with the entire satisfaction of the listening public, although little evidence is brought forward in the report to back up this assumption.

Too Much Complacency.

Early in the report we are told "entertainment naturally formed the bulk of all programmes, but there was a strong and growing demand for other features." Later we are told "educational work, as a feature in broadcasting, gains steadily in importance and in popularity." Now these are, we venture to think, expressions of policy on the part of the Governors of the B.B.C. rather than facts. We do not deny for one moment that a certain section of the public does welcome the extension of the educational side of broadcasting, but the statements in the report are not qualified in any way, so that as it stands the report would imply that the demand for more educational matter is unanimous on the part of the listeners; we doubt very much whether such is the case.

Other little instances occur in the report which serve to emphasise in our minds that the Governors are in too contented a frame of mind with their own programme policy. As examples, we quote the statement: "There was a *due* proportion of familiar works, but many first performances were also given," and again, "In all parts of the country, whether in England, Scotland, Ireland, or Wales, *full* respect has been paid to national and local sentiment and tradition," and again, "Light music, besides being included in special programmes, was given a *fair* share in the daily programmes." The italics are ours, and our comment is that we think it out of place in a report submitted by the Governors for them to take upon themselves to decide so definitely whether they have included in the programmes various types of material in so proper and fair a proportion as they seem satisfied to believe has been the case.

The Financial Side.

On the financial side the report may undoubtedly be regarded as satisfactory, although there is indication that the funds available, after the Post Office has retained so large a share as at present of the licence fees, are not by any means in excess of what the Corporation is capable of spending if a high standard in programmes is to be maintained.

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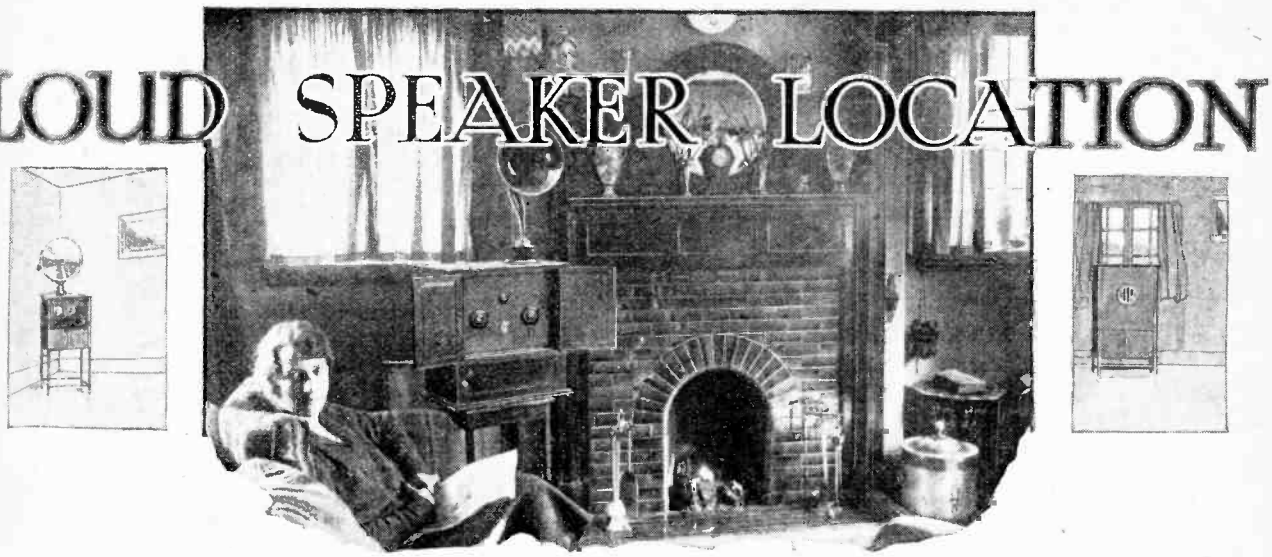
LOUD SPEAKER LOCATION



How Resonances in Small Rooms may Affect Loud Speaker Reproduction.

By A. H. DAVIS, D.Sc., Physics Department, National Physical Laboratory.

(*Concluded from page 655 of last week's issue.*)

THE astonishing development in recent years of electrical loud speakers and of powerful amplifiers has enabled speech and music to be conveyed not only to private homes and domestic circles, but also to larger audiences in public places. In addition, it has brought into use a new instrument for assisting the voice of a speaker in cathedrals or halls too large to be filled by an ordinary human voice. It is of interest, therefore, to consider some of the points which arise in connection with the placing of loud speakers in rooms or halls.

Resonances in Small Rooms.

Before discussing the question of loud speakers in large halls, we may note one or two considerations which may affect quality in small rooms. In small rooms the chief difficulties in hearing are absent. There is an adequate volume of sound; there are no echoes and no undue reverberation. There may, however, be resonance phenomena. Resonances may usually be noticed by singing up and down the scale in an ordinary bath room, when a certain note or notes may boom out prominently. There are various ways in which resonance may arise. Just as a column of air of a given length in an organ pipe will vibrate in a manner dependent upon that length and cause a note of corresponding pitch to be emitted, so an unobstructed column of air of definite length opposite blank surfaces in a room will vibrate in resonance to a note of appropriate pitch. Also, just as the volume of air in a bottle tends to vibrate in a special manner that may be identified in pitch by blowing across the mouth and listening to the note emitted, so the air in an alcove or in a small room may also exhibit resonances of this type. Whatever the cause of the resonance, the effect upon a source of sound in the resonant region is the same. It reacts upon the source and accentuates sound of its own particular frequency.

An interesting case of the effect a room resonance may have in special circumstances recently came to the writer's notice. A loud speaker had been set up in a bare room, and, driven by means of an electrical oscil-

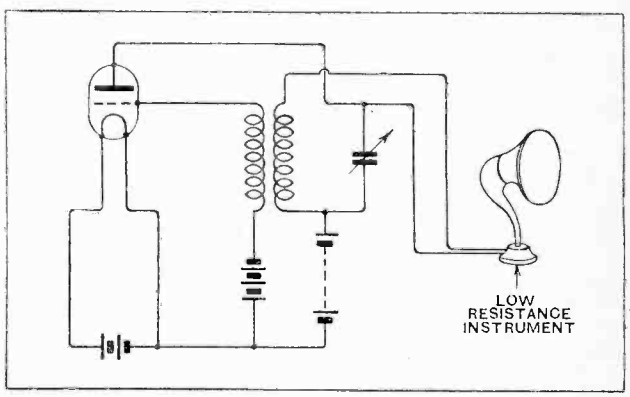


Fig. 7.—A circuit with which the frequency of the note emitted by the loud speaker was affected by the acoustical conditions in the room.

lator, was emitting an approximately pure note. The circuit arrangement is shown in Fig. 7. For sound of most pitches conditions were quite steady, but for a certain note about an octave above middle C it was noticed that both the strength of the note and the current through the loud speaker fluctuated periodically about once a second. Quite suddenly this ceased. As the pitch of the note emitted differed by a few vibrations per second from that desired in the experiments, attempts were made to alter it slightly. It was, how-

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Loud Speaker Location.—

ever, found that altering the tuning condenser by a small amount made no change in the pitch of the note emitted, the reason presumably being that the resonance in the room was to some extent controlling the frequency of the acoustical electrical system represented by the

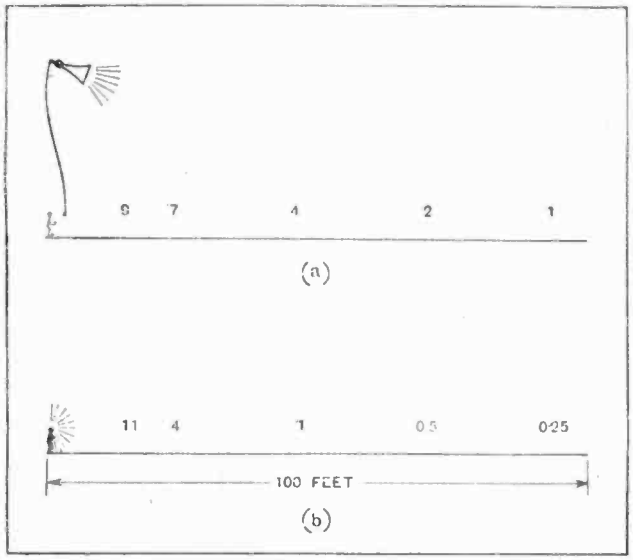

Fig. 8.—The intensity of sound is here shown at head level in the open air; (a) from overhead loud speaker, (b) from human voice.

loud speaker and oscillator. In order to alter slightly the pitch of the note emitted, it was necessary to stop the loud speaker before altering the tuning condenser, and then to switch on again. The phenomenon disappeared when the position of the loud speaker in the room was altered. This is, of course, an extreme case, but it illustrates that resonance in the air of a room can react upon the loud speaker so as to assist or retard its output at given frequencies.

Loud Speakers in Large Halls.

As regards the situation of loud speakers in large halls, resonance effects due to the room are not so likely to occur, and the conditions for good hearing involve other factors which arise from the size of the enclosure. These factors are essentially that the sound shall be adequate everywhere without being focussed to some spots to the detriment of others, and there shall be no perceptible echoes or echo effects. Further, for good hearing there must be none of the confused general prolongation of sound that arises from excessive reverberation. This latter requirement, however, is almost entirely determined by the condition of the auditorium.

Reverberation.

While it is not proposed to deal here with the control of reverberation in auditoriums, it may be stated briefly that the duration T of reverberation in a hall for a sound of standard initial intensity should be from 1-2 seconds or so, according to the size of the hall, and may be determined experimentally, or may be calculated in seconds from the formula

$$T = \frac{1}{20} \times \frac{\text{Volume of Hall in cubic feet}}{\text{Total absorbing power of the surfaces of room}}$$

Data are available in original scientific papers and in books on acoustics of buildings showing the absorbing power contributed towards the total by each square foot of exposed plaster, glass, wood, and other ordinary building materials, for the special absorbents and aerated plasters used for purposes of acoustic correction, and for audience. Excessive reverberation is the most frequent cause of poor acoustics. It is least pronounced in the presence of large audiences, and the cure, which is sometimes troublesome and expensive, consists of introducing draperies, etc., or applying suitable sound-absorbing material to the walls and other surfaces of the hall.

It should be noted that for natural effect in the repro-

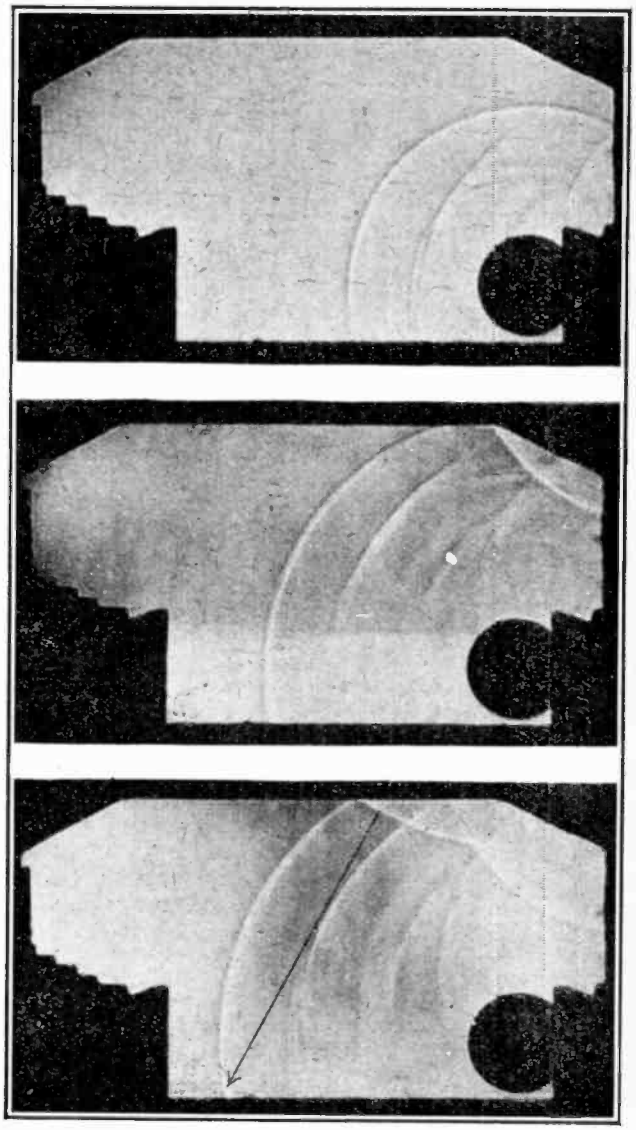

Fig. 9.—Sound pulse photographs showing the progress of a sound wave in model vertical section of an auditorium. The source indicated by the large black spots represents an ordinary loud speaker at the end of a hall.

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Loud Speaker Location.—

duction of speech or music, whether by headphones or by loud speaker, the intensity of sound at the ears of the listener must have approximately the same loudness as the original sounds at the microphone. Excessive loudness results in apparent distortion of the sound

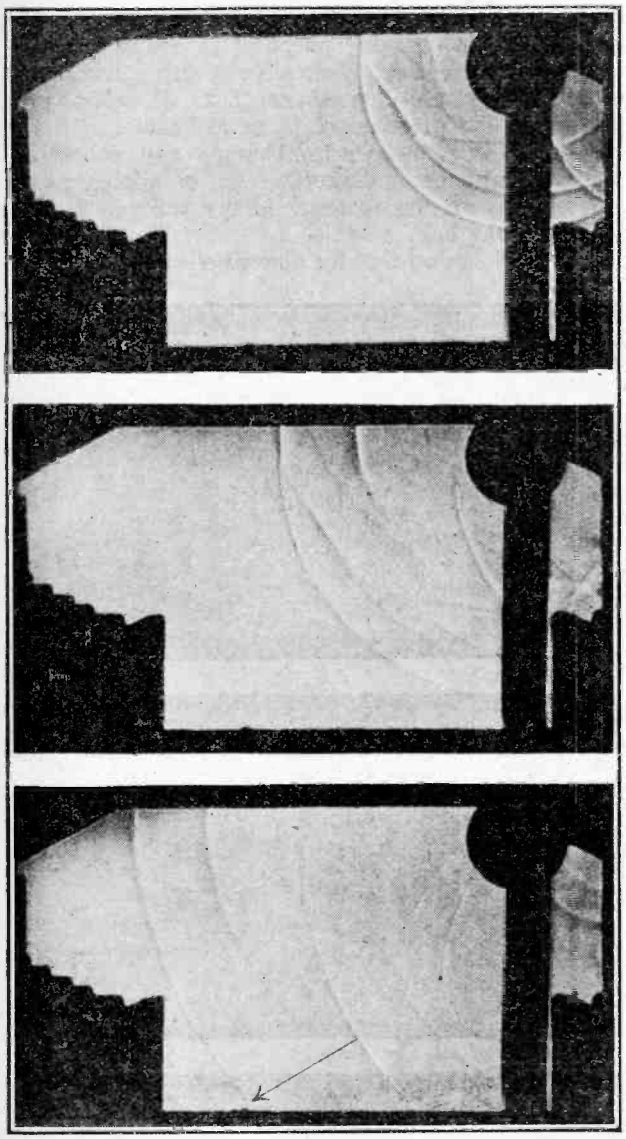

Fig. 10.—Sound pulse photographs as shown in Fig. 9, but here the black spots represent a loud speaker high in the air.

owing to certain characteristics of the ear, and low-pitched constituents become unduly prominent. It is possible with suitable apparatus to show this effect. If a high quality loud speaker, capable of faithfully handling considerable power—such as is used for public address purposes—is worked at a loudness much in excess of that acceptable to the ear, the speech seems distorted. It may then be shown that the distortion is not due to defects of the instrument by slightly closing the ears with the fingers. This reduces the loudness at the ear drum and restores the natural effect. Similar effects may also be shown with a powerful high-quality gramophone, and may sometimes be observed when demonstrations are given in unsuitable rooms. Incidentally, of course, excessive loudness is fatiguing.

Now an ordinary human voice may be heard satisfactorily only at a limited distance from a speaker, so if loud speakers are used in large halls to reach hearers at much greater distances, it is clear that there is risk of excessive loudness near the instrument. It is desirable, therefore, to place the projectors well above the platform. Fig. 8 is a scale drawing showing the intensity of sound in open air at various points due to an overhead loud speaker (assumed to radiate equally in all directions), and also the corresponding sound intensities arising from an unaided human voice. The unit of intensity adopted is the minimum acceptable in ordinary public address, namely, that at about 50ft. from an ordinary speaker. It is seen that, while the sound from the loud speaker is markedly the greater at horizontal distances along the floor of 25ft. or so, the overhead arrangement leads to only natural loudness near the platform.

Directive Action of Large Loud Speakers.

In actual practice loud speakers likely to be used for large audiences have a directive action upon emitted sound, and, by directing them towards the rear of an audience it is possible to use still greater amplification without causing the sound to be unduly loud in front.

The volume of sound, however, must always be limited to that necessary to ensure that remote listeners shall just hear with comfort. In the special case in which a microphone and loud-speaking equipment are used to facilitate addressing large audiences, it may be mentioned that with the loud speakers at a reasonable height above the head of the speaker the effect is very natural to hearers, and they have the impression of listening to only one source of sound, namely, the speaker himself.

As regards the directive action of large loud speaker horns, it is usual to regard them as covering only a limited angle, depending upon the type of instrument used. A good arrangement, therefore, is a cluster of horns high up in the hall, so arranged as to project the sound towards the whole of the region it is desired to cover.

There is another acoustical detail in which loud speakers have an advantage over vocal speech or instrumental performances. This is in the question of echo. Echoes may arise on account of reflection of sound from walls or ceilings provided these surfaces are sufficiently distant from the source of sound. Ceilings higher than about 40ft. are liable to give echoes, and, since many large halls have ceilings two or even three times as high as this, the ceiling is the surface which very frequently gives rise to echo in the case of ordinary speaking or singing. Loud speakers have an advantage over human beings that they can be—and as we have seen frequently should be—placed high in the air, so that late echoes from the ceiling are largely eliminated.

Figs. 9 and 10 present two series of sound pulse photographs taken with apparatus at the National Physical Laboratory, and which will serve to illustrate

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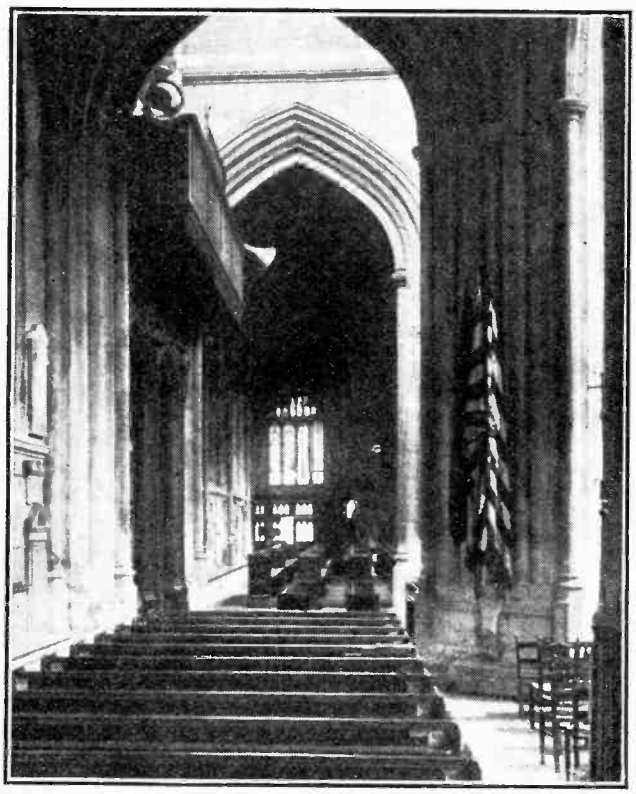
Loud Speaker Location.—

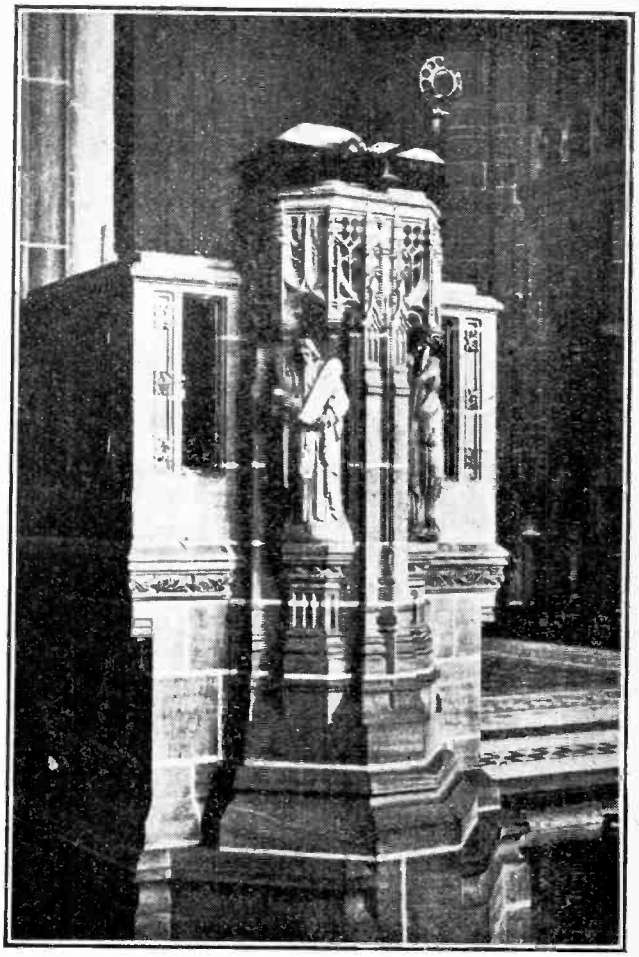
the point. Both figures relate to the same longitudinal section of an auditorium. In each the ceiling is at the top of the outline, the floor at the bottom, the main gallery is to the left, and a small gallery—supposed to be behind the speaker's platform—is on the right. In Fig. 9 the top photograph shows the early history of a sound travelling outwards equally in all directions from a source—revealed by the large black dot—representing a speaker at one end of the hall. The second and third are two subsequent photographs showing conditions a fraction of a second later, after reflections have commenced to return from the ceiling. The arrow in the third photograph shows the shortest path by which the ceiling reflections will reach auditors on the floor of the hall, who at present have just been reached by the original wave. On the scale adopted for the model, the time lag at the point between the direct sound and the ceiling reflections is just sufficient for echo to be perceptible. For persons nearer the speaker the time lag will be greater and echo more noticeable.

In Fig. 10 the source has been raised high in the hall to represent to some extent the case of a loud speaker near the ceiling. The large black dot again represents the situation of the source of sound, and the black vertical band is merely the shadow of a support for the source which—being behind the model and not in its plane—did not interfere with the sound waves. The top photograph shows early spreading of the sound. The second, somewhat later, shows the development of a reflection from the back of the gallery behind the speaker. The third shows the main wave to have reached auditors towards the rear of the floor of the hall, and it is seen that late ceiling echoes do not occur. The most important reflection directed to the floor is that



Courtesy of the Marconiphone Co., Ltd.

Fig. 11.—View of loud speakers in Bath Abbey.



Courtesy of Standard Telephones and Cables, Ltd.

Fig. 12.—The lectern of Liverpool Cathedral with microphone.

arising from the wall behind the gallery. This, as shown by the arrow, follows the unreflected sound within an interval sufficiently short to be imperceptible as echo, and it will increase usefully the level of loudness. If this gallery did not exist, the various portions of the sound would reach the floor almost simultaneously.

The reflection from the back wall just mentioned illustrates another point. It is seen that in Fig. 9 reflections from the back wall proceed towards the *upper parts* of the hall, whence, after one or more reflections, they will be returned after an appreciable time lag to the floor of the hall, and cause echo effects. In Fig. 10, however, reflections from the walls are directed downwards towards the *audience* without delay. It is thus clear that a high source not only eliminates ceiling reflection, but tends to direct all sound almost simultaneously to the audience where it is required, and where it is most likely to be absorbed.

While speaking of echo in connection with loud

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Loud Speaker Location.—speakers, we may note that the arrangement referred to earlier of a cluster of horns high in the air is preferable to placing a number of instruments in widely separated parts of a large hall. For if there is any considerable separation of instruments which are simultaneously projecting into the same space, effects of repetition similar to echo will naturally arise, the sound from the various loud speakers in general reaching any given hearer at different times.

Fig. 11, reproduced by courtesy of the Marconiphone Co., Ltd., is a view looking across the transepts of Bath Abbey, and showing two loud speakers in position in the organ loft. Owing to its shape, a large church or cathedral presents a special problem in acoustics. It will be seen that the disposition of the projectors enables each transept to receive a satisfactory volume of sound. Being high in the air, they avoid excessive loudness for nearest auditors, and also minimise the untoward effect of reverberations and echoes from the upper parts of the building. The two instruments serve spaces which can be regarded as separate to some extent, but, nevertheless, the separation of the two loud speakers is not sufficient to give rise to the impression of echo.

Difficulties when Microphone and Loud Speaker are in the same Hall.

The special case of the use of loud speakers for purposes of amplifying ordinary speech in an auditorium presents a few additional difficulties. One of the chief is due to the fact that, with the microphone in the same room as the loud speaker instead of in a separate studio, there is a tendency for the microphone at any moment to pick up sound already emitted by the loud speaker. The apparatus thus "sings" when the sound from the projectors reaches the microphone with sufficient intensity and suitable phase to aid the original sound. Even if a continuous sound is not emitted, there may be distortion and lengthening of sounds of appropriate pitch. Placing the loud speakers high above the speaker and directing them towards the back of the hall reduces this, and suitable sound absorbents should cover any walls or other surfaces which reflect sound from the projectors back to the microphone. Reducing amplification also suppresses "singing," but it is a form of cure which obviously may defeat the object of the apparatus. A highly reverberant hall is disastrous, for with sound reflected to and fro from hard, non-absorbent surfaces a considerable volume of diffused sound is built up throughout the building irrespective of the position of the loud speakers, and it becomes almost impossible to place the microphone in a position of comparative silence. Fortunately, this effect is least pronounced in the presence of an audience owing to the additional acoustical absorbing power introduced and the consequent reduction in reverberation. It must, therefore, be clearly understood that loud speaker equipment is by no means a cure for the acoustical defects which arise from excessive reverberation. Used with discrimination —say, in a case of reverberation due to very high ceilings—it has a value in the directive action of the loud speakers which, in projecting the sound downwards upon the audience-covered floor, are directing it towards what is usually the most absorbent area in the auditorium.

In using speech-amplifying equipment it is essential to pay attention to the input end of the installation, i.e., the microphone, for if this is inappropriately housed it will be impossible to obtain good results, however carefully the situation of the loud speakers may be chosen. The region of the microphone must be substantially free from extraneous sound, from echoes of the speaker's voice, from general reverberation, and from direct and reflected sound emitted by the projectors. The latter requirement can be met by placing the line of the loud speakers a few feet in front of the microphone, and in such a position as to avoid reflection to the microphone from hard, undraped walls. Heavy carpets on the floor and sound absorbents upon the walls and ceiling near the speaker will reduce local reverberations and resonances. The microphone itself should not be concealed on account of the tendency of housings to act as resonators and cause distortion. Fig. 12, reproduced by the courtesy of Standard Telephones and Cables, Ltd., shows the agreeable manner in which a microphone was made to harmonise with its surroundings upon the lectern of Liverpool Cathedral, there being no attempt at concealment.

LETTERING TERMINAL STRIPS.

THE employment of transfers for marking, on the panel of the receiver, the uses of the various terminals and adjusting dials, appears for some reason to have become unfashionable. Possibly the cause is to be found in the fact that transfers, unless carefully applied, are not always satisfactory, and their place has to some extent been taken by the use of terminals on which are marked letters indicating the connection that should be made to them.

But there must be many who have a stock of terminals of the ordinary kind, and who therefore require to put some indicating mark beside them on the ebonite to show their purpose. Now that terminals are generally banished from sight to a terminal strip at the back of the receiver, the need for neatness in marking is not very insistent, so that something more quickly applied than transfers, and less expensive than engraving, may be conveniently used on the ordinary home-made receiver where no pretensions are made to the perfect finish that characterises the commercial article.

For this purpose white ink, such as is used by photographers for lettering mounts, may be turned to account with every satisfaction. Provided that the surface of the terminal strip is free from grease, which can be ensured by rubbing it over with fine sand-paper, this ink will "take" on the ebonite without any difficulty. It is most conveniently applied with a mapping pen, and the lettering so made is quite reasonably permanent. The ink can be obtained from a photographic dealer, and the results, if not beautiful, are certainly serviceable, while the time taken to letter a terminal strip is not more than two or three minutes. A. L. M. S.

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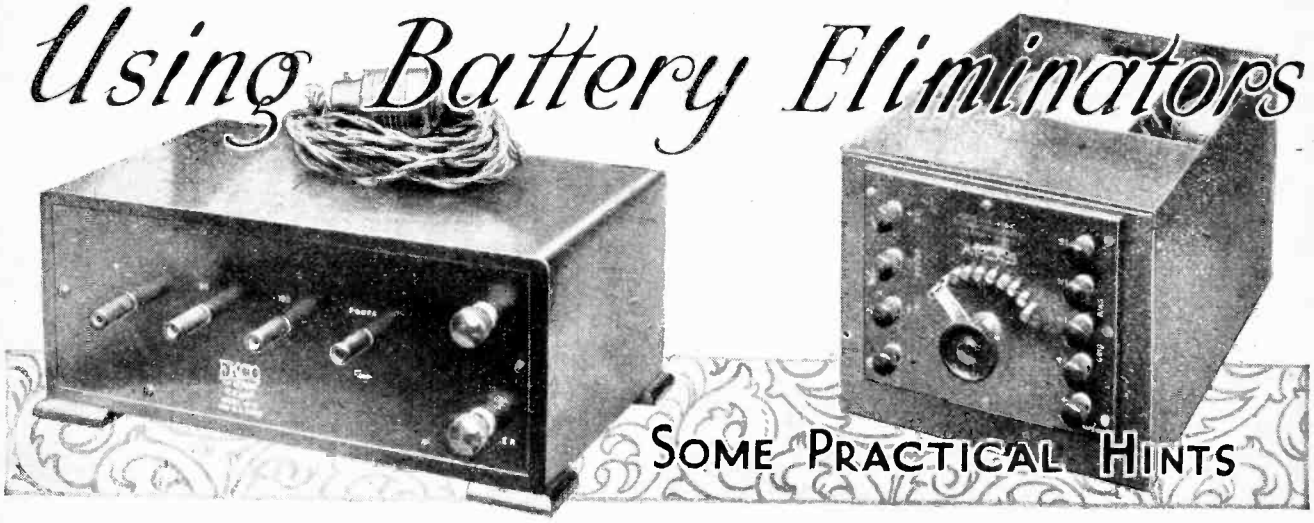
Using Battery Eliminators



SOME PRACTICAL HINTS

By N. P. VINCER-MINTER.

BEFORE an eliminator is purchased or constructed, thought should be given to the type of receiver, number of valves, valve characteristics, etc., with which it is going to be used; for it should be remembered that a small eliminator which will give perfect satisfaction on a two-valve set will probably be unsatisfactory on a large five-valve instrument. The converse, however, is not necessarily true, although it is rather foolish to have an instrument with a large reserve of power to operate a small and simple set.

Most eliminators will be found to possess three positive terminals—a high voltage one for the output valve or valves, a terminal marked with a somewhat lower voltage for supplying H.F. valves, and perhaps the first L.F. valve, whilst in the case of the third terminal, intended probably for the detector, a variable control device may be fitted. Modern eliminators can be relied upon to give the output voltages stated upon their terminals when the load drawn is within reasonable limits of the figures given by the manufacturer for the particular terminal concerned. It is unfortunate that some manufacturers still neglect to indicate the maximum current at which the voltage marked on the terminal will be maintained.

A Wise Precaution.

When connecting up an eliminator, a point which is usually insufficiently stressed, however, is the need for using adequate grid bias on the output valve, which, naturally, will be of the super-power valve type. It should not be forgotten that the voltage used should be in the neighbourhood of 20 for this type of valve, and in no circumstances, particularly when using an eliminator, should the grid circuit of this type of valve (which takes a heavy plate current) be broken, or its efficiency will in all probability be seriously impaired by the large flow of plate current which will ensue. The correct procedure, when it is desired to vary the grid bias value of the output valve—or indeed of any valve—is to switch off the H.T. supply first.

The risk of ruining the output valve can, however, be obviated if the protective resistance scheme is used. This method was used in the "New All-Wave Four" set, and readers should refer to the article dealing with that receiver if they require further information.[1] The detector valve, if of the leaky grid type, usually gives better results on a fairly low H.T. voltage, and adjustment should, therefore, be made accordingly. In the case of anode bend, however, a voltage in the neighbourhood of 120 or more will be required.

Special Types of Receivers.

If, on switching on, a loud humming noise is heard, the first point to be noted is the position of the eliminator relative to the receiver. The eliminator should on no account be placed near the receiver, and the remedy for this type of trouble, which is known as direct induction, is proper screening. If the set commences, on the other hand, to "motor boat," it is a sad, but nevertheless true, fact to relate that in the case of many eliminators the only thing to stop it is to reverse the secondary winding of one of the L.F. transformers in the set, if such a device be included in the receiver. There are, however, certain technical reasons against this procedure which will be discussed later.

That type of set which employs an H.F. stage coupled to the detector by means of a transformer in which the capacity between primary and secondary is low, and employing but one L.F. stage of any type, will be found to give no trouble in this respect, even though the eliminator may be of very poor design. Such a receiver is exemplified in *The Wireless World* "Regional" receiver published some little while back, which was capable of receiving several stations on the loud speaker at good volume and excellent quality without the least tendency to oscillate at low frequency, thus giving rise to such annoying troubles as "motor boating," howling at low frequency, or producing that peculiarly muffled type of reproduction brought about by incipient L.F. oscillation.

[1] *The Wireless World*, June 13, 1928, page 622.

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Using Battery Eliminators.—
It is worthy of note, however, that if the H.F. coupling be of the tuned anode type, with a grid condenser, then the kind of receiver we have just discussed may give results fully as bad as those just mentioned, and, in fact, such a receiver may be no better than a receiver with two L.F. stages.

The fact, therefore, that a receiver may give perfect results on batteries, and poor results on very many good and expensive eliminators, does not indicate that the set is a bad one. It does indicate, however, that in reality every set should have its eliminator designed to meet its

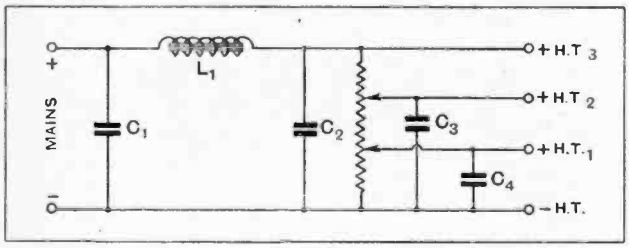

Fig. 1.—A very common form of eliminator using a tapped potential divider.

particular needs, the only exception being *The Wireless World* "Regional" type of receiver, just referred to, which will work on any eliminator, even if it be of mediocre efficiency. Even such a popular receiver as the "Everyman Four" can give bad results on a good eliminator, but, as readers will be well aware, a special eliminator was designed to work in conjunction with this receiver. Sets like the "Regional," in which there are a minimum of stages capable of feeding back L.F. energy, are usually free from all L.F. oscillation troubles.

An Undesirable Palliative.

If we reverse the secondary windings of the L.F. transformer, as already mentioned, or one of the transformers if two are used in the set, it will usually stop "motor boating," but only at the expense of amplification and quality. If the set is of the type using two stages only of resistance coupling, then results will usually be passable with most eliminators, but if "motor boating" does occur, we cannot, of course, cure it by a phase reversal as in the case of the transformer. The writer doubts whether it is possible to operate any receiver having three stages of R.C. low-frequency coupling without trouble, using an ordinary "general purpose" eliminator, two common forms of circuit for which are shown in Figs. 1 and 2.

This once more emphasises the necessity for a receiver to be built in conjunction with an eliminator—that is to say, if one has electric light mains and intends taking H.T. from them, one should consider the eliminator as an integral part of the receiver, and design it accordingly. Readers should not deceive themselves into thinking that they are obtaining perfection of results with an eliminator when the only reason for absence of "motor boating" or L.F. howling is that, owing to the inadequate output of the eliminator, the actual voltage on the plates of the valves in the set is so low that they are thereby prevented from oscillating. If the voltage is so low that it acts as a combating force against oscillation, it is impossible to obtain good quality, owing to the resultant limited permissible grid swing.

In the case of most D.C. eliminators put forward by reputable firms there is usually a terminal for a connection to the earth terminal of the set. The result of making this connection is to insert a large capacity condenser in series with the earth lead of the receiver in order to prevent short-circuiting the mains if it so happens that the positive main of the supply is earthed. It should not be forgotten that if the positive main is earthed special care should be taken to insulate adequately the aerial and the lead-in from earth. If the aerial or lead-in accidentally comes into contact with an earthed object, the house will be plunged into darkness, as the effect is the same as a breakdown in the condenser in the earth lead.

A Point of Law.

Apart from this, those with a positively earthed main should remember not to touch the lead-in tube connection, as if they are standing on damp ground they will experience the annoyance of a shock from the mains. It should be borne in mind that the eliminator should always be switched off first before the L.T. is switched off, and before the aerial is earthed for the night; then there will be no risk of blowing fuses or leaving a standing charge in the condensers of the eliminator throughout the night.

It is often asserted that if the negative main is earthed no precautions need be taken with regard to aerial insulation, and the other points just dismissed. This is fundamentally untrue. Although omission of these precautions will not result in the blowing of fuses, a far less spectacular but much more sinister trouble will be laid up in store for the unhappy user, who will probably receive a visit from the officials of the Electric Supply Company to inform him that he is putting an earth on to the mains, which is strictly forbidden by law. Anyone ignoring this regulation is liable to severe penalty.

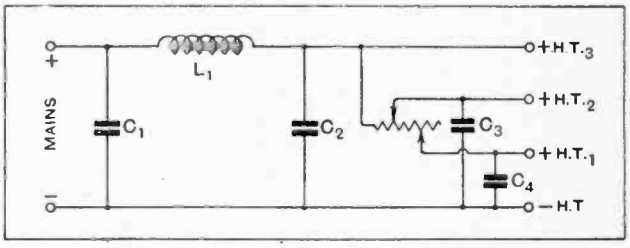

Fig. 2.—A similar instrument using a tapped series resistance.

A condenser in the earth lead will prevent this trouble, but in some cases this will give rise to wireless troubles such as mains hum, and the writer repeats the advice he has given in previous articles, namely, that readers who are on D.C. supply should use a loosely coupled aerial which will cure most of these eliminator troubles. In the case of A.C. mains these difficulties do not rise, as the mains are completely insulated from the receiver by the power transformer.

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AMERICAN SETS OF TO-DAY

Progress in Radio Receiver Design during the Last Year.

THERE are some years in the development of radio which mark the end of one era and the beginning of another. Among these years has been 1927, for during this year certain basic tendencies have demonstrated their importance in the advancement of wireless, have been definitely accepted by the engineers and the public, and may now be expected to lead to further continued development along proved lines.[1]

In America it has become evident that an indefinite multiplication of stations in a given district will be greatly reduced, and the field strengths corresponding to the various programme signals will be systematically increased. The designers of receiving sets have been enabled to produce generally useful but simple and compact receivers with greater assurance than heretofore. It is now reasonably certain that stations of considerable power having frequency allocations less than 50 kc. apart will not be erected within a given district; that the building of powerful stations in regions of hign population density will be discouraged; and that stations giving a demonstrably valuable service to the public will be afforded channels for clear reception up to the reasonable range of the station.

An Era of High-power Broadcasting.

The end of the era of low-power broadcasting transmitters and freak long-distance reception is also at hand. Transmitters of 5 to 50 kW. capacity have become increasingly common, and several stations of 50 kW. have either been established during the year or are planned for early erection. Experimentally, a power of 100 kW. has been successfully used by Station WGY at Schenectady. These station powers are in marked contrast to the half-kilowatt power of the average station only a few years ago, which was at that time regarded with entirely undue optimism as capable of spanning tremendous distances.

Concurrent with the use of transmitters having a power of several tens of kilowatts has been the inevitable improvement of radio reception in millions of homes. Signal field strengths capable of riding above local man-made and atmospheric electrical disturbances have become so common in the more fortunate districts of the United States that the listeners have been definitely educated to regard such powerful and clear signals as normal. At the same time, the average listener naturally is dissatisfied with the feeble and mangled signals from distant stations, and, as a result, only those listeners who are compelled by their location to listen exclusively to distant stations can be included under this category of "long-distance searchers." This change in listener psychology, corresponding to a demand for loud and clear signals and a refusal to listen to weak or mutilated signals, together with a considerable loss of interest in distant reception, has brought to the fore the matter of quality or fidelity of tone reproduction. The influence of this demand by the listeners has led to the widespread use of higher quality loud speakers, capable of giving considerable sound intensities and fed from so-called "power valves" in the last audio-frequency stage of the receiving set. Where a few hundredths of a watt was at one time regarded as adequate for the final practically undistorted audio-frequency output of a receiver, to-day a power in excess of a watt is becoming common.

Simplicity of Operation.

The listeners are concentrating their attention on local stations which give high-quality programmes and produce loud and clear signals in their vicinity, and this audience demands receiving sets having excellent tonal quality of reproduction with adequate volume of sound. As is but natural, such listeners insist also upon simplicity of operation.

We have, therefore, also come to the end of the era of radio receivers, which are complicated to operate. To-day the single selector (uni-control) type of receiving set is practically standard. A minimum of receiver adjustment is regarded with favour by the listeners, and even more marked is the tendency toward mains operation of receiving sets. The replacement or charging of

[1] Set designs recently described by Dr. Alfred N. Goldsmith, Chief Broadcast Engineer, Radio Corporation of America.

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batteries is on the decline. Simple and reliable receivers utilising lighting circuit power exclusively for their operation have now become widely available, and the public response to them has been so enthusiastic that there can be no question that the mains-operated receiver is the type to be most generally used during the next radio era.

Typical of the simplicity of the modern receiver is Radiola 16, a six-valve set having only two controls—one for station selection and one for volume. This receiver is adapted for use in circumstances or neighbourhoods where batteries are regarded as necessary or desirable. The receiver has three tuned radio-frequency circuits, is inexpensive, and utilises standard UX-201-A Radiotrons in all except the final output stage, which contains a super-power valve.

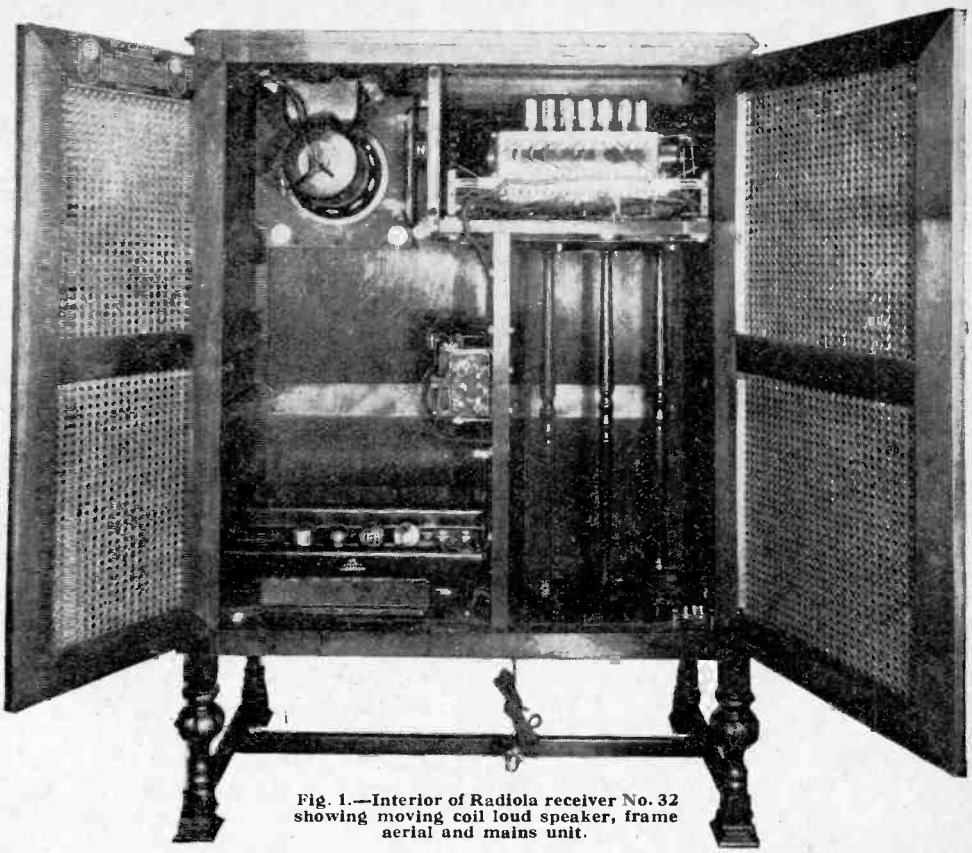

Fig. 1.—Interior of Radiola receiver No. 32 showing moving coil loud speaker, frame aerial and mains unit.

Another receiver, shown in the title illustration, clearly illustrating the simplicity of the modern operation of such devices is Radiola 17. This also is a six-valve receiver, utilising an outside aerial and having three tuned radio-frequency circuits. Adequate output volume is given by the use of the power-amplifier Radiotron UX-171 for the last stage of audio-frequency amplification. This receiver is specifically adapted for mains operation and requires neither batteries nor external device of any sort. It will operate from alternating current of either the 50- to 60-cycle range or (in an alternative form) the 25- to 40-cycle range. This receiver employs new alternating-current Radiotrons, which are described later in this article.

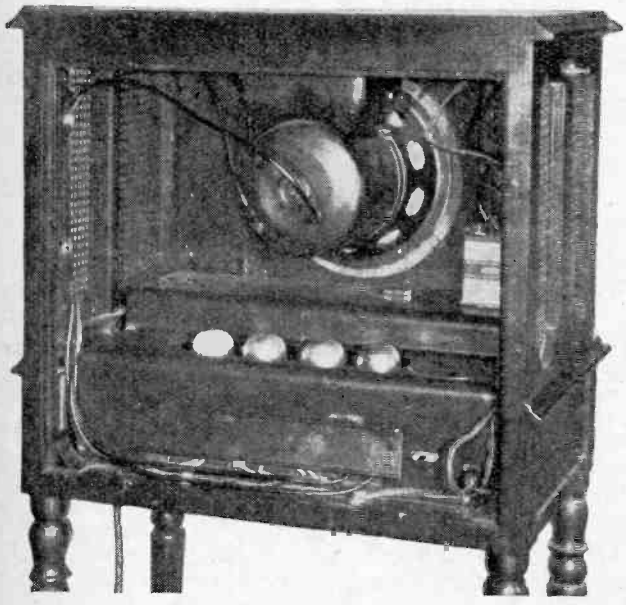

Fig. 2.—Rear view of Radiola coil-driven loud speaker showing D.C. mains eliminator and power amplifier.

An interesting coil-driven loud speaker has been embodied in Radiola 32, a view of which is shown in Fig. 1.

Unusually difficult electrical and acoustical problems are presented when placing in a single cabinet an extremely sensitive frame receiver, a power-output valve, and a loud speaker of wide tonal range and capable of producing sounds of great intensity, particularly as it is necessary to maintain high quality of reproduction despite the effect of the cabinet enclosure. The enormous amplification which exists in a highly sensitive radio receiver further complicates the production of such an effective system. There have been developed certain electrical and acoustical expedients which are embodied in the Radiola 32 and which lead to the same performance as that of its component parts. The receiver is operated on a frame or outside aerial as desired, and can be used with mains operation of 40- to 60-cycle alternating current or (in another form) on direct current. In the alternating current form, a UX-210 Radiotron is utilised as the output valve.

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Loud Speakers.

The public is becoming increasingly critical of loud speakers that are incapable of delivering considerable sound outputs without rattling or other disturbing effects. It has also become increasingly insistent on the proper reproduction of the lower audio-frequency tones (which give body and mellowness to music and naturalness to speech) as well as the higher frequencies.

A curious result of the excellence of performance of the loud speaker embodied in Radiola 32 has been the insistence of persons residing in districts served by direct current that a device of the same capabilities be developed for them as well. Accordingly, there has been produced a direct-current loud speaker (Fig. 2) for operation on 110-volt circuits. This device is provided with a new mains unit incorporating a group of four UX-171-A Radiotrons operating on lower plate voltages. These four output valves are arranged as a balanced single-stage amplifier in push-pull.

Valves.

As a necessary part of the rapid development of the mains-operated receiver, there has been produced a number of alternating-current valves during the year.

There are two main groups of alternating-current valves. The first employs alternating current directly as a source of filament supply. This "raw A.C." type of valve (Fig. 3) is known as Radiotron UX-226 and has a special low-voltage high-current filament which permits direct excitation of the filament by alternating current. The average characteristics of this tube at proper voltages are as follows: Plate voltage, 135; negative grid voltage, 9; filament voltage, 1.5; filament current, 1.05 amp.; plate current, 5.2 milliamperes; voltage amplification, 8.2, and plate resistance, 8,000 ohms.

The second type of alternating-current valve employs an indirectly-heated cathode, i.e., an equipotential cathode, which is heated by a low-voltage alternating-current heater element, but is not electrically connected to the heater. It is known as Radiotron UY-227, and is illustrated also in Fig. 3. The output of such a valve is markedly free from "hum," and such valves are therefore especially suitable for use as detectors. The valve is inherently more elaborately constructed than the UX-226 type. Its average characteristics under correct conditions are: Plate voltage, 90; negative grid voltage, 6; filament voltage, 2.5; filament current, 1.75 amp.; plate current, 2.8 milliamperes; voltage amplification, 9; plate resistance, 10,000 ohms; and mutual conductance, 900 micromhos. When used as a detector, the preceding values are changed by using zero grid voltage and a reduction of plate voltage to 45 volts.

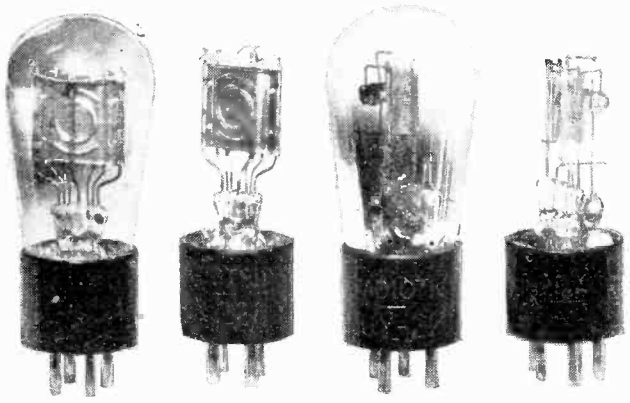

Fig. 3.—The two valves on the left have filaments suitable for raw A.C. heating. The two valves on the right have indirectly heated cathodes.

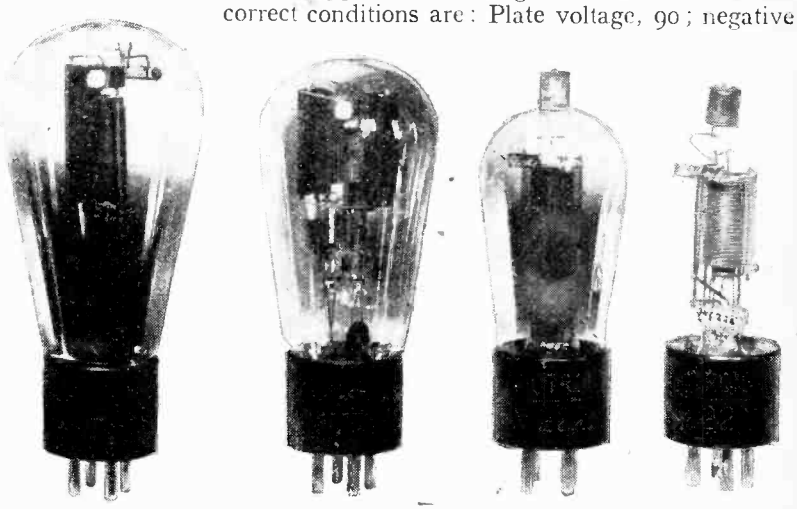

Fig. 4.—On the left is illustrated a full-wave heavy-duty oxide-coated filament rectifier valve. The next valve to this is a half-wave oxide-coated rectifier. The two illustrations on the right represent a tetrode having an amplification factor of 300.

Rectifiers.

A new heavy-duty oxide-coated filament type of full-wave rectifier has been produced as the Radiotron UX-280. This valve, which is shown on the left in Fig. 4, is of sturdy construction, and the plates have been specially treated to insure its having a long life. Its normal characteristics are as follows: Maximum applied alternating current voltage (r.m.s.), 300 volts per anode; filament voltage, 5; filament current, 2 amp.; and maximum direct-current output, 125 milliamperes.

Another heavy-duty oxide-coated filament type of rectifier, but for half-wave rectification, is known as the Radiotron UX-281, and appears in Fig. 4. It is generally similar to the UX-280 valve and is useful where higher voltages are desired, as indicated by the following characteristics: Rated applied alternating-current voltage (r.m.s.), 650 to 750; filament voltage, 7.5; filament current, 1.25 amp.; and rated direct-current output, 65 to 110 milliamperes.

There has recently been developed a shielded grid amplifier valve known as Radiotron UX-222. This valve, Fig. 4, has a very small effective plate-to-grid capacitance (approximately 0.025 micromicrofarads). This characteristic, together with its high-voltage ampli-

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fication factor, makes it especially suitable for radio-frequency amplification. Valves of this type may also be used as two-grid valves in resistance-coupled audio-frequency amplifiers.

The approximate characteristics of such a valve when used as a screen-grid amplifier are as follows: Filament voltage, 3.3; negative bias of first grid, 1.5 volts; positive voltage of screened grid, 45; filament current, 125 milliamperes; plate voltage, 135; plate current, 1.7

Fig. 5.—Front view of the Panatrope-Radiola set with gramophone pick-up.

milliamperes; plate resistance, 850,000 ohms; mutual conductance, 340 micromhos; and, most unusual of all, a voltage amplification factor of 300.

The possibilities of valves of this type in the field of radio-frequency amplification are being rapidly developed, and it is already evident that they afford a powerful tool to the designer of radio receivers.

The refining of circuit design and construction of radio receivers has been paralleled during 1927 by that of gramophone pick-up equipment. These devices consist essentially of a "pick-up" which is generally an electro-magnetic device producing an output voltage of wave form controlled by the movement of the needle which rests in the gramophone record groove, a suitable volume control and filter circuit, an audio-frequency amplifier having a power output valve, and a high-quality loud speaker. The fidelity of music reproduction obtainable from the electric gramophone is so high that the public interest in these devices has steadily grown. An effective and economical arrangement consists in the combination of an electric gramophone with a radio receiver, the electric gramophone utilising the same audio-frequency amplifier system and loud speaker as is alternatively employed for radio reception.

Electrical Gramophone Equipment.

Carefully developed forms of this combination instrument have been produced in a number of different types. Those utilising the Radiola 28 (superheterodyne) receiver, together with a coil-driven loud speaker and associated electric gramophone mechanism in one cabinet, are typical of the furthest development of such devices yet reached commercially.

One of these is the Electrola-Radiola Model 9-55, a Victor Talking Machine Company product. This electric gramophone is provided with an automatic record changing mechanism whereby a sequence of records comprising an entire programme can be heard in succession. Another example of radio gramophone sets is the Panatrope Radiola, of the Brunswick Balke Collender Company, shown in Figs. 5 and 6.

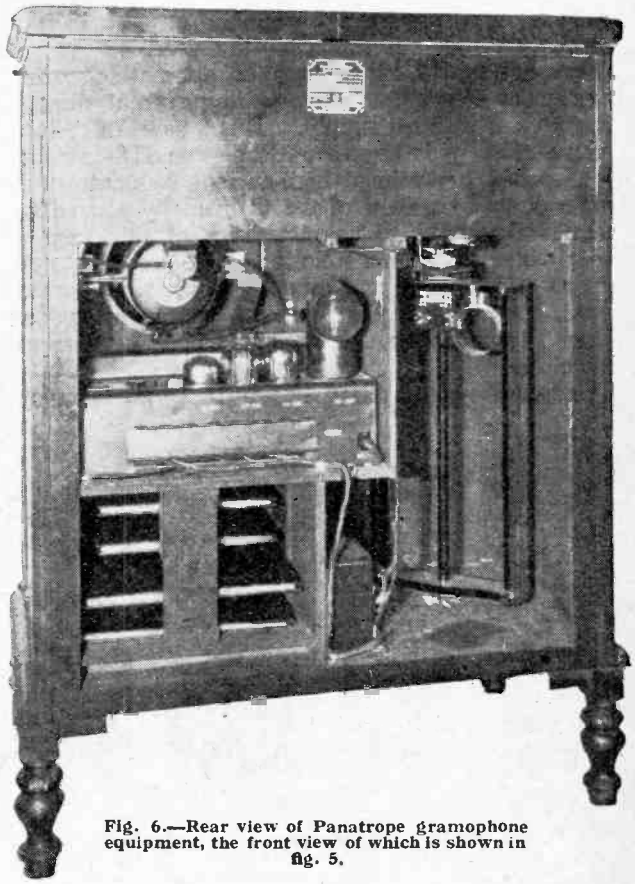

Fig. 6.—Rear view of Panatrope gramophone equipment, the front view of which is shown in fig. 5.

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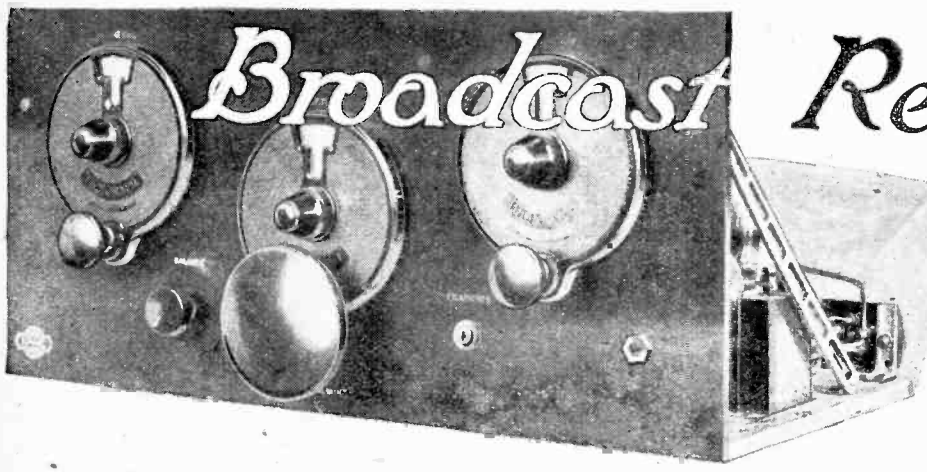


Broadcast Receivers

IGRANIC THREE-VALVE SHORT-WAVE SET

Stable H.F. Amplification Down to 15 Metres.

THE Igranic short-wave receiver was first described in this journal by F. Charman in the issue of October 12th, 1927, and at once became a subject for heated discussion among short-wave enthusiasts, the majority of whom hold the rooted conviction, probably as the results of their own individual efforts, that H.F. amplification on short waves is impracticable. The classical reacting detector and L.F. type of receiver seems to give all the results one could possibly wish for, and the general attitude towards this arrangement is not unlike that of the cobbler who thinks there is "nothing like leather."

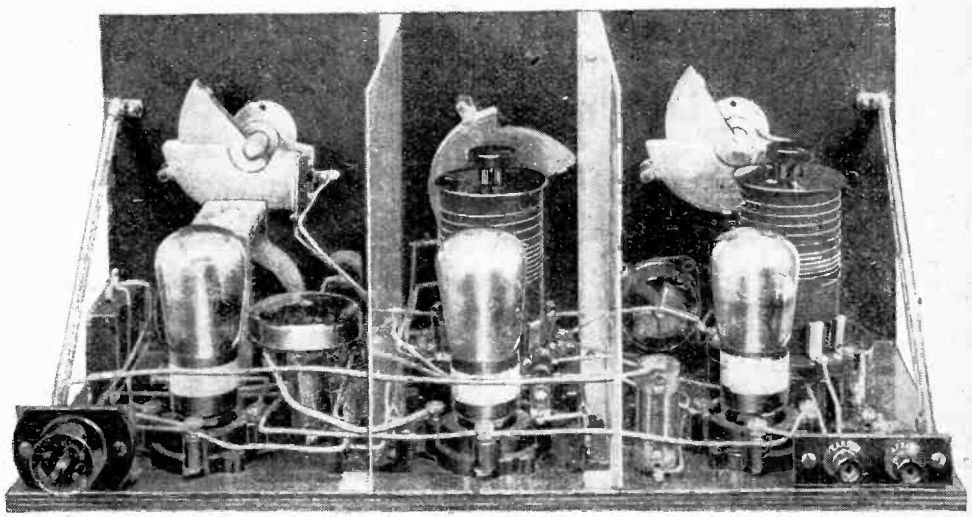
But the reacting detector is open to criticism on many points. In the first place the reaction control must be constantly adjusted to follow up the changed circuit conditions brought about by the tuning control. Secondly, the circuit as a whole lacks stability, and is susceptible to hand capacity effects; there is only one tuned circuit, and this is affected by the slightest change in any of the stray capacities associated with it. The object of the Igranic design is to give constant control of reaction and improved stability quite as much as to increase sensitivity by direct H.F. amplification; in fact, it would be safe to say that the principle of introducing an H.F. stage with its additional tuned circuit would be justified for the above reasons even if no amplification resulted. There are three tuning controls it is true, but experience shows that it is virtually a two-control receiver, for the reaction control holds its adjustment over large sections of the dial.

To obtain the best results from the circuit correct balancing is essential. The balancing condenser is properly adjusted when the reaction condenser reading required to produce oscillation with the two circuits in tune is the highest. As a means of checking whether the correct setting has been obtained the following procedure is recommended: Adjust aerial and H.F. tuner circuits exactly to resonance, with the receiver just not oscillating. If the balancing condenser is correctly adjusted the slightest movement *to either side* of its initial setting should bring the receiver into oscillation. Naturally, the balancing condenser must be reset each time a pair of coils is changed, but over the wave range of each pair the setting remains constant.

Once the correct balance has been found the receiver is delightfully easy to operate. The reaction goes in and out of oscillation smoothly and with no trace of backlash. There are no blind spots, and with the reaction set at the required point the wave-range of the particular coils in circuit can be explored with the two tuning dials quite as rapidly as with the two controls of the conventional reacting detector. And when an interesting transmission is discovered a final consolidation of the three dial settings enables the station to be held for hours—always assuming that the transmission is itself constant.

A Valve Voltmeter Test.

Quite apart from these exceptional qualities of stability and ease of control, we found the Short-wave Three to have definitely more punch than the best two-valve receiver with reacting detector, indicating either that there is H.F. amplification or that improved use is made of reaction or both. A simple test for H.F. amplification was carried out on 52 metres (the lowest wavelength available on the H.F. oscillator). An E.M.F. was induced in the aerial system from this oscillator and the volts developed between grid and filament of the H.F. valve measured with a valve voltmeter. With the set perfectly balanced and the reaction control at zero the voltage input to the detector was then measured across the secondary of the



Rear view of the Igranic Neutro-regenerative short-wave receiver. H.T., L.T. and grid bias are supplied through a multiple cable and plug to the socket on the extreme left of the baseboard.

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Broadcast Receivers.—

H.F. transformer; this measurement was taken with the detector valve removed. The results were as follows:—

WAVELENGTH 52 METRES.

Grid to filament volts on H.F. valve 0.6
Grid to filament volts on detector ... 1.25

It is admitted that the method is crude, but at least it proves that amplification is taking place, and it is probable that the true amplification of the H.F. stage unencumbered by valve voltmeters, etc., is higher than this figure.

It would be impossible to enumerate in detail the stations received. The telephony transmissions of Continental amateurs were easily picked up, and were in many cases louder than the best British amateurs. Two attempts were made to pick up American short-wave broadcasting, but, due to unfavourable conditions, without success. At the moment of writing these notes, however, 3LO (Melbourne, Australia) is coming through at faint loud speaker strength. With the four-valve set the announcements would be as clearly distinguishable as they were on phones with the present set before the loud speaker was connected. Fading is, of course, present, but the signal strength at the "peaks" is equal to that of 5SW in London. This performance effectively wipes out any suggestion of inefficiency which might have been entertained as a consequence of the negative results from American stations during the previous week.

Sets of coils covering wavelengths up to 2,000 metres are available for ordinary broadcast reception, and on these wavelengths the set performs like any normal three-valve receiver. On short waves phones are necessary for all except the strongest stations, such as PCJJ, but on medium and long broadcast wavelengths a loud speaker can be used for many stations. For general loud speaker work a four-valve edition of this set is available.

The essential components of the short-wave set, including a pair of coils for 30-65 metres, are made up as a kit of parts for constructors and sell at 63s., extra pairs of coils being obtainable at 35s. per pair. The cost of production of the coils is necessarily high on account of the narrow two-start grooves for holding the neutralising windings. A list of recommended additional components for completing the receiver has been prepared by the company and should be consulted before commencing to build the receiver.

Complete three- and four-valve sets in mahogany cabinets, including two pairs of short-wave coils, but excluding valves, batteries, etc., cost £25 17s. 6d. and £29 5s. respectively, and are obtainable from the Igranic Electric Co., Ltd., Bedford (London Office, 147, Queen Victoria Street, E.C.4).

General Notes.

N U2BJG.—J. Betz, 65, New Nutley Avenue, Nutley, N.J., is transmitting on 40 metres and will welcome reports from Europe.

EP 3MK.—Union Radio Club, Horta, Fazal, Azores, transmits on 45 metres and also welcomes reports.

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Mr. H. V. Scott (GI 5OT), 44, Hawkin Street, Londonderry, is experimenting with a radiating system 20 metres from the transmitter, and wishes to co-operate with other stations who will help him to determine the directional effect of his aerial system, the most efficient form of feed arrangement, and any noticeable fading. The wavelength used is 45 metres, and he is usually working after 2300 B.S.T.

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Mr. R. J. Pursey (2AHU), 2, Northdown Way, Cliftonville, asks us to state that he is willing to listen and report on any 'phone signals on 45 metres at 1000-1300, 1530-1800, and 1800-2000 B.S.T. on Sundays.

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British Stations Heard in Australia.

Mr. J. W. Mawman, Premont, Cheltenham Road, Black Rock Square, Victoria, a native of Whitby, Yorkshire, who went to Australia in 1912, has sent, through Mr. G. A. Jeapes (G 2XV), a report of the British stations he has recently heard on the 20-metre waveband, using a two-valve receiver.

Call-sign.	Character.	Strength.
2NH	D.C.	R4.
2NV	R.A.C.	R5.
2OD	R.A.C.	R5.
5MA	D.C.	R4.
5MQ	R.A.C.	R5.
5HS	R.A.C.	R4.
5BY	R.A.C.	R5.
5UW	R.A.C.	R5
6RW	R.A.C.	R5.
6WY	D.C.	R4.
6YQ	D.C.	R5.
6NP	R.A.C.	R3.
5ML	R.A.C.	R4.
2NM	Telephony	R6.
5SW (B.B.C)	Speech & Music	R8–9.

TRANSMITTERS' NOTES AND QUERIES.

Danish Short-wave Transmissions.

ED 7RL, the experimental station of "Radiolytteren, and "Populær Radio," is again transmitting pictures on 84.24 metres from 2300 G.M.T. on Friday, June 29th, to 0100 on Saturday morning.

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Short-wave Stations.

The following list of short-wave stations supplements and corrects that published in our issue of February 8th, page 150, and the subsequent supplementary lists which appeared on February 22nd, March 21st, May 16th, and June 6th.

8XW	Seletar, Singapore, 30.67 metres.
8XY	Stonecutters Island, Hong Kong, 15.20 and 31.06 metres.
BYA	Admiralty, Whitehall, 38.86 metres.
BYZ	Rinella, Malta, 21.46, 35.0 and 38.0 metres.
GBM	Leafield, P.O. Station, 56.02 metres.
GBO	Leafield, P.O. Station, 17.40, 21.58, 25.04, and 30.0 metres.
GKS	Dollis Hill, P.O. Station, 11.0, 22.01, 36.45, and 52.49 metres.
KIF	Davao, Philippine Islands, 47.0 metres.
KIO, KEIO, KSIO	Kahuku, Hawaii, 25.66, 37.52, and 51.33 metres.
KIW	Zamboanga, Philippine Islands, 50.0 metres.
KPI	Cebu, Philippine Islands, 43.5 metres.
KPM	Iloilo, Philippine Islands, 44 metres.
KZAJ	Legaspi, Philippine Islands, 44.5 metres.
KZCK	Davao, Philippine Islands, 50.0 metres.
KZCN	Cebu, Philippine Islands, 47.0 metres.
KZCP	Manila, Philippine Islands, 44 metres.
KZMM	Manila, Philippine Islands, 41.0, 55.4, and 60 metres.
KZPL	Panabutan, Philippine Islands, 20.0, 54.5, and 60 metres.
PCH	Scheveningen Port, Holland, 27.8, 23.5 35.3, and 53 metres.
SAB	Göteborg, Sweden, 30.4 metres.
SAS	Karlsborg, Sweden, 31.8, 43.0, 52.5 metres (in place of SAJ, which no longer works on short waves).
VIX	Ballan, Victoria, 24.959 metres.
VIZ	Ballan, Victoria, 25.71 metres.

Spanish Amateurs.

We give below the QRA's of Spanish amateurs, EAR 78 to EAR 95, omitted from the list published on June 13th.

EAR 78	F. Visiedo, Plaza San Francisco 8, Cartagena.
EAR 79	M. Cubero, Alfredo Calderon 1, Valencia.
EAR 80	P. Roa, General Porlier 30, Madrid.
EAR 81	F. Barcelo, Gasset 8, Castellon.
EAR 82	B. Aleman, Sargento Llagas 9, Puerto de la Luz (Canarias).
EAR 83	L. Sanchez de Lamadrid, Calzada Reina Mercedes, Sanlucar de Barrameda.
EAR 84	A. Aragon, Escalerilla 1, Almeria.
EAR 85	G. Maestre, Postigo de San Martin 3 y 5, Madrid.
EAR 86	J. Raduan, San Nicolas 3 y 5, Alcoy.
EAR 87	R. Baptista, Juan Joanes 3, Melilla.
EAR 88	J. Roldan, Sor Josefina 11, Melilla.
EAR 89	J. Lafulla, Consejo de Ciento 246, Barcelona.
EAR 90	M. Blanes, Bordin 5, Almeria.
EAR 91	J. L. del Pozo, Canovas 52, Jerez.
EAR 92	Conde de Vilana, Paseo de Santa Engracia 15, Madrid.
EAR 93	M. H. Egana, Ateneo Mercantil, Valencia.
EAR 94	L. Sagues, Provenza 211, Barcelona.
EAR 95	E. Costa, Cirilo Amoros, Valencia.

We also draw attention to the fact that E 078, which was included in the supplementary list on June 13th, is the call-sign of a receiving station only.

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A Correction.

We have to correct the QRA's which appeared under "General Notes" on page 641 of our issue of June 13th:—

NU 2ET should read H. W. Hollister, 17, Denton Avenue, East Rockaway, New York.

NU 4EY should read NU 4EJ, Capt. Charles Glover, Prince Street, Georgetown, South Carolina.

NU 1BBN is Warren W. Anthony, East Main Road, Portsmouth, Rhode Island.

Our correspondent originally gave us the call-signs only, and, wishing to supplement this information, we took the names and addresses from the current number of the American list of amateur stations, but unfortunately happened upon two which had been changed since that list was printed. We acknowledge our indebtedness to Mr. A. Lambourne for giving us the correct addresses.

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ADDING H.F. AMPLIFICATION.

Difficulties in Modifying Existing Sets.

By "RADIOPHARE."

IT is rather discouraging to begin an article by repeating Punch's immortal advice of "Don't," but one is tempted to do so when dealing with the question of adding an H.F. amplifier to an existing receiver not specifically designed with this object in view. Sweeping and unqualified statements are no more justified in this case than with regard to most other wireless matters, but it may be asserted with some confidence that the majority of receivers do not lend themselves readily to this kind of modification.

As is generally known, an L.F. stage can easily be connected to the output end of any set; the essential difference between this addition and that of an H.F. amplifier is that the latter, instead of being *added*, is really *interposed* between the aerial tuning circuit and the detector valve. As a rule, this means that the components must be completely rearranged, and, instead of regarding the task as a matter of addition to the original design, it is better to rebuild, adopting a well-tried circuit, including the desired feature of high-frequency amplification, and using as many as possible of the existing parts.

An exception to the above exists in the case of a simple local-station set with anode bend rectifier followed by one or more L.F. stages, and without reaction. The detector part of such a receiver is shown at (a) in the accompanying diagram; as there is no damping due to grid rectification, and as the aerial circuit is of extreme simplicity, there is not the slightest difficulty in operating it in conjunction with a high-frequency unit. In the absence of damping, this may include a modern high-efficiency coupling without reaction, and the transformer secondary leads of the unit may conveniently be joined to a coil plug, which is inserted in a socket in place of the normal aerial tuning coil. At the same time provision must be made for feeding the H.F. valve with L.T. and H.T. current from the common batteries which feed the detector-L.F. set; this can generally be arranged conveniently by means of a three-pin plug and socket.

We now come to the regenerative detector set, of the kind which depends largely for its sensitivity on the critical adjustment of reaction; here the addition of H.F. is difficult, and, unless well done, unlikely to confer any very obvious benefit. As an example, we may consider the popular Hartley circuit, shown in diagram (b), which serves well to illustrate some of the pitfalls to be avoided.

Referring to the diagram, it will be seen that the set must, so to speak, be cut in two at the dotted line, at which point the H.F. valve and its associated coupling transformer and tuning condenser are interposed, as shown between dotted lines in diagram (c). Neutralising arrangements are omitted as not essential to the present discussion.

So far the alterations do not seem to have presented any very great difficulty, but let us consider diagram (c) a little more carefully; it will be seen that the state of affairs is not as happy as it might be, as only one-half of the aerial coil is joined between grid and filament of the H.F. valve. This was quite a good arrangement when energy was being taken from the tuned circuit by the grid detector previously connected to it, but is no longer defensible under the changed conditions, and signal strength will be reduced unnecessarily.

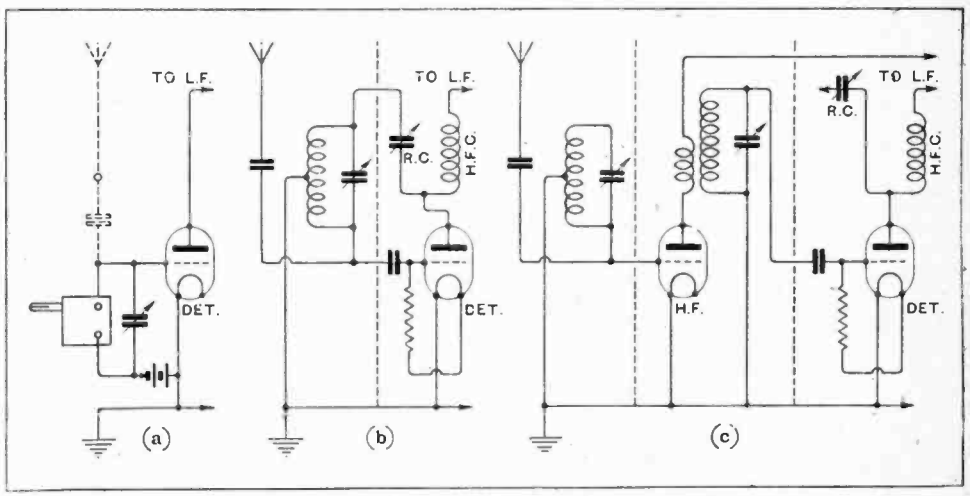

Diagram showing how an H.F. stage is interposed.

The next problem is the connection of the reaction control condenser (R.C.) which is not completed in the diagram. It is no longer possible to join it to one end of the aerial-grid coil, as before, because the feed back will now be in an incorrect sense; this is apart from the fact that reaction is best applied to the detector grid circuit, in order to overcome the damping due to the method of rectification employed. We must accordingly add a reaction coil, coupled to the H.F. transformer secondary, or "centre-tap" this winding.

From the foregoing, it will be fairly obvious that the modifications involved in the satisfactory addition of H.F. amplification are so extensive that, except in the case of a receiver like that shown in diagram (a), the final circuit may quite possibly have but little in common with the original.

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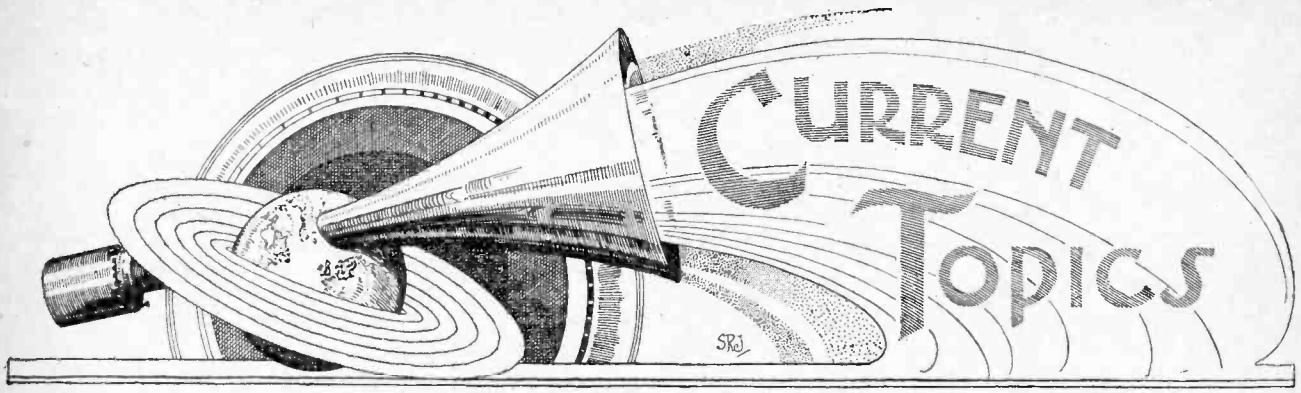

Events of the Week in Brief Review.

TOO COMPREHENSIVE ?

Despite a considerable demand on the part of members, the South African Radio Relay League has declined to change its title to "The Radio League of Africa."

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DUBILIER DIVIDEND.

The Dubilier Condenser Company (1925), Ltd., reports that the net profits for the year ended March 31st, 1928, reached £33,331. This compares with £12,260 for the preceding year. The directors propose paying a dividend of 5 per cent., less tax, on 426,250 ordinary shares.

NUNC DIMITTIS.

Soon after Dr. Henry Brierley, registrar at the Wigan County Court, had been presented with a portable wireless set on his retirement last week, the words "Now let thy servant depart in peace" were heard from Westminster Abbey.

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TRANSPACIFIC BEAM SERVICES.

The United States were linked with Australia by wireless beam service for the first time on Monday, June 18th, following the opening of the Canada-Australia beam service on the previous Saturday. The distance covered is approximately 10,000 miles.

ON SENATORE MARCONI'S YACHT. The photograph taken recently on the S.Y. "Elettra" at Southampton shows left to right: Mr. W. A. Winterbottom (Traffic Manager of R.C. of New York), Mr. David Sarnoff (General Manager of the Radio Corporation of New York), the Chief Officer of the "Elettra" (Mr. Frank K. Stanton of New York), Mrs. Sarnoff and Mrs. Marconi. Senatore Marconi has recently been conducting a number of wireless beam experiments, and we understand that he entertains great hopes of the shorter waves of the order of 10 metres and below on account of their remarkable directive properties.

TIMES AND DISTANCES.

A Radio Distance Table and Time Map of the World, produced by the Burgess Battery Company of Chicago, has been forwarded to us by the Rothermel Radio Corporation, Ltd. This useful publication, which gives distances and times at a glance, has been prepared for amateurs "in recognition of the help which the amateurs all over the world have given to radio."

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HE NEEDN'T FEEL LONELY.

An American statistician has been computing how many telephones in Europe can be communicated with from the U.S. by means of the Transatlantic telephony system. His list is as follows:—Great Britain, 1,630,000; Germany, 646,000 (3 cities); Belgium, 97,000 (2 cities); and Holland, 109,000 (3 cities). An American subscriber can also talk to 45,000 people in Mexico, 75,000 in Cuba, 850,000 in Canada, not to mention 18,365,000 in his own country.

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IN CUBA—

All kinds of educational establishments in Cuba, from the university to the smallest school, are to benefit by a new scheme of the Department of Public Instruction whereby complete wireless sets are to be supplied on loan. These instruments, which will be used for the reception of broadcast lectures, will ultimately be presented to the schools as permanent equipment.

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—AND GREAT BRITAIN.

The different state of affairs existing in this country in regard to school wireless was referred to by Major T. H. Howard, station director at Sheffield, in a recent speech. He expressed regret that the provision of wireless sets to schools should be left to private initiative and the contributions of school children and their parents. Many municipalities, he said, had already provided public assistance, and he looked to the time when every city would feel that it was for the benefit of its citizens that something should be done to ensure that every child should be able to receive the adjunct of broadcasting to its education.

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TELEVISION HOPES IN INDIA.

The development of a system of image and picture transmission in India is the object of a new company formed in Bombay under the title "The Indian Television Company."

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FUTURE OF THE BEAM.

A resolution of protest against the rumoured transfer of the beam wireless and cable services from the Government to private interests was passed by the Union of Post Office workers at a meeting in London last week.

Mr. Bowen, secretary to the Union, declared that whereas the British Post Office had been successful in maintaining international communications, private enterprise had been "beaten to a frazzle."

EIGHT MILES OF WIRING.

The wireless installation opened last week at the Lodge Moor Hospital, Sheffield, operates 40 loud speakers and can feed 400 telephone points. Mr. J. W. Ridgeway, of Messrs. Metro-Vick Supplies, Ltd., stated that the installation incorporated eight miles of wiring. The bulk of the subscriptions came from readers of the *Sheffield Independent* and *Sheffield Mail.*

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KENYA CALLING.

The first broadcasting station in East Africa was opened on June 14th.

This new station is situated in Kenya a few miles out of Nairobi, the capital of the colony. This noteworthy enterprise was locally promoted and financed, Lord Delamere, the leading settler, being the chairman of the company, which is under the management of Commander L. Mansfield-Robertson, a well-known naval airman.

Kenya is, therefore, the first British Colony to possess a short-wave broadcasting station.

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SAVING TIME AND SHOE LEATHER.

Mr. Hoover, who has been nominated as Republican candidate for the Presidency of the United States, states that he intends to travel little during the election campaign. He will address the entire country as often as possible by wireless.

The new candidate's association with radio affairs is no new move. As Secretary of Commerce, Mr. Hoover has frequently been called upon to make decisions regarding wireless administration. It was he who convened the Federal Radio Commission, which has done so much to clear the American ether.

A 25-kW. LAND TRANSMITTER.

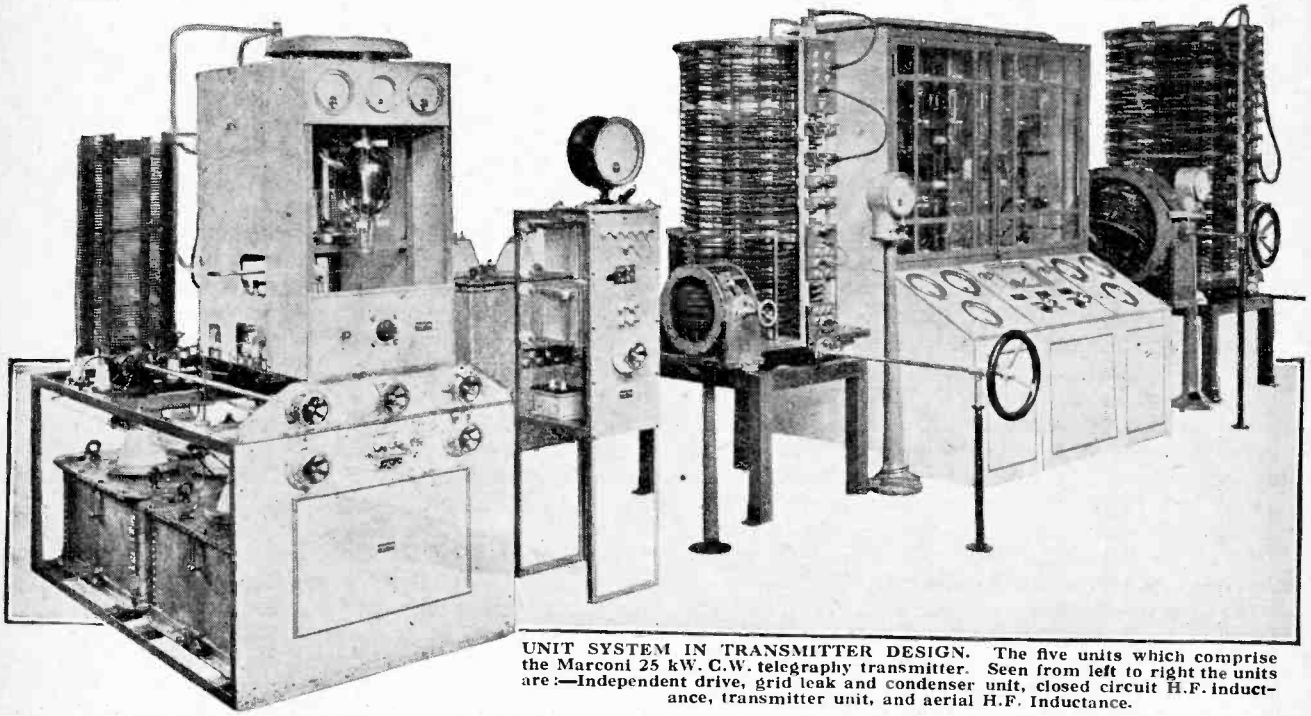
The 25-kW. Type T2 transmitter illustrated on this page is one of three Marconi Type T transmitters designed for use in land stations for commercial and service communications, at naval bases and in aerodrome ground stations. Its companions in the series are the T.1, a 15-kW. telegraph transmitter, and the T.A.1, a 4-kW. instrument for telegraphy or telephony. A feature of these sets is the adoption of a unit system of design, which facilitates installation in places where accommodation may be limited.

The transmitting unit is totally enclosed in a form of metal "bookcase," the upper portion of the cabinet being provided with glass-panelled doors or meshed screens through which the valves are visible. The use of a master oscillator ensures constancy of wavelength and secures close coupling to the aerial circuit without sacrificing the purity of the wave. Telegraphic signalling is effected by the "absorber keying" method whereby a proportion of the power of the transmitting valves or power magnifiers is shunted through an absorbing system during the spacing period. The transmitter is controlled through an electro-magnetic relay. Special relays are also incorporated to prevent damage to the apparatus due to incorrect adjustment, while a "safety gate" ensures that current is cut off when inspection is necessary.

The nominal power is 25 kW., the approximate power distribution being as follows:—

To aerial	10.0 kW.
To magnifier anodes	14.0 kW.
To drive anodes	2.0 kW.
To filaments	5.2 kW.

The normal wave-range of the T.2 transmitter is from 2,000 to 4,000 metres.



UNIT SYSTEM IN TRANSMITTER DESIGN. The five units which comprise the Marconi 25 kW. C.W. telegraphy transmitter. Seen from left to right the units are:—Independent drive, grid leak and condenser unit, closed circuit H.F. inductance, transmitter unit, and aerial H.F. Inductance.

ATLANTIC PICTURE SERVICE EXTENDED.

Since May, 1926, it has been possible, by means of the Marconi wireless photogram service, to send pictures between London and New York. An extension has now been made to the service on the American side, enabling pictures received in New York to be forwarded by wire to other important commercial centres in America. The cities embraced by the new service are Boston, Cleveland, Atlanta, Chicago, St. Louis, Los Angeles and San Francisco.

A photogram sent from London addressed to these cities is transferred in New York to the telephone-wire picture service of the American Telegraph and Telephone Company.

Since the inception of the Transatlantic photogram service it has been used for the transmission of news pictures, illustrations of the latest Paris fashions, cheques, facsimile signatures, newspaper advertisements, and even Christmas cards.

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ON RETAINING SIDE BANDS.

High Note Loss Due to Low-loss Tuning Coils.

IN designing a high-frequency amplifier for the reception of stations at a considerable distance, it is usual to give first place in the design to efficiency. This implies that the coils used will have the lowest practicable high-frequency resistance, and that the loss of side bands, which is inseparable from the use of low-resistance tuned circuits, will have to be accepted as a necessary result.

The loss of high notes from this cause will not usually be a serious matter when a distant station is being received, for under these conditions perfection of quality is seldom attainable in any case. But if it is intended to use the same receiver for reception of the local station, the adoption of some device to minimise this fault becomes a matter worthy of consideration.

In a very large number of cases some means of eliminating the high-frequency stages, and coupling the aerial to the grid circuit of the detector valve, is used when listening to the local station. If this is done a number of ways of flattening the tuning can be devised. The simplest and most obvious is to remove the low-loss coil and to replace it with a coil of higher resistance. This, however, will not appeal to those who are not using interchangeable coils.

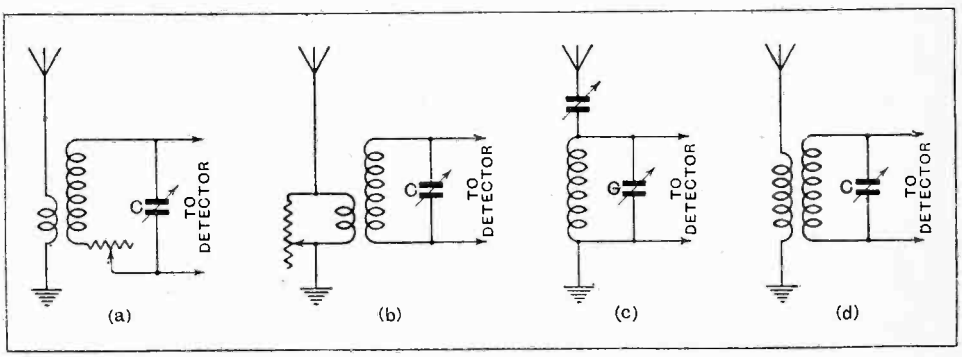
Some of the alternative methods possible, lettered *a* to *d*, are shown in the figure. Of these, (*a*) shows the introduction into the tuned circuit of a variable resistance, which may take the form of a rheostat having a maximum resistance value of some 30 to 50 ohms. This may be set at or near its maximum value when the local station is being heard, and can readily be turned to the position of zero resistance when the H.F. amplifier is again put into use for distant reception.

A variable resistance in parallel with the tuned circuit might equally well be employed, but the maximum resistance value required in this case would be in the neighbourhood of a quarter of a megohm, so that a much more expensive component would be needed. Further, resistances of this type seldom have an " off " position, so that its presence would impair seriously the efficiency of the receiver for long-range work. It is possible to employ a shunt resistance more conveniently if it is placed in parallel with the primary to which aerial and earth are connected, as shown at (*b*), for the resistance required in this position is much lower in value. For this purpose some 2,000 to 5,000 ohms would be found convenient as a maximum value of the resistance.

It is not really necessary, though it is sometimes convenient, to put in an artificial resistance in the manner suggested, for we can make use, instead, of the resistance possessed by the aerial itself. If, with this idea in mind, we were to connect it directly to the grid of the detector valve, we should throw not only the resistance of the aerial, but also its capacity, into the tuned circuit. With a coil designed to cover the broadcast band of wavelengths when used as the secondary of a high-frequency transformer, under which conditions the minimum capacity present when the tuning condenser C is set to its smallest value is only of the order of a score or so of micro-microfarads, the addition of the aerial capacity might well raise the minimum wavelength attainable so greatly as to make it no longer possible to tune in the local station. This difficulty is not so insuperable that it cannot be avoided by the exercise of a little ingenuity; (*c*) and (*d*) show two different schemes of connection for this purpose.

In (*c*) the aerial capacity is reduced by connecting in series with it a variable condenser. The adjustments in this circuit are made by setting the tuning condenser C to its minimum value, and then tuning in the local station with the aid of the series condenser, which may have a maximum capacity of 0.0005 mfd. or thereabouts. In this way we can be sure of throwing the maximum aerial load that the size of the coil permits on to the tuned circuit. The series condenser, which will only need to be altered in value when the wavelength of the local station, or the constants of the aerial, are varied, may well be of the " semi-variable " type, using mica dielectric, which has recently been introduced.

Another way of throwing on to the tuning coil as much aerial load as it will bear without putting its tuning range up to such an extent that the local station can no longer be tuned in is shown at (*d*). In this case the aerial is coupled to the tuned circuit by means of a primary (or by tappings on the main coil), and the ratio of primary to secondary is increased until the local station is heard with C adjusted to somewhere near its minimum position. High-note loss can thus be avoided when H.F. amplification is not used. A. L. M. S.



The prevention of side-band cutting is achieved by damping the tuned circuit. (a) Variable resistance in series with the secondary. (b) Variable resistance shunted across the primary. (c) Series aerial condenser to alter aerial capacity. (d) Coupled circuit in which ratio of turns on primary to secondary is made large.

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EMPIRE BROADCASTING.

Results of the Recent Range Tests Conducted by the Wireless League.

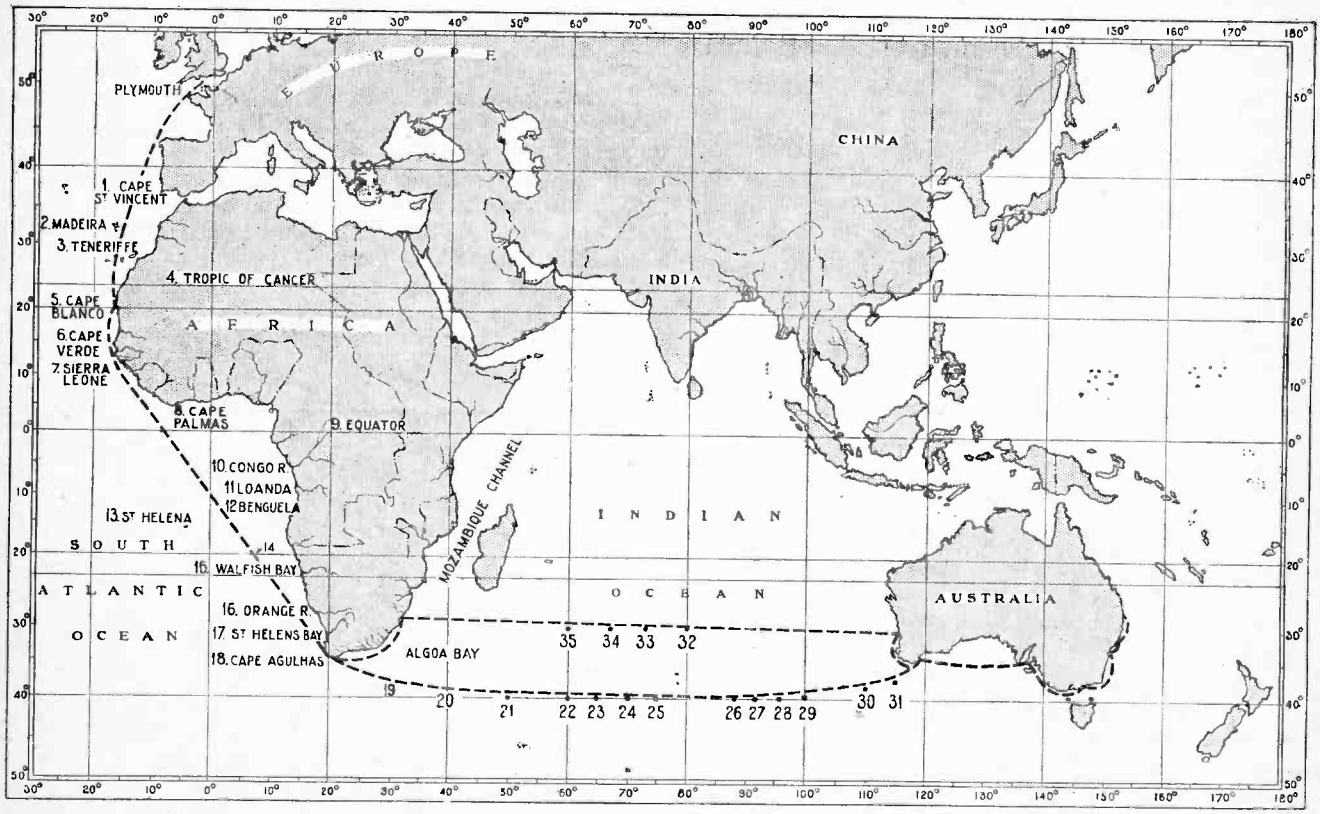
By H. A. HANKEY, League Representative.

DURING a recent voyage to the Antipodes, *via* South Africa, in order to interview broadcasting authorities, etc., in connection with Imperial broadcasting, the writer was enabled to install a short-wave "Eddystone" three-valve equipment (Det. and 2 L.F.) on the s.s. *Demosthenes* of the Aberdeen Line. The apparatus was rigged in the navigation room just below the bridge, and a 50ft. aerial projected through an insulated hole in the door and was guyed clear of an adjacent ventilator, and rose at an angle of 45° to a signal yard on the foremast. Incidentally, the earth connection seemed to serve no useful purpose, and when tried on several occasions brought in too many ship noises. A silent background was never available, "rush" coinciding with 5SW's sending period, and just at the time when atmospheric conditions are apparently splendid. A promising outlook may be indicated for the following day, only 5SW is then off duty owing to some holiday or other. And so it goes on.

Atmospherics were seldom troublesome below 40 metres or so, and by way of occasional experiment in the tropics the normal broadcasting coils were inserted when the din was usually terrific.

Reception of 5SW in South Africa.

The appended signal strengths will probably be of interest, giving roughly half an hour's reception at the figure shown, with an additional half hour's woolly and



Map showing route taken for testing signal strengths from the short-wave station 5 SW. The figures, which are referred to in the text, represent points where reception was attempted.

and there were so many variables that shore reception was comparatively a picnic! In tropical conditions there are large numbers of electric fans and refrigerating devices working in the immediate neighbourhood of the receiver, and in heavy climatic conditions the vessel is usually playing some sort of prank which may not affect C.W., but where short-wave broadcasting is concerned usually brings about strong silent tears! Then one has to contend with the law of cussedness, to wit, the traffic distorted reception. It appears that 5SW comes through in Cape Town with quite good strength and quality between 7.30 and 8 p.m., South African time, when Chelmsford is testing with America, but after this time reception is erratic, at any rate on 24 metres. There seems to be no reason why an earlier transmission should not take place from the British Isles, and the same applies to Australia, where, of course, the noon G.M.T. transmission is usually receivable and a transmission

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Empire Broadcasting.—

some three or four hours previous to this time would be received in Australia so much earlier in the evening. It is not to be expected that the general public would wish to listen after midnight, otherwise 5SW might very well transmit from noon until 3 or 4 G.M.T.

Greater Co-operation Needed.

In passing, it is well to observe that the authorities in Australia are quite willing to co-operate to a much greater extent with the Home authorities, recognising that the consolidation of effort should make it possible to link officially with the various outposts of Empire in an Imperial scheme of broadcasting. South Africa is of the same opinion, and there was evidence of surprise in both countries that more rapid progress is not being made, considering the vast importance of these means of communication between Great Britain and the Dominions.

RECEPTION STRENGTH FROM 5SW EN ROUTE.

R=Signal Strength.
Carrier=No Resolution into Signals.
— =No Reception.

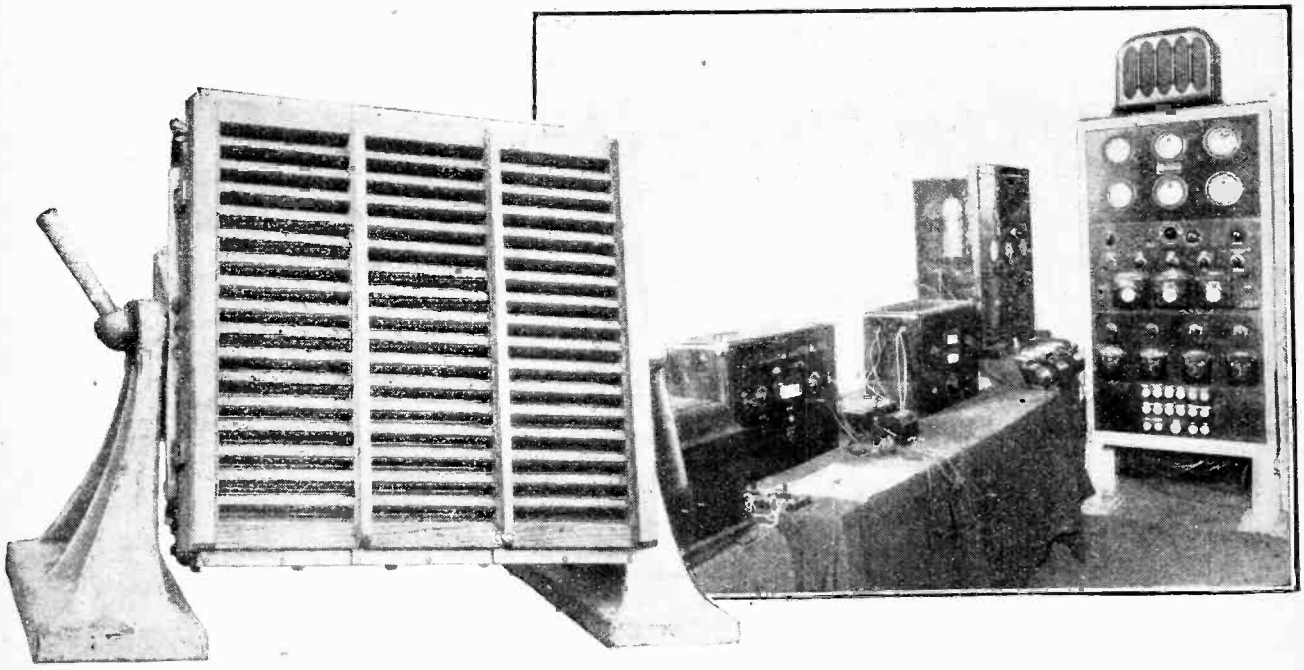
The figures which precede the names of towns, etc., are identical with those shown on the map.

Location.	Noon.	7 p.m.
1. Cape St. Vincent	R. 8	R. 9
2. Madeira	R. 9	R. 9
3. Teneriffe	R. 6	R. 9
4. Tropic of Cancer	R. 9	R. 9
5. Cape Blanco	Carrier	R. 2
6. Cape Verde	R. 2	R. 4
7. Sierra Leone	Carrier	R. 8
8. Cape Palmas	Carrier	R. 9
9. Equator	Carrier	R. 6
10. Congo River	Carrier	Carrier
11. Loanda	—	R. 9
12. Benguela	—	— (2 N.M. 4 p.m. G.M.T., R. 6)
13. St. Helena	—	R. 9
14. 20° South Equator	Carrier	R. 8
15. Wallish-Bay	R. 2	R. 6
16. Orange River	—	R. 8
17. St. Helen's Bay	—	R. 8
18. Cape Agulhas	—	Carrier
19. Algoa Bay (South of)	—	Carrier (Severe Lightning)
20. Mozambique Channel (South of)	—	R. 6
21. Lat. 40° S. Long. 50° E.	Carrier	R. 9
22. „ 40° S. „ 60° E.	Carrier	—
23. „ 40° S. „ 65° E.	Carrier	R. 6
24. „ 40° S. „ 70° E.	Carrier	R. 3
25. „ 40° S. „ 75° E.	Carrier	Carrier (*Demosthenes* jamming)
26. „ 40° S. „ 88° E.	Carrier	Carrier
27. „ 39° S. „ 92° E.	Carrier	—
28. „ 39° S. „ 96° E.	Carrier	—
29. „ 39° S. „ 100° E.	—	R. 6
30. „ 39° S. „ 110° E.	—	— (No programme 5 S.W.) (2NM just distinguishable)
31. „ 38° S. „ 115° E.	R. 3	R. 5
32. „ 30° S. „ 80° E.	R. 5	—
33. „ 30° S. „ 73° E.	Carrier	R. 8
34. „ 30° S. „ 67° E.	Carrier	R. 8
35. „ 30° S. „ 60° E.	Carrier	—

It is interesting to note that off Loanda (R.9) a special Albert Hall programme at which the Prince of Wales was present was received practically in its entirety.

The figures given above should be read as being "off" the various places mentioned, as, of course, the track of the steamer was well away from land between Sierra Leone and Cape Town.

A glance at the accompanying map will indicate what is meant. It was strange to observe on several occasions that the carrier strength was appreciably great, but that no modulation was discernible.



"MOVING RIBBON" LOUD SPEAKER. The Siemens Halske loud speaker in which the diaphragm is driven by attachment to a single strip conductor interwoven between the poles of a large number of electro magnets. It is capable of giving an enormous sound output without a marked directional effect. The amplifier and power board for controlling the H.T. and L.T. generators are shown.

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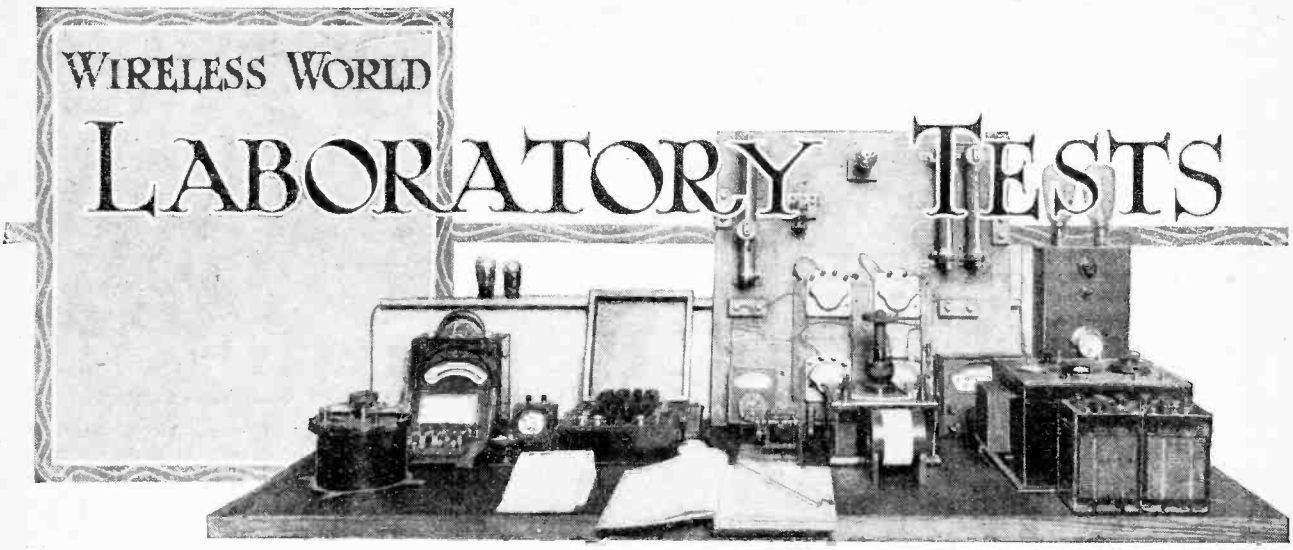
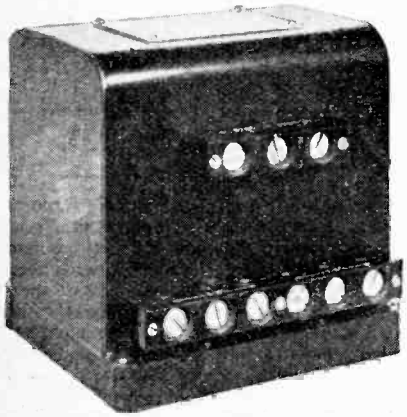


A Review of Manufacturers' Recent Products.

TRANSFORMER FOR MOVING-COIL LOUD SPEAKERS.

The rapidly spreading popularity of the moving-coil loud speaker is creating a demand among those possessing A.C. supply for a battery eliminator transformer of liberal output. Practice has shown that the shortest cut to good results, and probably the best results for home conditions, is to make use of two valves of the R.H.1 type as high-voltage rectifiers, together with an L.S.5A valve in the output stage of the amplifier. Although the R.H.1 valve is capable of dealing with an R.M.S. voltage as high as 500, it is unwise to build an eliminator giving an output approaching this value, as obviously difficulties would arise in avoiding overrunning the L.S.5A valve. Many an ambitious amateur, having provided himself with a high-voltage eliminator, has, in his endeavour to save the output valve, increased its grid bias, only to find that the consequent reduction in load has further increased the output potential. A reasonable value to decide upon is about 375 volts on a load of 100 mA.



R.I. and Varley power transformer.

A special transformer for moving-coil loud speaker operation has just been added to the range of R.I.-Varley products (R.I. and Varley, Ltd., Kingsway House, 103, Kingsway, London, W.C.2). It is designed to run completely the output stage. Although made for all mains voltages, the specimen examined had a tapped primary winding to cover supply voltages of 200, 220, 240. In addition to a centre-tapped high-voltage winding rated at 375+375 volts at 110 mA were two centre-tapped sections giving respectively 7.5 volts at 3.5 amperes, and 5.5 volts at 3 amperes. As the R.H.1 valve is of very low resistance, only a small voltage drop occurs, so that the average output potential on moderate load does not fall below the R.M.S value delivered by the transformer. The 7.5-volt winding feeds the R.H.1 filaments, and the 5.5-volt output is for filament heating the L.S.5A valve, an entirely satisfactory arrangement that solves the difficulty of filament current supply to a liberal output stage. Test figures show that this transformer on a 220-volt supply consumed about 150 watts when fully loaded on all windings. The outputs were then 370+370 volts at 110 mA, 7.9 volts at 3.5 amperes, and 5.8 volts at 3.0 amperes. The efficiency is therefore of the order of over 80 per cent., quite a high figure for a small transformer. This load would not be reached in practice, as in the process of rectification only one of the two high-voltage sections is fully loaded at a time. Three parallel-connected L.S.5A valves can be run from the eliminator incorporating this transformer, though on lighter load the output did not rise appreciably, showing the desirable property of good regulation. No mechanical hum was emitted on load—an important requirement—while extra screening in a substantial metal case encloses the stray field. A new style of finish is adopted, the case having rounded corners and a pleasing matt black surface. Polished ebonite terminal blocks are provided with screw connectors. This transformer, type W.W., can be well recommended for moving-coil loud speaker work with A.C. supply, and it is understood that it will shortly be followed by several other interesting components of the "heavy duty" type.

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P.D. ULTRA SHORT WAVE COIL.

The grid and reaction windings of this tuner consist of 18 S.W.G. enamelled wire on a 2½ in. diameter ribbed ebonite former. The reaction coil is wound with the turns touchings but a spacing of about two diameters is allowed between the grid coil turns. There are 7 turns in the grid coil with an aerial tap at the second turn. The wavelength range covered is from 19 metres upwards, depending on the maximum capacity of the tuning con-

P.D. short wave coil for use in the Mullard Master Three.

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denser employed. The former is fitted with a standard 6-pin base and the unit is intended for use in the Mullard Master Three. The price is 7s. 6d. and the makers are Messrs. Automobile Accessories (Bristol), Ltd., Sion Road, Bedminster, Bristol.

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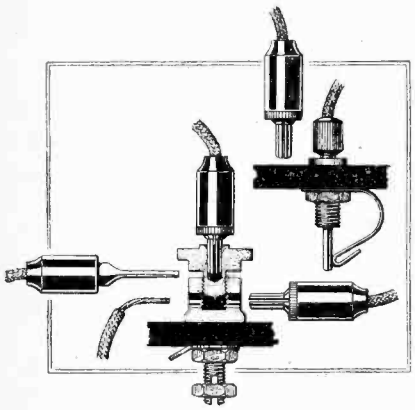
EELEX TERMINALS.

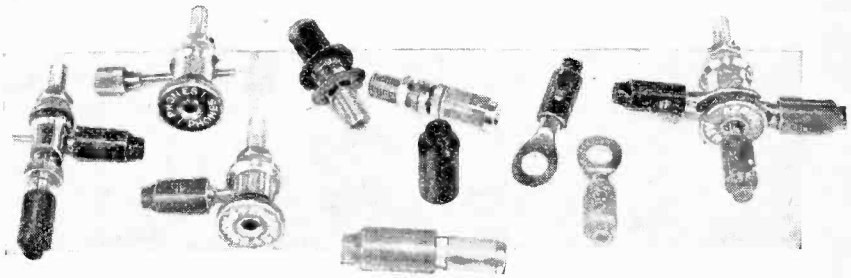
Messrs. J. J. Eastick and Sons, 118, Bunhill Row, London, E.C., have evolved a complete system of plugs, sockets and terminals which deserves the closest attention of set constructors. By careful standardisation all part are interchangeable, and in any circuit fitted with these terminals and connectors an infinite variety of connections is possible.



Eelex Treble Duty terminal showing method of connecting plugs and spades. Spring jack fitting for standard Eelex sockets.

The most important unit in the series is the Eelex Treble Duty Terminal, which is adapted for wire, spade, eyelet or plug connections. Standard Eelex plugs may be fitted temporarily in the top of the terminal head or clamped permanently in the lateral hole which is of the correct diameter. Each terminal is fitted with a coloured and engraved indicating disc let into the head; there are no fewer than 33 distinct types of marking.

A useful addition to the standard sockets particularly when these are used for telephone connections is the type T14 spring jack, which enables ordinary telephone tags to be inserted in the large diameter hole. The lateral pressure of the spring ensures a firm and silent electrical contact.



A few of the terminals, plugs and sockets described in the Eelex Catalogue.

These are only a few of the specialities to be found in the eight-page illustrated price list issued by the firm. Readers are recommended to apply for this list, which contains particulars of other components such as ratchet and see-saw switches for panel mounting; many of these are of unique design, and would add distinction to any set in which they were incorporated.

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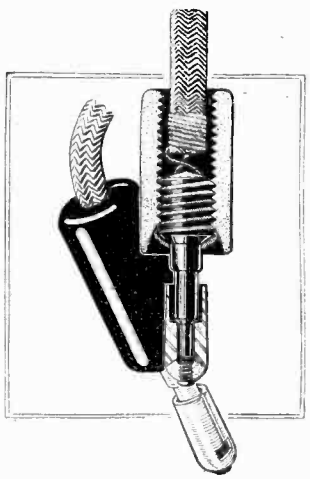
"CLIX-LOX" WANDER PLUG.

Lack of standardisation in the diameters of H.T. battery sockets and wander plugs is a frequent source of annoyance and noisy contacts. The adjustable wander plug recently produced by Messrs. Lectro Linx, Ltd., 254, Vauxhall Bridge Road, London, S.W.1, offers a complete solution of this problem; not only is it adjustable to the diameter of any H.T. or grid bias socket, but may also be locked in position so that an accidental pull on the connecting lead will not withdraw the plug from its socket.

Constructional details of the plug are shown in the sketch. The expanding sleeve is forced open by a screwed central spindle which carries a cone-shaped shoulder. The sleeve is turned and milled from the solid, and is a fine example of small repetition work, the unexpanded diameter being only $\frac{1}{8}$in. The top of the plug is covered with a polished ebonoid sleeve, and the method of fixing the wire is the same as in other Clix plugs, namely, a lateral hole and side channels for sinking the wire below the level of the screw thread. The price of the Clix-Lox plug is 2½d.



Clix-Lox expanding and locking wander plug.

CATALOGUES RECEIVED.

Garnett, Whiteley & Co., Ltd.—A leaflet dealing with the application of Lotus remote control devices to the Cossor Melody Maker.

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Nora-Radio, G.m.b.H., Wilmersdorfer Str. 39, Berlin, Charlottenburg.—Illustrated leaflets in English describing Nora" receiving sets and loud speakers.

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The British Radio Corporation, Ltd., Weybridge, Surrey.—Illustrated leaflet giving specifications and prices of B.R.C. Long Range Five, Long Range Six, and Radio Exchange receivers.

E. K. Cole, Ltd.—Illustrated leaflet describing the model T.500 permanent trickle charger.

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General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—"Osram Valves for Power Amplification with Cone and Moving Coil Loudspeakers," a booklet showing how to improve loud speaker reproduction.

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Ferranti, Ltd., Hollinwood, Lancs.—Three sheets giving amplification curves of AF3, AF4, and AF5 transformers when used in conjunction with a valve of 10,000 ohms A.C. resistance and amplification factor of 14.5.

○○○○

J. H. Taylor & Co., Macaulay Street, Huddersfield.—"The Reliability Wireless Guide," a list of wireless, electrical gramophone and television apparatus.

BOOKS RECEIVED.

Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain, M.O. 252 (6th edition), issued by the Air Minstry. Pp. 161, with map of area covered by wireless weather messages, explanation of international code, and list of stations transmitting meteorological reports. Published by H.M. Stationery Office. Price 4s. net.

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Map of the World, or Mercator's Projection, giving position of principal coast and D.F. stations and times in various parts of the world as compared with noon G.M.T., together with separate key index of coast stations. Issued by the Marconi International Marine Communication Co., Ltd.

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Some Records Specially Chosen for Electrical Reproduction.

ALTHOUGH we read of a new record which is undamaged after being run over by an omnibus, yet at present with existing types of records the problem of minimising record wear is a very real one. Undoubtedly it is desirable that one's library of records should be in the nature of an asset and not be stock which depreciates very rapidly. This problem has been exercising the minds of users of sound-box gramophones and is of still more importance to those using pick-ups. The damping on an ordinary sound box is more or less a fixed quantity, but the damping of a pick-up may vary very widely. If the damping is very light chatter takes place and there is not sufficient load on the armature to absorb the energy imparted by the needle. In a sound box this energy is used in starting a sound-wave down the horn. Under these conditions wear takes place out of phase with the record impulses, that is, the needle load is reactive and not resistive. On the other hand, if the damping is too heavy reproduction may be improved, but wear due to the pure resistance load becomes great. Records, as at present manufactured, owing to the deep indentation of electrical recording, wear fairly rapidly with an ordinary sound box, and wear may also take place with a pick-up owing to faulty adjustment.

Fibre Needles.

A suggested remedy for eliminating record wear is the greater use of fibre needles. The first impression on hearing a fibre needle on an ordinary gramophone is usually one of disappointment—the volume is very much reduced, and in addition the pitch seems to be altered. Fibre needles, however, are an acquired taste, and after experiments have been made, first with different types of records and then with individual records to find those most suitable for this purpose, they are found to have quite a definite utility. Generally speaking, 'cello, violin, and organ solos, chamber music, and the soprano voice sound quite well with fibres. On orchestral records they are not so good. The pick-up user benefits by all the advantages and encounters but few of their disadvantages when using them for his reproduction.

As before, record wear is greatly minimised. Although there is a large drop in output this can readily be compensated for by adjusting the amplifier gain.

In addition to the foregoing there is this further advantage. A steel needle transmits the higher voice frequencies almost too well, and if the amplifier, as the majority of thermionic valve amplifiers tend to do, over-amplifies the treble, the resulting tone in the loud speaker is shrill. Fibre needles seem to discriminate in favour of the base notes, although not excessively so, hence the use of fibres tends to give a true reproduction by correcting the amplifier characteristic, much in the same way as the use of a resistance stage with a falling frequency characteristic followed by a transformer stage with a rising characteristic tends to give a correct output in an amplifier.

Unfortunately, the advantages of fibre needles in this connection have not been fully realised by pick-up manufacturers. I believe I am correct in stating that only in one maker's product is the needle holder cut for fibres. Doubtless, as soon as the need for them is appreciated, not only will needle holders be made suitable, but pick-ups will be designed exclusively for use with fibre needles. Adapters are not entirely satisfactory, and the enthusiast who wishes to try fibres should round off the ends of each needle, a process apt to be rather tedious, although well worth while from the point of view of the increased life of records thus obtained.

A disadvantage of fibres is the annoying possibility of the point breaking down in the middle of a record, but by paying attention to such things as needle-track alignment and the levelling of the turntable, the probability of a breakdown taking place can be materially lessened.

A Review of Records Recently Produced.

HIS MASTER'S VOICE.

The H.M.V. May Bulletin contains some further Backhaus recordings. The Chopin Waltz in E flat—DB1131 was found to be particularly pleasing, its well-known air and the nice balance of tone contributing to this result. The other piano record, Liszt's 8th Hungarian Rhapsody—B2667, played by Mark Hambourg, gave a good reproduction with fibre needles. Although not so well known as the 2nd Rhapsody, the 8th is quite an effective composition. Another record that gave really good results with fibre needles was Raff's Cavatina, played by Arthur Meale on the Central Hall Organ—B2695. On the reverse side is the Blue Danube Waltz, and the two combine to make what should prove a popular record.

The Elisabeth Schumann record of four Schubert songs, Die Post (The Post), Die Vogel (The Bird), Im Abendroth (At Sunset), and Wohin (Whither), seemed well suited for pick-up reproduction. The volume is sufficient, but not excessive, and also does not vary too widely; that is to say, you have not constantly to adjust the amplifier volume control. The singing is clear, and, as so often noticed during broadcast transmissions, the piano accompaniment is natural in tone.

Turning to the lighter records, Winnie Melville and Derek Oldham sing two songs, Just a Memory and The Song is Ended, on B2696, with great success. The voices blend well, the orchestral accompaniment is satisfactory, and the style being that of musical comedy, the record is sure to have a wide appeal.

Two other successful H.M.V. records, issued in the mid-April list, are DB1119, The Love Duet, Act 1, from Puccini's Madame Butterfly, sung by Margaret Sheridan and Aurelian Pertile, and D1305, Spanish guitar solos by Andres Segovia. The former record is very brilliant, and in parts has tremendous volume. Margaret Sheridan's tone is always good, and the tenor uses his voice to great advantage. The guitar record will have a particular appeal to those who collect the unusual, and must certainly be placed among the best electrical recordings because of the naturalness of the tone of the guitar.

Dance music is in almost all cases well recorded, and the present H.M.V issues are no exception to this rule. Two records which were found to be particularly good were B5456, Broken Rhythm, played by the Rhythm Band, and B5457, Clowns in Clover Medley, played by Sydney Baynes and his orchestra. Two special records for teachers of dancing have been made by the Gramophone Co., but they will have a much wider circulation than this select circle. They are B5454—Rain, competition slow foxtrot, and B5455, Miss Annabelle Lee, competition quick foxtrot. Both are played by the Palais De Danse Orchestra, and are in what may be called the English style—comparatively straight tenor and alto saxophone solos with a

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Records for the Gramophone Amplifier.—

background of banjos and an absence of pretentious trombone effects.

COLUMBIA RECORDS.

There are two noteworthy features about the May Columbia issue. The first is that the recording is distinctly heavier, and the second is that the speed on several of the records is 78 revolutions per minute in place of Columbia's previous standard speed of 80. This is a step in the right direction, as it is rather troublesome to alter the speed regulator when using different makers' records, although for good results the correct speed is necessary.

Undoubtedly the plum of this issue is Haydn's Clock Symphony, played by the Hallé Orchestra, under Sir Hamilton Harty, and recorded in the Free Trade Hall, Manchester (L2088/2091). This orchestra is well known to broadcast listeners, and this record is quite up to their usual standard. Although the volume is decidedly great, it was found quite possible to play all the records without shock excitation of the pick-up and its supporting arm—by no means always the case. The album for containing the records has a certain amount of descriptive notes, which should prove helpful.

A feature of the composition is the fact that the movements split up naturally into lengths suitable for records.

The second record contains the whole of the andante, the dominant rhythm of which gives the symphony its name, and forms a good sample record for those who do not wish to incur the expense of the complete work.

Sir Thomas Beecham, conducting the Royal Philharmonic Orchestra, gives a notable recording of Delius—On Hearing the First Cuckoo in Spring, L2096. The music is exquisite in character, and the atmosphere of the composition has been very satisfactorily recorded.

Those who treasure Dvorak's New World Symphony among their best records will no doubt also enjoy the London String Quartet's record of the same composer's Quartet in F, L2092/2094. Old negro melodies inspired Dvorak in each work. Although not appealing to everyone, chamber music undoubtedly reproduces splendidly through the medium of a pick-up, and also with fibre needles. The music improves on better acquaintance, the third record being the most effective.

Solo Instruments and Electrical Recording.

A new orchestra on the Columbia list is that of the Brussels Royal Conservatoire, and is conducted by Desire Defauw. From their first record, which is successful, although inclined to be heavy, one imagines that more records will be requested. They play Strauss's Till's Merry Pranks on Nos. 9375/9376, both of which have intense volume.

A record that is recommended with every confidence is No. 9374, the Mandolin Band of Leghorn recording of Semirande. The tone of the mandolins gives a kind of relish to a rather old-fashioned tune, and, as the recording is excellent, the record is certainly one that should not be missed.

William Murdoch provides an excellent record on No. 9372, and plays Paderewski's Minuet in G major. The reverse side, Duetto, Song Without Words, No. 18 (Mendelssohn), is equally good. The same Minuet is splendidly played as a Xylophone Solo by Ray Starita on 4782.

The recording of solo instruments seems to have been much improved by electrical recording, although at the commencement it was supposed that this type of recording would be of value only for mass music such as choral and orchestral works.

The same excellence of recording is maintained in the Billy Mayerl record of Pianoforte Solos, No. 4783. The pieces are syncopated, although very melodious, and the record recalls the very successful Edythe Baker recording of "My Heart Stood Still."

Joseph Szigeti on L2097 gives a good performance of Slavonic dance in G minor No. 1 (Dvorak-Kreisler), played as a violin solo. The record is notable for crisp playing and double stopping.

Although Roy Henderson is somewhat heavy in No. 5 of his "Maud" Song Cycle, 4772, No. 4 of this series is pleasant.

Another newcomer to the Columbia list is Bella Baillie, who gives a very good performance of two Mozart airs from "The Marriage of Figaro." Both the airs, which are sung in English, are well known to gramophone record collectors, being *Voi che sapete and Deh vieni, non tardar.* Both the numbers are sung in good style, and the record does not suffer by comparison with other recordings of the same airs by better-known singers. Organ records have benefited tremendously by electrical recording; in fact, it can be stated that there were no really good organ records prior to its invention, and the records of the Egyptian Ballet by Quentin Maclean on the Shepherd's Bush Pavilion organ on No. 4769-70 are good representatives of their class. There is a very deep chord at the end of Part 4; if your equipment is able to render this adequately you can be quite satisfied.

Some Lighter Records.

A further good pianoforte record is that of Gil Marchex playing Gigue in G minor (Scarlatti) and Rondo Alla Turca (Mozart). The gigue was found interesting, the recording of the peculiar Scarlatti staccato effects being very clear.

Reviewing the lighter records, Layton and Johnson have set a high standard in their previous records, and in their latest issue they are as good as ever. The outstanding features of their recordings are the natural blend of their voices and their clear articulation. They have returned to the old well-known nigger troupe tunes in their Plantation Medley—9318, and their second record, 4775—Miss Annabelle Lee, is noteworthy for a piano solo by Layton on one side and for a typical hummed chorus in "So Tired" on the other.

Vaughn De Leath records for several companies, and the reason for the demand for her services is evident in her recorded duet with Frank Harris on 4779. Her style is that of the variety stage. Florence Oldham has a very good record in 4776, and both sides are daintily sung. Hers is a *petite* style, and this record is notable for the way in which the intimate atmosphere of her singing is reproduced.

It is interesting to contrast the styles of British and American dance bands. Of the British records No. 4785, "I'll be Lonely," by Debroy Somers Band, and No. 4787, "Sweet Suzanne," played by Ray Starita and his Ambassadors' Band, were of outstanding merit. The Debroy Somers record recalls the Savoy bands at their best.

The American style is more bombastic in character, and trombone effects are a marked feature. Of records of this class the following can be recommended with all confidence: 4791, "Worryin' Waltz"—Don Voorhees and his orchestra; 4790, "Down the Old Church Aisle"—Ted Lewis and his band; 4792, "Let a Smile be Your Umbrella on a Rainy Day"—Paul Specht and his orchestra; and 4793, Miss Annabelle Lee, "The Knickerbockers."

A. G. McD.

A BIAS BATTERY PITFALL.

BIAS batteries are all-too-often neglected, more especially the small cell used for giving a negative potential to the grid of the H.F. valve. It would seem desirable, therefore, that there be only one grid battery in a receiver to perform all the functions now undertaken by the usual large grid battery, and the small battery biasing the H.F. valve, since there would then be only one battery to remember when testing. Unfortunately, however, if a flexible lead is brought across the various components in the receiver to the large grid battery, it is not unlikely that instability may take place due to the presence of H.F. energy in this lead.

This can be overcome by adapting the principle of the anode feed system to the grid of the H.F. valve, a 0.25 mfd. fixed condenser should be connected to the low potential end of the oscillatory circuit of this valve, the other side going to the negative side of the filament. One end of a small resistance (which need not be of the wire wound type) is connected to the first point, the other end of the resistance connects to the flexible lead attached to the wander plug. The high frequency energy is then definitely deflected by the resistance and compelled to pass through the fixed condenser to the negative side of the valve filament.

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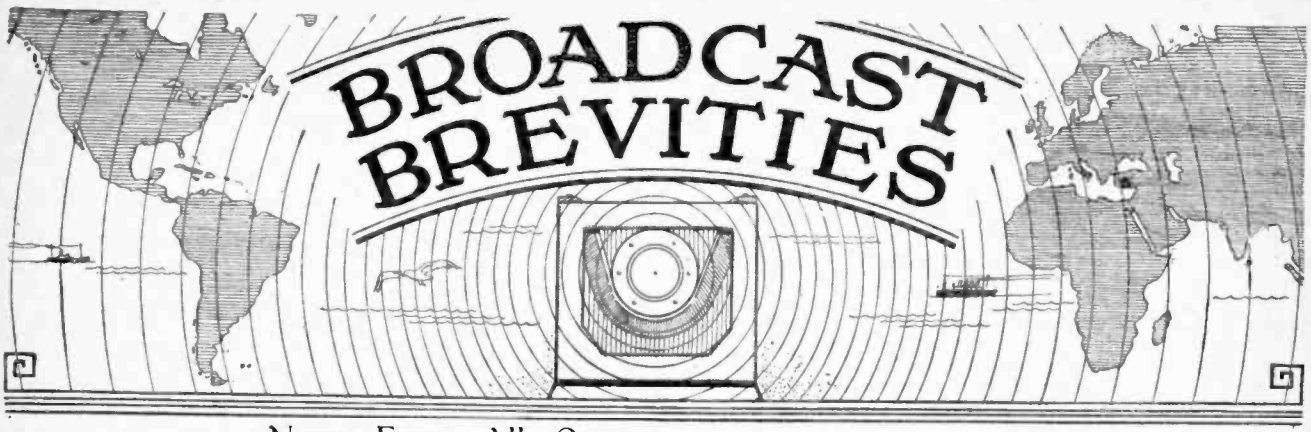

News From All Quarters: By Our Special Correspondent

The B.B.C. Report.—Two Stations: One Wavelength.—Dual Transmission Doubts.—New Work at Clapham.—Another Hour Talk.—End of Poetry Series.

An Historical Document.

The B.B.C. Annual Report has an historical flavour—historical, not in the sense that it makes memorable history, but in the sense that it deals with a year that was dead and gone nearly six months ago.

Readers of *The Wireless World* are thoroughly acquainted with the work recorded in the Report, but some of the figures mentioned make new and interesting reading.

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Interesting Percentages.

The total revenue expenditure was £773,289 16s. 8d., of which £487,728 8s. 6d. was spent on programmes and £131,036 14s. 8d. on maintenance of plant. Against these expenses there are the healthy looking sums of £800,959 5s. and £93,686 10s. 1d., the former being the income from licences, and the latter the revenue derived from their publishing business. The balance carried forward was £128,336 17s. 6d.

How the expenditure was distributed over various sections of activity is shown in tabulated form. The expenditure on programmes amounted to 63.07 per cent. of the total. The maintenance of plant, power, etc., absorbed 16.95 per cent., rent, rates, insurances, etc., 8.18 per cent., and administration expenses 6.58 per cent. The remaining 5.22 per cent. was devoted to the staff provident fund, Governors' fees, and provision for depreciation.

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Music and Talk.

Perhaps one of the most significant facts mentioned in the Report is that music formed about two-thirds of the total programme material. This may have surprised many listeners, especially those who dislike talks, but their surprise is probably due to the fact that an unwanted talk generally seems to last twice as long as a piece of music of the same duration.

On the other hand, there are listeners to whom certain pieces of music seem to last an eternity.

"A Crucial Experiment"

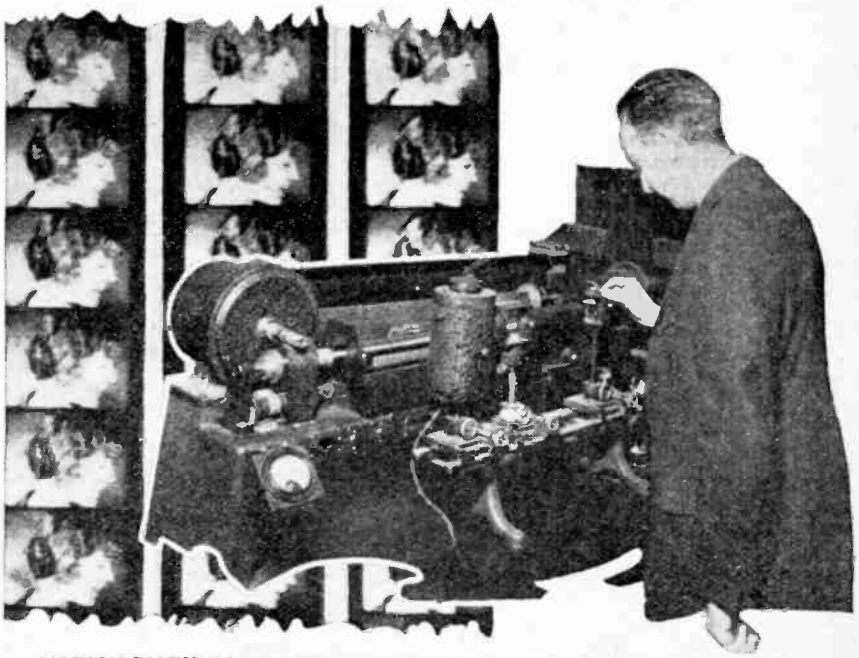
The Report also mentions "a crucial experiment," planned for the early part of 1928, in transmitting from two stations on the same carrier frequencies without mutual interference. A test of this kind, which did not achieve newspaper publicity, and does not seem to have been so "crucial" after all, took place about a month ago.

The stations concerned were the old Birmingham transmitter and Daventry Experimental. The same performance was broadcast from each, a special effort being made to keep both stations on exactly the same wavelength. I believe that the experiment was not entirely a success, there being a suggestion of heterodyning whenever one or other of the stations "wobbled."

Doubts about Dual Transmissions.

It is considered extremely unlikely that the London Regional Station, when it begins working, will operate on both its allotted wavelengths, although the twin transmission system will be installed. Single wavelength working will first be carried out in deference to the doubts expressed by the Postmaster-General as to the feasibility of double transmissions from the same station. This is not an indication of any weakening of expert opinion on the matter at Savoy Hill, and I was assured by a B.B.C. official that the engineering staff still pins its faith to dual transmission.

It is expected that both transmitters will be used simultaneously for tests after broadcasting hours.



MOTION PICTURES BY WIRE. The photogram service of the American Telephone and Telegraph Service was put to a novel use recently when Vilma Banky, the screen star, was filmed in Chicago at 10.30 in the morning, the picture being exhibited in New York the same evening. Ten feet of the film were transmitted by wire in two-and-a-half hours. Above can be seen the transmitter and a portion of the film.

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A Studio at Clapham.

The B.B.C. research establishment at Clapham has been steadily increasing in size during the last few months, the staff now numbering 76.

Sound measurements form the basis of experiments just now, and a special studio is being erected resembling in every way a typical studio at Savoy Hill. There will, of course, be no actual transmissions from Clapham, but the "performances" in the new studio will be heard by engineers in an adjoining room. The reproduction of normal broadcasting conditions should go a long way towards the conquest of those little acoustic freaks which are still noticeable in many of the transmissions.

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Sic Transit . . . .

Although the exterior of the secluded house on Clapham Common has undergone few changes since the B.B.C. invasion, the same can hardly be said of its interior. I fancy that the late occupant—a Deputy-Governor of Brixton Prison—would rub his eyes if by any chance he had a glimpse into his former domicile.

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"P.P.'s" Vocal Chords.

How many wireless speakers can hold the interest of listeners for a whole hour? They can be numbered upon the fingers of the hand. Sir Oliver Lodge is among them; so also is Captain Eckersley, the B.B.C.'s chief engineer, who is to chat to 2LO and 5XX listeners about broadcasting on July 9th. For these special hour broadcasts, "P.P." himself says, he has to go through a period of intensive training to get the vocal chords in good trim.

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Play on an "Agony" Advertisement.

In his one-act play "Stars," which is to be broadcast from Glasgow on July 12th, Guy Rawlence has used the "agony" advertisement with telling effect. His play deals with an eccentric old gentleman who inserted an advertisement in a daily paper asking anyone who was thoroughly unhappy to join a party at his house on a certain evening. His guests naturally enough formed a very strange gathering indeed, and the play relates the story of their meeting. It will be presented by a strong cast, consisting of William J. Rea, Elsie Brotchie, Gordon Gillard, Seath Innes, Catherine Fletcher, and C. R. M. Brookes.

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A Thankless Occupation?

A writer in a Sunday newspaper recently referred to "one of the most thankless of all occupations—that of wireless accompanist." But is this a thankless occupation?

"Our accompanists do not regard their occupation as such," said a B.B.C. official when I raised the point. "They fill a most important rôle in the presentation of programmes, and we believe that their efforts are appreciated by the public."

A more thankless task is surely the announcer's. In his job there is no room for the projection of personality; practically every word that he utters is governed by the printed slip, and if his own idiosyncracies should creep through to the extent of a mispronunciation, or even an unusual intonation, he may hear of it before the next sunset. The accompanist, on the other hand, has a fair scope for the expression of his own individuality, especially as, in most cases, his work extends to short recitals and improvisations between programmes.

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Next, Please!

If statistics could be prepared regarding the causes of broadcast transmission stoppages, quite an imposing number of the smaller animals could claim honours. In the early days, Daventry was held up by a suicidal mouse, and I believe that a house-fly once had a hand (or leg) in bringing an American programme to an abrupt conclusion. Birds are more insidious in their efforts, as they attack insulation in aerials, often with the assistance of spiders, though the latter limit their sphere of action to tropical countries.

The latest recruit is a lizard which, in dying unpleasantly between the main tuning coils of the Calcutta station last week, cut short a news bulletin. This shows that even a lizard will turn.

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"The New Portia."

A Dion Titheradge play, "The New Portia," will be transmitted from 2LO and 5XX on Saturday next, June 30th. Lawrence Anderson and Mark O'Farrell are taking part.

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A Posthumous Programme.

Arranged in the late Sir Herbert Brewer's lifetime, a programme which he had hoped to conduct himself will be broadcast from the Cardiff station and relayed to 5GB on July 8th.

It is called "On Severn's Banks," and will be a tribute to many great English musicians who were born within sight and sound of the Severn, including Sir Edward Elgar, Sir Hubert Parry, Sir Herbert Brewer, Mr. Basil Harwood, Gustav Holst, Vaughan Williams, Herbert Howells, not forgetting the musical historian, Sir Henry Hadow.

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Poetry Series to End.

The "Foundations of English Poetry" readings, which have been broadcast on Sunday afternoons during the past six months, will be concluded on July 8th.

Thereafter a return is to be made to the Old Testament readings. The new series will be arranged by Professor James Moffat, of the Union Theological Seminary, New York, and will consist of lyrical passages from Judges and Job.

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Heterodyned History.

Phases in the story of Henry VIII. have at various times provided L. du Garde Peach with excellent material for amusing listeners in his "Heterodyned History" series. Manchester station will broadcast some of these skits to-morrow evening (Thursday), under the title of "Henry VIII.: Some More Heterodyned History." L. du G. will be present in the Manchester studio to read those parts of the story which link up the dramatic numbers.

FUTURE FEATURES.

London and Daventry.

JULY 2ND.—"The Crossing," a play for broadcasting by Holt Marvell and Cyril Lister.
JULY 3RD.—Vaudeville Programme.
JULY 4TH.—Symphony Concert.
JULY 5TH.—"Turandot" (Act 2), relayed from the Royal Opera House, Covent Garden.
JULY 6TH.—"I Pagliacci" (Act 1), from the Royal Opera House, Covent Garden.
JULY 7TH.—"The Linkman," an original revue of musical comedy tunes and scenes arranged by George Grossmith.

Daventry Exp. (5GB).

JULY 2ND.—From the Musical Comedies.
JULY 3RD.—"Aida," from the Royal Opera House, Covent Garden.
JULY 4TH.—"The Last of Carlovitch," a play by Edwin Lewis.
JULY 5TH.—Concert relayed from the Arts Theatre Club.
JULY 6TH.—"The Linkman," an original revue of musical comedy tunes and scenes arranged by George Grossmith.
JULY 7TH.—A Concert of British Music.

Cardiff.

JULY 2ND.—Clapham and Dwyer in a Spot of Bother.
JULY 4TH.—A West Country Programme.
JULY 6TH.—Arthur Prince and Jim.
JULY 7TH.—A Mediterranean Night.

Manchester.

JULY 3RD.—A Roger Quilter Programme, arranged and conducted by the Composer.

Newcastle.

JULY 3RD.—Concert by the Municipal Orchestra, directed by Frank Gomez.
JULY 6TH.—"Jessie of Jesmond Dene," a revue written by Hugh Francis.
JULY 7TH.—Hebburn Colliery Prize Silver Band Concert.

Glasgow.

JULY 1ST.—Day of Remembrance Parade relayed from the Cenotaph, Glasgow, including an address by H.R.H. The Prince of Wales.
JULY 3RD.—Italian Music.
JULY 7TH.—Scots Favourites.

Aberdeen.

JULY 6TH.—Arthur Prince and Jim.

Belfast.

JULY 2ND.—Irish Variety Programme.
JULY 6TH.—A Garden Concert.

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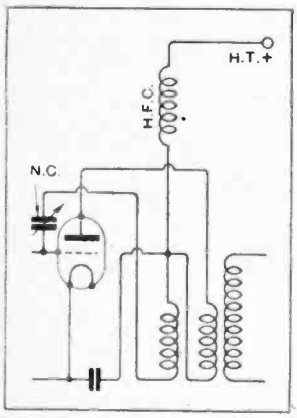
The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

RESISTANCE FEED.

Sir,—I was rather interested to note that an anode feed resistance had been included in the plate circuit of the H.F. valve of the new "All-Wave Four," described in your issue of June 13th. It reminded me of a good deal of trouble I experienced some time ago in dealing with a five-valve receiver having two stages of H.F. amplification and fed from the mains.



It had been found impossible to stabilise the H.F. valves. The eliminator in use was one not having H.F. chokes incorporated, which may have had some bearing on the trouble. However, by including H.F. chokes in the anode feed of the H.F. valves, as shown in the accompanying diagram, the set became absolutely stable. Incidentally, it was found that by shunting the H.F.C. with a condenser, a reaction effect was obtained, which in this case was almost constant over the tuning range.

Perhaps some of your readers using multi-valve sets may be interested in the circuit and may find that that which they had considered an efficient stage of H.F. amplification owed its efficiency to inherent reaction.

Those of your readers who are interested in reception with a reaction detector followed by L.F. amplification may like to know that the anode feed system cures L.F. howling when the detector is pushed to the edge of self-oscillation; this is especially so when a H.F.C. is included in series with the anode feed resistance.

R. CUSTERSON.

Connaught Road, Ilford.
June 14th, 1928.

IDENTIFICATION OF FOREIGN STATIONS.

Sir,—May I be permitted to add my voice to those who have expressed opinions on this subject? I suppose it may be taken as an axiom that a listener wishes to know what station he is hearing; he may not have heard the beginning of an item—many of us are too busy to spend a whole evening, but just tune in when we are at liberty and perhaps only listen for a short time. For this reason every station should frequently announce both the preceding item, its identity and the next item. But for this to be of any use it must be *understood*. The B.B.C. appears to think that the needs of listeners who do not understand English should be ignored, but we all know how much of a commonplace it is becoming to roam abroad in the ether, and no doubt foreign listeners do the same, naturally. The ether is free to all and broadcasting should be a thoroughly co-operative affair. To develop this to the utmost it is necessary that the identity of stations and essential items such as duration of pauses, time of next item, termination of programme, etc., should be announced in some way that listeners *everywhere* may easily prepare themselves to understand. Very well then, how is this to be done? Not by some weird and intricate combination of musical notes that cannot be memorised—nor by morse which few people know and can use for any other purpose.

The Union Internationale de Radio gives us the expert guidance needed—*it advises the use of Esperanto.* Why have a central body such as this if we pay no attention to it? This is the practical, scientific solution of the problem. Thousands of people in every land know Esperanto already—those who do not can easily learn sufficient for this purpose and if they carry on until proficient they will acquire something of great use to them in other directions.

The way to get this matter settled is for those who are informed to make up their minds and urge others to do likewise. I hope, therefore, that you, sir, will come off the fence and will strongly urge your readers and the B.B.C. to fall into line with the 40 or 50 other stations now regularly announcing in Esperanto (in addition to the national tongue, of course). The world of to-day badly needs Esperanto in many other spheres and this is one more direction in which radio can serve the world—by helping to propagate what is the most beneficent and useful instrument that has ever been given to us for our assistance and uplift.

THOS. E. A. SOUTHERN, M.U.E.A.

Cardiff.

MOVING COIL REPRODUCTION.

Sir,—I am interested in the correspondence to you on the subject of moving coil reproduction, and having read one or two of your correspondents' opinions on this subject I would like to give the results of some experiments I have carried out in connection with the question of good quality with small volume.

In the first place I decided that the set should be a three-valve Det. and 2L.F., also that the magnification per stage should be such that the output could be easily handled by a super power valve with from 120 to 150 volts on the plate. The intervalve couplings being resistance and transformer, ordinary commercial apparatus being used.

The speakers used for the test were of two types :—

(1) Low resistance moving coil with 25-1 O.P. transformer, very small air gap and strong field.

(2) High resistance moving coil, fairly large air gap, and not a particularly strong field.

Results :—

No. 1 Speaker.—Volume too great for comfortable audibility, low notes especially, such as double bass viols and timpani, causing what I can only explain as an irritation to the nerves (this is not characteristic of myself alone, but was experienced by several listeners; nor was it due to any resonance in either set or speaker). Speech was akin to a man making announcements through a megaphone.

No. 2 Speaker.—Volume just comfortable with slight accentuation of high notes, low notes well reproduced and soothing in

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intensity. Speech natural, giving one the impression of a person reading aloud in the room.

From the results of these tests I came to the conclusion that good and natural quality of reproduction did not necessarily mean that the intensity of output from the speaker had to equal the input at the transmitter; and if such was attempted for ordinary home use would lead to abnormal conditions.

Further, that if the volume was controlled by means of the magnetic field better results were obtained than by the usual methods of variable anode or grid resistances, and finally that high power output was only necessary in the case of public demonstrations in large halls.

I should very much like to hear some opinions from your readers on these results. LIONEL COLE.

Clapton, E.5.

HOSPITAL INSTALLATIONS.

Sir,—Your correspondent BM/BB3A has raised a point of considerable importance in his letter on the maintenance of hospital installations.

Our experience of this class of receiver has convinced us that there is only one absolutely satisfactory solution—the automatically controlled, mains operated installation which may be locked up and requires no attention other than a short visit once a week.

Such an installation is admittedly more expensive in the first instance, but we have definitely proved that this is more than offset by the subsequent saving in running costs and freedom from breakdown due to negligence, forgetfulness and other causes which may affect a battery-operated receiver.

We generally recommend that a member of the hospital staff should be made responsible, and that the key to the equipment should be kept by him alone, thus avoiding the possibility of unauthorised interference.

THE MARCONIPHONE CO., LTD.,
W. H. PEAK, Managing Director.

June 16th, 1928.

PUSH-PULL.

Sir,—Our attention has been called to an article on page 547 of your issue of May 23rd, 1928, entitled "A New Method of Push-Pull," by Mr. L. E. T. Branch, B.Sc.

The method of amplification as disclosed by Mr. Branch is a direct and undoubted infringement of our British Patent No. 275/15 which covers the principal of Push-Pull amplification.

We would ask you to be good enough to find space, if possible, in your valuable paper for this letter so that we may take this opportunity of warning all constructors of sets that we intend to uphold our patent rights but that, on the other hand, we are quite prepared to grant licences for the construction of amplifiers using this principle, for use with radio broadcast receiving sets, to all manufacturers and serious amateurs who care to apply to us.

H. P. A. DISNEY, Secretary,
STANDARD TELEPHONES AND CABLES, LTD.

London, W.C.2.
June 14th, 1928.

MORSE INTERFERENCE.

Sir,—Replying to Mr. W. R. Younger's letter in *The Wireless World* of June 13th, it is obvious that he has only a very vague idea of the regulations that govern the activities of the wireless office ashore and afloat. The last paragraph of my letter was intended to apply to every wave upon which Morse was heard. Mr. Younger says he does not "grin and bear it" when he is experiencing interference on the waves 500-550 and 1,000-2,000. Now I propose to show him that not only must he grin and bear it, but that interference round about those waves really comes from the broadcasting stations and not Morse stations, since ships and coast stations were busy on those waves long before broadcasting was thought of. He was suffering from no delusion when he thought ships had certain specified waves upon which to work. They have, but one happens to be 450, another 300 metres, and, in many cases, 500. Also there are many ships and coast stations which work on 1,000, 1,200, 1,400, 1,600, and 2,000 metres, and have done so for years now. So he will see that when he hears Morse on the broadcast band he is hearing ships and coast stations working on their officially appointed waves, and must "grin and bear it."

In conclusion, I may inform him that not only are there many regulations for the use of Morse commercially, but that they are rigorously enforced, as many operators can testify from bitter experience. The solution to the trouble *may* lie in allotting to the various broadcasting stations waves that do not "interfere" with the commercial working of ships and shore stations. A LISTENER.

London, S.E.24.
June 18th, 1928.

CLUB NEWS.

Teaching the "Why and Wherefore."

A worthy attempt to attract recruits from the large number of listeners who have built multi-valve sets while ignorant of the "why and wherefore" is being made by the Hackney and District Radio Society, which has decided to commence a series of discussions on the elementary principles of wireless. It is hoped that, among other things, these informal meetings will help to mitigate the oscillation nuisance in the district.

The Society meets every Monday evening at 8 o'clock at the Hackney Electricity Showrooms, Lower Clapton Road, E.5. Visitors and prospective members will be welcome.

Hon. secretary, Mr. G. E. Sandy, 61, Lauriston Road, Hackney, E.9.

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Special Sets for Field Days.

By the time these lines appear the North Middlesex Radio Society will have held the first Field Day of the season (Saturday, June 23rd), during which the direction-finding experiments which were spoilt last autumn by continuous rain were to be re-attempted. The Society possesses a special transmitter for Field Days besides a portable receiver presented by Mr. W. Gartland. This instrument is a two-valve Hartley employing four-electrode valves. The complete receiving set weighs only 12 lb., and is contained in an ordinary attaché case with the frame aerial surrounding the set.

The Society would be pleased to welcome visitors on Field Days.

The new club room (St. Paul's Institute, Winchmore Hill) is very much appreciated, and an attractive programme of lectures, demonstrations, etc., has been prepared. Full particulars can be obtained from the hon. secretary, Mr. E. H. Laister, "Endcliffe," Station Road, Winchmore Hill, N.21.

Constructing an H.T. Rectifier.

Members of the Coventry Transmitters' Association have now finished the construction of their H.T. rectifier and the building of the oscillator is the next task to be undertaken. It is hoped that by the time these notes appear the necessary transmitting permit will have been obtained.

On June 5th members of the Association visited the Coventry Telephone Exchange and found much to interest them in the automatic and auto-manual equipment and the power boards. Specially noteworthy were the fault alarm devices, which seemed superhuman in their operation.

Hon. secretary, Mr. L. W. Gardner (5GR), 10, Ludlow Road, Coventry.

FORTHCOMING EVENTS.

THURSDAY, JUNE 28th.

Leyton and Leytonstone Radio Society.—At 8 p.m., at "Grove House," High Road, Leyton, E.10. Discussion on "Elementary Electricity."

SATURDAY, JUNE 30th.

Tottenham Wireless Society.—Visit to Croydon Aerodrome.

WEDNESDAY, JULY 4th.

North Middlesex Radio Society.—At 8 p.m., at St. Paul's Institute, Winchmore Hill. Lecture, "The Care of Accumulators," by Mr. L. F. Summers.

Clearing Up Difficulties.

A lively interchange of views and opinions took place at the last meeting of the Croydon Wireless and Physical Society when members were free to discuss many little questions and perplexities concerning wireless. Among the subjects covered were wave-traps, resistances, transformers, "howling," and gramophone reproduction.

Visitors are warmly welcomed to the Society's meetings.

Hon. secretary, Mr. H. T. P. Gee, Staple House, 51-52, Chancery Lane, W.C.2.

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Short Waves on Field Days.

In preparation for the summer field days of the Tottenham Wireless Society the last meeting was devoted to experimental work on the Society's short-wave transmitter. Under the direction of the technical officer, Mr. F. Dyer, members received instruction in the operation of the transmitter. The alteration and checking of the wavelength, by means of an absorption wavemeter, were some of the operations carried out by individual members. Ample power was available from the Society's 400-volt H.T. eliminator.

At the conclusion of the experimental work, Mr. Dyer gave a short account of some 20-metre transmission and reception experiments he had recently conducted. He exhibited a 20-metre absorption wavemeter and carefully explained its construction. Circuit diagrams and lay-outs for both receiver and transmitter for use on this short wavelength were given. Full instructions were given regarding the construction of the essential parts of such apparatus, such as the coils and the H.F. choke.

Hon. secretary, Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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READERS' PROBLEMS ANSWERED

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

"The Wireless World" Supplies a Free Service of Technical Information.

A Condenser Fallacy.

Will the selectivity of my receiver be improved by substituting "straight line frequency" variable condensers for the "square law" components at present used? G. G. F.

The true selectivity of a circuit is in no way affected by the shape of the variable condenser vanes, although damping and consequent flatness of tuning may be introduced if the design is poor, or if indifferent dielectric material is used; this applies to each type. The advantage of the present-day modified S.L.F. condensed is that the settings corresponding to various stations are more evenly spaced round the dial; this is quite apart from the selectivity question.

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Centre Tapped Moving Coils.

With reference to the article "A New Method of Push-Pull," in your issue of May 23rd, I should like to know if the two halves of the loud-speaker moving coil should be wound in separate sections, and if these windings should be in opposite directions. L. J. S.

It is only necessary that the winding should be tapped at the centre point, and it is immaterial from the electrical point of view whether the two halves are wound in separate sections or as a single continuous winding; the former method may, however, be more convenient. It is essential that the coils should be in the same direction.

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A Switch Change-over.

My set has two stages of H.F. amplification (shielded valves), which are coupled by "split" coils in the manner adopted in "The Wireless World" "Screened Valve Five." Up to the present I have not troubled about long wave reception, but am wondering if it would be possible to make provision for this by means of a switch change-over, using D.P.D.T. switches, which I already have. I am particularly desirous of retaining full efficiency on the short waves, but am not so particular as to the others, and should appreciate your suggestions. F. C. M.

There are several methods open to you, but we suggest that the most satisfactory will be that shown in Fig. 1, in which

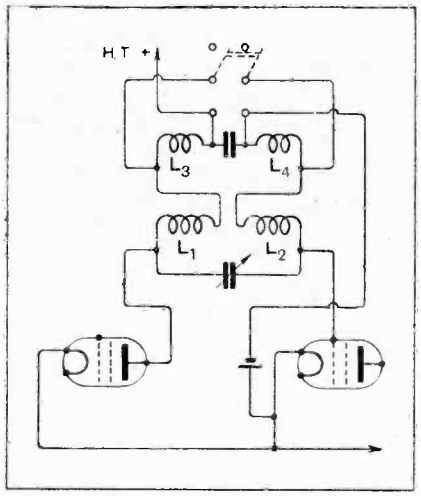

Fig. 1.—Connection for short-circuiting loading coils in a split-coil H.F. coupling.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

L_1 and L_2 are the two halves of the present short-wave coil; these are insulated from each other by means of the fixed condenser as usual. L_3 and L_4 are the two halves of the long-wave loading coil, which may be short-circuited by the switch when they are not required.

The performance of the receiver on the short waves should be in no way impaired, as the switch is connected to the low-potential ends of the coils.

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Electrical Interference.

My situation is particularly unfavourable for wireless reception; an electric railway runs past the end of my garden, and when a train passes, the interference is sufficiently great almost completely to drown reception. Do you recommend me to replace the outside aerial by a frame? H. N. R.

There is no doubt that the substitution of a frame aerial will reduce interference, but at the same time the strength of received signals will be decreased. If this reduction is too great, you might, if possible, try the effect of moving your aerial, arranging for it to be as far as possible from the source of interference.

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A.C. Valves and D.C. Supply.

Will you please give particulars for constructing a fixed resistance to enable me to work four indirectly heated cathode valves (connected in series) from 240-volt D.C. mains?

I have read the reply to "F. P. H." on the subject of "A.C." valves in your issue of May 30th, and realise that the consumption will be rather high; but as I obtain current at a low rate, I do not consider that the arrangement will be unduly extravagant. My mains supply is at 240 volts; the valves consume 1 amp. at 4 volts. J. L.

You will require a total resistance of 224 ohms, and a suitable resistor could be wound with 205 yards of No. 22 Eureka resistance wire, the temperature of which will not rise unduly, provided you wind it in such a way that the heat may be radiated. Alternatively, you could make the fixed resistor with 200 yards of wire and insert a rheostat of some 10 ohms in series with it in order to compensate for fluctuations in the mains voltage.

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Reaction Difficulties.

My "Hartley" frame aerial receiver, in which reaction is obtained by connecting the plate of the detector valve to one end of the centre-tapped frame through a small condenser, gave quite good results, but I find that on adding an H.F. stage this form of reaction control does not operate properly. Can you suggest any reason for this failure? R. F. P.

Reaction on the "Hartley" system between the anode of the detector and the frame aerial is no longer applicable when an H.F. stage is interposed, due to a phase change brought about by this addition. If you wish to feed back from the detector to the grid circuit of the H.F. valve it will be necessary to add either a loading coil in series with the frame aerial, or a few turns connected in series with it.

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Four-electrode Valves.

It seems to me that the weight and bulk of the "Everyman Portable" receiver could be still further reduced by using four-electrode valves, which should operate quite satisfactorily on a high-tension pressure of a few volts. If the idea is practicable, will you give me a diagram showing the necessary modifications? I do not propose to make provision for long-wave reception. T. C. N.

Your proposed modification is quite practicable, but the reduction of weight will not be very great unless the four-electrode valves are extremely economical in filament current. Good results should be obtained with H.T. voltages of from 4½ to 15 volts.

From the accompanying circuit diagram, Fig. 2, you will observe that the inner grids are connected together and to the positive H.T. terminal. As to the filament connections, you will be guided by the characteristics of the valves chosen; we have shown a parallel connection, as this will be most convenient if you use an L.T. accumulator.

A Question of Range.

Would the receiver of which the circuit diagram appears in the "Moving Coil Loud Speaker" booklet give sufficient output for operating the instrument described there from my nearest station, which is about 50 miles away, or would it be advisable to use two H.F. stages? K. J.

The specification of the receiver in question calls for the use of a single highly efficient stage of H.F. amplification, so there is little doubt that it will be sufficiently sensitive fully to load up the output valve on the input you are likely to receive at your distance. We are assuming that your local conditions are not particularly unfavourable.

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Talk: Not Wanted.

Is it possible to devise an automatic relay which will switch on a receiver during the broadcasting of musical items, and switch it off while speech is being transmitted? I ask this because I am a restaurant proprietor as well as a wireless enthusiast, and have installed a set at my business premises. It seems to me that my customers are disturbed by the announcements between items. I realise that the problem is not a simple one, and hardly expect you to supply me with a solution; however, a word of advice as to a possible method would be appreciated. W. M. G.

We fear that the difficulties in the way of a satisfactory solution of your problem are almost insuperable, and it would be hardly possible to devise a completely satisfactory arrangement to operate on ordinary transmissions, let alone those in which music is interspersed with speech. It is suggested, however, that you might experiment with an L.F. amplifier (in parallel with the existing one) tuned to a particular audio-frequency which is present in music but not to any great extent in speech. The output of this amplifier might operate a delayed-action relay in such a way that the L.F. valves of the set would be switched off when the "control" amplifier has not received an impulse at its resonant frequency for a period of, say, five seconds.

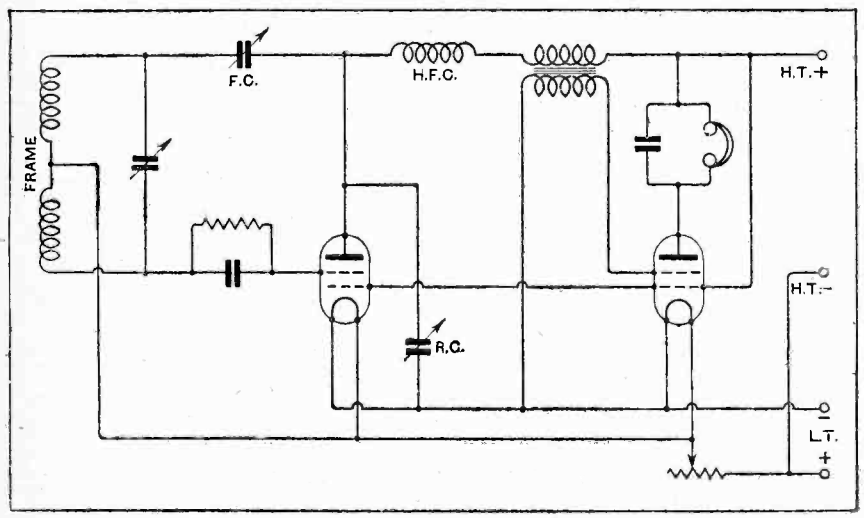

Fig. 2.—A portable receiver for a low H.T. voltage.

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Short Waves and the "Super Seven."

I am about to construct the short-wave unit described in your issue of June 13th, and should be glad to know which Gambrell coils would be suitable for the oscillator of my "Super Seven," with which this unit will be used. J. S.

Coil No. a2 would be suitable for the plate coil L_2, and No. a3 for the grid inductance L_3. The pick-up coil L_1 may have a single turn, as shown in the illustration at the head of the article in question.

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A Faulty Transformer?

Can you help me to trace a difficult fault in my receiver (detector and two transformer-coupled L.F. stages), which has so far eluded my efforts? Reception is sometimes quite good, but is interrupted by cracklings, and at times signals fail altogether. They are generally restored, however, by taking out the H.T. battery plug and replacing it. C. M.

It is clear that there is an intermittent connection, or, less probably, an intermittent short-circuit, in your receiver. It is impossible for us to say definitely where this is located, but we think it likely that it will be traceable to the primary winding of one of the L.F. transformers. We suggest that you check this by substitution.

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Telephone Polarity.

I am well aware that telephones must be correctly connected as to polarity when inserted in series with the anode of a valve. Are any precautions necessary in joining them to a crystal set? D. C. R.

The sensitivity of a telephone receiver is at maximum when the clearance between the pole-pieces and the diaphragm is small. It is just possible that signal strength would be noticeably greater if the connection were such that the unidirectional current output from the crystal is of such a polarity that it tends to assist the attractive force of the permanent magnets. We do not think, however, that this is a matter of very great importance.

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Matching Valve and Transformer.

I am told that a certain L.F. transformer works at its best "with a valve of 20,000 ohms impedance." Does this refer to the valve preceding or following the transformer? E. L. S.

Without a doubt, this statement refers to the valve preceding the coupling component, and in the anode circuit of which it is connected. The impedance of the next valve has no direct bearing on the design of the transformer which precedes it.

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The LISTENER

WIRELESS LEAGUE NOTES AND NEWS

ALTERNATIVE PROGRAMMES.

More Definite Contrast Needed.

"To be able to choose from alternative programmes is one of the things most earnestly desired by the listening public."

THE above quoted statement appeared in these columns in the issue for August, 1926. The word "alternative" no doubt then was a fair description of what we wished. For the past three months we have had what the B.B.C. call an alternative programme, and although it is a change to turn from one station to the other, the programmes sent out by 5XX and 5GB may be alternative, but there is lacking the definite contrast in the items and general make up of the programmes earnestly desired and hoped for by the listener.

The success of the new station may be assured from the technical point of view (although we have heard complaints of periodic fading when the Birmingham studio is used), but we are far from being satisfied that it is a success from the listener's point of view. Last month we said a change of programme was the main thing. We were not wholly correct. A change of programme is welcomed by all listeners, but the change to wholly satisfy must be in the direction of definite contrast, not merely between one composer and another or between one artist and another. Up to the present the B.B.C. have not achieved this desirable goal, and until they do the programmes sent out by 5GB now the novelty has worn off will continue subject to the criticisms we have pointed out.

We would like to add that at the moment the Programmes Committee of the League are considering correspondence and suggestions received on the matter with a view to forwarding to the B.B.C. constructive criticism.

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CHEAP COMEDY.

Sir John Reith's Views.

READERS of these pages will have read on many occasions expressions of dissatisfaction with the quality of the "variety" items provided by the B.B.C. It was earnestly hoped by most of us when the Corporation supplanted the old company, and had control over a greater income, that better "variety" artists would appear before the microphone. Apart from the broadcast of a few of the big stars, some of whom were notable failures, the quality of this type of broadcast has not improved. Six months ago we wrote in The Listener: "Amusement is our great need when we listen, whether it be given by music, song, or patter, or a mixture of the three. Generally speaking, broadcast music meets the requirements of the listener. We cannot, however, make the same observation as to comedy, monologues, and humorous songs." Much to our regret we have to-day to reiterate these views. And, too, we repeat our suggestion of July last that the Corporation should direct its Programme Department to concentrate on the search for artistes of the type needed, and when assured it has discovered any who can get their humour over, to give them a contract of some months at a reasonable figure. Well-produced and well-acted comedy, sparkling revues (not those out of the stockpot of 1880, or thereabouts), and good humour—these, complete with good music, are what the listener wants. We have every sympathy with the B.B.C. ideas of the educational side of broadcast, but something "Merry and Bright" can be educational to most of us.

However, as the result of remarks made by Sir John Reith at Manchester recently, our hopes have revived. Sir John, after asking his audience not to judge broadcasting by periodical items, is reported in the Press to have said: "Don't judge them (the programmes) by children's hours or variety entertainments. I know they are dreadful. . . . There are occasions when I cannot get across the room quickly enough to turn my set off." It is gratifying to the League to read this confirmation of its views on B.B.C. variety items, but it will not gratify the listener, unless it is accompanied by a change for the better. We can only add that when the Director-General makes such drastic criticism of the "variety" which his Programme Department consider good enough for listeners, surely we can feel assured that he will report in the same sense to the Governors of the B.B.C.? In that event, we have every reason to hope that before long we shall see a much needed improvement in the entertainment side of broadcasting.

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EMPIRE BROADCASTING AND THE LEAGUE.

IN connection with the visit of Mr. H. A. Hankey to South Africa and Australia, it was anticipated that he would be able to broadcast a short talk on his trip through the short-wave station of the B.B.C. at Chelmsford before he sailed. Unfortunately, the B.B.C. were not far enough advanced with their new station to be in a position to afford the League facilities for Mr. Hankey's talk. However, the League are glad to be able to inform members that Mr. Gerald Marcuse, at his well-known short-wave station at Caterham, very generously gave the League facilities to speak there to Oversea listeners on Sunday, December 11th last.

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THE LEAGUE AND THE PROGRAMMES.

THE bulk of the correspondence received by the League is concerned with the broadcast programmes, for this question is the one which always exercises the minds of listeners. The League is fortunate, too, in having at its disposal the advice of a number of local officials, who make it their business to keep in touch with the feelings of listeners up and down the country. Probably none of the organisation's numerous sub-committees is more active and enthusiastic than that which devotes its labours to this important subject. The committee, which was formed in the early part of last year, meets regularly every month and deals with the numerous complaints and suggestions which have come to hand. Many letters merely contain criticisms of a negative kind, but the majority of writers adopt a fair-minded attitude and their communications often result in the League being able to make very valuable recommendations to the B.B.C. The following are some of the various matters which have received the committee's attention.

Earlier religious services on Sundays so that church-goers are not compelled to listen to another service on return home and also ensuring that hospital patients and others who are not permitted to listen later in the evening, are not deprived of religious devotion. This suggestion is being considered afresh by the B.B.C.

At the invitation of the broadcasting authorities the League submitted a report on broadcasting in relation to adult education. We are fully aware of the objections which many listeners have to the inclusion of an excessive number of "talks," but we feel a leavening of interesting discourses is acceptable to a large number of people and the League suggestions were aimed at improving this section of the programmes so that the matter is at once interesting and instructive without savouring of text book style.

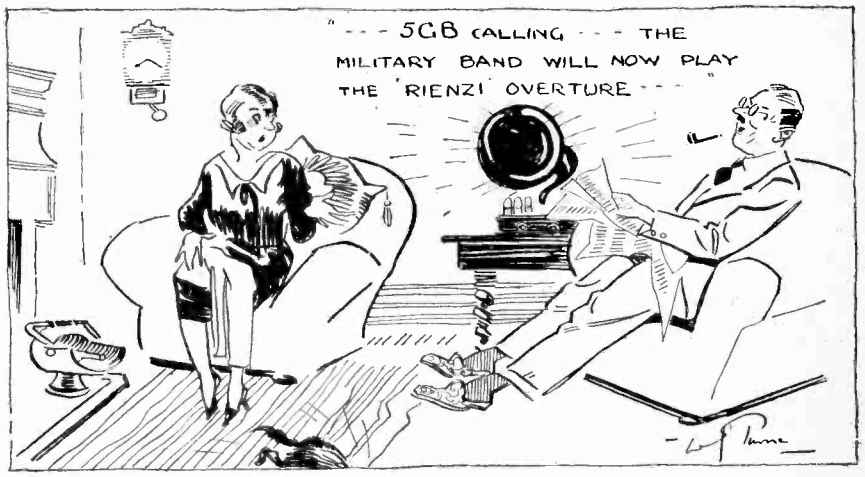
The interference which is caused by Morse has not been lost sight of, and at the suggestion of the sub-committee a parliamentary member of the League emphasised in the House of Commons the importance of placing the subject on the agenda for the Washington Conference. Numerous complaints of general interference such as that caused by local electrical undertakings and telephone wires have been dealt with and the assistance of the post office has been successfully sought in this connection.

In order to substantiate the reports made from time to time to the broadcasting authorities the programmes sub-committee invited some of our members, when circularising them regarding their subscriptions, to fill in a ballot form showing their preferences for the broadcast items in order of popularity. The information thus gained was invaluable and showed the remarkable accuracy of the statements the League had previously made to the B.B.C. It is proposed to take further advantage of listeners' advice by organising a "Best Programmes" competition, the winning entry of which will probably be broadcast from London, Daventry, and 5GB. Further announcements will be made as soon as possible in the weekly editions of *The Wireless World*, in *The Radio Times*, the general Press and *via* the microphone.

A NEW COMEDY.

That Alternative (?) Programme in two Scenes produced by the B.B.C.

SCENE I. (Time 8.5 p.m.)—**Mrs. John Citizen: I'm tired of that—heard it so often lately. Mr. John Citizen: Well, I like it: let's have it. I'll get the new station afterwards, there's a different programme from there.**



SCENE II. (Time 8.20 p.m.)—**Mrs. John Citizen: ? ? ? ! ! ! !**
Mr. John Citizen: ? ? ? ! ! ! !

CORRESPONDENCE.

A Definite Suggestion.

Sir,—Owing to an enforced stay at home and being compelled to remain indoors for the past fortnight, I have been able to listen to several regular items in the programmes broadcast in the afternoon and early evening. I have enjoyed them all the more probably because they were new to me. It occurs to me that our representatives on the Listeners Committee may care to raise at that Committee the advisability and desirability of giving the evening listener a chance to hear some of these afternoon and evening items. I would refer in particular to the gramophone recitals on Monday evenings at 6 p.m., and to the broadcast of new gramophone records on Thursdays at 1 p.m. Other regular items, as I have said, were pleasing in their newness, but the two I have specifically referred to were exceedingly welcome to me, and, I am sure, considering the great interest

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shown to-day in recorded music, would be equally welcome to many thousands of evening listeners. SYNOVITIS.

Horsham, 15/12/27.

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Programmes.

Sir,—The great blot on broadcasting to-day is the large amount of Yankee so-called "singing." If the dance music players must burst into song cannot English voices be employed for the purpose? One can stand the instrumental part of the proceedings, but the awful nasal twang used by these so-called "vocalists" is sometimes beyond endurance, and one simply has to switch off. Are all these dance bands American, and, if so, why are they employed in preference to Britishers? Surely the Radio Dance Band, operating from Savoy Hill, might be composed of Britishers. The large proportion of so-called "variety" is also American, and we are thankful for 5GB when 5XX is taken that way, and *vice-versa*. When the women start on syncopated duets and try to make noises like saxophones one feels like getting a gun and going to look for the cats in the garden! GODFREY LOWE.

Lincoln, 13/12/27.

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Sir,—With reference to letter of "Grid Bias," 4/11/27, the opinion of the ballots in the daily Press is only what you would expect, but I am glad the B.B.C. has not started pandering to their tastes yet. I trust the opinion of Wireless League members will always carry weight however. We are told the public like the shows at present presented by the cinemas, but the Government has even had to intervene there. Personally the talks appeal to me as generally of great interest, and the regular criticisms dramatic, etc., enjoyable and helpful. I endorse your impression writer's remarks, "we are agreed programmes are good." I like also the plays and sketches, which are usually very well done. I should place last jazz-bands as noisy, and less suitable to cheap loud - speaker reproduction. D. P.

Bream, Glos., 9/12/27.

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Concrete Criticism.

Sir,—I generally look at the broadcast programme in the train on my way home in the evening. Sometimes I see a programme or an item I would like to listen to later, but I more often see items which have been broadcast earlier in the day which are more attractive. I have discussed the point with friends and acquaintances, and there seems amongst my small circle to be a decided "tiredness" of the present evening programme. We agree with your contributor O.H. It is not that the programmes are not good—they are. But we feel they are *too good, too highbrow*, too much tinged with *a snobbish educationalism*. They lack conviction or human touch. They smack of the machine—a cycle of items each recurring at its maddening regular point at a definite time. In fact, too little material of a good entertaining nature and too much organisation. Let us have a change. Let us hear in the evening sometimes an organ from Southwark or Bishopsgate, a recital of gramophone records, old and new, Corelli Windeatts Band, Frascati's Orchestra, the Astoria Orchestra and Organ, the New Gallery Organ, the Orchestra Colombo, etc., etc. The B.B.C. have got into a groove of complacency and they want jerking out of it. Listeners don't want dull boring concerts and jig-saw music. Let the B.B.C. put their educational efforts on in the afternoon and give the evening listener some enjoyable musical entertainment when he needs it. I hope the League will press these views, and that some day we shall learn how the administrative cost of the Savoy Hill branch of the Post Office compares with its expenditure on artistes.

Caterham, 19/12/27. J. H. S.

AROUND THE BRANCHES.

Yorkshire District.

The Sheffield branch appeals for more members, although meantime it is not staying its hand in any direction. The City Council have written to the hon. secretary of the branch appreciating the League's action in providing crystal sets for the blind and a free copy of the *Radio Times* in Braille where this is useful. The branch expresses its thanks to Messrs. Christie and Hodgson, Ltd., for installing the sets and erecting the aerials free of cost; other branches might follow the lead. The scheme is to appeal to the public to send in all discarded crystal sets for the purpose, and to make arrangements for a local firm to instal and put up aerials free of cost, the branch paying for the issue of the *Radio Times* in Braille. Sheffield has lost one of its most genial staff by the promotion of Captain H. Saunders-Jacobs to an appointment at Savoy Hill.

Mr. S. J. Adams, Yorkshire District Secretary.

The Approved Traders Scheme is proving of great service to the public inasmuch as local firms have confidence in recommending other traders on the list to their clients leaving the city. The new class of membership (21s.), including personal visits of an expert, is likely to prove very popular.

Those desiring to form local branches in Yorkshire, to ensure local facilities in addition to the many others afforded by the nominal subscription, should communicate with Mr. S. J. Adams, 38, Church Street, Sheffield, when every possible facility will be afforded. No city, or even village, should be content without having a say and casting its well-supported vote in the interests, not only of its immediate locality, but of broadcasting in general. The B.B.C., it is confidently believed, will give every consideration to recommendations of a constructive nature, if the listener will show his interest by the simple method of joining the only League now existing to champion his cause. Every listener should join so that he may have a voice in programme construction, receive technical advice, free insurance of his sets, and also, from an *esprit-de-corps* point of view, the satisfaction of having done his duty.

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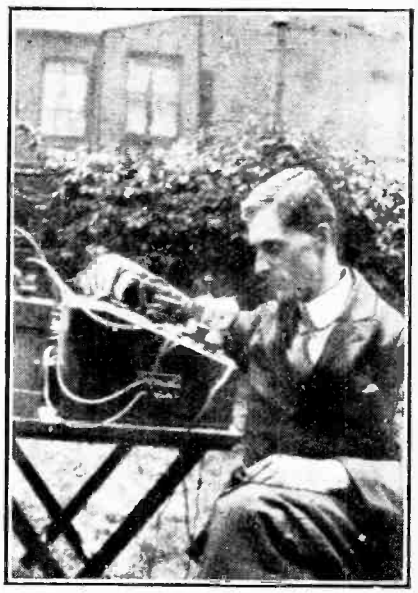
London District.

Since the new constitution was adopted, no time has been lost in keeping alive the interests of present members and to increase the membership of the League. Various people have already been assisted with advice, particular attention having been paid to the blind. Interesting reports on various aspects of wireless have been, and are being, written up for the Press, and numerous wireless traders have been enlisted to display posters and distribute literature.



The Hon. C. M. de Adlersparre, London District Secretary.

Efforts are being made to keep in touch with feeling regarding the present B.B.C. programmes. Valuable assistance is being secured in ascertaining the likes and dislikes of our listeners in this connection, and members are being asked to give their own individual suggestions.

Members in the London postal area are urgently reminded that the annual subscription for the year ending September 1928 is due, and not to hesitate to renew at once. Listeners should not miss the very many benefits that are available not only to associate members, but also to ordinary members.

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PROGRAMME SUB-COMMITTEE.

A meeting of the Programme Sub-Committee was held at the League Headquarters on Wednesday, January 18th.

The question of effectively contrasting programmes from 2LO and 5GB was considered. The Committee had before them reports showing that listeners were dissatisfied and disappointed with the "alternative" programme. They further discussed a proposal by the Editor of *The Listener* with a view to eliciting the views and ideas of listeners on what was thought to be the best alternative programmes. The Committee hope soon to be able to make a public announcement on the matter.

Further consideration was given to the broadcasting of earlier religious services on Sunday evenings.

The League's representatives were instructed as to the attitude they should adopt on various matters likely to come before the Wireless Organisations Advisory Committee.

The Committee discussed the question of a permanent chairman, in place of the present method of each member taking the chair in turn.

DISTRICT AND BRANCH NEWS.

The following is of particular interest to listeners in the counties of Oxfordshire, Berkshire, Buckinghamshire, Bedfordshire, Cambridgeshire, and Huntingdonshire

The District Secretary for this area is a most willing horse. You can never tire him with letters, be the subject of the most trivial kind. He is out to help any member of the League when in difficulty or doubt; so make a note of his address.

All he asks, on behalf of the League, is that each existing member should make a New Year resolution to bring in one friend, possessing a wireless set, who is not yet a member.

The District Secretary, who is also on the League's Programmes Committee, would welcome letters of constructive criticism on the daily broadcast programmes.

Here is his address:—A. W. Shirley, 133, Walton Street, Oxford.

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East Coast Area, Comprising Lincolnshire, Norfolk, and Suffolk.

Reports from some of the districts in this area point to a greater interest being taken in the doings of the Wireless League. Many new members are offering to act as local secretaries and correspondents in their districts.

It is the earnest wish of all district secretaries to get into touch with those who will represent the Wireless League in their localities, and any enquiry in this connection will have most careful attention. Every facility will be afforded those undertaking the work. The duties are interesting, and not in any way onerous.

Members in this area are specially interested in what the Ipswich Branch has accomplished, and congratulations are due to that branch on the success that has attended their efforts in being able to present a very fine wireless set to the Suffolk Convalescent Home. District Secretary, R. T. Little, 39, London Road, King's Lynn.

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Gillingham (Kent) has one of the liveliest branches of the League. The branch holds regular meetings, social and otherwise, and also issues a Monthly Bulletin free to its members. This, with the lectures so ably given by Mr. W. M. Cox, contributes largely to the continued success of the branch. All these activities are controlled most ably and efficiently by the Chairman, Mr. W. E. Norton, and the Hon. Secretary, Mr. R. Harrison.

Mr. W. E. Norton, Gillingham Branch Chairman.

NEW YEAR DRAMA IN COURT.

(Recorded by E. C. Thomson.)

"I'M only an engineer; don't blame me!" was the dramatic cry wrung from Major Ecstasy, Chief Engineer of the Superior Broadcasting Company, when giving evidence at the resumed hearing of the case of S.B.C. *v.* Albert Harks at the Courts yesterday. Mr. Albert Harks is alleged by the S.B.C. to have uttered publicly a disrespectful remark concerning a transmission from Station "2 Hallo."

Mr. Justice Sighs threatened to clear the Court at one point in the proceedings when the defendant was intimating his desire to express his unbiassed opinion of the S.B.C. talks.

Seen in the Old Kent Road.

Outlining the case for the plaintives, Sir Harry Haugh-Haugh said that, on a certain night in January, 1927, the defendant was seen walking along the Old Kent Road. No sensible jury would need to be reminded that this circumstance was not, *per se*, a point in the defendant's favour. However, that was as it might be. Suddenly the defendant was observed to stop and listen to the emanations of a loud-speaker suspended outside a radio emporium.

Mr. Justice Sighs: What is "radio?"

Sir Harry: Forgive me, m'lord; I should have said "wireless."

Mr. Justice Sighs: Don't fog the issue.

Sir Harry continued by saying that the defendant, after pausing a moment, was heard to say something calculated to lower the prestige of the S.B.C. in the eyes of two steel hawser makers, a meat purveyor's messenger, a charlady's consort, and a number of "supers." Mr. Haydn Seeking, of the S.B.C., was present at the time.

Poetry for Sevenpence.

Giving evidence, Mr. Haydn Seeking said he was of poetic temperament and was attached to the S.B.C. He had recently published a little book of lyrical verse entitled: "Stifled Spawn, and other Spasms," price 7d. post free to anyone present—

A Voice: What the deuce—!

The Judge: Turn that man out!

Sir Harry: It's the defendant, your Lordship.

Cross-examined by Mr. Cheep-Breefe (for the defendant), witness said: "I think the loud-speaker was reproducing Prof. R. Kive's stimulating talk on 'Fallacies about Flamingoes,' but it may have been Chamber Music."

Mr. Cheep-Breefe: I put it to you that you couldn't tell the difference?

Witness: I think Prof. R. Kive was imitating the cry of a flamingo.

Mr. Cheep-Breefe: Was it a melodious cry?

Witness: Oh no; it sounded like Chamber Music. But it was very beautiful.

Mr. Cheep-Breefe: And what did you hear the defendant say?

Witness: The defendant said: "Lumme, ain't it rotten?" [Sensation in Court.]

Judge on Flamingoes.

Sir Harry Haugh-Haugh then called upon Major Ecstasy, the Company's Chief Engineer.

Sir Harry: I believe, Captain—er—Major Ecstasy, you are of a poetic temperament?

Witness: Oh, rather! I mean to say—

Sir Harry: I beg your pardon; I have mixed up my papers. What I want to ask is whether, technically speaking, Prof. R. Kive's talk could have carried as far as the Old Kent Road.

Witness (with conviction): Most certainly. We have been heard in Sidcup!

Sir Harry: Could it have been mistaken for Chamber Music?

Leaning forward, and with a voice charged with deep emotion, Major Ecstacy said: "I'm only an engineer; don't blame me! It is true that what goes into the microphone is not always what we send out. We engineers try to improve it!" [Sensation in Court while Colonel Sandstone Curry, an official of the S.B.C., was observed to lean over and whisper excitedly to Sir Harry Haugh-Haugh.]

Mr. Justice Sighs: How can you improve a talk on flamingoes?

Witness: We should endeavour to introduce more modulation, increasing the sidebands and—

Mr. Justice Sighs: And if that had no effect?

Witness: We should say, "Please don't do it."

Professor in Arson Case.

Professor R. Kive was next called but

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did not appear. It was stated that, owing to chronic myopia, the Professor had strayed into Court VI. and was now giving evidence in a case of arson.

The Judge: Where the flaming goes? (Loud laughter.)

Examining the defendant, Mr. Cheep-Breefe said: "I believe, Mr. Albert Harks, that you are a bookmaker's assistant, a man of taste, and a student of some of the most widely-advertised correspondence schools?"

Mr. Harks: That is so, Sir.

Mr. Cheep-Breefe: Now did you, or did you not, say: "Lumme, ain't it rotten?"

Witness (with emphasis) I did not! [Sensation in Court.]

Mr. Cheep-Breefe: Then what did you say?

Witness: I said, "Ain't it chronic?" [Renewed sensation.]

The Court then adjourned to recuperate.

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STOP PRESS.—Our Legal Correspondent wires that Mr. Albert Harks' case is not so black as it looks. He has just joined the Wireless League and is obtaining Free Legal Advice.

STOP STOP PRESS.—Our Legal Correspondent wires: Case off. S.B.C. apologises and undertakes pay costs.

IMPRESSIONS OF THE PROGRAMMES.

I WONDER was I dreaming while I listened to the final of "Rigoletto," or did the stage clock strike only six when the time was midnight, and then a few seconds later strike twelve? The performance was interesting (as nearly all Verdi's opera music is), but I don't think it was good. An opera with three such dramatic moments in it should be given in a place where the voices and the orchestra have room to do the music and themselves justice.

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During the Christmas programmes a dozen of us heard a most interesting talk on "The ABC of Faces" given by Mr. John Clennell. It provided all of us with quite an exciting, amusing, and, perhaps, instructive fifteen minutes. The B.B.C. might easily do worse than ask Mr. Clennell to give us some more.

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Just a word to the many kind and helpful correspondents who send me their views on the past month's programmes. These notes have to be written about eight to ten days before they are published, and the views and suggestions sent me would be still more helpful if I could receive them *not later than ten days before publishing day, which is the first Wednesday in each month.*

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One correspondent (A/H 3599) suggests that too many of the good things broadcast are put on too late. She says "It is not everybody that can sit up till eleven o'clock." I suppose not, but I find it difficult to get to bed until well after that hour. However, what are the views of our members on the point? (As a coincidence I am told by the secretary that this very point is being considered by the Programmes Committee of the League at this moment.)

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A large number of correspondents have written in praise of the morning service at 10.15 a.m. I have not been able to hear it, but it does appear to meet a need amongst those listeners who are at home and those, unhappily, in hospitals and similar institutions.

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One of the most zealous and successful of the district secretaries of the League writes me, saying:—

"It does seem a pity, in the writer's opinion, that in such excellent fare as was provided by last month's programmes there should still have been in evidence the old faults to which so much attention has been called in the past: (1) Cutting up an enjoyable 'menu' with often uninteresting talks, language lessons, etc., making the programme 'bitty'; (2) American turns of a twangy and irritating nature, tending to deprave instead of to elevate taste. I do not think the hands of Bridge are likely to appeal to many. When may we expect an uninterrupted entertainment from 7.30 to 10 p.m. from any one station? The Sunday services still follow those returning from service at a church or chapel, in spite of the fact there is any amount of light and suitable music for this day of rest; and patients at hospitals and other institutions are still needing their wireless evening service earlier in the evening on Sunday."

The views of the writer of the above are worth very serious attention. He comes into contact, daily, with many members and listeners, and the particular branch of the League he is connected with is one of the biggest in the country.

From quite another kind of listener, a lady who has been forced to spend the greater part of her life in bed or on a couch, I get the following:—"The pieces of music played at the Symphony Concerts are too long. The interest of the listener wanes before the end is reached. I like opera and oratorio music, national songs, playlets, informal programmes by the B.B.C. staff (we ought to have these oftener), and the Epilogue on Sunday evenings. I think there are too many chamber music concerts."

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This listener also tells me she listens to practically everything 2LO broadcasts *every day*, and that she thinks the programmes of the old Company were more enjoyable than the stilted ones of the Corporation.

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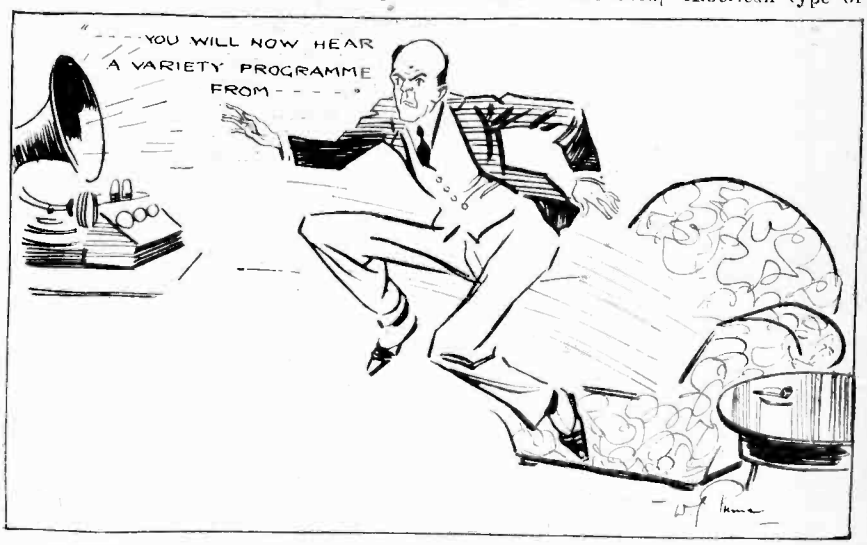
Another energetic district secretary writes:—"The cheap American type of artist is becoming too prevalent. One doesn't mind a good artist, even with a strong American accent, but the Saturday night variety programmes are being inundated with the 'soul-killing species.' The ultra-highbrow Symphony concerts on Sunday afternoons and evenings are causing dissatisfaction to a great number of listeners. Many are works being tried out by unknown composers. The popular pieces are, of course, welcomed."



WANTED: REMOTE CONTROL! Our artist recalls the sentiments recently expressed in public by the Director General of the B.B.C. on the subject of variety programmes.

○○○○

Some variety broadcasters who seem from expressed opinion to have pleased the listener lately are:—

Julian Rose,
Tex Macleod,
Mimi Crawford, and
Jen Latona.

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The idea of the play "Pursuit" was good, and the greater part of the dialogue well written. The weak back-chat between the plane and the air station could have been omitted with advantage. The

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noises left the listener with too great an imaginative difficulty to overcome. It would seem necessary to exaggerate some noises rather than to be too accurate. As a contrast I would refer the B.B.C. programme builders to the excellent noise effects produced at some cinemas (and sometimes broadcast). In a good many instances these are provided by the marvellous Würlitzer organ.

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And, by the way, why does the *Radio Times* announce things for two or three weeks consecutively which fail to happen? For instance, the Plaza organ.

oooo

The "light operatic programme" on the 10th was good (since when have "Tannhäuser," "Aïda," etc., been "light" opera?). The artistes, Rachel Morton and Parry Jones, sang well, and seemed in sympathy with those parts of the various operas selected for the programme.

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Another couple of good variety turns recommended to listeners—Harry Hemsley and his "kids" and Gracie Fields.

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And what about the new idea, "Charlot's Hour"? I thought it disappointing, and I hope Mr. Charlot will not depend too much upon the gong and the limerick competition. I have no doubt he has many good things up his sleeve, but his singers don't suit "good" songs; he ought to get singers who can sing without so much tremolo, and perhaps a little less "cackle" would be an advantage.

oooo

The Hallé Concert on the 19th came through excellently, and this cannot always be said for relays from Manchester. A good programme, well played and most enjoyable to listen to. The Stravinsky piece the only doubtful item.

O. H.

CORRESPONDENCE.

Morning Religious Service.

Sir,—May I send through you a message of thanks to those who are broadcasting the religious service each morning.

Here, at any rate, are some listeners who very much appreciate what is being done, and who hope that the effort will be continued. (Mrs.) M. A. D.

South Devon.
January 15th, 1928.

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Sir,—I wish to say that I am most thankful for the morning service daily at 10.15. It is *just right*, in every way, and this morning the singing was beautiful.

I love the prayers specially chosen for current events, and the thanksgiving in the same way. It is a great help and privilege to us all to be able to join in this service. A/H. 6379.

Sussex.
January 11th, 1928.

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Evening Programmes.

Sir,—I was interested to read the two letters in this month's *Listener* from "Synovitis" and "J. H. S." *re* the suggestions for putting on some of the afternoon items for an evening occasionally. I think this idea has good ground for being carried out, as some of the best items I have heard have been during afternoons, when I have been able to listen. I hope our representatives will go in for some of the orchestras and cinema organs coming on at night now and then.

Lancashire. J. J. G.
January 14th, 1928.

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A Wireless Appeal.

Suffolk Convalescent Home.

Sir,—I am very pleased to inform you that the appeal of the Ipswich branch of the Wireless League, on behalf of the Suffolk Convalescent Home (Felixstowe) wireless installation, can now be closed with a total of £45 6s. 6d. We have secured a tender which is much cheaper than at first anticipated. I have pleasure in acknowledging the final amounts. L. H. WOODWARD,

Ipswich. Hon. Secretary.
January 16th, 1928.

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Controversy.

Sir,—I have read lately with much interest various articles and letters in the newspapers expressing the views of a number of people—some of them well known; one of them is a governor of the B.B.C., and one of them a chairman of one of its committees. All the views expressed are, I have no doubt, excellent from their particular point of view. But why should such expression be necessary? The League have supplied the B.B.C. with the collated views of thousands of its members, and a big daily paper has also provided good indication of the desires of the listeners. The wishes of the listening public surely can be met by the governors of the B.B.C. directing their programme officials to draw up their programmes in accordance with the votes of listeners as cast in the two efforts referred to. E. A. G. H.

Earlsfield.
January 18th, 1928.

ENROLMENT FORM.

To be filled in by readers who wish to become members of the League, or to renew their membership for a further period.

To the Secretary, The Wireless League,
7, Southampton Street, Holborn, W.C.1. 19

Please *enrol me as a member / renew my membership *of the Wireless League. I enclose P.O. for* †..... *which entitles me to* ‡.....*with all the privileges and rights as enumerated in the Constitution of the League for the period ending* §.....

* *Cross out line not required.*
† *Associate Members pay a minimum annual subscription of Two Shillings, whilst the fee for full Membership is One Guinea per annum.*
‡ *Insert "Associate Membership" or "Membership."*
§ *Associate Membership subscriptions lapse on the 30th September; One Guinea subscriptions, however, cover membership until the anniversary of the date of payment.*

WRITE IN CAPITAL LETTERS.

Name (in full) .....
(State whether Mr., Mrs., or Miss.)

Address .....

.....

My Membership No. is.....
(This is only applicable in the case of renewals.)

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The LISTENER

WIRELESS LEAGUE NOTES AND NEWS

SUNDAY PROGRAMMES.

A Regrettable Decison.

THE decision of the B.B.C.'s Advisory Committee on Religion, a committee composed of clergy and ministers of various denominations, that they cannot see their way to recommend that the broadcast religious services be given at an earlier hour than eight in the evening, is a great disappointment to listeners. From the evidence collected by the League's officials and derived from many hundreds of letters, the decision will be a disappointment to the majority of the listening public.

The Programmes Committee of the League, in response to requests from local branches and members, have, from time to time in the past twelve months, reviewed the question, and on each occasion when publicity has been given to the matter, such publicity has evoked more and more approval for the earlier broadcasting of the service.

The argument advanced in some quarters that such a change would tend to keep people away from church or chapel is, we are convinced, a false one. On the other hand, there is abundant evidence that the broadcast of the service at an earlier hour—and from a place of worship, not from the studio—would be welcomed and listened to by many thousands who do not attend any place of worship. We think it a short-sighted policy on the part of the representatives of the churches to have decided against an alteration which, we believe, is desired by the broadcast public and which, too, we think would have advanced the cause these representatives have at heart, by providing them with a more receptive and sympathetic audience.

Lighter Music Wanted.

There is, too, another alteration in the Sunday programmes urged by listeners. Readers will have seen in recent LISTENER pages letters from correspondents in various parts of the country asking for a brighter type of music on Sunday than is the usual fare served to them by the B.B.C. These letters are only a few out of many hundreds, and a further selection appears in this issue.

It is probable that more people listen to the broadcast on Sunday evening than on any other evening of the week, yet the musical fare is the dullest and most insipid of the week's programmes. It is, too, the only evening of the week without even the so-called "alternative." We have suggested in these pages on more than one occasion that the example of those responsible for the programmes of the National Sunday League Concerts might be followed with advantage and pleasure to the listener. It is even possible that the B.B.C. might discover elements of "education" in such programmes. There are, too, the programmes of music given in the parks and on commons and other open spaces on Sunday afternoons and evenings, any of which would please the listener a great deal better than those which he is forced to receive from the B.B.C.

One consequence of the policy followed in this direction by the B.B.C. is that valve users more and more turn to the Continental broadcast stations for their Sunday programmes, and get them. Notwithstanding Captain Eckersley's opinion that any station outside this country reaches the British listener as "a nasty noise," most of us know better, and with a valve set of modest pretensions there are several Continental stations, particularly German, which reach listeners in this country nearly as good as 5XX and, in a good many parts of the country, a great deal better than 5GB.

Surely the policy followed by those responsible for the music given in our public spaces and by the administrations of the big broadcast stations on the Continent cannot be wholly bad? But such would seem to be the conclusion one must draw from the non-progressive policy of the governors of the B.B.C. We hope, before the long-promised regional scheme comes into being, that there will be a change for the better and that the listener will be able to switch on during Sundays with a confident feeling that he is going to hear something good and pleasing, not dull and boring.

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THE REGIONAL SCHEME.

A GOOD deal of interest has been and is being shown by the listener in the recent announcements on "controversial" broadcasts. At the moment, the listener himself is on the fence, and there he will remain until he has heard one or two samples of the items. One thing he is sure of, and that is, he wants to be entertained and not *talked at*.

For this reason he is much more interested in the Regional Scheme and when he may expect to be given really alternative programmes.

There have been startling rumours lately, vaguely hinted at in the daily press, that the Postmaster-General is withholding his approval of the scheme. "Rumour is a lying jade," but even a "lying jade" does not always lie, and if the B.B.C. want backing in their negotiations with the P.M.G. the sooner they tell the public the better

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THE INSURANCE DEPARTMENT.

The Extension of Cover for Members.

When the insurance benefits shared by members of the League were widened, three or four months ago, to cover the re-erection of aerials blown down by storm and tempest, it was expected that the League's insurance assessor, Mr. S. J. Adams, would have a much busier time. This anticipation was correct. Mr. Adams reports to headquarters that he has had the busiest three months since the League was established. He thinks, without doubt, that the recent extension of the insurance benefits meets the greatest insurance need of the listener. Most of those whose claims he has settled have expressed their satisfaction, and have become active propaganda agents for the League. There have been some claims which have proved difficult to settle, particularly those where the aerials collapsed in a gale, and it was found after the claims had been made that the subscription to the League was overdue. Mr. Adams adds that similar insurance cover to that offered free by the League would cost the individual member a premium of 10s.

PROGRAMMES COMMITTEE.

The Programmes Committee of the League held their usual monthly meeting at Headquarters on March 7th last.

The Committee discussed reports and letters before them from local secretaries and members with regard to the programmes of the B.B.C. in general, and in particular with reference to the dissatisfaction shown by listeners with the type of programme broadcast on Sundays. Strong representations were before the committee pressing for the religious service to be broadcast at an earlier hour than eight o'clock in the evening, and that, whenever possible, such services should be relayed from places of worship, and not given from the studios. The committee decided to bring this matter again to the notice of the B.B.C., and a memorandum was prepared for forwarding to the Religious Advisory Committee of the B.B.C. setting out the reasons for the proposed change.

Reports received as to the broadcasting of controversial matter were considered. It did not appear from the reports that listeners generally were much interested in the question. The aspect of the matter which appeared to concern the listening public was that more talk might mean less entertainment. The Committee recorded their opinion that the B.B.C., before applying for a removal of the ban, should have made some attempt to discover the wishes and desires of listeners on the matter. It was felt by the Committee that the concession had placed on the B.B.C. a serious responsibility, and time alone would show whether the Corporation were capable of bearing it impartially and fearlessly.

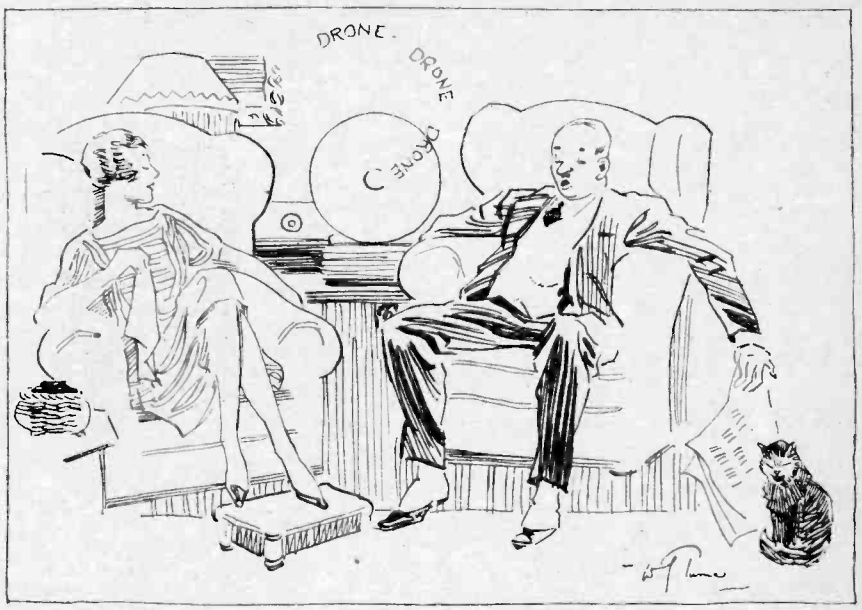
The Committee discussed the Regional Scheme, and regretted the apparent delay in pressing forward the scheme, a delay which was causing more and more listeners to turn to the Continent for their alternatives. The Secretary was directed to press for further information as to the causes of delay.

In future, the Committee decided to meet on the third Wednesday of the month.

A SUNDAY SECRET.

As the disclosure of official secrets is such a fashionable pursuit nowadays there can be no real harm in acquainting the listening public with the history of what I may term "The Great Sunday Scandal" (said the night watchman).

It is a little difficult to trace exactly how the incident was reported to the ears of the Mighty at Havoy Sill, but it got there, and the place became an inferno.



Those Sunday programmes!

Some say that a Prominent Official himself witnessed the revolting affair. Others maintain that the news filtered through second-hand, garnished with those trifling extravagances which always creep in when truth is in the balance. It was suggested, for example, that Murthwaite laughed aloud, whereas subsequent reports went to show that he merely smiled very broadly.

I am inclined to believe that the real witness was none other than a Havoy Sill office boy, who, it appears, may have been in Myrtle Avenue at the time of the incident, as his Sunday School teacher reported him as missing.

According to the story which the boy is said to have taken to Havoy Sill the next day, he distinctly saw Murthwaite on Sunday afternoon sitting at his dining room window in Myrtle Avenue, Golders Green, wearing headphones. This would be about 3.45 p.m., when the Sabbath String Scrapers were just warming up in their elevating recital of the "Fifty-Seven Preludes in Consecutive Fifths."

The boy would instantly have dismissed the image of Murthwaite from his mind in order to meditate upon higher things more appropriate to the day, if Murthwaite had not suddenly smiled. Naturally the boy was dumbfounded; all the lessons he had learnt at Havoy Sill rushed through his brain, and he wondered whether he should disturb the Sabbath calm by calling a constable, or nourish the rankling truth in his youthful bosom until he saw his employers next morning. He decided on the latter course.

We can well imagine (continued the night watchman) what a night that little fellow spent waiting till the dawn of Monday.

Next morning the story was told and Havoy Sill became a seething cauldron. Courts of Enquiry sprang up like ocean fungi and proved about as useful. The Sunday announcer swore by all the little knobs in the Control Room that nothing unseemly had occurred in the studio to mar the sanctity of the day, the hour, or the minute. Nothing could possibly have raised a smile, even among a music hall audience. The String Scrapers, too, were submitted to interrogation, but as they were Jugo-Slavians and were forbidden to point because it was rude, their gesticulations were pointless.

After a solemn meeting of the whole

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staff in No. 1 studio, to organ accompaniment, it was finally decided that a new Committee of Elucidation should send two delegates—one uncle and one aunt—to cross-examine the miserable Murthwaite in his den, and find out what he had been laughing at.

I am not surprised (said the night-watchman) that the 53 page report of that interview was suppressed. How it reached me at the hands of a High Official who refused payment I do not choose to disclose.

On the score of Perfect Propriety, the Havoy Sill people emerged unsullied. Murthwaite admitted that their Sunday programmes were nothing to laugh about. What he added, and what, I hope, the Havoy Sill people will take to heart, is best said in his own words: "Listen to *your* programmes on Sunday? Hardly, dear friends. Six days do I labour with hand and brain. On the seventh I prefer relaxation—with a little of life's joy to crowd out the sadness. Do you really mind if I listen to foreign stations?"

I am not sure (said the night watchman) whether Havoy Sill has supplied an answer.

DISTRICT AND BRANCH NEWS.

Western Area.

District Secretary: Mr. W. O. Coate, The Elms, Wembdon, Bridgwater, Som.

The Western Area is so large and scattered that the great bulk of the activities of the District Secretary have to be performed through the post.

Mr. Coats reports that space is reserved weekly for "Wireless League Notes and News" in the columns of the *Bristol Times and Echo*, the value of which publicity to the League is fully realised and appreciated.

It is hoped at an early date that the League may be represented on the Bristol section of the Advisory Committee of the Cardiff Station.

Interest in the League in this Area has been fully maintained, and it is hoped that the continued local publicity will be reflected in increased membership.

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Nottingham Branch.

Secretary: Mr. A. Gullick, Conquest House, 51, Burton Street, Nottingham.

This branch is organising a "junk" sale of wireless apparatus, accessories, etc. The quantity of material sent in to the Secretary up to date makes it certain the sale will be a success. It will provide an easy "exchange" for a good many listeners and experimenters, who, with one hand, will be able to dispose of unwanted material, and, with the proceeds of the sale in the other hand, acquire material of use to them. Arrangements can still be made by the Secretary for the collection of goods, provided he receives the name and address of the seller, a list of the material it is desired to sell, and the prices at which it is to be sold. Mr. Gullick will be pleased to advise and help other secretaries in connection with any similar venture, if they will communicate with him.

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East Coast Area.

District Secretary: Mr. R. T. Little, 39, London Road, King's Lynn.

The past month has been fully occupied in the fixing up of meetings with the local branches. Encouraging reports continue to reach Mr. Little of the activities of the local branches. In this area there seems general dissatisfaction with the delay in connection with the B.B.C. regional scheme, and listeners are turning more and more to foreign stations for their "alternative"; on Sundays this is done so regularly by many listeners that the English programmes leave them "cold."

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Ulster.

District Secretary: Mr. John G. Blair, Rosemary, Station Road, Greenisland, Co. Antrim.

The unflagging enthusiasm of members of the Experimental Section is abundantly evident in the good attendances at the nightly meetings at 37, Fountain Street, Belfast. Under the able tuition of Mr. B. McCann many members of the Morse Circle are showing wonderful proficiency. The investigation and comparison of various types of aerial installation and earth equipment has been undertaken by the Chairman, Mr. J. Stewart, who is supported in the endeavour by an able band of experimenters.

Mr. J. G. Blair, Ulster District Secretary.

Another feature of the Section's activity, and one which is proving of inestimable service to members and their friends, is the construction of various combinations of receiving apparatus, and careful tabulation of the results achieved in their operation. The pooling of equipment for this purpose makes possible such observations as are available only to very few single experimenters in possession of a wide range of component parts, and the idea is one that commends itself to the members in other areas.

The rapid increase in the number of advertisement flashing signs, with their interference effects, is a subject to which attention will shortly be directed by the Section.

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South Wales Area.

District Secretary: Mr. F. A. Davies, 106, Newfoundland Road, Cardiff.

Although South Wales has been badly hit by the general depression in trade, which in turn has greatly affected the renewal of membership of the League and the obtaining of new members, the District Secretary reports that a bright spot has appeared in one district, viz., Maesteg. A very successful branch meeting has been held in this district, and a new start has been made, with Mr. H. W. Shilbach, 49, Neath Road, Maesteg, as Secretary. Mr. A. J. Lloyd is Chairman, and Mr. T. S. Pugh is Treasurer. With these three gentlemen at the head of affairs things will go swimmingly.

Members are still coming in from all the surrounding districts. Legal and technical queries have been received, and have been or are being dealt with by the departments concerned.

Enquiries are still being made regarding the six free visits by an expert to which the "guinea" members are entitled each year. A patrol-engineer has now been appointed for the Cardiff district for this purpose.

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Lancashire, Cheshire and North Wales Area.

District Secretary: Mr. J. E. Kemp, 50, Garswood Road, Moss Side, Manchester.

The Lancashire, Cheshire and North Wales Area have taken up the matter of the B.B.C. programmes in the Press, and listeners are forwarding daily useful and critical letters in connection with their dissatisfaction with the programmes. It is too early to give a résumé of this correspondence, but in next month's issue comments will appear in the form of extracts from these letters, which might prove of use to the programme-building department, if they desire assistance in the matter.

The Wireless League members had the opportunity of listening to an interesting lecture at the Albert Hall, Manchester, by Mr. P. K. Turner, on "Modern Broadcast Receiving Apparatus." The chair was taken by S. Z. de Ferranti. The lecture was organised by the Association of British Radio Societies. Wireless League members are always welcomed at these lectures.

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Yorkshire Area.

District Secretary: Mr. S. J. Adams, 38, Church Street, Sheffield

The branches in this area which appear at the present time to be doing most for the listener are Leeds, Goole, and Sheffield. It is hoped that propaganda work now going on in other centres will produce, in time, results similar to that in the three places mentioned above. Leeds Branch had a stall at the exhibition held a short time ago, and, with the united efforts of the local committee and secretary, many hundreds of new members were added to the list of an already prosperous branch. Goole has set itself the task of equipping with wireless local hospitals and sanatoria. Sheffield has under consideration the provision of a wireless installation in a local sanatorium, where it is hoped to instal with the set 70 headphones and the usual loud-speaker. It is interesting to state here that the Shef-

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field Education Committee have decided, after enquiry, that there is not a majority of the local teachers in favour of wireless installations in schools, and that there is doubt regarding the value of wireless for educational purposes. Consequently, to the relief of the ratepayers, but to the disgust of the scholars, the committee has further decided that the cost of installing wireless in Sheffield schools is not warranted. It is hoped the Education Department of the B.B.C. have survived the shock produced by Sheffield's pronouncement, and that steps are being taken by the Corporation's Director of Education to cause the fathers of the city to change their views.

CORRESPONDENCE.

Sunday Programmes.

Sir,—I was sorry to read that the Wireless League's request for Sunday services to be broadcast at 6.30 p.m. has been rejected by the B.B.C., who, following their usual custom of ignoring the wishes of the great mass of listeners, have decided to continue the present policy of closing stations down from 5.30 to 8 p.m. on the only day of the week during which most of us are able to listen at that time of the day.

I see that in coming to this decision the B.B.C. have acted on the advice of a religious advisory committee. How is this committee constituted? Are the members elected by the various religious bodies? I am sure that most God-fearing people support your proposal. The Church cannot afford to inconvenience such a vast body of potential followers, who, until broadcasting came, gave little thought to religious matters. I sincerely hope that the B.B.C. will do their duty to the public by carrying out the League's recommendation.

I enclose one or two suggestions for consideration when you are drawing up your next Programme Report.

"SOUTHAMPTON."

March 22nd, 1928.

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Licences by Instalments.

Sir,—As a member of the League I wish to put forward the suggestion that licences be payable by instalments on the same system as Health and Unemployment Insurance, *viz.*, by means of cards issued by the Post Office.

There is much to recommend this scheme, especially as the poorest now has his wireless set and enjoys the educational and other advantages of wireless in the humblest home. Ten shillings sometimes represents a substantial amount to such people, and if it were payable, say, at 1s. a week, and the card were the licence until completed, when it could be exchanged for a licence, there seems little difficulty. To the unemployed, who should not be debarred the advantage of wireless, and to the very poor, the system would be a great advantage. S. J. A.

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Oscillation Again.

Sir,—Since the early days of broadcasting I have been a contented, grateful and admiring listener. I should now like to register my first growl against the B.B.C. It is this, Why arrange for more programmes when such a large number of listeners cannot enjoy the existing ones because of interference by neighbours? By a weekly visit to the microphone Capt. Eckersley could teach the valve-set user how to *play the game*, and give the crystal user a chance to hear the good things which are already provided.

"EXASPERATED."

Brockley, S.E.4, Feb. 16th, 1928.

Radio Plays.

Sir,—It is especially noticeable that plays are more often commenced at 9.30 p.m. than at 7.45 p.m., and this is most unfair to the great majority who go to bed before 11 p.m. and is only in favour of the classes who dine at 8 p.m. I pointed this out a year ago to the B.B.C., who replied that they intended to give more plays early, but they have hardly given us any. I have heard the same complaint from many listeners. We want our main programme at 7.45 p.m. or 8 p.m., and second news at 9.30 or 10 p.m.

As regards variety programmes, are the B.B.C. trying to kill this popular form of entertainment by the deplorable quality of the so-called artists, especially the dismal American syncopated singers who all sing the same dismal songs in a manner only suited to the poorest efforts of jazz band singers, or is it that the B.B.C. will not pay for decent artists? It is quality we want in every form of programme, not quantity. G. B. LYLE,

Brig.-General, C.B.

Lyndhurst, Hants.
February 4th, 1928.

APPROVED WIRELESS TRADERS AND REPAIRERS.

FURTHER LIST.

EALING, W.5.—Western Wireless Co., 9, High Street, Ealing, W.5.

HAMMERSMITH, W.6.—Sydney Hellyar, Ltd., 393, King Street, Hammersmith, W.6.

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Change of Address.

Mr. W. A. Craft, formerly of 46, Vergam Terrace, has removed to 10, West Street, Fishguard.

ENROLMENT FORM.

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7, Southampton Street, Holborn, W.C.1. 19

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WRITE IN CAPITAL LETTERS. *Name (in full)* .....
(State whether Mr., Mrs., or Miss.)
Address .....
.....

My Membership No. is.....
(This is only applicable in the case of renewals.)

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The LISTENER

WIRELESS LEAGUE NOTES AND NEWS

SIR OSWALD STOLL ON BROADCASTING.

Although the Wireless League does not necessarily subscribe to all the statements made below, we are pleased to place the columns of "The Listener" at the disposal of such a prominent leader of the entertainment industry.

ON various occasions when the B.B.C. have been in conflict with theatrical managers in attempts to extend the vaudeville and variety side of broadcasting, offers have been forthcoming for the provision of programmes of that character, and none created more interest than that made about a year ago by Sir Oswald Stoll. Sir Oswald needs no introduction even to those people who take only a casual interest in the British entertainment industry, for apart from his associations with the Stage he has been for some years the outstanding personality of the British film industry. With the idea of obtaining more detailed information as to Sir Oswald's views on broadcasting, a representative of the Wireless League recently interviewed him on the subject.

"The function of broadcasting is many sided," said Sir Oswald, who was quite ready to discuss the matter. "Its programmes should satisfy the reasonable requirements of listeners of all types. In its ideal form, it should be the greatest purveyor of news, politics, religion, science, instructional entertainment; but these subjects should be handled by the most experienced journalists, the most statesmanlike politicians, the most eminent divines, the most erudite scientists, the most learned pedagogues, and the most instructive entertainers."

Sir OSWALD STOLL.

"What in your opinion is the primary function of broadcasting, Sir Oswald?"

"To entertain. Large numbers of the public are very dissatisfied with programmes which have a strong educational flavour without being entertaining. No educational effort can be successful unless it is also entertaining, which also means interesting."

"No one authority," Sir Oswald continued, "not even one with large resources placed at its disposal by the State, can ever, in the nature of things, hope to obtain this ideal. The subjects mentioned (and they are only a few) can only be adequately treated by the masters of each, and can only be satisfactorily distributed by the most expert purveyors of each."

Sir Oswald did not vouchsafe a reply to a question as to whether he felt adequate funds were at the disposal of the B.B.C. to carry out his suggestions, but he said: "If sufficient money is not available, some branches of broadcasting should obviously be placed in other hands."

"It is obvious that in order to prevent such happenings as the over-multiplication of broadcasting stations and consequent overcrowding and clashing, there must be some control over the allocation of wavelengths, and so forth, but, subject to that, there should be entire freedom for any interest, trade, profession, or enterprise to broadcast what it may desire and what the public may require."

"Do you suggest, Sir Oswald, that the state of affairs existing in the United States should obtain here?"

"A combination of the two systems should be adopted. In America there are innumerable stations run by private enterprise. In one city alone I know of sixteen. There is no reason why this system should not include the B.B.C. as one of the enterprises."

"There must be some limitation of the number of stations erected here. By what method do you consider the wavelengths should be allocated to avoid heartburnings?"

"There would be fewer heartburnings under any method than there are under a single monopoly."

"How would the undertakings responsible for the provision of programmes under your scheme be financed, Sir Oswald?" "By the American method of payment for advertising their services."

"What of the present programmes?"

"They are a mere travesty of the potentialities of broadcasting," said Sir Oswald. "The ultimate development of broadcasting can, I think, be foreseen. From one station, let us say the University of London, science, arts, and all its general curriculum of learning will be dispensed; from another, say the headquarters of political parties, their views on current matters; from say, some central theatre, the best drama; from another, the best music, and so on through the whole series of possible broadcast subjects. In this way, and in this way only, can the ideal aimed at be achieved."

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MORE EDUCATIONAL BROADCASTING?

WHILST the majority of listeners have felt that too much time has so far been devoted to Talks which can only be described as "educational," most of us have thought that the B.B.C. had reached the zenith of their activities in this respect. It comes as an unpleasant shock, therefore, to hear that the recently published report of a committee, under the chairmanship of Sir Henry Hadow, appointed to enquire into the possibilities of broadcasting in relation to education, recommends the further development of this phase of the service. In placing the report before the public, the B.B.C. do not state whether it is their intention to bring the proposals to an early fruition or whether the recommendations will be delayed until the high-power regional station scheme and consequent alternative programmes are available.

Whether the programmes of a station or stations should be devoted entirely to the broadcasting of this class of matter when other programmes are within the reach of every listener is a matter which is certainly open to question, but there is no doubt that, under the existing scheme of distribution, the only alteration which would meet with general approval is the substitution of bright talks of topical interest for those dry-as-dust discourses which are finding their way into the programmes in increasing numbers.

The B.B.C. would be well advised not to read approval of their schemes in the public apathy on this subject. We are now approaching the time of the year when interest in broadcasting is inclined to lag, and if in the meantime the programmes take on a more educational flavour there will be a great outcry when listening again becomes a more regular habit in the autumn. We feel it is no exaggeration to say that if the policy of education first—both in talks and music—with entertainment a bad second is persisted in, the number of receiving licences issued will gradually fall off and broadcasting will lose the high place it at present holds as a national institution.

OVERSEAS LISTENING.

MR. H. A. HANKEY, who in December last set off on a journey to South Africa and Australia in connection with formation of Overseas Branches of the League, is due back in this country within a few days, and those listeners who are interested in the development of broadcasting for Imperial purposes will be interested to read an account of his experiences.

Apart from his knowledge of broadcasting viewed from the listeners' angle, gained whilst Secretary of the Wireless Association of Great Britain, Mr. Hankey is also well acquainted with the official side, being for some time on the staff of the B.B.C. at Savoy Hill. His observations on the progress of the science in British Overseas possessions will therefore be of particular interest. It will be recalled that Mr. Hankey took with him on the voyage a short wave receiver with the object of obtaining personal data regarding reception en route and in the various places visited.

Arrangements have been made for Mr. Hankey to write a series of articles describing his trip, the first of which we hope to publish in the next issue of "The Listener."

DISTRICT AND BRANCH NEWS.

Home Counties Area.

District Secretary: Mr. R. J. Venner, Lynwood, Malden Hill, New Malden, Surrey.

The steady enrolment of new members in this area during the winter months has been most satisfactory, and the Secretary has been fully occupied in dealing with numerous enquiries. Whilst Mr. Venner welcomes communications from members seeking advice, it would be of considerable assistance to him if the fullest possible particulars were forwarded with the enquiry. This is particularly the case where a member seeks technical assistance.

Mr. R. J. Venner, Home Counties District Secretary.

The Joint Committee of the R.S.G.B. and Wireless League continues to appoint Approved Wireless Traders and Repairers in this area, and information as to firms who can be relied upon to give satisfactory service will be supplied by the secretary on application.

In order to keep the district secretary informed of the views of listeners, not only in the thickly populated parts of the Home Counties, but in the rural districts, Mr. Venner would like to hear from members who would be prepared to act as Honorary District Representatives in any part of Surrey, Essex, Middlesex and Hertfordshire.

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Ipswich.

Branch Secretary: Mr. L. H. Woodward, 28, Withipoll Street, Ipswich.

A successful conclusion to several months' hard work on the part of the officers and committee of the Ipswich Branch was reached by the presentation of a wireless installation to the Suffolk Convalescent Home, Felixstowe. The apparatus consists of a 4-valve receiver operating five loud-speakers installed in the various rooms of the institution.

Mr. G. R. Gaunt, acting as chairman, stated that, appreciating what a great boon broadcasting is to the sick and suffering, the Ipswich Branch of the League undertook some months ago to supply the Home with the necessary apparatus with which to receive the programmes.

In asking the matron, staff and governors to accept the installation, Mr. W. Slack paid tribute to the untiring efforts of the Branch committee. In addition to a public appeal, funds were raised by a competition for which over 2,000 tickets were sold.

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Redruth, Cornwall.

District Secretary: Mr. W. S. Trevena, Stanley Villas, Redruth.

Although there are many larger places in the United Kingdom than Redruth, the members and staff of the League's local branch do not intend to be outstripped in the matter of charity. The branch secretary, Mr. Trevena, reports that after several months' hard work, during which an appeal was made throughout the county, a fund of nearly £250 was raised for the purpose of providing the Tehidy Sanatorium with a wireless installation. The receiver, which is complete with 6 loud-speakers and 70 pairs of headphones, was formally handed over to the Institution by Mr. Cook, on behalf of the Redruth Branch of the League, and amongst the first signals to be received were greetings from 2LO.

The proceedings closed with a short concert which included items rendered by the Redruth Trelawney Male Voice Quartette.

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South Midlands Area.

District Secretary: Mr. A. W. Shirley, 133, Walton Street, Oxford.

Reports from this area, which includes the counties of Oxford, Cambridge, Northants, Bedfordshire, Hunts, Rutland, Bucks, Berks and Worcester, show a satisfactory increase in membership. Despite geographical difficulties, Mr. Shirley continues to administrate the area with energy and enthusiasm, and many members who have applied to him for assistance have reason to be grateful. Negotiations on behalf of members who fail to obtain satisfaction from manufacturers of wireless apparatus is only one of the many incidents which have claimed the District Secretary's attention during the past month.

Mr. Shirley reports that those who believe "howlers" no longer exist would be quickly disillusioned if they were to peruse the correspondence he is constantly receiving from Midland listeners. The difficulty of actually tracing the offender is not always surmountable, but in most cases Mr. Shirley, with the judgment of Solomon, is able to put matters aright.

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Gillingham (Kent).

Branch Secretary: Mr. R. Harrison, 48, Charter Street, Gillingham, Kent.

The happy relations which exist be-

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"Never mind the taste. It'll do you good."

tween the League's local organisation and Radio Societies was evident when a large band of members of the Gillingham (Kent) Branch recently paid a visit to the Maidstone Radio Society and heard a very interesting lecture. Mr. J. W. Clark, in the absence of the president, welcomed the League members, who reciprocated by inviting the Maidstone Radio Society to pay a visit to Gillingham.

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Brighton and Hove.

Joint Branch Secretaries: Mr. D. J. Gadsby, 30, Willbury Villas, Hove, and Miss C. Foot, 15, Prestonville Road, Brighton.

Formed to enable Radio listeners and experimenters to obtain instruction and advice, the first meeting of the Technical Section of the Brighton and Hove district branch of the Wireless League was held at Union Church Institute, Queen Square, Brighton, Mr. A. E. Curtis presiding. Mr. Privett gave a very interesting and instructive lecture on "Wireless Waves."

Local listeners wishing to take advantage of the practical assistance provided by the Branch's latest activity should apply for particulars to the Technical Section's Honorary Secretary, Mr. Charles Prior, 443, Portland Road, West Hove.

It is satisfactory to note that the Branch has been able to arrange for representation in a local monthly journal—"Downland"—in the pages of which members will always find news of the Branch's activities and progress.

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New Malden.

Branch Secretary: Mr. R. J. Venner, Lynwood, Malden Hill, New Malden, Surrey.

Over 160 people attended the last whist drive of the season held by the local branch at the Spicer Institute. The honorary secretary, Mr. Venner, acted as M.C. and the prizes were presented by Mrs. G. Bourne. The successful visitors were: Mrs. Sinclair, Mrs. Frewer, Miss Reader, Mrs. Pennack, Mrs. King, Mr. Gordon, Mr. Stewart, Mr. Rowe, Mr. Gray, Mr. Woodman, Mr. King, and Mr. Thomas. At the conclusion the secretary thanked those present for their support and made reference to the amount of oscillation which was occurring in the neighbourhood. He invited those who were in doubt regarding the manipulation of their receivers to make use of the assistance he was very willing to give them.

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London Area.

District Secretary: Mr. C. M. de Adersparre, 37, Enbrook Street, London, W.10.

Since the suspension of lectures and meetings held in various parts of London the district secretary has received many letters from members suggesting that these activities should be revived with a view to assisting listeners the better to understand their receiving apparatus. All who are interested and would support such functions, which must be self-supporting, should communicate with Mr. Adersparre at the above address.

Lady Day brought forth an unusually large crop of enquiries regarding tenants' rights in connection with the erection of wireless aerials, and the District Secretary has referred the matter to headquarters for their advice.

The task of appointing honorary local representatives throughout the London area is no mean one, but Mr. Adlersparre is tackling the problem with considerable zeal, and would be glad to hear from enthusiastic listeners who are prepared to assist him in this capacity.

[*Note by the General Secretary.*—It is rather "sharp practice" for landlords to ask for additional rent from tenants who desire to erect a wireless mast, but if a clause is included in the agreement when the tenancy is taken up or a separate agreement is made, the tenant has no redress. It has come to our notice, however, that some landlords have attempted to extort an additional fee on Quarter Day, although no such agreement has been in force. In these cases the tenant can safely refuse to make the payment. With regard to the question as to a tenant's rights in the matter of aerials, we are advised that unless there is a clause in the tenancy agreement to the contrary, a landlord cannot restrain a tenant from erecting a wireless aerial mast, providing the tenant makes good any damage to the property caused thereby. It should be noted that the use of the word "structure" in a tenancy agreement may be taken as referring to a wireless aerial mast.]

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Western Area.

District Secretary, Mr. W. O. Coate, The Elms, Wembdon, Bridgwater.

We are pleased to be able to report that the League's Western Area has been invited to nominate a representative to serve on the Bristol Advisory Committee of the Cardiff station. Mr. Coate would welcome letters from members expressing their views on broadcasting, and if he finds that there is a general desire for any particular change or alteration, the League's representative will make the necessary representations.

CORRESPONDENCE.

Membership Fees by Instalments.

Sir,—I have just been perusing the League's booklet, and as an enthusiastic listener with no knowledge of the technicalities of wireless, I feel sure that Full Membership of the League would be very helpful to me. The annual subscription of One Guinea certainly seems quite rea-

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sonable, but as a man of very moderate means I am afraid such a payment would not be possible unless I could send it by instalments. There must be many listeners throughout the country who are in a similar position, and perhaps you would consider the advisability of giving the necessary facilities.

A WORKING MAN.

Bethnal Green, E.

[*Note from the Wireless League.*—As a result of numerous requests, the League has decided to accept Full Membership Subscriptions by instalments, in cases where the listener is unable to make the total payment of One Guinea. The fee can be paid in a first instalment of 6s., followed by three weekly payments of 5s. The member is covered by our free insurance scheme from the date of the receipt of his initial remittance, and his membership, of coutse, lapses on the anniversary of the date of that payment. In forwarding a remittance it is important to indicate that it is a payment towards the Full Membership subscription.]

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Impressions of the Programmes.

Sir,—Following my recent suggestion that listeners should send me their programme suggestions and complaints, I have received many letters. Several of them, of course, follow the same lines, and only those giving outstanding views are quoted :—

One Manchester listener has taken the trouble to obtain the views of his friends, and they are unanimous on the following :—

"6 to 10 p.m., all entertainments and light music, with news and weather at 8 p.m. Music to be tuneful, as anything without a tune is usually highbrow and not wanted. All talks to be before 6 and after 10 p.m. Sunday programmes to be more lively. If the B.B.C. must give a sermon make it at church time, 6.30 to 7.30; and if they must educate us at all to put it all on one station, such as 5GB, and leave the rest of the stations for light entertainment between 6 and 10 p.m."

Another listener writes complaining that a promise was made in the *Radio Times* that every consideration would be given to local writers and composers. "Acting on that statement I submitted some of my works by request, which, strange to say, were never returned. What became of them I never found out." This writer stated that his songs were sung at Manchester, Blackpool and other festivals, but they were not good enough for the B.B.C.

Another listener from Blackpool states : "I do not know what lines they (the B.B.C.) follow in planning the programmes, but it seems to me that they do not make it a very popular one. They appear to say 'This is a good programme; if you do not like it you ought to, and if not you must be taught to do so.' The tired worker does not wish to be wearied with so many talks and dry, tuneless music. Between 7.30 and 9.30 p.m. and 12.30 to 2.30 we should have a programme similar to that given by De Groot or Sandler. The reason why these orchestras are so popular is because the conductors, in addition to broadcasting, have to please an audience in the hotel. How long would one of these conductors reign at a place where the general public have to be pleased if he gave such a musical bill of fare as the B.B.C.?"

Another listener, commenting on an atmospherical roar which has been experienced in his district, says : "I, like many more people, have been annoyed by this nuisance, but at the same time I feel that it is at least as interesting as most of the programmes which are broadcast."

"First of all to night we had a long account of what ambulance people are doing to mitigate road accidents. Then we had some German songs written by Schumann. Then we had a learned professor talking about Greek tragedy. This went on for an interminable time, and a quarter of an hour after it finished we had another professor talking about science, followed by a lady who discussed for twenty minutes the problems of heredity."

"The news consisted of a dreary extract from some politician's speech about overseas trade, followed by an exposition of 'form and phrase' in music. Then the Daventry shipping forecast provided a delirious interlude. Having recovered from that excitement we were treated to three-quarters of an hour of the weirdest 'chamber music' imaginable. Then followed a quarter of an hour of what sounded like two or three cats wailing, after which the interference came as a welcome relief."

On the whole there is not a letter received which agrees with the present Sunday programmes, and 94.8 per cent. of the communications ask for light, tuneful music instead of symphony and chamber. The vote is also unanimously in favour of the Sunday services being held at the usual church time.

The correspondence referred to is open to inspection if the B.B.C. would like to take advantage of it, and as district secretary of Lancashire, Cheshire and North Wales I am now convinced that the people who really like the technically classical music represent about two per cent. of the listeners.

J. E. KEMP,
Manchester. District Secretary.

ENROLMENT FORM.

To be filled in by readers who wish to become members of the League, or to renew their membership for a further period.

To the Secretary, The Wireless League,
7, Southampton Street, Holborn, W.C.1. 19

Please *enrol me as a member / renew my membership *of the Wireless League. I enclose P.O. for* †..... *which entitles me to* .....*with all the privileges and rights as enumerated in the Constitution of the League for the period ending* §.....

* *Cross out line not required.*
† *Associate Members pay a minimum annual subscription of Two Shillings, whilst the fee for full Membership is One Guinea per annum.*
‡ *Insert "Associate Membership" or "Membership."*
§ *Associate Membership subscriptions lapse on the 30th September: One Guinea subscriptions, however, cover membership until the anniversary of the date of payment.*

WRITE IN CAPITAL LETTERS.

Name (in full) .....
(State whether Mr., Mrs., or Miss.)

Address .....

.....

My Membership No. is.....
(This is only applicable in the case of renewals.)

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