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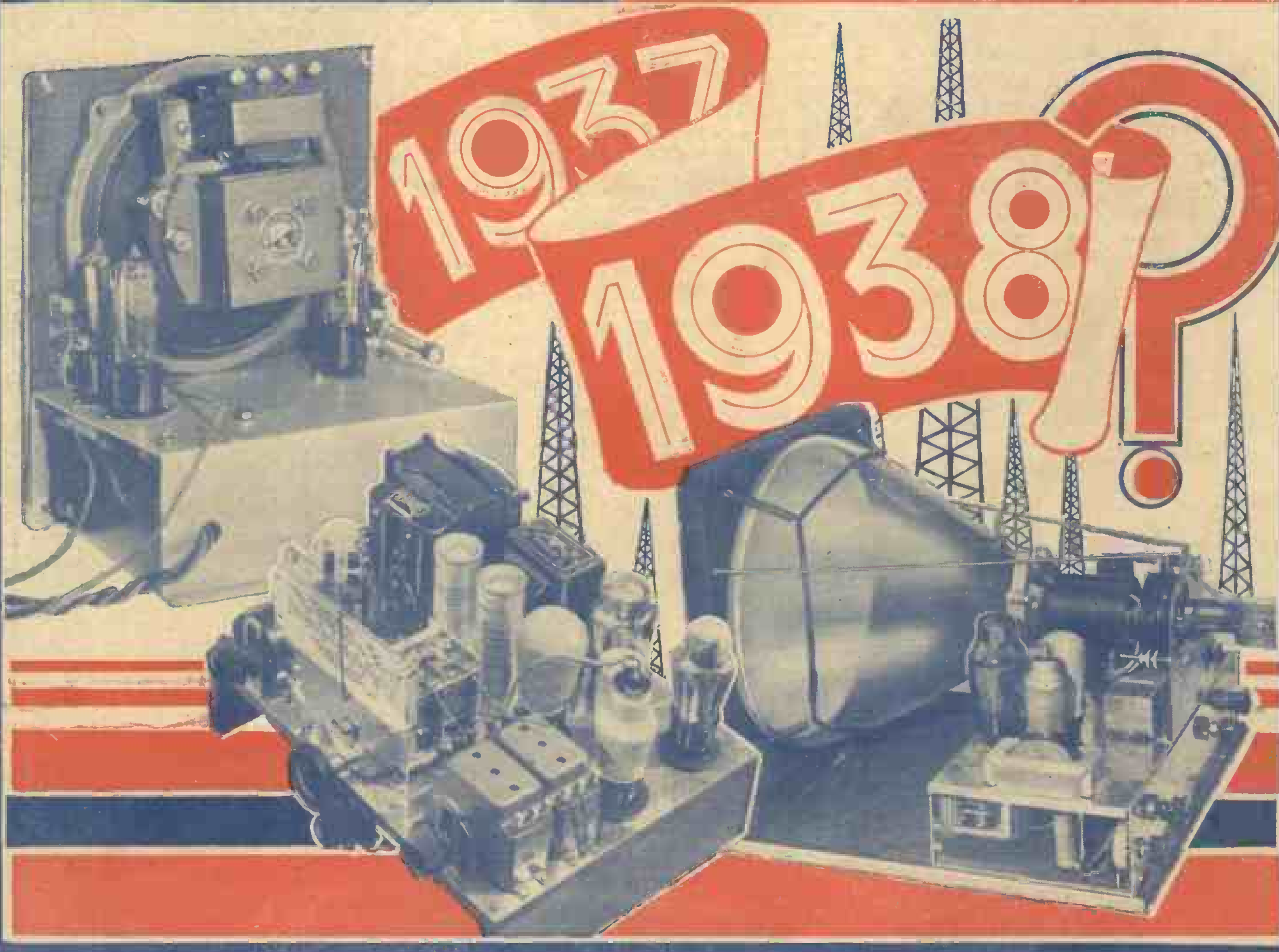
AND PRACTICAL TELEVISION



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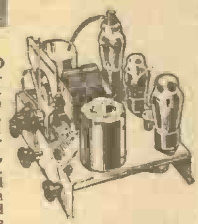

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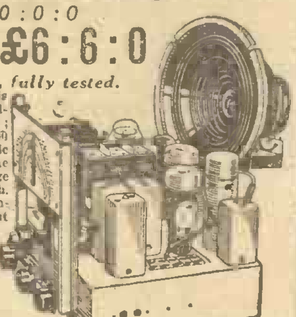

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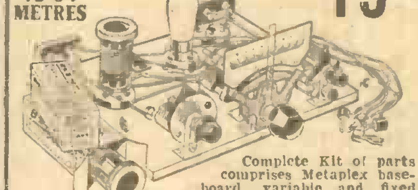

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The ONLY Journal for the Amateur

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:
W. J. Delaney, H. J Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. XI. No. 276. January 1st, 1938.

ROUND *the* WORLD *of* WIRELESS

IN wishing every reader a Happy and Prosperous New Year may we remind them that PRACTICAL AND AMATEUR WIRELESS is now the only journal catering for the amateur.

When this journal commenced publication five years ago it had several competitors. To-day it has none. From its very first issue this journal maintained the lead in wireless journalism, and it has done so to date by virtue of its policy of guaranteed sets, free advice and service. We have cheerfully and promptly answered all technical questions sent to us by our regular readers; when sets have been constructed to our specification we have serviced them free of charge. We shall continue with this policy now that we are alone in the field. We merely ask in return that readers take this journal *regularly*. Our Free Service is not intended for any but those who take the paper week by week.

There is no need for us to reiterate the many innovations in wireless construction for which this journal has been responsible. It is a matter of history, and the story has been told before in these columns. Naturally, we are gratified to know that PRACTICAL AND AMATEUR WIRELESS maintains its virile readership and large circulation. There is every reason to state that it will faithfully continue to record for a long time hence the technical developments of radio, the news, to sponsor the best designs for constructors, to assist readers with their technical difficulties, and to maintain the healthy, active interest in home construction which this journal created; the fittest must always survive!

With this issue many new readers will peruse our pages and we welcome them to our ranks. We thank our regular readers for their loyal support of a journal which has sincerely endeavoured to place home construction on a sound basis. May we ask all new readers to place a regular order with their newsagents, for by this means alone can they ensure regular receipt of the only journal for amateur constructors.

The Diode Detector

IN order to make radio signals audible in 'phones or loudspeaker, it is necessary to rectify, or more correctly demodulate, the H.F. currents. The process of rectification is a most interesting one and may be traced from the early coherer through many stages to the modern multi-electrode valve. It is claimed that the crystal and the diode, or similar two-electrode rectifiers give better quality than the ordinary triode, but there are many points which have to be considered when designing the detector stage. The ordinary receiver using a reacting triode detector will give very high efficiency, the reaction circuit in many cases proving as valuable as an H.F. stage. Consequently, when building a receiver for quality reproduction, the designer is faced with a difficulty in regard to range of reception, and many amateurs feel that reaction cannot be dispensed with. On page 445 this week we deal with the subject of the diode detector, and show various methods by means of which the all-important reaction circuit may be introduced. Obviously, however, when quality is the main consideration, the straightforward diode rectifier would be employed, with, say, two H.F. stages in front of it to give the necessary signal load, and at the same time to give an adequate selection of stations.

German Television Station

A NEW television station has just been built on the summit of the Brocken in the Harz Mountains. The main building is of wood and it stands 3,733 feet above the sea level. When transmissions commence it may be found that the range of reception will be even greater than with our own B.B.C. transmitter, and details are anxiously awaited.

High-power Station for S. Africa

WE understand that a new short-wave station is proposed for South Africa, and tenders have been called for the supply and erection of a 20 kW transmitter. The wavelength now in use by ZNB, the Mafeking transmitter, is 50.3 metres.

New Swedish Transmitter

SM5SX, the experimental station in Sweden which was formerly heard on 25.63 metres, has now been replaced by a new station, SBG, broadcasting on that wavelength and also on 49.46 metres. The address of the station is Motala Rundradio Station SBG, Tjansterbrev, NR4, Motala, Sweden.

QSL's to S. Africa

IT should be remembered that under the new postal scheme all postcards and letters sent to South Africa go by air at a flat rate of 1½d. per ½oz. You should, therefore, make quite certain that your reports do not exceed this weight, as otherwise the recipient will be surcharged and this may result in your not receiving a QSL card.

Three-channel Radio

AT a sanitorium just outside Cleveland, Ohio, a novel flexible three-channel sound system has been installed. This includes four souncell microphones, one in the office of the director of the sanitorium, one in the auditorium, the third in the main office and the fourth in the office of the Director of Social Service. The three-channel system is built to serve three radio programmes simultaneously to 450 beds. There are 35 loudspeaker outlets for the games room, recreation room, sun lamp treatment room, and other assembly rooms. The equipment is operated by an electric time clock which turns the set on at 7 a.m. and 4.30 p.m. and off at 2.30 p.m. and 9 p.m.

Cup Tie Broadcasts

THE Football Association has given permission, subject to approval by the clubs concerned, for a description to be broadcast of the play of any of the F.A. cup tie replays which may occur. It has also been arranged to broadcast the draw of the fourth round of the cup tie. This takes place on January 10th.

ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL NEWS and NOTES

Circus to be Televised

IT is interesting to note that Bertram Mills' circus at Olympia is to be televised daily from January 4th to January 8th. It will be the first time the mobile television unit has transmitted pictures direct from a London entertainment. Frederick Grisewood will be the commentator.

New B.B.C. Appointment

WE are informed that Mr. John Coatman, C.I.E., Chief News Editor, has been appointed North Regional Director. Mr. R. T. Clark, Assistant Chief News Editor, succeeds Mr. Coatman.

Welcoming the New Year at Blackpool

BLACKPOOL, never for very long out of Northern programmes, is the locale of the entertainment to be heard on January 5th. Horace Finch at the organ of the Empress Ballroom; Norman Newman and his Band from the Empress too; and variety from the Palace Theatre, will form the nucleus of the "New Year's Eve Entertainment" at this popular resort.

Melodies from the Comedies

REGINALD BURSTON has arranged another programme of Melodies from the Comedies and will conduct the Revue Orchestra in it on January 6th. The soloist will be Alex Penney, the Derby soprano. Martyn C. Webster will present the programme.

Beach Pavilion Memories

ON New Year's Day Miss Violet Davidson, whose North Stars concert party has long been a favourite with Scottish listeners, will look back over the years and recall the songs which were best loved by a previous generation. Miss Davidson was formerly leading light at the Old Beach Pavilion, Aberdeen, where Harry Gordon, the comedian, made his first appearances on the corner stool reserved for the comedian.

Midland Revue

MARTYN C. WEBSTER will compère and produce one of his "Follow On" revues, so-called because each number or sketch suggests the next, on December 31st. The artists will be Dorothy Summers, Marjorie Westbury, Doris Nicholls, Denis Folwell and Godfrey Baseley, with the little Revue Orchestra, conducted by Jack Hill.

Broadcast from Olympia

IN addition to the television broadcast from Olympia, Regional listeners on January 5th will hear a broadcast from Bertram Mills' circus, and Pleasurefair, Ltd.'s production at Islington. The broadcast will open at Olympia at 7.30 p.m., and from then onward the descriptions by John Snagge and Thomas Woodrooffe will alternate between Olympia and Islington; broadcasting being guided by the suitability of the act in the ring at the moment.

In addition to the description, microphones will pick up the atmosphere of the auditorium and applause of the audience, the sounds of the acts, the music and the quips of the clowns.

For many children this annual broadcast is the nearest approach to a circus, and hence is a considerable radio attraction.

George Formby—popular Lancashire stage, screen and radio artist who recently appeared in the Command Performance, photographed with his Pilot model 106.

Minister Televised

LORD STANHOPE, President of the Board of Education, gave a television talk recently at the Alexandra Palace as an introduction to the last of a series of televised demonstrations of physical training. He remarked that "some people don't want to touch their toes first thing in the morning. Perhaps they couldn't if they tried." That is why the National Fitness Council are just as interested in games, swimming, cycling and mountaineering as they are in the "daily dozen." They want to encourage any kind of physical activity which will help people to get the best out of life.

Wireless on Loan

ACCORDING to a recent report, persons residing in the outlying districts of Berlin who are without wireless receivers are being loaned sets for 14 days, after which the sets are taken away and passed on to others. After a short period has elapsed, inquiries are made as to whether it is desired to purchase a receiver, and in this way the German radio industry hopes to increase its sales. The Postal Ministry is helping matters by refraining from demanding fees for the fortnight during which the loaned set is being used.

Radio Helps Chinese Refugees

HONG KONG'S broadcasting station, ZBW, has been having a very busy time dealing with refugee messages. The camps which have been established there to provide accommodation for hundreds of homeless people who have had to leave Shanghai have been the scene of many affecting re-unions, which can better be imagined than described. S O S messages, giving names and addresses, etc., are sent out from station ZBW in batches, several times a day.

G.E.C. Fans a King

THE King of Saudi Arabia has ordered a number of electric fans from the G.E.C. for installation in the Palace at Mecca. These include 30 ceiling fans and thirty table fans.

Children's Hour Request Week

JANUARY 3rd to 8th is set apart as a request week for the children's hour. Last November children were invited to send postcards naming their favourite items for this week, and well over ten thousand responded.

Interesting Travel Talks

Special broadcasts of *Travelogues* of interest to foreign listeners may now be found in the W2XAD and W2XAF, Schenectady (N.Y.) programmes. A simultaneous broadcast is made from both stations on Mondays at G.M.T. 21.00 in the French language, followed at G.M.T. 23.15 by an English translation, and at G.M.T. 00.15 in Spanish, for the benefit of the South American Latin States.

SOLVE THIS!

PROBLEM No. 276.

Jarvis built a 4-valve A.C. mains receiver which worked satisfactorily for some time. When he switched on one day no signals could be obtained, but hum was audible from the speaker. After some attempt to tune a station, he turned the chassis up on end and found that a decoupling resistor was smoking and hot. He checked the output from the mains section and found this was much lower than it should have been. What was the most likely cause of the trouble? Three books will be awarded for the first three correct solutions opened. Address your attempts to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 276 in the top left-hand corner and should be posted to reach this office not later than the first post on Monday, January 3rd, 1938.

Solution to Problem No. 275.

When Hoskins purchased his new H.F. valve he overlooked the fact that this type of valve is now manufactured in two patterns. One has the anode joined to the top cap and the other has the grid connected at that point. His original valve was of the anode top-cap type and the replacement which he obtained was the grid top-cap type and thus he was unable to obtain signals.

The following three readers successfully solved Problem No. 274 and books are accordingly being forwarded to them: F. Orchard, 208, Wood Lane, Chippenham, Wilts; E. Hepple, 4, Collinson Avenue, Middlesbrough; S. Richard, 30, Glentrees Road, Liverpool, 12.

SUPERHETS AND AERIALS

The Importance of Aerial Design in Connection with Modern High-power Receivers is Explained in This Article

IF a superhet has any shortcomings, the greatest of them is undoubtedly background noise, and it is probably not exaggerating to say that 50 per cent of superhet trouble with background noise could be cured, or at least very much improved, by the use of a suitable aerial. There appears to be a growing misunderstanding regarding the proper way to handle a receiver of this type. Development has brought about more sensitive and still more sensitive circuits which have made owners and those responsible for the arranging of aerials somewhat careless. One is apt to feel, when buying a superhet having, perhaps, a gain fifty times greater than strictly necessary, that a piece of disused clothes line (metaphorically speaking) is unnecessarily generous aerial equipment. Those people who must get China will automatically realise the necessity of putting up a really good aerial, but those who buy a receiver "guaranteed to get China" and are content with a couple of dozen European stations, feel that expenditure on aerial equipment would be a wicked waste.

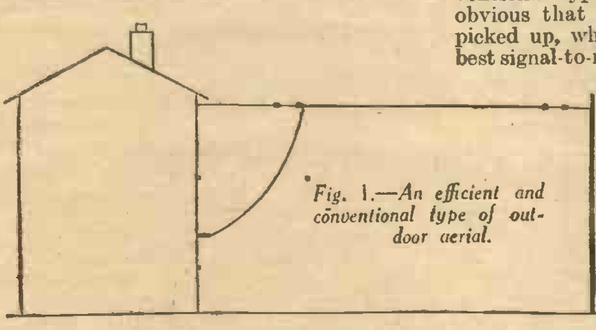

Fig. 1.—An efficient and conventional type of outdoor aerial.

When the bogy of background noise appears, one's friend or dealer, or anybody else who may be interested, suggests the use of some sort of screened anti-interference aerial. This is undoubtedly very sound advice, but it is not everybody who can afford, say, £2 for an aerial outfit, plus the cost of erecting it, when there is no guarantee forthcoming that the interference is of such nature that it may be cured in this manner. The idea that a large aerial will bring in more background noise than a small one is one of the greatest fallacies of radio, which is saying a good deal, and it is very definitely time that some clear thinking on the subject be made available to users of superhets.

Signal-to-Noise Ratio

Consider first of all what happens with a modern superhet working with an indoor aerial say 20ft. in length—first, the signal input being small, the signal-to-noise ratio of the receiver will be very poor. Secondly, the aerial will almost always be in close proximity to electric-light wires, water pipes, gas mains, and possibly a telephone, all of which are carriers of background noise interference, and as the superhet will be in a sensitive condition by virtue of the small signal in the aerial, it will be well able to pick up a large amount of interference from these sources. Thirdly, if the receiver has a bandpass pre-selector, it is highly probable that the use of an aerial of a size quite remote from that which the designer would expect to be used will very probably result in upsetting the ganging of the pre-selector circuit. This will impair both sensitivity and quality, and result in the automatic or manual volume control being set at a greater degree of sensitivity, with further increase in background noise.

The only justification for a short aerial must surely be when a straight receiver is used which would be unselective with a large aerial, but the selectivity of a superhet is for all practical purposes sensibly constant, irrespective of the length of the aerial, providing only that the latter does not differ so widely from the normal standard that ganging is thrown out. Bearing in mind, then, that the use of a large aerial will not impair selectivity, it will be useless to consider the working of the receiver under this condition and compare it with the alternative condition outlined above. Assuming that the aerial is of the conventional type, as shown at Fig. 1, it is obvious that a very large signal will be picked up, which will result, firstly, in the best signal-to-noise ratio possible; secondly, low pick-up from house wiring, pipes, telephone, etc., as the large signal will operate the automatic volume control and reduce the sensitivity of the set, and thirdly, the aerial being of normal proportions, it will not impair ganging.

Indoor Aerials

It is apparent, therefore, that a highly efficient aerial will increase sensitivity, decrease background noise, and affect selectivity. It is also evident that for maximum performance it is just as important to use an efficient aerial with a modern superhet as it was when using a crystal detector in the early days, although the reasons may not be the same. For convenience the writer has cited a small indoor aerial, and compared it with a large outdoor aerial, but it should be clearly understood that efficiency rather than size is the ruling factor. Generally speaking, an indoor aerial cannot be classed as efficient, but certain cases will arise where quite a good aerial can be placed in the loft, which will be found quite satisfactory, particularly in houses without electric light and situated well away from sources of interference. Such cases cannot be generalised, so attention may be directed entirely to outside aerials.

It is not intended to finish this article with a general treatise on aerial erection, as this has been dealt with on numerous occasions, but for the purpose of suiting the requirements of the type of receiver under discussion attention is drawn to the aerial shown at Fig. 2. The aerial pictured is low and long, and has its down-lead end at a considerable distance from the house. Assuming that the wire is strung along a garden, this arrangement has certain advantages. Being below the level of the house, it is to some extent screened from interference, particularly if the garden backs on to other gardens in the conventional way, so that the aerial might be considered to be between two rows of houses, and reasonably remote from either. Since for the very distant reception the sky wave has to be relied upon, the screening effect of the houses will not be serious; in fact, it may be quite negligible, and by keeping the down-lead end away from the house, the aerial can be led in so that it is a compromise between appearance and the avoidance of pick-up from house-wiring, etc. In the writer's opinion, the best possible aerial for a superhet is that illustrated in Fig. 2, but using the screened down lead with the necessary impedance-matching transformers each end; where this expense cannot be countenanced, it will be found worth while to use screened wire for the last six feet of the down lead, not using the transformers. For this purpose the screened wire should be one of the several types available which have a minimum amount of insulating material between core and shield.

In conclusion a warning will not be out of place on the subject of impedance-matching transformers. Many manufacturers have produced aerial coils in their latest sets which are really extraordinarily efficient, and rely for the overall performance of their set very largely on the excellence of this component. We have in mind one moderately priced superhet which has the excellent figure of 18 for the magnification of the aerial tuning coil. If an impedance-matching transformer is used in conjunction with such a set, the efficiency of the aerial coil will be reduced to a very much lower figure. The moral is obvious.

Vertical Aerials

The advantages of the vertical aerial should also be kept in mind, and in certain conditions it may be found preferable to use a vertical aerial, or the lead-in section of the arrangement shown in Fig. 2. Such an aerial will be non-directional, and when the house is situated near or by the side of a main road it will be found that interference from car electrical equipment will be reduced to a minimum, and if any electrical signs are nearby they also will be reduced in intensity if not removed entirely by the use of a vertical aerial.

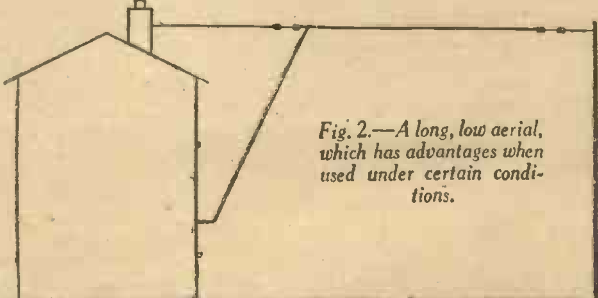

Fig. 2.—A long, low aerial, which has advantages when used under certain conditions.

The Harmonic Problem

An Explanation of the Meaning of the Term Harmonics, and the Importance of Them in Modern Radio Reception

THE beginner is often at a loss when he sees descriptions of various types of output or amplifying stages. It is frequently stated, for instance, that Class A amplification gives freedom from third harmonic distortion, and that a push-pull or Class B stage removes second harmonic distortion. Similarly, he often comes across a note that when searching on the short waves you are likely to encounter one of the harmonics of the London or some other medium-wave station. In order to understand these terms it is necessary to have a slight understanding of music, or at least of the manner in which musical sounds are produced, with especial reference to the stringed instruments.

On a banjo, violin or similar type of instrument, a string is stretched from one end of the instrument to the other, resting at the upper end on the nut or a slotted bar, and at the other end on a bridge. If this string is struck, plucked or bowed, it is set into vibration and will emit a note dependent upon the material and length of the string. Thus a gut string will sound different from a steel string, but no matter what the string is made from the sound will be the same for a given length and given tension of the string. By being the same in sound, we mean the pitch or fundamental frequency. Thus the "E" string on a violin, when tuned to the correct tension, will give off the sound which we know as E when bowed or plucked. But if we take a string made from some other

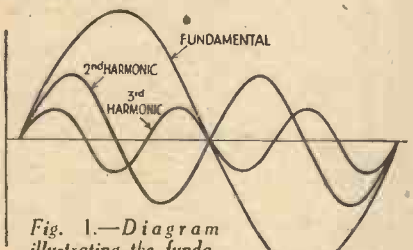

Fig. 1.—Diagram illustrating the fundamental with second and third harmonics.

material and put this to the requisite tension we can also obtain the note E, although the quality of the note will be different due to the string material.

Harmonic Content

This difference in quality is due to the fact that when the string vibrates, although it does so throughout its entire length, it at the same time splits up into shorter sections and these give rise to slight modifications in the large vibration and thus convey to the note the difference which is noticed. The longer the string the slower the vibration and, consequently, the lower the note. If the string is stopped in its exact centre it will sound one octave higher, or in other words, the vibrations will be just twice as fast. If the string is only lightly touched at the centre point, and the moment it is struck the finger is removed, the string will vibrate in two separate sections, resulting in the setting up of a beat note which is twice as high as the note which would be obtained had the string been kept down at the half-way point. This gives rise to the very high-pitched note which is often heard in violin and banjo music, and which is called a "harmonic."

The difference in sound between a cornet or trumpet note "E," and the violin note

Harmonic	*Notation*	*Mathematical Frequency*	*Piano Frequency*
Fundamental	C	129	129
2nd	C	258	258
3rd	G	388	388
4th	C	517	517
5th	E	647	652
6th	G	776	775
7th	B Flat	905	922
8th	C	1035	1035
9th	D	1164	1161
10th	E	1293	1304
11th	G Flat	1423	1463
12th	G	1552	1559
13th	G Sharp	1681	1642
14th	B Flat	1811	1843
15th	B	1940	1953
16th	C	2070	2070

of the same pitch, and in fact, between any two instruments giving the same note, is due to harmonics which are produced owing to the type of stringing and the material upon which the string rests or resonates. For the benefit of those who are interested we attach a table showing the main notes of the musical scale with the mathematical frequency and the piano frequency, from which it will be noted that there is some slight discrepancy at different points. There is no need to go into this now.

It will be obvious from the above remarks that to obtain the correct reproduction of a note or instrument all the harmonics must be reproduced faithfully, and any musical tone which is converted electrically into the receiver should be reproduced with the same harmonic content as the original. Owing to the fact that the signal, when passed to an L.F. valve, can be partially rectified, the harmonics of the note may be suppressed or emphasised. The wave-form of the signal may, of course, be split up into the fundamental, or basic, note and its harmonics, and the ideal state is to give the correct degree of amplification to every part so that the wave-form is a true replica of that which would be obtained in the studio. If a valve is overloaded it can be proved, not only experimentally but mathematically, that additional harmonics are introduced. The effect of this, when added to the remaining frequencies, is to make the reproduction sound shrill, or squeaky, and this is most noticeable on soprano voices, giving rise very often to a jarring sound which might lead one to suspect a faulty loudspeaker. If a triode valve is the one being overloaded the harmonics which are introduced are the even ones (second, fourth, etc.), and this does not produce such a distressing effect as when odd harmonics are introduced (third, fifth, etc.). The pentode valve introduces these odd harmonics and this accounts for the particular type of squeaky reproduction which is often experienced on pentode output stages. It is cured, of course, by using a tone-control filter across the speaker or across the valve.

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The accompanying curves illustrate the manner in which the distortion above mentioned is introduced. In Fig. 1 we have a fundamental curve plus second and third harmonic curves, each of which is seen to be slightly different from the fundamental. When these curves are combined the effect or resultant curve is as shown in Fig. 2, and it will be noted that this is a rather peculiar wave-form. If, therefore, the second and third harmonic curves already mentioned are modified from those shown in Fig. 1, the resultant wave-form would not be as shown in Fig. 2, and thus we should say that the signal was distorted.

Other Forms of Harmonic

When a station transmits on, say, 500 metres, the electrical wave will give rise

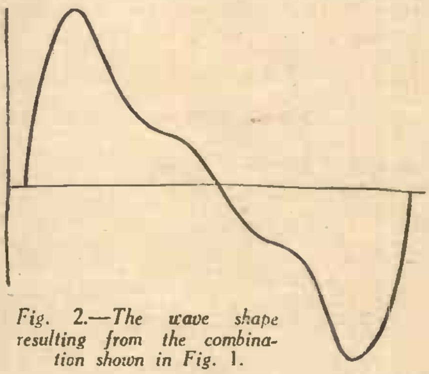

Fig. 2.—The wave shape resulting from the combination shown in Fig. 1.

to harmonics in just the same way as the musical strings already mentioned, and these will be found at 250, 125, 62.5 and so on, being referred to as the second harmonic, etc. Consequently, you can often tune to a medium-wave station on one of these wavelengths, and it will be noted that some are weaker than others. The reason for this is that the harmonic plus the fundamental can give rise to a beat which may coincide with the harmonic, and this strengthens or reinforces it and so gives the louder signal.

Avoid These Things

To conclude this article it may be stated that in addition to overloading the following may be responsible for harmonic distortion: Wrong grid-bias; faulty valve; saturated L.F. transformer due to too high a D.C. current flowing through the primary, and an unbalanced push-pull circuit. The remedies for such forms of distortion are evident.

DIODE DETECTORS AND SECOND DETECTORS

A Description of a Number of Diode Circuits and of Different A.V.C. and Delayed-A.V.C. Systems. Reference is also Made to the Question of Using Reaction with Diodes - By FRANK PRESTON

DIODE valves were the first type to be used and were made long before the triodes and multi-electrode valves that are to-day used in most stages of the receiver. As the name implies, a diode has two main electrodes only; the anode and the cathode. In practice the cathode is generally indirectly heated, but the heater is not actually an electrode. During recent years diodes of various patterns have been used very widely for the detector stage, particularly in superhets, in which case they are referred to as second detectors.

The simplicity of the diode is not the only feature that makes for its popularity. It is generally claimed to produce less distortion than are other valves, and besides this the diode is able to handle a greater signal input than is the normal triode. That is an important point when designing a sensitive and powerful receiver with a number of pre-detector stages. Another valuable feature of the diode, however, is that it can be used to provide A.V.C. in a simple and satisfactory manner.

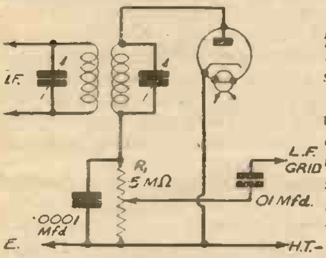

Fig. 1.—The simplest single-diode circuit, where the diode is used for second detection only—in a superhet.

Simplest Diode Circuit

Probably the simplest detector circuit incorporating a diode is that shown in Fig. 1, where it is shown following the I.F. transformer of a superhet. The signal voltage developed across the tuned circuit (the secondary of the I.F. transformer) is rectified by the diode, which has the property of passing a current in one direction only. Due to the fact that the H.F. signal voltages are converted into pulsating voltages, the current flows in one direction only. That is, very briefly and incompletely, the principle of this type of detector.

There is a load resistance, marked R1, and the rectified output from the diode is developed across this. Consequently, the output for the following L.F. amplifier can be taken from the two ends of the resistance. One end is the earth line, which is automatically joined to the cathode of the L.F. valve. The other end is connected to the grid of the following valve, through a low-frequency grid condenser of value between about .005 and .5 mfds.; a value of .01 mfd. is found to be as satisfactory as any. In Fig. 1 the load resistance is shown as a potentiometer, for it can well be used as a volume control to enable any portion of the audio voltage developed across the resistance to be tapped off. If desired, however, a fixed resistor could be used and the feed to the L.F. valve taken from the "top" end.

In a "Straight" Circuit

Fig. 2 shows a method of using a diode in a "straight" circuit. In this case it is important, when using a gang tuning condenser, at any rate, that the moving vanes and frame of the condenser be earthed. A .0001 mfd. fixed condenser is therefore included between the tuned circuit and diode anode—to prevent the tuning circuit from being heavily damped by the valve—and the load resistance is joined between the anode and earth. In this case, for purposes of example, a fixed load resistor is indicated, but it could be replaced by a potentiometer as in Fig. 1. It will also be seen in Fig. 2 that an H.F. choke is included between the diode and the grid of the L.F. valve; a .0002 mfd. fixed condenser is also connected between one end of the choke and earth. The purpose of the choke is to act as an H.F. "stopper," preventing H.F. from reaching the L.F. amplifier. The by-pass condenser further assists in this direction. This "stopper" circuit is not a refinement, but is in nearly every case a practical essential. A similar circuit would have to be included in the arrangement shown in Fig. 1. In practice it is found that the choke can quite well be replaced by a fixed resistor of about 100,000 ohms, and this is more often used due to its more compact form and lower cost.

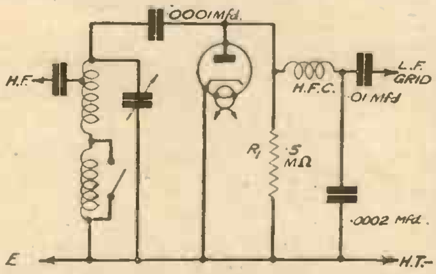

Fig. 2.—This skeleton circuit is of the same general form as that in Fig. 1, but applies to a diode used in a "straight" circuit, where the frame of the tuning condenser is earthed.

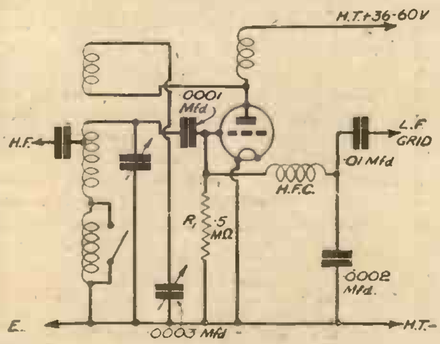

Fig. 3.—An ordinary triode valve used as a diode detector and reactor. The grid acts as a diode anode and also as a normal grid in conjunction with the "legitimate" anode, which is now used in a reaction circuit.

Using a Triode

It is significant that the valve shown in Figs. 1 and 2 is of the indirectly-heated kind; most diodes, whether for battery or mains operation, are of this kind.

Nevertheless, it is possible to use an ordinary battery (or mains) triode as a diode, either by joining together the grid and anode to act as a single anode or by using one of these electrodes alone. The circuit would be the same as in Fig. 1 or 2. Reaction is not normally used with a diode, nor is it desirable in most instances. Some constructors prefer to have it, however, especially if the receiver is not of a sensitive type having one or more pre-detector stages.

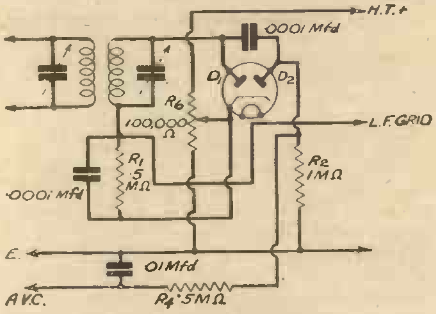

Fig. 4.—A usual form of double-diode circuit for detection and delayed A.V.C.

A very simple method of applying reaction when using a triode is as shown in Fig. 3. If the anode and reaction connections are ignored it will be seen that the circuit including the grid and filament is fundamentally the same as that in Fig. 2. The anode connections are rather strange with a diode circuit, mainly due to the fact that they extend to the H.T. circuit; high tension is not used or required with a diode employed in the normal manner. Connected as in Fig. 3, the valve behaves as a diode and triode in parallel, since the grid is used both as a grid, in conjunction with the "legitimate" anode, and as an anode in conjunction with the filament alone. The triode "portion" acts simply as a reactor or oscillator, and reaction control is the same as when using leaky-grid detection. This circuit is fairly effective when the valve is of the small-power type.

The Double-diode

It is more usual to employ a double-diode, either as a full-wave rectifier or for detection and A.V.C. A typical circuit is given in Fig. 4. Here the diode anode, marked D1 is for detection and D2 is for A.V.C., and both anodes are linked together through a .0001-mfd. fixed condenser. R1 corresponds with the resistor of similar denomination in the previous circuits, while R2 is the load resistance for the A.V.C. diode. The general operation of the detector diode will be clear

(Continued overleaf)

DIODE DETECTORS AND SECOND DETECTORS

(Continued from previous page)

from what has been stated before, so we can pay attention to the A.V.C. circuit alone.

A rectified voltage appears across R2 and, due to the "one-way action" of the diode, the upper end becomes negative in respect of the lower when a signal is tuned in. Moreover, the magnitude of that voltage is dependent upon the strength of the signal applied to the valve; as the signal increases in strength the voltage attains a greater value. The negative voltage or potential is applied, through the decoupling circuit consisting of a .01-mfd. fixed condenser and resistor R4, to the grids of the variable-mu valves preceding the detector. Because of this the amplification provided by those valves is reduced on stronger signals. This is, as you will remember, the principle of A.V.C.

Delayed A.V.C.

The main objection to simple A.V.C. is that it might impair the performance of the set on weak signals. This is simply because a negative bias is applied to the variable-mu valves even on the weakest of signals reaching the detector. The difficulty can easily be met, however, by using what is commonly known as delayed A.V.C. The principle of this is that a negative bias is passed back through the A.V.C. circuit only after signal strength has reached a certain (controllable) minimum value. To make this possible, it is necessary to apply a limiting voltage acting "in opposition" to the A.V.C. voltage. In other words, the A.V.C. voltage has to cancel out an existing fixed voltage before it can have any effect on the controlled valves.

A simple and effective method of providing this delay voltage is by making the cathode of the diode slightly positive in respect of earth and of the A.V.C. diode—D2 in Fig. 4. In our circuit a 100,000-ohm potentiometer (R6) is used for this purpose. An alternative to the variable potentiometer would be a fixed one comprising a 100,000-ohm resistor and a 1,000-ohm resistor. That would give a delay voltage of, roughly, 1.5 volts with 150 volts H.T.

A corresponding but alternative circuit is given in Fig. 5, where corresponding resistors are given the same references as in all of the other circuits shown. In this case a dry battery could be inserted at the point marked X to provide any required delay. In an accurately designed receiver the maximum output from the detector should just be capable of overloading the following L.F. valve. Overloading must be

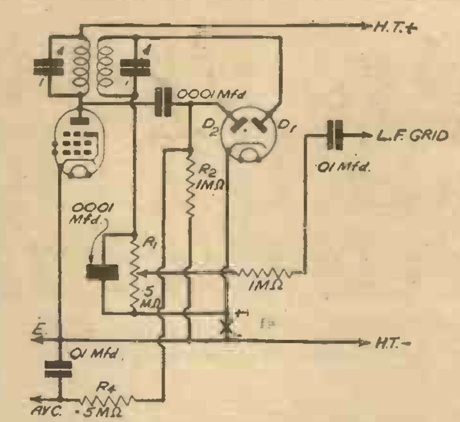

Fig. 5.—Double-diode used for second detection and A.V.C., one anode being employed for each purpose. If desired, a delay voltage can be applied at the point marked ×.

avoided in the interests of good reproduction, so the delay voltage is adjusted so that the L.F. valve is just overloaded when the receiver is tuned to a distant station, and when the volume control is at maximum.

Another point that will be observed in Fig. 5 is that the A.V.C. anode D2 is joined, not to the secondary of the I.F. transformer, but to the anode of the preceding valve through a .0001-mfd. condenser. This is generally a more satisfactory arrangement, although the principles cannot be discussed in the available space for this article.

Double-diode-triode

It is generally found desirable to have not less than two L.F. stages after a diode, although this is not necessary when using a high-efficiency pentode. In order to simplify the design and construction of the set, it is therefore usual to employ a double-diode-triode, which comprises a double-diode and triode L.F. valve in one glass envelope. A "standard" circuit for this is given in Fig. 6, which will be seen to be very similar to Fig. 5 in many respects. In this case a small delay voltage is provided by the bias resistance in the cathode lead—which carries the H.T. current for the triode portion. Additional bias—a voltage from 1 to 6 is normally adequate—can be provided if desired by adopting the connection shown in broken lines.

Applying Reaction

On one occasion when referring to diode detection in these pages, I made the statement that reaction cannot generally be used very satisfactorily when a normal diode or diode-triode valve is employed. This brought several letters from readers to say that I was in error; many readers stated that they had used reaction with complete success. I still maintain that the system is not one to be recommended, and several technicians with whom I have discussed the matter agree.

But to avoid a repetition of any similar charges, I give a circuit incorporating reaction in Fig. 7. This is not the only one, in addition to that given in Fig. 3, but it is one that has probably been more successful than the majority. You can see that reaction is applied to the tuned circuit from the anode circuit of the L.F. valve. To make this feasible, the usual "stopper" resistance or choke and condenser must be omitted.

It is possible to use an ordinary dual-range coil with reaction winding along with a .0003 mfd. variable condenser, but this is not wholly satisfactory. A far better arrangement is to use a very large reaction condenser and a very small reaction winding. A .01-mfd. condenser is shown, and with this the reaction winding might consist of only about 15 turns. The object is to minimise the inductance of the reaction winding and to provide an easy by-pass by stray L.F. which must be mixed with the H.F. in the amplifier circuit. A variable condenser of the value stated is not easy to obtain (although there are some made for tone-control purposes), and it will generally be easier to use a fixed one in parallel with a large pre-set. Thus, a .002 mfd. pre-set condenser could be wired in parallel with a fixed one of about .005 mfd.

In most cases, the optimum setting of the pre-set can be found and the adjusting screw then locked. This will give fixed reaction, which will "hold" sufficiently well over the tuning range.

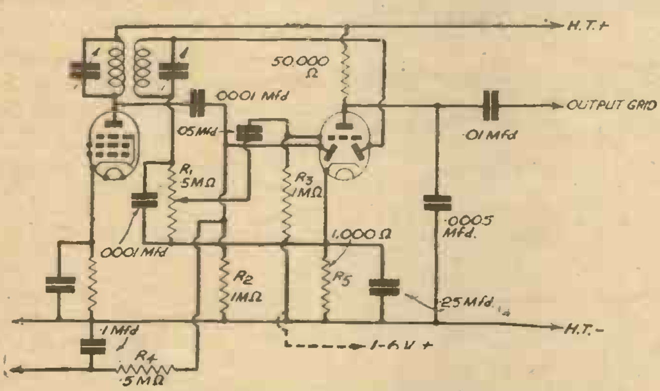

Fig. 6.—Here a double-diode-triode is used for second detection, A.V.C., and first L.F. amplifier. The general arrangement is similar to that in the preceding circuit.

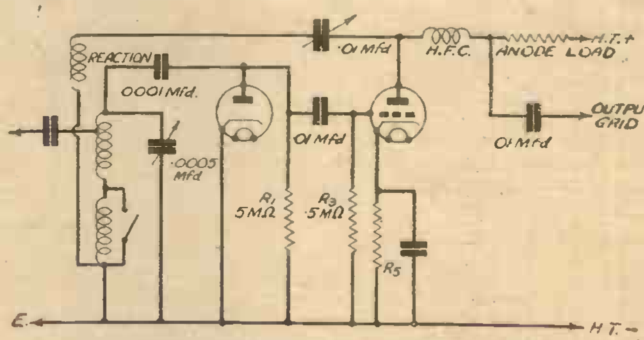

Fig. 7.—A method of obtaining reaction when using a diode detector in the normal manner. Feed-back is from the first L.F. stage.

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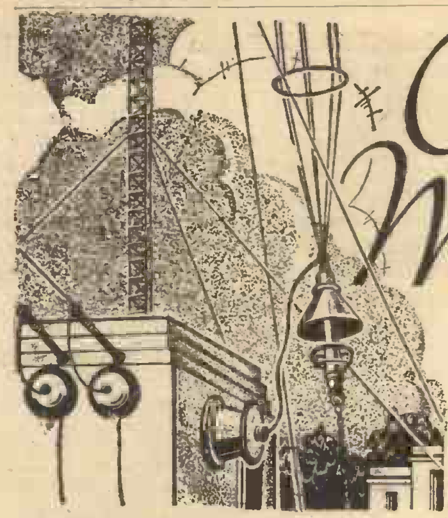

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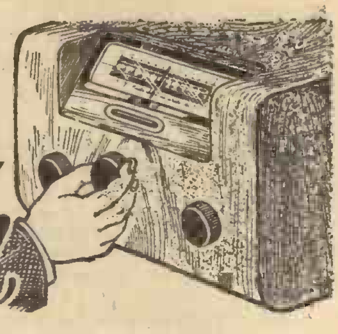


By Thermion

Our New Building

A WEEK or so ago I wrote some notes concerning the new building which houses the staffs of the innumerable journals published by the famous house of Newnes. I show on the following page an artist's sketch of it, but wild horses are not going to drag from me any hint as to that part of it which shelters your present scribe. If I did so the pro-croonerites and the pro-jazzites might descend upon me in their wrath. Those who feel that way should remember that as a scribe sitting at a desk I may be a lyddite (I am always slamming the lid of my desk), but I am also a Hittite. At any rate, this new building is in every way worthy of me and the pearls of wisdom which fall from my pen like dewdrops from the rose leaf. The sweet young thing who sometimes has the painful duty of taking my dictation has another name for it, but her vocabulary is improving daily.

Encouragement

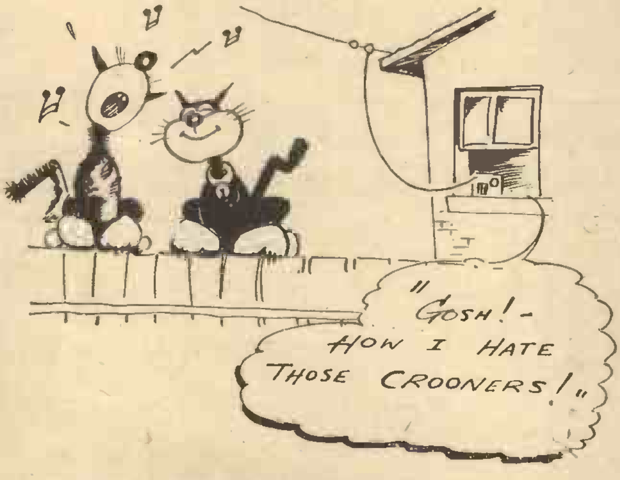
I PUBLISHED a reproduction of an envelope I had received from a reader the other day. This has spurred him on to further efforts and I show a sketch which he has sent to me. If any of my readers are caricaturists I hope they will go and do likewise.

Early Morning P.T. Broadcasts

GLAD to see that my recent notes about the B.B.C. refusing to broadcast physical training exercises on the flimsy pretext that they could not afford it has had some effect. I learn that at the sixth meeting of the National Fitness Council at the Board of Education, Lord Aberdare, in reply to a question, said that the National Fitness Council were in consultation with the B.B.C. and it was hoped that an arrangement would soon be concluded whereby these broadcasts would be made possible. The B.B.C. can afford it when they should afford it.

Jokes

E. H., of Greenhithe, tells one : "An old lady complained of the profanity of two men mending the telegraph cables near her house.



"A crooner by any other name——"

When questioned, one of the men said that he had only tipped some molten lead down his mate's neck and he merely said, 'Can't you be more careful, Bill?'"

* * *

J. E. L., of Southend, sends me details of a television adapter, which Master Battisin Belfry can never hope to achieve. He sends me a drawing of it. Valves consist of the hot anode type and have an output of three candle whats! The outstanding feature is the vision sorber, which is a kind of large magnet that absorbs all the vision and static electricity from the air when turned in the direction of the aerial, thereby providing pictures and doing away with the battery. It works on any set, but the main thing to remember is to heat the receiver for half an hour before use to prevent the tuning condensers becoming alive. The receiver, I am told, should sell and smell well.

The Old Days

I HAVE received the following from A. R., of Seaford :

"I played a wireless joke in this manner back in the days of swinging-reaction coils, when I was only a lad—they were the days, though! I couldn't afford an accumulator after I had paid for the parts, licence and H.T. battery, so I got two jam-jars, two porous pots from some old Leclanché cells, zinc rods, sulphuric acid, and bichromate of potash, and obtained the necessary four volts for my one-valver. After a week or so, if there was a special item I wanted to hear and the L.T. supply caused the valve to gutter, I used to stir up the acid with zinc rods and carry on. And that reminds me, a crony I knew wanted a one-valve set like mine, so I made him one, and when the time came to make up the cells I found that I had left the acid at home. After it was brought along we carefully added the exact quantity to the water, hooked up, switched on, and nothing happened. After a great deal of fiddling about we found that my folks at home had sent father's bottle of eye-lotion which was in the same kind of bottle as my acid; after that I saw to it that father didn't use my acid for his eyes! The funny thing about my friend's set was that it only worked with my valve, a Dutch one costing 4s. 6d. I don't know how many kinds of valve we tried in it, also different valveholders and condensers; we tried for hours and got only silence for our trouble, but as soon as the Dutch valve was put in the set 'just went.'

"My set worked with any valve almost—we gave his set up after an expert failed to get a sound out of it; but this joke—I got a Ford spark coil coupled to my jam-jars, a length of wire from one secondary leading out to the back yard and the other to earth. A neighbour came into view, so I called out to ask if she would like to hear the wireless. She said yes please, she hadn't heard it yet, and so on. I gave her the wire to hold and told her that I'd go inside to switch on. I did, and she dared me to come out again. She did jump, though.

"My friend with the dud one-valver graduated to a det.-2 L.F., and after a month or so it distorted horribly, and one day his mother said, 'You'll have to leave the window open when you use the wireless—you can't expect it to play clearly when the music is all squashed up in the wire when the window is shut.' If I was capable I could write a lot more about those times.

"But wireless was really worth while then—chaps helped one another and there were interesting problems to discuss; now, about the only mention of wireless is: 'Oh, I gave twelve guineas for mine.'

"I hope PRACTICAL AND AMATEUR WIRELESS continues to prosper and trust you will give us your entertaining articles for years to come."

Do Dealers Ever Listen In?

MR. M. W. P. WARD, of Harrow, sends me the following:

"In reply to your comment on 'Do dealers ever listen?' A friend of mine, seeking a cabinet, was shown an old Marconi set with quite a good cabinet. It was an S.G.3, complete with three Cossor valves, a large G.B. battery (it had anode bend detection), and a D.C. eliminator. The set was in perfect going order, with very little hum. On getting it home we attached an L.T., connected the eliminator to the mains, connected the L.S. and received the National at good volume. This was the only station that we could get, but it came through at R9. We bought the whole lot for 7s. 6d. How about that?

"Why is it that the 15 kW station Radio Normandy (Fecamp) comes through so well in the South of England?

"I quite agree with you about Sunday programmes; I always listen to Normandy or Luxembourg.

"Can you explain why certain dealers display in their windows certificates saying that they are competent service engineers, and signed by some well-known manufacturer, yet when you ask them any question they always are unable to answer it? Are they supplied with special service sheets, telling them to test here and there, and if they do not get a reading the component is obviously broken!!

A friend of mine bought a portable from a well-known London store recently. Having sent it back three times to be mended, he footed a bill for 19s. 6d., and still the set did not work. He handed it to me in despair. I tightened up the valveholders, tested the resistors, etc., and found all O.K. After reassembling, the set worked perfectly!

Drawing the Waves!

THE following is sent by W. J. W., Bootle:

"The day before the Liverpool Grand National I was asked to make the set go louder, ready for the race. I did my best. But the man of the house had his own ideas on why he couldn't get the set loud when a good programme was on. He said, 'With so many people tuning in to the race there won't be enough to go around—the best thing to do is to tune in the National early, and hold it there before everybody else gets on it.' That night, after the race, I asked how the set had worked.

"Said the man of the house: 'It was just as I said—I tuned in at dinner time and left it on the one station, and by the time the race came on the aerial had got so used to one station, it acted like a magnet—nothing could draw it off. Marconi himself couldn't have got it better.'"

The B.B.C Ballroom

HEREWITH letter from K. Brownless, of Acomb:

"*Re* your remarks about this 'B.B.C. Ballroom.' I think that they are utterly ridiculous. The tempi are not correct, as a rule. The lack of vocals in these shows, also those such as 'Thé Dansant,' and any other 'no vocal' sessions, simply provokes boredom.

"I think it utter piffle to say that vocals put off dancers. Joe Loss at the Astoria has vocals in his programmes, and the same applies to Ambrose, Carroll Gibbons, and others.

"With reference to the actual problem of whether listeners dance to the 'dance time' sessions, there are three points worth noting:

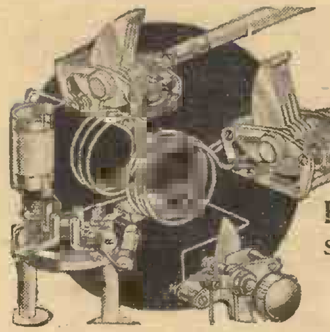
"1. Constant slithering wears away the carpet.

"2. If we are to remove the carpet it is going to be a waste of time.

"3. In ballrooms there are intervals between dances; the B.B.C., of course, hasn't the time to waste.

"Strange as it may seem, I long for Commercial Radio on an Anglo-American basis, not the Continental stuff."

Our artist's impression of the imposing Tower House building (The House of George Newnes, Ltd.) which is a landmark in the Strand district.



Short Wave Section

H.F. AMPLIFICATION ON THE SHORT WAVES

Some Details of the Uses of this Form of Building Up Signal Strength with Suggested Circuits.

By W. J. DELANEY

IT has been repeatedly stated that a short-wave receiver of the simple detector or detector-L.F. type may bring in stations from all parts of the world, but many constructors find that they are unable to get satisfactory or consistent results when using this type of receiver. Among the many defects or troubles which they experience may be mentioned erratic reaction and excessive background noises. Provided that the receiver is properly designed it should be possible to obtain smooth reaction over the entire waveband, but it is often found that the peculiar effects introduced in the way of damping by the aerial-earth system may result in some trouble with the reaction control. Unfortunately the simple type of receiver referred to depends to a large extent upon the reaction circuit and this is used to build up the signal—often making audible a station which could otherwise not be obtained. If, therefore, you wish to ensure smooth reaction on all wavebands, one of the first things to do is to remove the damping of the aerial-earth, and this may be done in several different ways. One of the simplest is to connect the aerial to the coil through a small coupling coil or through a fixed or variable condenser, but this is not ideal although it is very often fully effective.

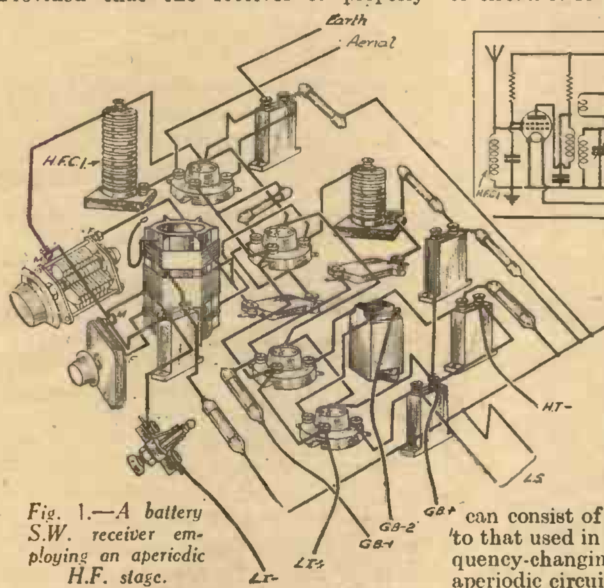
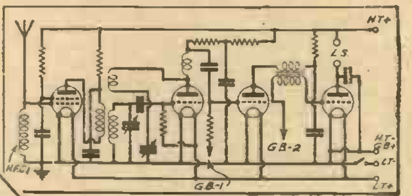


Fig. 1.—A battery S.W. receiver employing an aperiodic H.F. stage.

With regard to noises, these are received with the signal in many cases, and thus it is more or less impossible to cut them out and hear the signal free from interference.

Superhet Circuit

It has been found, however, that if a receiver of the superhet type is employed, and if this has a signal H.F. stage plus well-designed I.F. stages, the ratio of the signal to noise is considerably modified. Tests with a superhet with and without an H.F. stage at the same time, will show conclusively that the latter will provide a quieter background. Similarly, the use of a number of tuned circuits will also be found effective in reducing background or static noises. Unfortunately, valves themselves are capable of introducing all kinds of noises, from hissing to cracks and bangs, and these may affect a signal. It is a simple matter to decide, however, whether valves or circuit is responsible for trouble of this type, merely by substituting the valves in use by others. If, therefore, you are using a superhet circuit and find that this gives noisy results, try the effect of a pre-signal H.F. stage added in front of the frequency-changer. A variable-mu pentode should be used, and the tuning circuit can consist of a similar coil and condenser to that used in the grid circuit of the frequency-changing stage. Alternatively, an aperiodic circuit may be used as is now to be described for the straight type of set.



Obviously, for maximum results it would be preferable to use the tuned arrangement, although this will add a further control to the complete receiver. If desired this could be ganged to the main tuning control.

Aperiodic Tuning

One drawback to the addition of an H.F. stage is that a further tuned circuit may be introduced. If the receiver already has one tuning control this may be held by some listeners to introduce difficulties which will prevent its adoption. Actually, however, it may be made so flatly tuned that it will not introduce difficulties of this type. To avoid tuning altogether, the circuit may be of the type known as aperiodic. For this purpose a grid leak or an H.F. choke is joined from the aerial to earth, and the H.F. valve is joined across this exactly as in the case of a tuned circuit. In Fig. 1 we show a battery four-valve receiver of standard design, in which an H.F. stage of the type referred to has been added. The H.F. valve in this case is of the "straight" type, but it could easily be replaced by a variable-mu type if desired, the control being carried out by joining a 50,000-ohm potentiometer across a grid-bias battery and feeding the arm of this control through a 1-megohm resistance to the grid of the H.F. valve. A .0001 mfd. fixed condenser should then be joined between the grid and the junction of the 1-megohm resistance and the H.F. choke and aerial. The H.F. choke should be of a reliable type, designed to afford adequate choking effect over the waveband or band of frequencies to be covered by the tuning coil which is included between the H.F. and detector stages. As shown, this is a home-made affair, but it would be quite in order to replace this by a standard 6-pin short-wave coil.

Mains Circuits

In the second illustration, Fig. 2, a circuit of the Universal mains type is indicated, and this utilises three pentodes so that maximum volume may be obtained with the minimum number of valves. The variable control for the H.F. valve in this case is included in the cathode circuit, and in place of the aerial choke a grid leak having a value of .25 megohms is employed. There is a wide scope for experiment in connection with this type of aerial circuit and it may be found that a resistance as low as 100,000 ohms may give satisfactory results, whilst in other cases it may be found necessary to go up to 3 or 4 megohms.

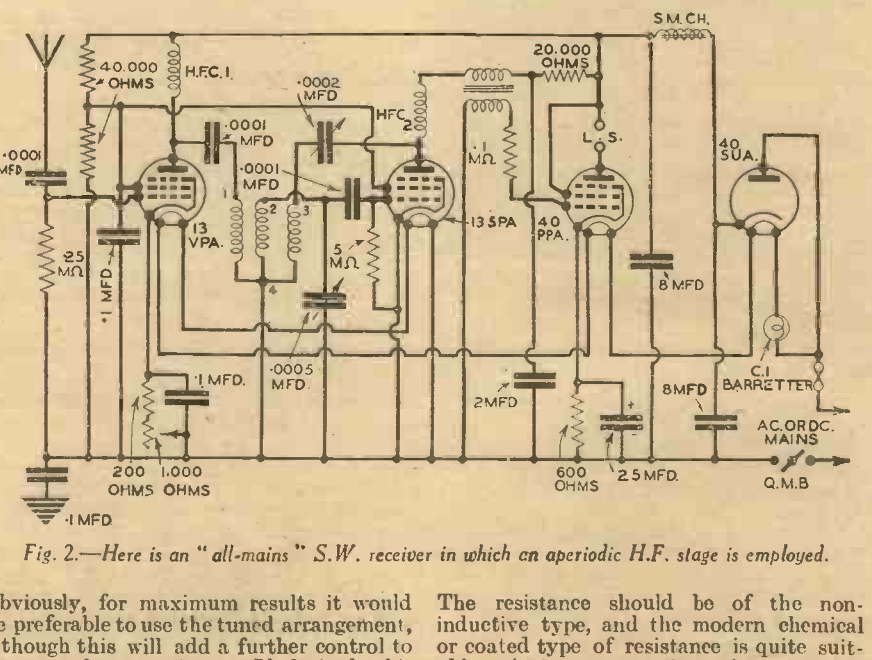


Fig. 2.—Here is an "all-mains" S.W. receiver in which an aperiodic H.F. stage is employed.

The resistance should be of the non-inductive type, and the modern chemical or coated type of resistance is quite suitable. An important point to be mentioned

(Continued at foot of next page)

Leaves from a Short-wave Log

New Cuban Broadcaster

THE Havana station, previously reported as CODX or CMDX, is now confirmed as COBX relaying CMBX, a medium-wave station in the Cuban capital. The channel used is 32.61 m. (9.2 mc/s), the power being given as 500 watts. Announcements in Spanish and English are followed by one stroke on a gong, a peal of four bells being broadcast four times during the hour. Reports of reception should be addressed to Estaçiones CMBX y COBX, San Miguel, 194, Havana, Cuba.

Two U.S.A. Expeditions

OX2QY, is the call-sign of the McGregor Expedition radio station in Greenland; transmissions are made irregularly on 20.86 m. (14.38 mc/s). VP3THE, a station of the American Museum of Natural History Expedition, under the leadership of Dr. W. H. Holden, is located some 500 miles up the savannahs of British Guiana, near the Essequibo river. It is now working with amateurs on 21.83 m. (13.745 mc/s) between G.M.T. 23.30 and 00.30.

Algiers on Short-Wave

The 10-kilowatt Government station, located at Algiers-Eucalyptus (North Africa), has been carrying out further tests on 24.75 m. (12.12 mc/s), with the relay of Algiers medium-wave broadcasts. They have not only been heard well throughout Europe, but many reports of good reception have been received from the United States.

Opera Broadcasts from New York

Every Saturday, from G.M.T. 19.00, a relay of performances from the Metropolitan Opera House, at New York, is being carried out by the N.B.C. The broadcasts for listeners overseas are made simultaneously through W2XAD and W2XAF, Schenectady, on 19.56 m. (15.33 mc/s), and 31.48 m. (9.53 mc/s), respectively, and through W1XK, Millis (Mass.), on 31.35 m. (9.57 mc/s). This will be a regular Saturday feature of the programmes throughout the winter months.

More Broadcasts from the Argentine

Nightly, at G.M.T. 21.00, the Ministry of Foreign Affairs of the Argentine Republic, at Buenos Aires, broadcasts a short propaganda talk, followed by a musical programme, simultaneously through two short-wave stations, namely, LRX, on 31.06 m. (9.66 mc/s) and LSY, Monte Grande, on 16.56 m. (18.115 mc/s). The latter is a commercial station used for regular public telephone service with Europe, and the United States.

For Calibration Purposes

IUD, Addis Ababa (Ethiopia) on 16.42 m. (18.27 mc/s) now a 15kw. transmitter, reconstructed by the Italian authorities, may be heard working during the afternoon, and early evening hours, and in telephonic communication with Rome.

LSF4, Monte Grande (Buenos Aires), on 15.08 m. (19.9 mc/s), gets into touch daily with Paris at G.M.T. 18.30.

Another U.S.A. High Power Transmitter

The General Electric Company (Schenectady, N.Y.), is erecting near Belmont (California), a fifty-thousand-dollar transmitter for the purpose of broadcasting special programmes to the Far East. This 20-kw. station will work on 19.56 m. (15.33 mc/s) and 31.48 m. (9.53 mc/s). Although these are the channels at present used by W2XAD and W2XAF, no interference will be caused to these transmissions, as the time schedules will be different, and also for the main reason that beam aerials from the new transmitter are directed towards the Pacific Ocean. It is the intention of the G.E.C. to operate this station from midnight until 6.0 a.m. Eastern Standard Time (G.M.T. 05.00-13.00), which will ensure good reception of the programmes in Manila from 4.0 to 10.0 p.m.; in Tokio, from 5.0 to 11.0 p.m.; in Shanghai, from 4.0 to 10.0 p.m., and in Sydney (N.S.W.) from 6.0 p.m. to midnight. All these are local times.

Djibouti Calling

French radio fans report good reception of FZE8, the 5-kilowatt commercial transmitter at Djibouti (French Somaliland), operating on 17.36 m. (17.28 mc/s). So far the broadcast is limited to one transmission which takes place on the first Thursday of each month between G.M.T. 13.15-13.35. For those readers who care to look up Djibouti on the map the geographical position is: 43° 07′ 20″ E.; 11° 35′ 15″ N. on the East Coast of Africa.

Call-sign Alteration

It has been decided to withdraw the call-sign 3LR allotted to the National Short-wave Transmitter established at Lyndhurst, Victoria, and allot in lieu thereof the call-sign *VLR*. This arrangement became effective as from 1st December.

The object is to give effect to the desire that the station in question should use a call by which it may more readily be identified by overseas listeners as an Australian station.

SHORT-WAVE SECTION

(Continued from previous page.)

in connection with this mains circuit is that the two condensers shown between aerial and earth are not part of the H.F. circuit but are merely included so that aerial and earth leads will be "dead" when the receiver is connected to a D.C. mains supply. It will be noted, of course, that the earth line of the circuit (H.T.—) is actually in contact with one side of the mains and it is essential to take the precaution of isolating aerial and earth leads.

In both of these receivers it would be possible to exchange the component in the aerial circuit, and the circuits are merely given as suggestions to indicate the use of this type of H.F. stage. It must be emphasised that we cannot supply wiring diagrams for these receivers, nor can we supply pictorial or other layouts, but for those listeners who are anxious to improve their short-wave reception and who are now using a simple type of receiver we recommend the addition of the H.F. stage as already mentioned. For those who are using a simple battery set a constructional article on an H.F. amplifier of the tuned type, with a 6-pin coil, will be found in our issue dated June 27th, 1936.

Colour Coded Condensers

A NUMBER of readers have recently written concerning the code employed for identifying fixed condenser values—the condensers in the majority of cases being taken from American receivers which have broken down. The code is identical with that employed for fixed resistors, and the basis is the micro-microfarad. The colours are usually placed in the form of a row of three dots, and are read in order from left to right. For the benefit of those who have not yet familiarised themselves with this code it is as follows: black—0, brown—1, red—2, orange—3, yellow—4, green—5, blue—6, violet—7, grey—8 and white—9. In both the resistor and condenser ratings, the final number is the number of noughts. On the resistor, of course, the order of reading is body, tip and dot (or in some cases a band of colour running right round the resistor).

Modifying All-wave Coils

A READER wrote to ask whether it would be possible to extend the range on the short-wave section of the all-wave coils recently specified for one of our receivers. It should be remembered in this type of tuning unit that three separate coils are employed—one for each waveband. Consequently, to increase the short-wave range a loading coil would have to be added in series with the short-wave coil. This would raise the minimum wavelength to which the coil would tune, and as, in most all-wave receivers, the minimum wavelength is the most important it is essential to take every possible precaution to keep down losses, stray wiring, etc., so that a useful minimum may be obtained. Alternatively, such a loading coil could be added with a short-circuiting switch across it, but the additional wiring to the switch would undoubtedly upset the efficiency of the coil and we do not therefore advise such a modification.

Increasing Current in Mains Unit

A PROBLEM which sometimes arises in designing a mains unit for a powerful set, is to obtain sufficient current—sometimes in excess of that given by rectifying valves which are available. It should be remembered that current output may be increased by connecting rectifiers in parallel, and half-wave or full-wave connections may be employed. Naturally, when using this system it is essential to ascertain that the transformer and choke will be capable of dealing with the increased current.

A PAGE OF PRACTICAL HINTS

SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

THAT DODGE OF YOURS!

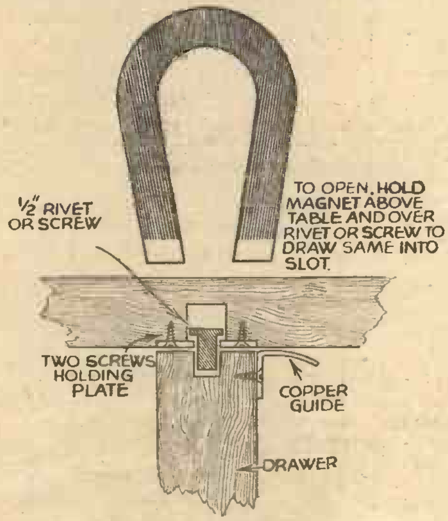
Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." DO NOT enclose Queries with your wrinkles.

SPECIAL NOTICE

All wrinkles in future must be accompanied by a coupon cut from the current issue.

A Secret Lock

THE accompanying diagram shows a secret lock which I have found very useful for a bench, table, or desk drawer. It is a magnet-operated lock without the exposed keyhole, and may be used without anyone discovering the secret of its operation. A hole into which a ½in. rivet, or screw, can fit loosely is drilled in the underside of the desk or bench top, and a metal plate mounted flush over it so that just the stem can pass through. Another hole the size of the rivet is then drilled in the drawer, and a copper guide piece screwed on as shown, to raise the bolt when the drawer is being closed. A magnet held over the bolt will serve as the key.—ARTHUR LARGE (St. Helens).

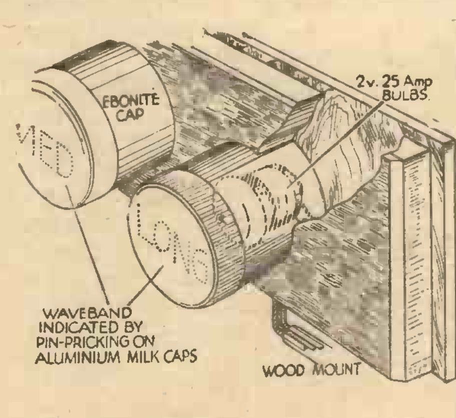


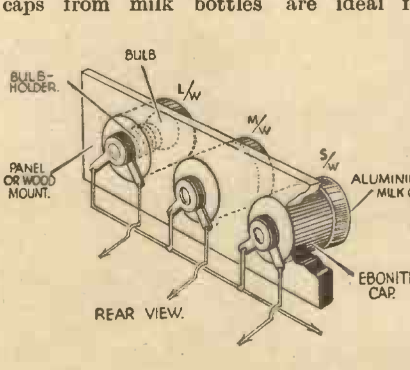
A novel magnet-operated concealed lock.

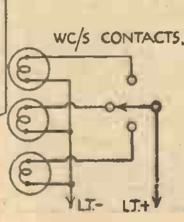
Simple Method of Wave-band Indication

THE accompanying sketches show how I contrived a simple wave-band indicator. A wooden panel is taken, and into this are drilled three holes large enough to take ebonite bottle caps, which are used as covers for the bulbs and holders. The metal covers of these are of aluminium, as, this being soft, they can be easily printed, and then pricked with a needle. The metal caps from milk bottles are ideal for this purpose, fitting over the ebonite caps snugly. The fitment is wired to the wave-change switch contacts as shown in the theoretical circuit drawing.

The holes to be drilled for the bulb holders should be 13/32ins. in diameter, this measurement ensuring a close fit for average holders. The holes for the caps, in my case, were done with a 1in. bit, and then sand-papered down to obtain a tight fit; glue is not necessary if the top panel is ¼in. to ½in. thick, this giving firmness to the caps, which are sweated into position. —A. J. WARD (Edgware).



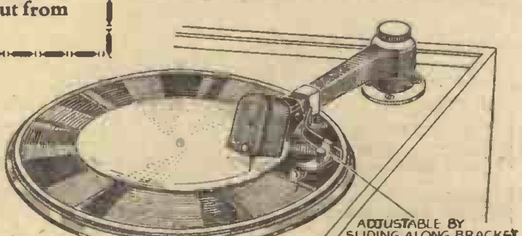


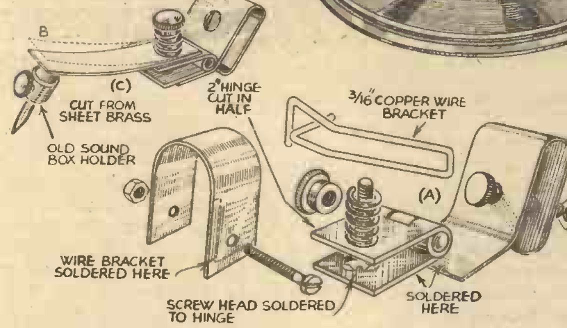


Front and rear views, and diagram of connections for a simple wave-band indicator.

A Tracking Device for Records

SOME time ago I became interested in home recording, so I set about making some sort of a tracking device with what odds and ends I had in my junk box. The accompanying sketches show the result.





General view and details of construction of a home-made tracking device.

I have used the device for some time now with complete satisfaction.

My pick-up is of the fixed swivelling arm type with a movable head. The tracking needle bracket is made to slip over the arm just behind the movable head, where it is held in place by a screw and nut about 1¼ins. long, the tracking needle being parallel with the cutter.

In the sketches, A shows the separate parts which go to make up the bracket. C shows the finished tracking-needle holder, the spring tensioned movement of the tracking needle being indicated by the dotted line at B. The tracker needle head should be so arranged that it gives a clearance of about ⅛in. from the surface of a record when there is no needle in the holder.

To cut a record, first an ordinary 10in. gramophone record is placed on the turntable, and on top of this is placed a 6in. aluminium blank. The tracking needle is adjusted so that it is on the beginning of the gramophone record while the cutter in the pick-up head is about ½in. from the edge of the blank. The turn-table is started, and as the pick-up head and the tracker head are movable they may be raised and lowered together on to the records.

For reproducing, the tracking needle is taken out of its holder, the cutter replaced with a fibre needle, and the record played off in the ordinary way.—D. J. MORRIS (Pentre, Rhondda).

1937 IN RE

An Account of the Developme
Some Forecasts of the Trend

ALTHOUGH the past year has not seen any drastic changes or developments in radio, there have been several important developments which will no doubt assume greater value as time passes. The most vital development has been the introduction of all-wave coils and coil units for the home constructor. This has enabled receivers to be built at home which will tune to the short waves in addition to the normal broadcast bands, and the method of building the coils has resulted in a very simplified design of receiver for all-wave reception. We have used these coil units, produced by different manufacturers, in several sets during the past few months, and the accompanying illustrations show two such sets. In the Corona receiver—which was published by us in both battery and A.C. mains versions—the Wearite coil unit was incorporated. This particular unit is no larger than a standard screened broadcast coil—in fact, it is much smaller than some such units. There are only six terminals to the coil, and it contains its own wave-change switch, thus removing a considerable amount of constructional work. In the Trident receiver we used a different type of all-wave coil—a B.T.S. product, in which no screening is employed, but the unit also incorporates its own switching mechanism.

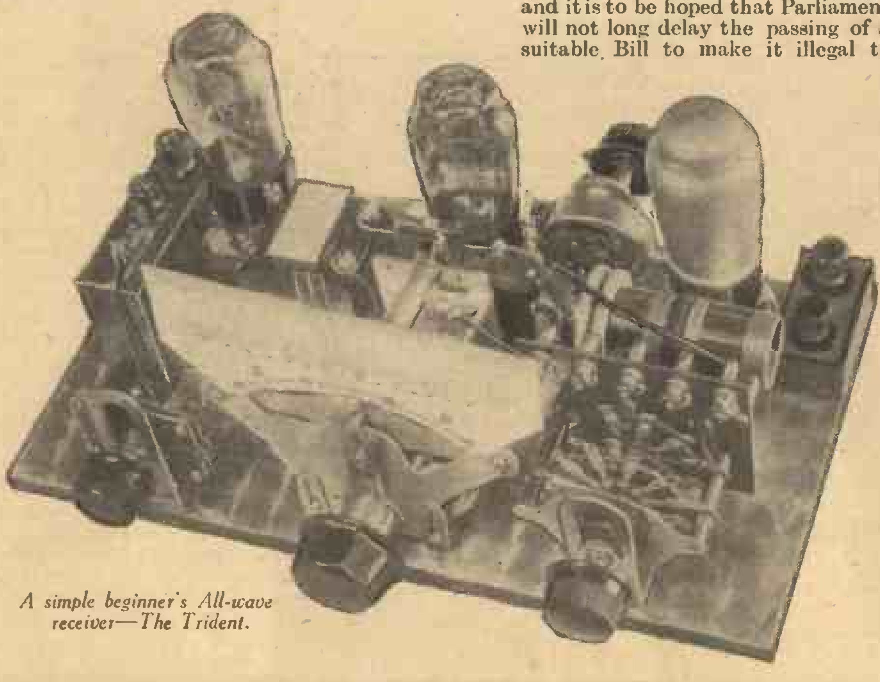
Television Dipole aerials being finished off at the Belling Lee factory.

Receiver Design

In the ready-built receiver market, it is noticed that there has been a much greater percentage of all-wave sets built than broadcast-band receivers, and the general effect of the additional wavebands which are now received has led to many interesting developments. More people are now using headphones, as this often enables long-distance stations to be heard which are inaudible on the loudspeaker. Furthermore, owing to the fact that interference is more troublesome on the short waves, there has been a general outcry against the use of interfering apparatus, and it is to be hoped that Parliament will not long delay the passing of a suitable Bill to make it illegal to use such apparatus. In an endeavour to mitigate the nuisance, aerial systems are being improved, and it is now possible to obtain several special all-wave anti-interference aerial systems, which enable the aerial to be erected out of the field of interference, and long leading-in wires employed without loss of sensitivity. These aerials consist in the main of two or three lengths of aerial wire joined at one point to a special matching transformer. From this to the receiver a long length of special screened cable is employed, and this is joined to a further transformer before connection to the receiver. The cable may, of course, be cut to any desired length and owing to the screening does not pick up interference.

An anti-interference aerial kit.

For the reception of television, special dipole aerial systems of suitable size have also been produced by two or three firms, and are simpler to erect than ordinary types of aerial.



A simple beginner's All-wave receiver—The Trident.

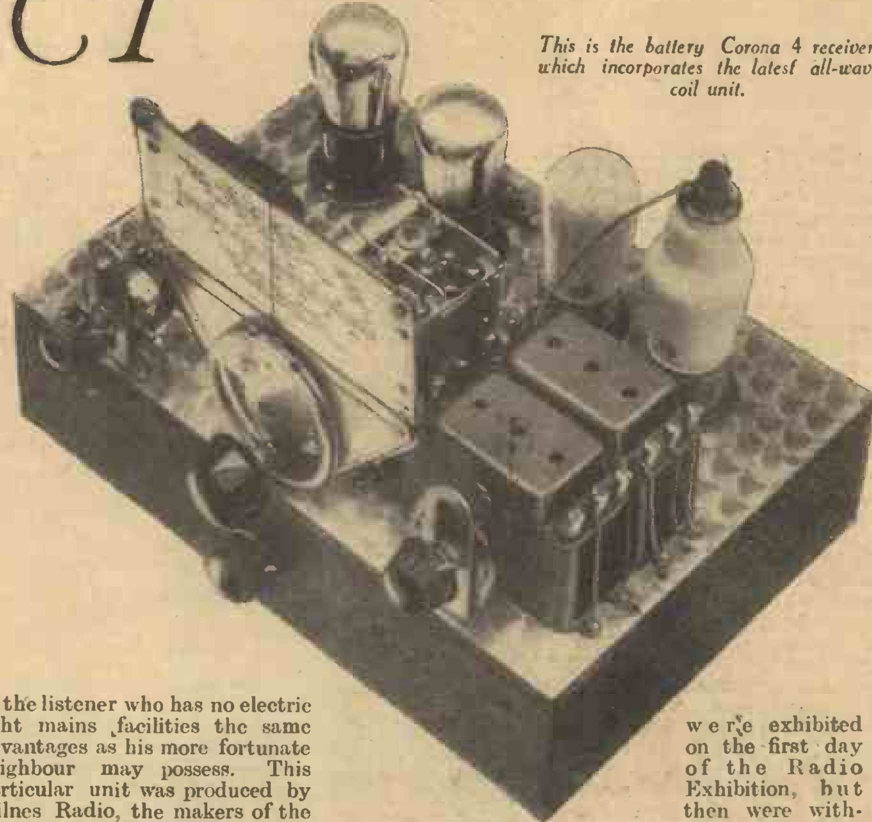
All-stage Valve

A special type of valve was perfected during 1937 and is now available for use in any stage of any type of receiver. From this, it has been named the "All-Stage Valve," and is a special Hivac product which should greatly simplify receiver design and construction. One firm is already producing a modern superhet in which this particular valve is found at every stage, from the frequency-changer to the output stage.

Another type of valve which has also been popularised during the past year is the tetrode. This is a special type of two-grid valve which is intended for use in the output stage of a receiver in place of a pentode. It overcomes many of the difficulties which are sometimes experienced with a pentode, and in a good many cases it may simply be plugged into a receiver in place of a pentode without any alteration being made to the wiring or potentials which are employed.

TROSPECT

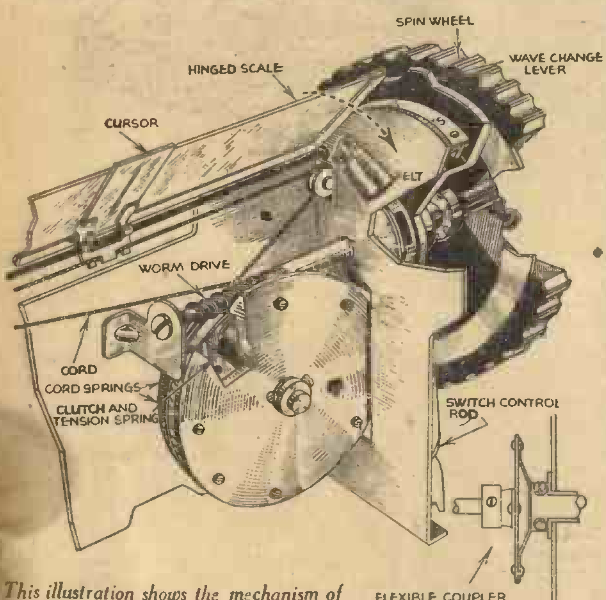
nts of the Past Year, and vents for the Coming Year



This is the battery Corona 4 receiver, which incorporates the latest all-wave coil unit.

New Tuning Devices

There has also been an attempt to introduce new forms of tuning, designed to replace the present method of turning a small control knob and watching a pointer move across a dial which is filled with station names. The Ekco control which is illustrated on this page has to be spun with the finger tip and the pointer travels freely across the dial. This is a very simple and effective scheme, and the receiver which is fitted with this type of control also has the remaining controls " camouflaged " so that it does not resemble the modern wireless receiver. As a forecast for the coming year we might suggest that push-button or "dial" tuning may be introduced, but although they are popular in America, English manufacturers have not yet put any such models on this market. There should be a demand for a receiver of this type for those who are interested in receiving various programmes, but cannot be bothered with the difficulties of tricky adjustments or station searching. In America it is also possible to purchase small units consisting of the button and drive mechanism which may be joined to an existing receiver, and there is a possibility that these also may appear on the English market this year.



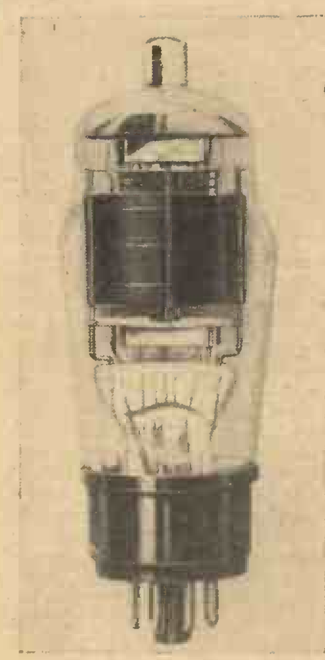
This illustration shows the mechanism of the Ekco flywheel tuning control. The drive has machine-cut gears (40 to 1), and the rim, which is 14in. in circumference, permits very accurate settings to be obtained.

For the Battery User

An ingenious device was shown at the Radio Exhibition in September, designed to avoid one of the main difficulties which beset the battery user. This was a charging unit for keeping the L.T. accumulator in good condition, but was designed for use with ordinary gas supplies and thus gives to the listener who has no electric light mains facilities the same advantages as his more fortunate neighbour may possess. This particular unit was produced by Milnes Radio, the makers of the well-known H.T. unit which is kept in good condition by means of an L.T. accumulator which is connected to it. A change-over switch enables the accumulator to be put in the charging position, but in the ordinary way, if no electric light mains are available, this accumulator has to be taken for recharging. With the aid of this gas charger, the battery type of set may be converted almost into an "all mains" receiver, in that no charging difficulties will be met with, and the receiver may always be operated in an efficient manner, with ample, smooth H.T. supplies.

Television

Towards the close of the year large screen television demonstrations, and colour television pictures were demonstrated. It would seem possible, therefore, that during this year the majority of cinemas in the London area will be fitted with large-screen vision receivers so that important events may be seen in a number of widely separated places whilst that event is taking place. Whether or not the home-television receiver will be reduced in price, or whether the size of picture will be increased, will depend upon the general programmes which are broadcast, as it is impossible to interest listeners in expensive apparatus if there are no suitable programmes to be received on it. Two big-screen home television receivers were exhibited on the first day of the Radio Exhibition, but then were withdrawn and have not been seen since. Whether or not the new mechanical television receiver will be capable of taking up the threads of interest remains to be seen, and it is unsafe to make any forecasts in the realm of radio, as developments come upon us so quickly, that in the space of a few months it is possible to be right out of date so far as concerns the apparatus which one is using.



The Hivac All-stage valve, which simplifies receiver design, as it may be used in any stage of a receiver.

NEW COSSOR SUPERHET—Model 583

A Description of this New Receiver and a Test Report upon its Performance

COSSOR Superhet Model 583 is unquestionably a de luxe battery superhet; furthermore, it falls into that class of battery receivers which are designed to compare favourably with their mains counterpart—both in performance and in the short wave-band covered. So many battery superhets do not include the 16-metre band, but by employing a separate oscillator this receiver covers a short waveband of 16-52.2 metres.

A point-by-point examination of the circuit most readily reveals the features of this receiver. The input circuit on medium and long waves is of band-pass type, with a high step up that is substantially constant over all wavelengths. The circuits are overcoupled to give a somewhat flat response in order to obviate side-band cutting and consequent clipping of the high notes. This flat tuning does not reduce the selectivity of a receiver, because this circuit is only called upon to discriminate between stations that are comparatively far away from each other, as adjacent station selectivity is obtained in the I.F. amplifier. On short waves single circuit tuning is used, but with a very loosely coupled aerial primary which allows very high signal-to-noise ratio, a feature that is so necessary on this waveband. Provision is also made for the use of the doublet type of aerial if desired. The frequency-changing circuit makes use of a pentagrid valve as mixer in conjunction with a separate triode oscillator, an arrangement giving the highest possible efficiency on the short waveband, and permitting the tuning range to go lower than would otherwise be the case. It is interesting to note that the trimming condensers actually make use of the chassis as one plate, an arrangement giving greater rigidity than the more conventional type.

Special I.F. Transformers

If it is possible to separate a single component in this receiver as being the most interesting, the choice must necessarily fall upon the special I.F. transformers used. They have been developed in the Cossor laboratories, and are new this year to the superhet receivers in this manufacturer's range. They consist of Litz wound coils shunted by *fixed* condensers to give the desired inductance capacity ratio. These condensers consist of silver deposited on mica, and are quite incapable of capacity variation, an advantage that is readily appreciated when it is remembered how the performance of a superhet falls if the I.F. circuits wander from their correct I.F. frequency. Alignment in these transformers is done by adjusting a "dust" iron core which is made in the form of a screw, permitting very close adjustment to be made by screwing the core in or out as required. After careful adjustment in the Cossor works with the aid of cathode-ray oscillograph apparatus, the cores are sealed in position with wax, and frequency drift is virtually impossible.

While both first and second I.F. transformers are constructed as above, the first transformer differs from the second inasmuch as the coupling between the primary and secondary is mechanically variable, and is actuated by a combined tone and selectivity control which has eight positions.

Combined Tone and Selectivity Control

The first four positions control band width acceptance of the I.F. amplifier, the minimum selectivity position being 14 kilocycles, and the maximum 5 kilocycles, while the last four positions of this control function as ordinary tone control, progressively cutting top in each position. The fourth valve is a double-diode triode which controls both frequency changer and I.F. amplifier on medium and long waves, and the I.F. amplifier only on short waves, in order to serve a high signal-to-noise ratio. Side-band shriek does not occur when tuning this receiver, the A.V.C. diode being fed by the primary of the last I.F. transformer. It is interesting to note that the tone control referred to above is applied between anode and filament of this valve, and not in the output stage; the latter arrangement is undesirable, as the control of tone would vary the impedance of the output circuit. The fifth valve in this receiver is the comparatively recently introduced Cossor quiescent output pentode 240 Q.P., which is capable of delivering nearly ½ watt to the specially designed permanent magnet moving-coil speaker, which has particularly flat response right up to 7,000 cycles.

The Cossor receiver which is reviewed in this article. Note the side control.

Performance

The performance of this receiver was quite up to expectations, the sensitivity being reminiscent of a mains receiver, and being extremely constant over the three wavebands. Some idea of the high sensitivity can be gained from the fact that the input required (at the middle of the scale) to produce 50 milliwatts output was only 48 micro-amps. on long waves, 45 micro-amps. on medium waves, and 90 micro-amps. on short waves. The selectivity of the receiver in either of the more selective positions of the band-width controls was quite remarkable, while the quality of reproduction from the local station with this control in the minimum position was so good that it was extremely hard to realise that it was a battery receiver. In the same way that remarkable sensitivity was obtainable over the whole of the tuning range, so was the audio frequency response amazingly level over the whole musical scale.

The automatic volume control is very good, both from the point of view of preventing fading and preventing the output valve overloading, so that in conjunction with the sensitivity, stations coming all round the dial had remarkably even volume.

The performance of this Cossor receiver may be summed up by saying that it is an outstanding example of the latest superhet radio. The mechanical construction of this receiver has one or two points of interest, inasmuch as many of the coils and the wave-change switch, and many of the trimmers, are mounted on a special chassis, which is lightly mounted on the main chassis by soft rubber bushes, while the triple gang condenser is in turn mounted on the special chassis in the same way. The condenser is so well sprung that a metal bar is used in packing to hold the condenser stationary during transit. It is particularly necessary that this packing bar should be removed before the receiver is put into operation, otherwise the elaborate precautions against microphony are lost.

Controls

The neat design of cabinet can be seen from the accompanying illustration. The tuning control and the on/off switch are sunk into the side of the cabinet, the former being divided with a finger-tip recess for rapid searching. The two knobs on the front are band-width control on the left, and volume on the right, the wave change being effected by the pendant switch in the middle. The cabinet is finished in a pleasant shade of walnut, very slightly matt, and elaborately but not ostentatiously grained.

The receiver is priced at 11½ guineas, which is moderate for the performance. Hire-purchase terms are available at 17s. 6d. down and eighteen monthly payments of 14s. 8d., or twelve monthly payments of 20s. 8d.

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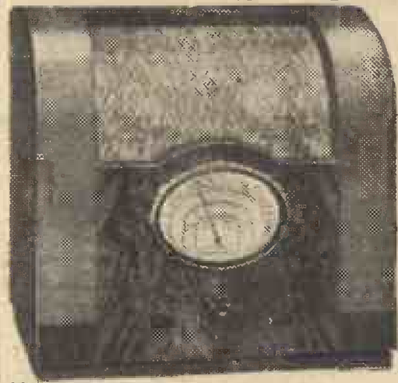

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WHAT IS AN ELECTRON?

Some Interesting Notes on this Important Subject are Given in this Short Article - - - By PERCY RAY

THE electron has become so much a part of our daily life that few people stop to consider what an electron actually is. What it does is well known. It lights our houses, provides power to drive our trains, makes wireless possible, and without it television could not exist. Its properties are taken advantage of to turn the front of a cinema into a blaze of light; in fact, its applications are legion, and would probably fill an encyclopædia, but in spite of this, or possibly because of it, the exact nature of the electron is scarcely given a moment's thought.

To express it simply, the electron is believed to be the smallest unit of electricity that exists, and further, it is the movement of electrons which constitutes what is called an electric current. Whether it is a current moving along a wire, spinning round the armature of a motor, or leaping into space from the gun of a cathode-ray tube, it is still nothing other than electrons moving in some fashion which may be either orderly or disorderly, but at an incredible speed. The electron can also be equally truly described as the unit that goes to build up an electric charge, in the same way that a brick may be described as a unit which goes to build up a house.

Weight and Speed

Until the noteworthy discovery that electrons could be persuaded to leave their conductor and cross an open space, as, for example, from cathode to anode in a valve, little progress was made with investigations, as hitherto the scientists had been at a disadvantage that can be likened to trying to study gas which could only exist in a pipe, but once the electron could be persuaded to move outside a conductor, a great deal was found out in connection with it. Its weight, for example, has been computed with considerable accuracy as being 9×10^{-28} gramme, or in other words, a decimal point, twenty-seven noughts, and then the figure 9. The actual electrical charge of each electron is equally small, so that for an appreciable electric current over an appreciable time, the weight of the electrons passing is relatively considerable. To take a case in point, if a valve passes, say, 5 milliamps for a period of 2,000 hours (which is probably the average use of a wireless set in a year), we find that the weight of the electrons passing from the filament to the anode is .0002 grammes which is about twice the total weight of the electron emitting material of a 2-volt valve. The idea that the electrons emitting from the filament or cathode derive their source from the sensitive coating is a fallacy. The sensitive coating is merely a substance which permits an electron to escape at a low temperature, the missing electrons that have flown off on their journey to the anode being immediately replaced by the current flowing from the H.T. battery; thus the electron on its passage through the valve may be considered as an electric current flowing from the H.T. battery to the filament a leap across space to the anode, and a return to the H.T. battery, the filament merely acting as a means of projecting the current into space, in the same way that a diving-board will assist a swimmer to leap into the air. The electron, or electric current, when travelling along a wire does so at very considerable speeds, and may travel through space at speeds approaching that of light. In the cathode-ray tubes used for television, for example, speeds of 40,000 miles per second are not unusual. It is perhaps worth while to mention that although electrons can flow along a piece of copper wire with great freedom, and in a vacuum they can be projected through space with comparative ease, they are, however, quite unable to pass through air, as they come into violent collision with the molecules that make up the air, in the same way as they are unable to move through an insulator. Ten volts may be sufficient to pull a certain number of electrons across ¼in. of vacuum, but it takes approximately one million volts to pull a similar quantity of electrons through a millimetre of mica.

Momentum and Inertia

Although the weight of the electron as given above is fantastically small, it possesses both momentum and inertia, which causes great inconveniences when using valves at really short wavelengths, where the inertia of the electron is such that when a really high frequency is applied to the grid of a valve, the potential of the grid reverses before the flow of the electron has appreciably altered.

It is probably true to say that electricity is the greatest servant of man, and it is equally true to say that the electron is the fundamental unit of electricity. If, therefore, the atomic theory of matter may be taken as correct, it is probably even more true to say that without the electron there could be no material existence.

Important Broadcasts of the Week

NATIONAL (261.1 *m. and* 1,500 *m.*)

Wednesday, December 29th.—Cinderella, a musical play by Spike Hughes.

Thursday, December 30th.—Orchestral programme.

Friday, December 31st.—The New Year—a series of impressions and sound shots of Great Britain's entry into 1938.

Saturday, January 1st.—Music Hall programme.

REGIONAL (342.1 *m.*)

Wednesday, December 29th.—Juno and the Paycock, a play by Sean O'Casey.

Thursday, December 30th.—A Grand Christmas Concert held in the Landithy Hall, Madron, Cornwall.

Friday, December 31st.—Variety from the Palace Theatre, Blackpool.

Saturday, January 1st.—My Life with Ernest Rule, a play by Horton Giddy.

MIDLAND (296.2 *m.*)

Wednesday, December 29th.—Aerbut and Gaertie: Resolutions for Nineteen Thaerty Eight.

Thursday, December 30th.—Old Time Dancing programme.

Friday, December 31st.—The Microphone at Large: A visit to Stow-on-the-Wold.

Saturday, January 1st.—Symphony Concert.

NORTHERN (449.1 *m.*)

Wednesday, December 29.—The Great North Road: A Chronicle of Speed.

Thursday, December 30th.—Concert party programme, from Leslie's Pavilion, Rusholme, Manchester.

Friday, December 31st.—Variety, from the Palace Theatre, Blackpool.

Saturday, January 1st.—New Year Resolutions programme.

WEST OF ENGLAND (285.7 *m.*)

Wednesday, December 29th.—Variety from the Colston Hall, Bristol.

Thursday, December 30th.—A Grand Christmas Concert held in the Landithy Hall, Madron, Cornwall.

Friday, December 31st.—Band concert.

Saturday, January 1st.—Folk Song Almanack: January, a talk illustrated by songs.

WELSH (373.1 *m.*)

Wednesday, December 29th.—Organ recital from Bangor Cathedral.

Thursday, December 30th.—Cinderella, a pantomime.

Friday, December 31st.—Cabaret from St. Mellons Country Club, St. Mellons.

Saturday, January 1st.—My New Year's Gift, or the Dawn of the "38," a light programme.

SCOTTISH (391.1 *m.*)

Wednesday, December 29th.—Town Band programme.

Thursday, December 30th.—An excerpt from Santa Claus, a pantomime from the Metropole Theatre, Glasgow.

Friday, December 31st.—Scotland in 1937, a review of the year's happenings North of the Border.

Saturday, January 1st.—Students' Songs: choral programme.

NORTHERN IRELAND (307.1 *m.*)

Wednesday, December 29th.—Juno and the Paycock, a play by Sean O'Casey.

Thursday, December 30th.—Organ recital from the Cathedral Church of St. Columb, Londonderry.

Friday, December 31st.—Account Rendered: Northern Ireland Regional Programme Director reviews a year's broadcasting.

Saturday, January 1st.—Orchestral concert.

Practical Television

January 1st, 1938. Vol. 3. No. 81.

EXPLAINING THE WAVE-FORM

In This Article the Relationship between the Component Parts of the Television Wave-form is explained.

A GOOD deal has been written on the question of time bases, and how they are controlled by the synchronising signal. Readers will be aware of the method in which the transmitted picture intelligence controls the light and shade of the picture reproduced by the cathode-ray tube. Very little, however, has been said about the actual transmitted wave-form radiated by Alexandra Palace, which is in itself a very remarkable combination of picture intelligence, line-synchronising signal, and picture-synchronising signal.

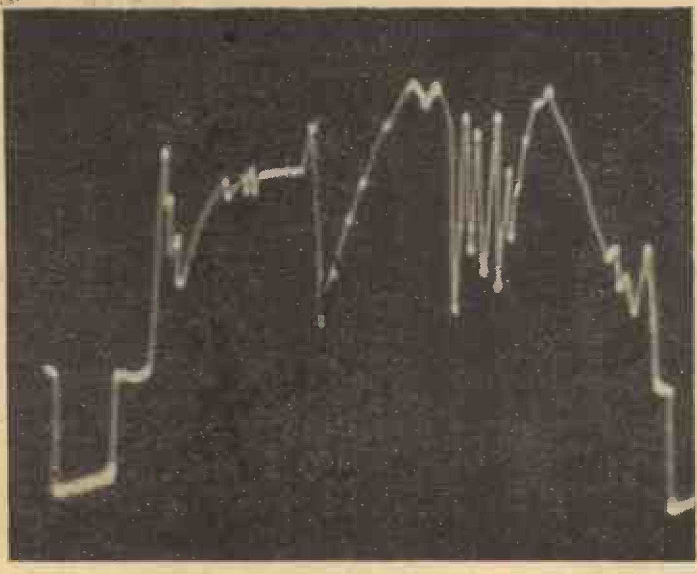

Fig. 1.—An actual photograph of a wave-form on a cathode-ray tube.

Diagrammatic representations have certainly been published in various media, but feeling that this is not sufficient, PRACTICAL AND AMATEUR WIRELESS have investigated the transmitted wave-form with the cathode-ray oscillograph in order that readers might be acquainted with the true nature of the television transmission with the various components in their true perspective.

The illustration, Fig. 1, is an actual oscillogram photographed from the end of the television receiver tube, while Fig. 2 is a drawn reproduction. Fig. 1 is reproduced primarily because of its great intrinsic interest; Fig. 2 is included because the exigencies of printing make it impossible to show the sudden frequency drop and rise of the synchronising pulse; owing to its great speed it is only just discernible on the original photograph.

Voltage and Time

These notes are based on Fig. 2, the reader being left to compare it with Fig. 1 as he may choose. Reference to these illustrations will show that the vertical direction represents voltage, while the horizontal direction denotes time. It should be noted that the total vertical sweep of the illustration constitutes the full 17 kW. output, and that the whole wave-form is divided by a line placed 30 per cent above zero, i.e., 5.1 kW. It is important to understand that this line represents black, that the top line represents pure white, and therefore the bottom line must represent "blacker than black." This last statement is, of course, strictly speaking, absurd, but it is by far the easiest way to look at it.

The wave-form shown is somewhat complicated, and is made up of several component parts; its full significance will be most readily grasped if it is followed systematically from left to right.

The section A, B, C, D, is a line-synchronising signal. Bearing in mind that the distance A-G is only 1/10,125 of a second it will be realised that voltage changes take place with incredible speed. The synchronising impulse A-B means a change in the transmitter output from zero to 5.1 kW. in approximately 1/1,000,000 of a second.

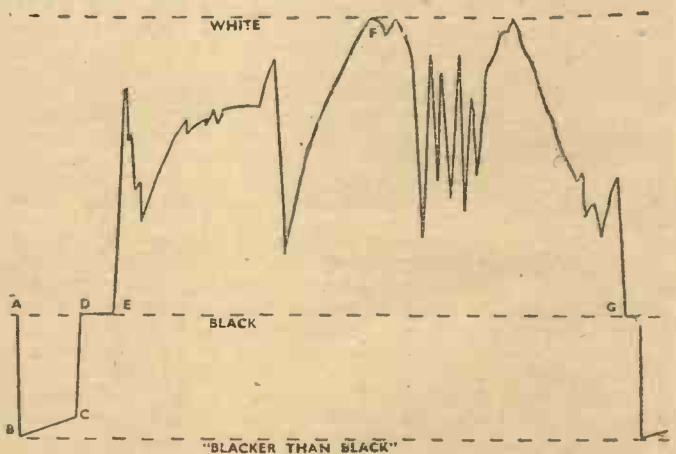

Fig. 2.—An analysis of the photograph shown in Fig. 1.

"Flyback"

After this short introduction it is desirable that the illustrations should be explained logically before delving deeper into this absorbing subject. Starting at the point A the voltage drops suddenly to B, which sudden change trips the time base in the receiver and sends the cathode-ray flying back to the beginning of a new line. This manœuvre is easily accomplished during the time of rest B-C, after which the voltage rises to the point D with a minimum waste of time.

There is a short rest D-E to allow the numerous circuits involved to settle down after the violent changes A-B and C-D. In Fig. 2 this is shown as a theoretically perfect rest, but reference to Fig. 1 will show that this is not so in practice as the circuits cause fluctuation owing to the presence of inductance and capacity.

The picture intelligence commences at the point E and the cathode-ray will have reached the edge of the mask fitted to the receiver; the voltage rises very quickly to the light grey level, and proceeds to convey shades varying between black and white to the modulating arrangements in the receiver tube. It will be observed that the voltage rises to dead white at F, and again at two other points, but does not fall to black at any point.

On completing the line the voltage falls to the black level at the point G, and after a very short rest the voltage falls to zero, sending the cathode-ray spot flying back to the beginning of the next line. It is interesting to note that the flyback is accomplished very much faster than the line trace, in fact, in something less than 1/100,000 of a second.

Interesting Facts

Quite apart from showing with unusual clarity the relationship between the component parts of the television wave-form it is possible to deduce a number of interesting facts from a direct study of Fig. 1.

It can be seen that only about 70 per cent of the transmitter output is available for conveying picture intelligence, 30 per cent being used for conveying synchronising intelligence. Observe also that some 15 per cent of the *line time* is used for purposes other than the actual picture, i.e. 10 per cent is given to the synchronising signal, and 5 per cent is used for a rest period. Since the flyback takes place within the period A-D it will not show on the screen because the voltage level *does not rise above black* for the whole of this duration.

Although the picture-synchronising signal is not illustrated, a few remarks concerning it will probably be found welcome, as it differs from the line-synchronising signal only in its duration. The picture-synchronising signal is, in fact, practically a series of line-synchronising signals inasmuch as the latter continue to

(Continued overleaf)

PRACTICAL TELEVISION

(Continued from previous page)

function so that the lines do not get out of step when the cathode-ray is moving from the end of one frame to the beginning of the next.

Scanning

When explaining scanning it is usual to assume that the cathode-ray spot proceeds directly from the end of one frame to the beginning of the next in a more or less straight line. This is done to simplify the explanation; from the pure theory point of view it is correct in so far as the principle of scanning is concerned. In the particular system now adopted it is modified by the practical consideration of the necessity for the transmitter to give the receiver unmistakable information for the purpose of picture synchronisation.

At the instant of the picture-synchronising signal the cathode-ray spot will travel in a vertical direction, but at the same time it will continue to scan in the line direction about eight times, so that its actual course is a slightly unsymmetrical zigzag taking, therefore, approximately 1/1,250 of a second. During this period the voltage to the cathode-ray tube modulating "grid" does not rise above black, so no visible trace is apparent on the screen.

Admittedly the wave-form is complicated, but every effort has been made to explain it as simply as possible, and it is suggested that it is well worth the reader's time to study this article carefully, as a thorough understanding will greatly facilitate the study of television. A knowledge of time base principles, and a thorough understanding of the transmitted wave-form should give a clear insight into the basic working of the modern television receiver.

TELEVIEWS

An Assurance

IN any investigation into the numbers of television receivers now in use throughout Greater London—those employed beyond this area, while increasing week by week, are still in the nature of interesting experiments to obtain figures of signal strength limitations, special aerials, etc.—the question always arises concerning possible obsolescence. The fear that the improvements in the B.B.C. television service which must continue to take place will make any present commercial set useless is now being removed. Responsible authorities in the industry are unanimous in voicing the opinion that for some time to come, any changes or improvements that do take place will be at the transmitting end, and this would only entail very slight and inexpensive alterations in receivers. The rate of increase of television receivers in use in the home, hotel, and club is accelerating, and figures at the moment put the number at nearly 10,000 sets. It must be borne in mind that in one respect television is very similar to radio. In the early days of radio development, the frequency range of the signal modulation was relatively low and receivers, provided the amplifiers covered this frequency, were adequate for the purpose. As time went on receiver design was sometimes ahead of the quality of the aural transmissions, and at other times the reverse was the case.

This same feature is noticeable with television. The initial quality of the Alexandra Palace transmissions showed that full advantage of the standards adopted was not being taken. This was due to a variety of causes, and was excusable inasmuch that the equipment was new, and the staff had had little opportunity of correlating each unit in the whole chain from camera to aerial to give the greatest combined efficiency. Any good quality receivers then in use were therefore capable of showing better television pictures than were being radiated. Subsequent work readjusted this position, but at the recent radio exhibition it was noticed that some sets were still ahead of transmissions. With the overhauling of the Alexandra Palace equipment and the improvements in sensitivity of the cameras, the radiated signals shown recently have exhibited very marked advances, but even so this does not mean that present receivers are not capable of portraying the full quality of the pictures. Minor set adjustments would be necessary if the picture standard, from the point of view of the number of lines, was altered, but this is an easily remedied matter and need not in any way deter potential home constructors or set purchasers.

Cinema Television Again

FOR some time rumours have been abroad that big screen television has taken a marked step forward, and the events of the past few days have proved that this is the case. It is now learned that immediately the Palais Cinema, Bromley, closed down to the public, the Baird Company commenced installing their big screen equipment to carry out tests under conditions which represent those which will obtain when television is introduced into cinemas on a large scale. The work proved so successful that after an afternoon demonstration to the directors of the Gaumont-British Corporation it was decided to show the results to representatives of the daily press in the evening. According to the consensus of opinion the pictures seen were outstandingly good. The Alexandra Palace programme provided the source of signals, these being picked up by an ultra-short-wave aerial on the cinema roof. During the whole programme the pictures were bright and clear, being visible from every part of the theatre, while focus and synchronisation were undisturbed throughout. These factors are particularly important, for with any service installation it is imperative that every member of the cinema audience should be able to watch the television pictures in comfort without any form of eye strain.

Equipment Used

FOR the Baird demonstration the equipment was entirely electro-optical in character. The picture reproducer was a cathode-ray tube of the projection type, giving a picture approximately two inches square on its front screen. This picture was so brilliant, however, that through the medium of a suitably designed optical system with a wide aperture it was possible to front or back project the picture on to a remote screen so that the size was 8ft. by 6ft. 6ins. To enable this to be done the anode voltage of the tube was increased to about 25,000 volts, as compared to the six or seven thousands volts used in an ordinary home receiver. This type of tube is a normal development of the one shown by Bairds' at the television exhibition staged earlier in the year at the Science Museum. It is built up into a small piece of apparatus, smaller than a cinema film projector, and at the Palais Cinema can be used in the centre aisle for front projection, or on the stage for back projection. Contrast is adequate, and no de-focusing in the highlights was apparent, thus ensuring that the pictures were clear-cut and realistic.

On the day following the demonstration Scophony showed their equipment in a theatre in British Industries House. Here, again, the results were good, the picture size being 6ft. by 5ft., while the process employed was electro-mechanical. It has always been contended that the present standard of television picture definition was inadequate for big screen working, but these demonstrations showed quite clearly that such was not the case. At the normal viewing distance now operating in the average cinema the lines were not apparent.

A Multiplier Cell Precaution

MULTIPLIER photo-cells are finding an increasing application for a large number of commercial purposes. In many cases they replace very conveniently the single cell with its associated amplifier, thus representing a saving in cost, space, and reducing the risk of breakdown as a result of the smaller quantity of associated equipment. The cells of this type are found to have an exceedingly long life, coupled with a high degree of stability, and a signal to noise ratio far in excess of that obtained with a normal photo-electric cell and amplifier giving the same degree of overall amplification.

Will 1938 see any drastic change in the general design of television receivers? Will larger screens become general?

THE BRITISH LONG-DISTANCE LISTENERS' CLUB

A New Year Resolution

THIS is the time of the year when one makes resolutions—either to be kept or to be broken. If you are not already a member of the British Long-distance Listeners' Club, make it one of your resolutions that you will join without delay. Remember that there is no membership or admission fee, all that is necessary being to complete the Enrolment Form at the foot of this page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may also obtain a neat badge, a replica of which is shown here. This badge costs only 1s. and you will be able to identify other members when you are out.

This is a reproduction of the red, blue and gold badge, which may be obtained for 1s. post free.

There are many other advantages of belonging to this club, chief of which are the various useful items of stationery which you may obtain. Printed notepaper for your private correspondence; pads of verification sheets upon which you can send reports to distant stations for the purpose of obtaining verification cards; log books in which you can keep neat and accurate records of your listening activities, and in addition you can become an A.E.L. This means that when you have successfully received a station in each of the five continents, and have obtained verification cards from them, they should be forwarded to us, and the President will then confer the A.E.L. upon you. In addition to this, we will place members in the same district in touch with one another when desired, will arrange special meetings and visits where necessary, and if desired arrange for the formation of local clubs or branches. Fill in the form without delay and address it to The Secretary, British Long-distance Listeners' Club, Tower House, Southampton Street, London, W.C.2.

Testing a Speaker

A member wrote recently asking how he could test the merits, so far as low-note response was concerned, of three different loudspeakers which he had by him. He was building a radiogram and did not know which speaker to incorporate, his main requirement being good low-note response to assist in obtaining balanced reproduction from a quality receiver utilising also a tweeter or high-note speaker. There is a very simple way in which one can test a moving-coil speaker for low notes and sensitivity, and this is by feeding into it a low-frequency A.C. supply, such as may be obtained from a signal generator. But if you do not possess an instrument of this type, you can carry out a similar test by utilising part of the primary winding of a mains transformer. This type of component usually has the primary tapped to provide for different mains voltages, and in general there is a tapping marked 0, and three tappings marked 200, 230 and 250. In some cases there is a further tapping marked 10 to enable intermediate voltages to be used. If your mains are 230, you will see that there is a spare section of winding between 230 and 250, and this will provide 20 volts A.C., whilst from 0 to the point marked 10 will provide 10 volts A.C. On many mains transformers it will also be possible to obtain 10 volts between the higher ratings. The speaker should be joined to a pair of terminals, therefore, which will give 10 volts, and by joining up each speaker in turn you will be able to judge as to its suitability for low-note reproduction, remembering that the A.C. supply is at 50 cycles, and the speaker will thus be giving a 50-cycle note.

A Renovation Hint

The question of cabinet renovation is a complex one, as it necessarily includes a number of separate operations, amongst them being French polishing and cellulose lacquering. Those of our members who are accomplished French polishers have doubtless been deterred from making receivers look like new again on account of the difficulty of dealing with the serious dents. Out of every 100 receivers on the market to-day that are housed in wooden cabinets, ninety-nine are made of laminated or plywood, and the most serious dents in this material are very easily removed. Take a damp cloth and a piece of hot metal of suitable dimensions (a soldering-iron will often serve), fold the damp cloth several times, lay it upon the dent, and touch with the hot metal, being careful not to scorch the polish. The idea is not to heat the wood, but to drive the steam from the drying cloth into the damaged part. Providing this operation is done with discretion, using several gentle applications rather than one severe one, a small bruise will completely disappear. Beware of using too much heat, which will blister, while an unnecessarily long application may spread the steam beyond the area required, and cause the layers of the plywood to become unstuck, which is quite disastrous if the operation be near the edge. If the bruise is of a severe nature, it is desirable to prick the wood in one or two places in order to permit entry of the steam more freely. It is, however, desirable that such incisions should not go beyond the top layer of the plywood, which, generally speaking, is $\frac{1}{16}$in. thick.


This illustration shows how a cabinet may be renovated as explained above.

After the bruise or dent has been removed a very gentle rubbing down with old sandpaper will make the surface quite true, after which the affected part should be coloured to the original shade, and then repolished, or treated with cellulose as may be necessary. Those skilled in French polishing and lacquering will have no difficulty in producing a piano or eggshell finish as desired, while those who are not skilled in this art are strongly advised to leave well alone.

BRITISH LONG-DISTANCE LISTENERS' CLUB

ENROLMENT FORM *(See announcement above).*

I wish to enrol my name as member of the British Long-distance Listeners' Club, it being clearly understood that no financial obligation is thus incurred. I am interested in long-distance listening and have* / have not a short-wave receiver at present in use. I am especially interested in medium-wave* / short-wave / ultra-short-wave listening.

Full Name (Block letters)..............................

Address ....

....

* Strike out words not needed.

Optional

Please forward me ....pads of 50 log-book sheets price 1s. 6d.

........badge, price 1s. each.

........pads of 50 verification forms price 1s. 6d.

for which I enclose cheque / postal order for £............

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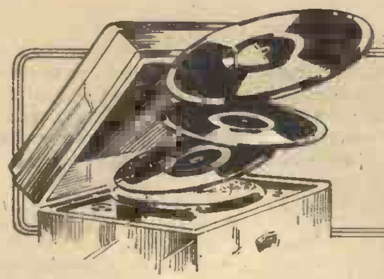
2/6, or 2/10 by post from Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.



Impressions on the Wax

Parlophone

OF the many new records issued by the Parlophone Company for the new year, I draw attention to "Stars Calling" on *Parlophone E* 11347. It is a 12in. disc compèred by Ronald Frankau and featuring Richard Tauber singing "Vilia," Gitta Alpar, "I Give My Heart," Joseph Schmidt singing "My Song Goes Round the World," "Heart of Gold" played by Harry Roy, "Rhythm is Our Business" by Nat Gonella, "I'll See You Again" by the Tiger-Ragamuffins, and finally Leslie Hutchinson singing "Good Night to You All." It is not very often that one has a chance of hearing so many well-known artists on the same record.

Richard Tauber also appears on Parlophone *RO* 20369 singing "O Mia Bella Napoli" (original version of "A Little Rendezvous") and "Erst hab' ich ihr Komplimente gemacht" (Sweet Compliments) from the original production of "Venus in Silk." Tauber sings both songs in German with orchestral accompaniment.

Voices from the Past

IN their historical series of famous voices of the past the Parlophone Company this month release Pasquale Amato singing "La Traviata" (Act 2, "Di Provenza il mar") and "Ballo in Maschera" ("Eri tu che macchiavi") on *Parlophone PX* 081. This record was originally recorded in 1909.

In the classic series we have "Waltzes of the World," a potpourri in two parts by Orchestra Mascotte on *Parlophone R* 2463, "Samson and Delilah" by Dajos Bela and his Orchestra on *Parlophone R* 2460 and "Valse Bleue" and "When Little Feet Start Moving" from "The Girl in the Taxi," played by Edith Lorand and her Viennese Orchestra on *Parlophone R* 2461.

"Hutch" (Leslie A. Hutchinson) makes two new records this month featuring "Remember Me" from the film "Mr. Dodd Takes the Air" coupled with "Blossoms on Broadway" from the film of that name, on *Parlophone F* 989, and "After All These Years" and "For Only You" on *Parlophone F* 990.

Murgatroyd and Winterbottom, two minds with not a single thought, aided by Monte Crick at the piano, have recorded "Grub" and "Music" on *Parlophone F* 994 and H. Robinson Cleaver, at the organ of the Union Cinemas' "Regal," Bexley Heath, plays "Knave of Diamonds" and "Black Eyes" on *Parlophone F* 999.

Harry Roy and his Orchestra have made four new records this month, introducing up-to-the-minute numbers, whilst Nat Gonella and his Georgians and Billy Thorburn and his music have each made two. Four new records appear under the heading of the new swing style series and two under the second new "Rhythm Style" series.

Rex

SANDY POWELL and Company make yet another humorous sketch this month on *Rex* 9156. The title is "Sandy's Happy Home" and when you hear this record you will agree that the title is appropriate.

Reginald Dixon, the famous Blackpool organist, has recorded "Gracie Fields' Memories" on *Rex* 9169.

Van Dusen yodels his way through "It's Party Time Again" and "The Yodelling Working Man" on *Rex* 9173, whilst the original "Pop-eye The Sailor" has recorded "Let's All Sing Like the Birdies Sing" and "The Teddy Bears' Picnic" on *Rex* 9172.

Phyllis Robins, the popular radio star, tells us about "The Little Boy that Santa Claus Forgot" and "Can I Forget You?" on *Rex* 9165, and another radio star, Brian Lawrence, sings two popular tunes, "In the Mission by the Sea," coupled with "Mine Alone" on *Rex* 9190.

Decca Novelty Records

RECORDS that will be extremely popular at parties have been recently released by the Decca Company. First we have "Decca Derby" an extremely thrilling race game recorded on five double-sided 10in. records sold complete with odds cards, punter's board and counters, together with full instructions, for 13s. 6d.

For football fans there is Decca Football Pools, a twelve-track record complete with board, indicator and full instructions, priced 1s. 6d.

Finally there is the Magic Disc, which is a running commentary on a horse race. There are six horses, only one of which can win. The result is unknown until the end, when it is announced by the commentator. It sells at 1s. 6d. complete with full instructions.

H.M.V.

UNDER the impressive title "A Symposium of Swing" an album is issued of four 12in. records giving representative examples of the playing of four of America's most notable Swing Orchestras, namely those of Benny Goodman, Fats Waller, Tommy Dorsey and Bunny Berigan. This is the first occasion on which 4-minute swing records have been available, and the extra time allows a much greater variety of treatment to these virtuosi of swing music. This set of records will appeal to hot rhythm enthusiasts. The numbers are *H.M.V. C* 2936–9. There is also a number of 10in. records of swing including "Solitude" and "When Day is Done," played by the Quintette of the Hot Club of France on *H.M.V. B* 8667. Tommy Dorsey and his Clambake Seven play "All You Want to Do is Dance" and "After You Played" on *H.M.V. B* 8670, and Benny Goodman and his Orchestra play "Sugarfoot Stomp" and "I Can't Give You Anything But Love" on *H.M.V. B* 8671.

"Songs that have sold a million" is the apt title given to a medley which includes "Somewhere a Voice is Calling," "Until," "The Lost Chord," and other favourites of yesterday.

Two other medleys of popular appeal are "1937 Song Hit Parade" on *H.M.V. BD* 471 and "1937 Film Hit Parade" on *H.M.V. BD* 465.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE CROYDON RADIO SOCIETY

MR. G. A. HOSKINS, vice-chairman, presented a musical programme on records for the Croydon Radio Society's meeting on Tuesday, December 14th, in St. Peter's Hall, S. Croydon. His quality reproducer consisted of the home-assembled S.12 Hartley-Turner amplifier. The first item was tuneful enough, being Gershwin's "Strike up the Band," and Mr. Hoskins thought that even those who criticised this composer's works would agree with him that this particular number was one of his best. No such programme would be complete without a Viennese waltz, and the "Fledermaus Waltz" played by the Vienna Philharmonic Orchestra was much appreciated. Indeed it made members realise the dearth of tuneful light music which existed to-day, and Mr. Hoskins had some difficulty in selecting a popular modern musical comedy, eventually deciding on "Crest of the Wave," this being at least recent. Very well received was the Serenade from "The Student Prince." The next meeting is on January 11th when Mr. Harris will demonstrate ultra-short-wave apparatus used in television. The New Year fixture cards of the society are now available for PRACTICAL AND AMATEUR WIRELESS readers on application to the Hon. Pub. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

THE SOUTHALL RADIO SOCIETY

ON December 7th the speaker was Mr. H. C. Spencer, G6NA, who took as his subject, "Receivers." He traced the development of the modern receiver from its earliest beginnings, and also discussed the respective advantages of straight and superhet receivers, and pointed out features of commercial sets which were worth while, and those which were merely sales-points.

On December 14th, one of the best talks of the season was given by Mr. H. J. Walters of the Belling-Lee Company. After describing the principal causes of interference, and their cure, Mr. Walters demonstrated a "cure" of a particularly vicious electric fan. It was impossible to hear the fan in a receiver even though the aerial was touching it! A number of questions were asked by the audience. Hon. Sec., H. F. Reeve, 26, Green Drive, Southall.

WIRRAL AMATEUR TRANSMITTING AND SHORT-WAVE CLUB

TO press the key and have the whole world answer must surely be the dream of every wireless amateur transmitter, but this, to some extent, has been the experience of Mr. W. E. Corbett, A.M.I.W.T., who gave a talk to the members at their meeting on December 15th. Mr. Corbett related his experiences as a "ham" and an army operator in the Egyptian desert. He said he was the first amateur in Egypt and for some time, the only one. "I pressed the key," he said, "and the whole world came back to me. Everyone wanted my QSL card."

One of his early transmitters was driven by a bicycle which was pedalled by a native, the only difficulty being to get the native to keep a uniform speed. Mr. Corbett amplified his talk with a collection of photographs of transmitters he had operated in various parts of the world, and added that when he left Egypt in 1928, there were only five amateurs there.

The club welcomed several new members, among them G3BH, Mr. W. H. Miller. The members were also pleased to learn that 2ACU, Mr. Cumberlidge, had qualified for his full call-sign. The next meeting will be held at club headquarters at Beechroft Settlement, Whetstone-Lane, Birkenhead, on January 5th. The secretary is Mr. J. R. Williamson, 13, Harrow Grove, Bromborough, Birkenhead.

THE KINGSTON AND DISTRICT AMATEUR RADIO SOCIETY

THERE was a good attendance at the December meeting of the above society. The lecture and demonstration was given by The Evrizone Radio and Television Co., on their Single Signal Superheterodyne. Despite heavy local interference from trolley buses and traffic lights, reception was very good. A 56 m/c demonstration was also staged by the 56 m/c group. The next meeting will be held at The Three Fishes Hotel, Richmond Road, Kingston, on January 5th, at 8 p.m. The lecture will be given by The Premier Supply Stores on Amateur Equipment. A hearty welcome is extended to visitors. Full particulars of the society, can be obtained from the Hon. Secretary, Mr. D. Biggs, 44, Pooley Green Road, Egham, Surrey.

"BON-ACCORD" SHORT-WAVE AND TELEVISION SOCIETY

A CLUB for experimental purposes has been formed in Aberdeen, called the "Bon-accord" Shortwave and Television Society. Unfortunately, the membership will have to be limited, and intending members are invited to get in touch with the Secretary. John Horn, 4, Broomhill Avenue, Aberdeen.

LETTERS FROM READERS

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Service Agents

SIR,—With regard to your many complaints about the lack of interest shown by service agents, it might interest you to know that I have always found them most obliging and helpful.

As for putting new prices on old parts, my experience of this is that if you are a good customer they are only too willing to give you their old parts.

I have taken your fine paper for about six months and agree with your other readers that it can be beaten by none.

I am 16 years of age and have just started short-wave work. I should very much like to correspond with some other reader of about the same age, preferably abroad, or in some other part of the country.—J. E. PRICE (Court House, Mountfields, Shrewsbury).

Variable Selectivity Circuits

SIR,—On reading the article entitled "Variable Selectivity Circuits" in the December 18th issue of PRACTICAL AND AMATEUR WIRELESS," we were surprised to note that the methcd employed in our B.P.124 I.F. transformer is covered in a few words in paragraph two, column two, page 396.

In this method a small winding wound over the primary coil can be connected in series with the secondary or disconnected at will, by means of a simple single-pole two-way switch. With the extra coupling winding in series with the main secondary a double-peaked response curve is obtained, whilst with this winding out of circuit the coupling is reduced to below optimum, resulting in a single-peaked response curve.

This method is now widely employed and has the following advantages:

(a) Simple switching, which takes place in that part of the circuit which is at low R.F. potential, consequently switch connections are not extremely critical as regards length and disposition, which is the case, for instance, with the schemes shown in which a condenser is connected between the high potential points of the two circuits, or resistances connected in parallel with each circuit.

(b) No loss of amplification, as with the series or parallel resistance or tertiary winding methods.

(c) The "Q" of the circuits is not altered, so that the spread of the "skirt" of the resonance curve is not unduly increased, as with the resistance method.

In view of the simplicity of the method employed in the B.P.124, and its freedom from the practical difficulties, so rightly pointed out by your contributor, attendant upon those methods involving the connection of critically variable condensers or resistances at high potential points in the circuit, we feel that it would be to the advantage of your readers if the arrangement used in the B.P.124 were more widely known.—VARLEY (Woolwich).

An S.W. Log from Brighton

SIR,—I am enclosing my 28 and 56 mc/s log for the past few weeks, trusting it will be of interest to other S.W.L.'s in this district. It is as follows: 56 mc/s on 0-v-1 super-reg.: G2HG, G2HV, G8OS, G8OI, G8OQ, G8II.

28 mc/s on 0-v-1 straight: G6LK, G5VM, G8OQ, F8ZZ, YL2BB, YL2CD, SP1HH, ES5D, OH1NR, OH2NB, OH5NF, OH6NR, OH7NR, U1CO, U2NE, U3FB, FA8JO, VE1DT, HI7G, YV5AA, VU2CQ, VU2FV, VK2GU, ZB1P, ZB1C, ZB1D, CN8AJ and numerous W's.

I should very much appreciate hearing from any reader who is using a battery straight 56 mc/s receiver.

I take this opportunity of wishing the PRACTICAL AND AMATEUR WIRELESS staff the season's greetings, and the success of the paper throughout the coming year.—C. T. FAIRCHILD (1a, Dover Road, Brighton, 6, Sussex).

CUT THIS OUT EACH WEEK.

Do you know

—THAT I.F. Transformers may be trimmed either by a parallel variable condenser or by modifying the core position.

—THAT the capacity of a variable condenser may be increased by immersing it in oil.

—THAT the proximity of a metal screen should be studied when modifying coils or chokes, as the inductance values will be altered if the screen is close.

—THAT in many cases a dancing blue glow in a valve indicates that the valve is being overloaded or is in need of replacement.

—THAT a hissing noise in an electrolytic condenser when switching on indicates that the condenser is being overloaded and it may break down.

—THAT soldering, badly carried out, may often prove worse than an ordinary twisted contact.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL AND AMATEUR WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Experimenting in Australia

SIR,—I made a small slip in my letter which was published in December 11th issue. The variable grid bias resistance should be 500,000 ohms—not 50,000 as shown.—H. R. WATSON (Hampstead).

A New Use for Valves

SIR,—I recently acquired an all-wave kit which covers wavebands from 12 to 2,000 metres.

Before going further, I must explain, I am at the moment living at the "back-of-beyond" and my neighbours are the only ones within half a mile.

On the said neighbours finding I was building an all-waver, they too decided that they also must have an all-wave set. It had to be a shop-built one, however, as they kindly informed me "a home-built one was no good." The result was, they sold their perfectly good set at a give-away price and bought another, same make, the only real difference being an additional band coverage from 17 to 50 metres.

I finished building my set and we then had some competition, resulting in me pulling in stations he can't get, which, of course, he can't understand, as my set is home-made.

However, he explained his set's deficiencies to his wife, who kindly handed the knowledge on to me as follows: "Jack says your set's the same as ours, with one valve for long waves, one for medium, and one valve for short waves." It was a new one on me.—G. Isherwood (Wentbridge).

PS.—Thanks to PRACTICAL AND AMATEUR WIRELESS, I'm not as bad as my neighbour.

Station VP3THE

SIR,—I read in the December 18th issue of PRACTICAL AND AMATEUR WIRELESS, a report from P. C. Gossling (Tonbridge). On the 9th inst. I was listening on the 20-metre amateur band at 20.15 and heard British Guiana calling. This station was VP3THE.

G6AG replied, and asked several questions. VP3THE said this was his first G, and he was 500 miles from the coast in the jungle. His communication receiver was being supplied by current from two gasoline engine generators. The object of the expedition was to collect reptiles, lizards, etc., for a New York museum. He reported receiving the Empire transmissions day and night quite O.K.

G6AG agreed to call again the next evening at 20.15. I listened and after 10 minutes calling from both ends they contacted, but after a short QSO called off as QRN was making reception impossible.

I again listened on the 12th inst. and heard VP3THE and G6AG contact, but although I could hear both QSA4 they discontinued owing to QRN. Immediately afterwards several G's called VP3 and were successful.

Perhaps some of this information may be of interest to other readers.—L. A. PALMER (Hounslow).

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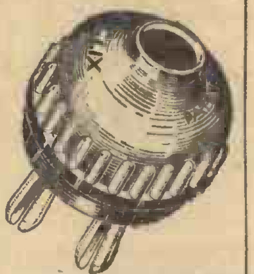

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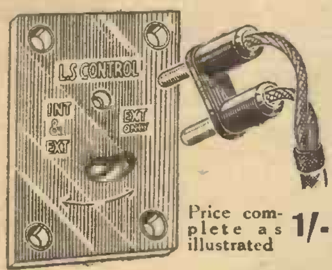

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TELEVISION TOPICS

Picture Beheading

Quite frequently users of television receivers have complained that when close-ups are featured during the course of the reception of the B.B.C. programme, the person's image is partially beheaded. This is very often the fault of the camera in the studio which has not been panned correctly, with the result that the top of the head is lost in the black edging which frames the picture. On the other hand, the fault may be in the set itself. In an endeavour to secure the largest possible picture on the screen of the cathode-ray tube, the knob controlling picture height may be advanced too much, so that the picture mask obscures part of the image, so giving the beheading effect. Again, in the case of electrostatically-operated tubes the vertical "shift" may be wrong, so displacing the picture and detracting from part of the enjoyment associated with the particular programme being radiated. With electro-magnetically-operated cathode-ray-tube receivers, however, this movement of the scanning field bodily upwards, so that the picture is cut at the top, can arise from another cause. No shift controls are necessary with a set of this nature, and on installation the engineer so positions the solenoid focus coil on the tube neck that the scan is disposed centrally with reference to the rectangular picture mask. Adjustment of the controls marked "height" and "width" then ensure that the picture conforms to the required size. If the set is moved bodily without due care, however, the setting of the focus coil may be thrown out of alignment, and this would cause the defect referred to as beheading. In every case mentioned, however, the remedy is quite simple, and a slight readjustment will restore the picture to its normal position.

Colour Television Again

Following on the recent announcement that Baird had succeeded in making big strides since his original low-definition colour television experiments in 1928, it is now learned that the principles of working have been applied to the equipment installed at the Dominion Theatre, London. This has a twelve-foot screen, and the picture signals are transmitted by radio from a low-powered ultra-short-wave transmitter at the Crystal Palace, where the studios are situated. The colours are quite vivid and sharply defined, the correct combination being secured by a blending of certain of the primary colours, just as is done in making magazine illustrations from colour block superimposings. Real artists as well as coloured picture stills have been featured, and no artificial colour is used in the process, which employs mechanical scanning with multi-interlacing to prevent flicker. It is hoped that complete details of the apparatus, and method of working, will shortly become available, for it represents quite another form of big-screen working dealt with in earlier paragraphs. As in colour film working, it is found quite often that details are revealed in colour pictures which cannot be seen with monochromatic pictures

QUERIES and ENQUIRIES

Radio Inventions

"I have made up a radio clock for switching and should like to know whether you have seen a similar device and if such device has been patented. Should I be able to sell this idea to any firm?"—G. H. (Stoke-on-Trent).

THERE have been several automatic clock switches of the type you indicate, although perhaps not exactly the same in detail. You do not state whether the apparatus will switch mains circuits or battery circuits. Whenever you get a good idea which you think is worth selling it is always advisable to take out a Provisional Patent Specification first. This only costs £1, and you may then send copies of the specification to various firms to ascertain whether they are interested, and you will be protected by the patent against any unscrupulous person who may wish to adopt the idea without paying for it.

Volume Control Working

"I have made up the Corona 4, but find that when the switch is turned on the volume is at maximum, and the control has then to be turned further to reduce volume. According to the instructions as soon as the set is in the 'on' position the volume should be at a minimum and should then be built up by means of the control. Can you explain this?"—F. G. (S.E.11).

THE control will work either way, and the connections to the two outside contacts on the side of the component will govern the direction of working. Some listeners prefer the control to be at maximum when switched on by means of the control knob, and others prefer the volume to be at minimum. You can, however, easily alter the effect merely by changing round the two outside contacts referred to. One of these contacts is joined to G.B.—3 and the other to the metal chassis. Unsolder the two leads and change them round.

Prefect H.F. Stage

"I have obtained a back number of your paper describing the addition of an H.F. stage to the Prefect S.W.3. There are one or two points I should like explained in this connection. When one changes the coil in the H.F. stage to receive a different band, does one have to change the coil in the set which has now become an H.F. transformer? Will the set work on the medium and long waves with the addition of this unit?"—J. H. (Yarmouth, I.O.W.).

IN order to receive signals on any waveband all coils must be tuned to that band, with the exception of the superhet, where all incoming signals are changed into a different wavelength and then amplified by stages in which fixed-tuned transformers are fitted. But these must be tuned to the wavelength to which the signal has been converted. Therefore, in the Prefect you must change both coils in order to change the wavelengths. The receiver may be used for the reception of medium and long-wave signals by using suitable coils in the two coil holders.

The D-Xmaster

"I am thinking of building the D-Xmaster but as it is for elderly people of limited means I am concerned about the H.T. consumption. I presume the fact that there is a pentode output valve will mean rather frequent renewals of the battery. If this is so would you recommend another circuit? Regarding selectivity, could you receive, say, the North and Midland Regionals at all times without interference under most conditions?"—L. S. (Ilford).

FOR the type of receiver the consumption is quite normal and this receiver may be regarded as average, with a normal total H.T. current of 15-16 milliamps. By obtaining good super-capacity H.T. batteries you should not find that replacement is needed too often. The selectivity is up to the average, but without details of your particular local conditions we cannot guarantee that you would hear the North and the Midland stations, but with a good aerial North Regional should be well received, and the Midland should be clear of the two London stations.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Carrier Interference

"I find that there is a terrible whistle when I listen to Luxembourg, and a kind of wobbling in the speech and music. Can you tell me what this is due to and how I can cut it out? My receiver is the Fury Four, brought up to date in accordance with your recent instructions."—F. H. (Romford).

THE trouble is due to the fact that another station is transmitting on a wavelength very close to the station you mention. The carrier waves are heterodyned, giving rise to the whistle, and the interfering station "wobbles" or shifts its wavelength, giving rise to the peculiar variation and distortion you have noticed. Unfortunately, you cannot cure the trouble.

Fury Four Modification

"I am modernising my Fury Four with the new coils as mentioned by you in May last. I have got the necessary coil unit but cannot quite follow the connections from terminals 3 on the two rear sections of the coil unit. Would you be good enough to explain how these are made?"—J. R. B. (Scarborough).

THE two .0003 mfd. fixed condensers on the underside of the chassis have to be disconnected on one side—the first from the grid terminal of V2, leaving the wire through hole 5 still joined to the grid, and the other condenser from the wire running through hole 10. The terminals No. 3 are then joined to these two condenser lugs, the rear coil to the last-mentioned condenser and the centre coil to the condenser which was disconnected from V2.

Measuring Eliminator Output

"I bought a small eliminator a while ago and on test it only measures 15 volts instead of 80, 45 instead of 90, and 130 instead of 150. Could I alter it with changing the resistances, and if so what should I get for each tapping?"—J. E. R. (New Mills, Nr. Stockport).

THE readings you give tend to show that you tested the output from your eliminator with an ordinary type of voltmeter. The two low outputs are intended for the screen of an S.G. valve, and the detector anode voltage, and the current in each case is only a few milliamps. The highest output is intended to supply up to 25 mA or so, and this is the current which will be taken by a small "pocket" type voltmeter. Consequently, as the low voltages are obtained by means of the voltage drop through series resistances, the additional current taken by your meter will result in a much greater voltage drop than is intended and would give the readings you mention. The output tapping would be more or less correct. Thus, to test this type of unit you must use a meter having a resistance of at least 1,000 ohms per volt—at which the current taken will only be 1 mA or so.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

R. W. S. (Dagenham).—You could use the separate valves as mentioned, but they will not work as well as the single valve.

S. W. (Handforth).—You could add a crystal tweeter, and it should be connected with the existing speaker in accordance with the manufacturer's instructions.

A. L. B. (Nottingham).—The difference is rather in the life of the component than in the hum produced. The valve may burn out and need replacement, whereas the metal rectifier is almost everlasting. You would not be able satisfactorily to use the trickle-charging output for operating battery-valve filaments.

W. J. S. (Chichester).—The transformer is perfectly suitable for the amplifier.

J. L. H. T. (Marlborough).—We could not give all the coil winding data in the form of a reply. You will find the necessary information in our latest book "Coils, Chokes and Transformers."

G. P. (Far Cotton).—The arms should be adjusted for best results. There will be found one position where quality is slightly better, and this will indicate correct matching.

D. C. H. (Chadderton).—As you increase the L.F. output so would you notice the effects of poor selectivity. The Class B stage could be used as indicated, with the P.M2A valve. An aerial volume control would be simplest, connecting a differential condenser across the aerial coil (fixed plates), with the moving plates to earth.

W. J. A. C. (Immingham).—There is no receiver in our blueprint list which conforms to your specification. The most recent receiver (A.C.—all-wave) is the "Corona 4," but this would not give 4 watts output, utilising only a single output valve. There is also only one short-wave band.

G. W. F. (Chadwell St. Mary).—The address in question is 44 Valley Road, Shortlands, Kent.

The coupon on cover iii must be attached to every query.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," Tower House, Southampton Street, Strand, London, W.C.2.

RECEIVERS, COMPONENTS AND ACCESSORIES

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Packed with short-wave information and circuits of mains and battery receivers, including straight, superhet and 5-metre transmitters, modulators, etc. Information on transmitting licences, aerials, Class B amplifications, neutralizations, superhet alignment, etc. The most comprehensive manual published, written by practical engineers, price 6d., post free, 7½d. including catalogue.

1938 Short-wave Catalogue only (3 times enlarged) price 1½d., post free.

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CONVERSION UNITS for operating D.C. Receivers from A.C. Mains, improved type, 120 watt output at £2/10/0. Send for our comprehensive list of speakers, resistances and other components.

WARD, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

THE largest stock of components in England, over 500 lines, new catalogue now ready 1½d.—J. Bearfield, 105, Upper Street, London, N.1.

HEADPHONES.—Brown, Ericsson, G.E.C., B.T.H. Standard Telephones, Nesper, Western Electric, Sterling, etc., 2,000 ohms, 2s. 6d.; 4,000, 5s. Postage 6d. **SPECIAL.** Ericsson, 4,000 ohms, as new, 7s. 6d. Telefunken, lightweight, adjustable, 7s. 6d.

CRYSTAL SETS.—Burne-Jones. Complete, Guaranteed, 5s. 6d. Ditto, double circuit, 8s. Sensitive permanent detectors, 1s. 6d. Crystal Detectors, complete, 1s. Crystals with silver cat's-whisker, 6d. Postage 1½d.—Post Radio, 2, Copenhagen Street, London, N.1.

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TELSEN A.C./D.C. Multimeters, 5-range (tests anything radio or electrical), 8/6; loudspeaker units, 2/6, Ace (P.O.) microphones, complete with transformer ready for use with any receiver, 4/6; headphones, 4,000 ohms, 3/- pair.

VALVES.—Full range for American receivers, 6/- each.

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BARGAIN Parcels of Assorted Components, including coils, resistances, condensers, chokes, wire, circuits, etc., value 21/-; 5/- per parcel.

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ALL lines previously advertised still available.—Radio Clearance, 63, High Holborn, W.C.1. Telephone: Hol. 4631.

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TWO NEW MODELS, completely enclosed.
To charge 6 volts at 4 amps. £3/19/6.
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NEW 1-VALVE SHORT-WAVE RECEIVER OR ADAPTOR KIT. 13 to 86 metres without coil changing. Complete Kit and Circuit, 12/6. **VALVE GIVEN FREE!**

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The circuit also is particularly up-to-date, whilst the short-wave band has been especially studied and American stations are readily obtainable.

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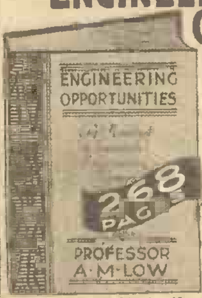

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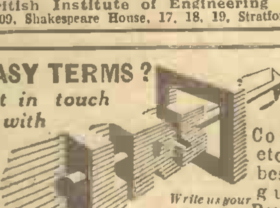

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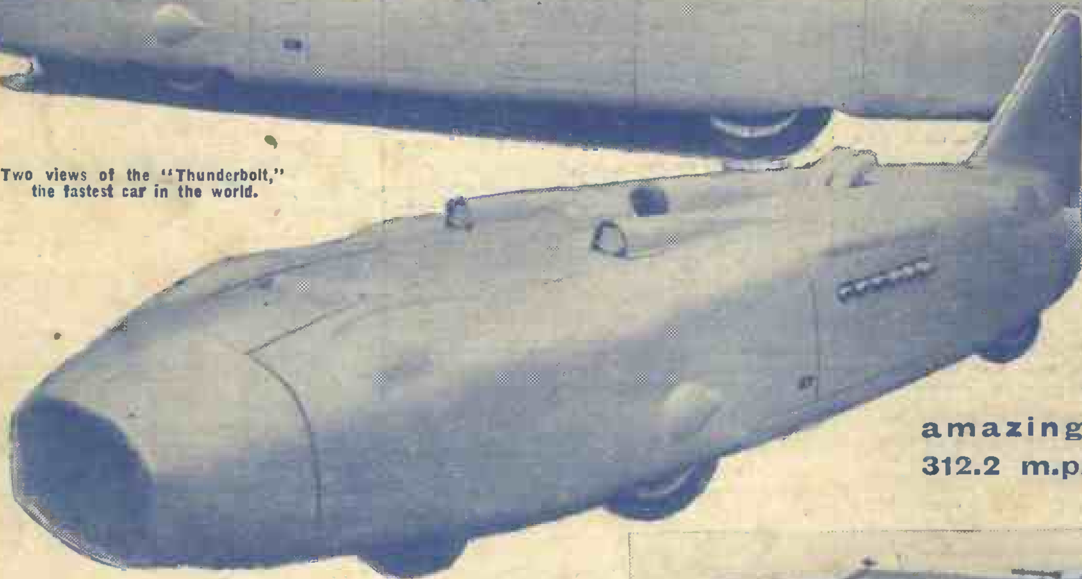

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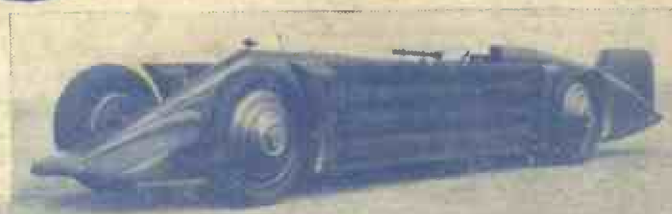

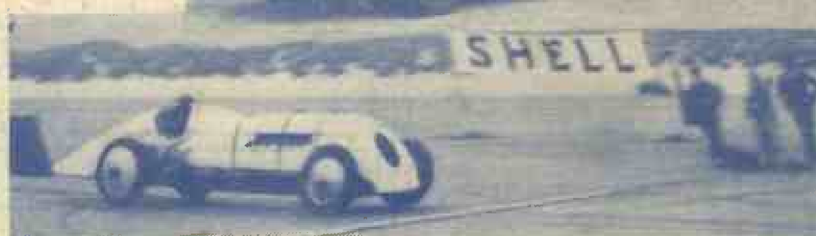

(Above) Sir Henry Segrave's famous "Golden Arrow" which created a record at 231.44 m.p.h. (Below) Parry Thomas with "Babs" breaks the record at 171.09 m.p.h. at Pendine. Both men were killed in speed attempts—Segrave on water.

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IN THE JANUARY

PRACTICAL MECHANICS

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AN EXPERIMENTAL A.C. POWER UNIT— See page 481.

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

a GEORGE NEWNES Publication

Vol. 11. No. 277.
January 8th, 1938.

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OUTPUT 'BEAM' TETRODE

★ **OSRAM U31**
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HALF-WAVE RECTIFIER

The OSRAM KT32 is a "Beam" Tetrode, designed to give a large undistorted power output with a low anode and screen voltage. It has therefore especial value for use in D.C./A.C. receivers where the available supply voltage is limited. A power output approaching 2 watts is obtainable under conditions of 100 volts from a single valve, so that a truly Universal Amplifier may be designed for operation on 100-250 volts A.C. or D.C. giving a similar output under all conditions. In addition the high mutual conductance ensures great sensitivity. A further important feature is the alignment of grids which effects a great reduction in screen current and effectively increases the available power output.

The self-locating "International" Octal base is fitted.

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The low internal impedance reduces the voltage drop across the rectifier in the case of D.C. mains operation.

CHARACTERISTICS OF OSRAM KT32

Heater Current	0.3 amp.
Heater Voltage	26
Anode Voltage	135 max.
Screen Voltage	135 max.
Anode Current	60 mA
Screen Current	5 mA
Mutual Conductance ...	9.0 mA/volt

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CHARACTERISTICS OF OSRAM U31

Heater Current	0.3 amp.
Heater Voltage	26
Maximum Rectified Current ...	120 mA
Anode Voltage	250 R.M.S. max.

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Experimental L.F. Amplifiers

See Page 469

Practical and Amateur Wireless
Edited by F. J. CAMM
Technical Staff:
W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.
VOL. XI. No. 277. January 8th, 1938.

ROUND *the* WORLD *of* WIRELESS

Fault Tracing

ALTHOUGH in many cases a tedious and troublesome business, the locating of a fault is nevertheless an interesting process. Every receiver goes wrong at some time or another, and in many cases it is useless just running haphazardly over the set in the hopes that the fault will be traced. Many hours may be wasted by an unsatisfactory search, whereas by adopting a systematic scheme the trouble may be located in the minimum of time and with the minimum of difficulty. There are, of course, many ways of setting about the process of fault finding, and we commence in this issue a new series of articles on the subject. This, in conjunction with other articles, which we have given on the same matter will enable the amateur, with the minimum of testing apparatus, to set about the work of servicing his own or other receivers, and the knowledge gained in finding faults and rectifying them is in itself of the utmost value to the student of radio practice. It should be remembered, of course, that good instruments are an investment, and although it is possible for a trained engineer, with every type of instrument available, to trace a fault in a very few minutes, the experienced amateur may take very little longer, provided he knows the best way of setting about the work and uses a little intelligence in adapting the results of tests which may be made.

New Baird Factory

FOLLOWING the tragic fire at the Crystal Palace last year, the Baird Company have acquired and are at present adapting some new premises to be used in place of the space which they previously employed at the Palace. It is hoped that the new building will be ready for occupation in the near future.

G.P.O. Radio Relay

IT is announced that the Post Office are to commence a radio relay service in Southampton during the coming season. It is hoped to be able to provide facilities for four programmes, B.B.C. National and Regional and two foreign stations, and it is stated that the service will cost subscribers 1s. 6d. per week. Experiments are to be carried out with a view to using the existing telephone system as a carrier for the broadcast signals.

For Empire Listeners

ON January 14th a programme is to be broadcast from the National transmitters telling Empire listeners something about the films which are being shown in London. A clever cast has been drawn up to demonstrate the popular current previews. Included are Anne de Nys, Ian Grant, who wrote the material, and William Walker, well-known composer, impresario and artist.

Handyman Talks

SIX practical talks on the upkeep of the home are to commence on January 15th by a practical builder. In the first talk Mr. Matthew will describe briefly the more obviously useful tools that should be kept, and give advice on using them in future talks, covering problems ranging from the replacing of a fuse to the modernising of an old-fashioned house.

ON OTHER PAGES

"After Dinner" Again

NORTHERN listeners will no doubt be pleased to hear that it has been decided to revive the "After Dinner" programme, commencing on January 12th. There have been many requests for the revival of this item, which consists of radio cabaret.

Benno Moiseiwitsch

ON January 15th Northern Ireland listeners will hear a programme by the brilliant Russian pianist Moiseiwitsch. He will be playing in the Wellington Hall in co-operation with the Belfast Y.M.C.A., and will include the Rachmaninoff Concerto No. 2 for pianoforte and orchestra under the conductorship of B. Walton O'Donnell.

World Radio Convention

LISTENERS who are anxious to obtain further details regarding the World Radio Convention to be held in Australia from April 4th to April 14th next should write to the Convention Secretary, O. F. Mingay, 30, Carrington Street, Sydney.

Radio for Air Lines

AT the World Tele-communications Conference, to be held at Cairo on January 30th, Great Britain is to propose an extension of the bands allotted to air services. It is stated that exclusive rights to the ultra-short wavelengths are to be sought for special radio apparatus used for blind approach and landing, such as are employed in the Lorenz and similar schemes. The regular use of this type of apparatus has been prevented, it is stated, by the restriction of available wavelengths not subjected to interference.

The I.B.U. Session at Nice

THE International Broadcasting Union recently completed a ten-days' session at Nice under the presidency of Monsieur Antoine Dubois, delegate of the Dutch broadcasting organisations. Represented at this meeting were twenty-one European States, the Palestine Broadcasting Service, two American Broadcasting systems (Columbia Broadcasting System and the National Broadcasting Company), the Dutch East Indies Broadcasting Company (NIROM) and that of Porto Rico. There were also present fifteen observers from the European P.T.T. Administrations, League of Nations, and from the Bureau of the International Tele-communications Union at Berne. The primary object of this meeting was the preparation and adoption of complementary proposals by the I.B.U. for the world Tele-communications Conference to be held in Cairo on January 30th.

ROUND the WORLD of WIRELESS (Continued)

Music of Other Countries

AUSTRIA has been chosen for the sixth in the series entitled "Music of Other Countries," on January 11th, and the programme will be played by Jean Salder and his Serenaders. Jean Salder formed the Serenaders in 1935 as a broadcasting combination; the six members form the nucleus of the orchestra which broadcasts from the Palace Hotel, Torquay.

The Rhythm Express

RADIO'S "Rhythm Express" sets out on its first journey on January 6th. National listeners will hear it speeding melodiously for the only three stations on the line—Romance, Humour, and Rhythm. Driven by Benny Frankel and his Orchestra, with Jack Davies Junior as Track Supervisor, it will have as singing travellers Dorothy Carless and Bert Yarlett. John Burnaby, B.B.C. Variety producer, says that he will ensure that no one goes off the rails.

Enterprise Pays

HERE is a good story told by a firm of British radio manufacturers.

In a recent B.B.C. competition to find the most interesting photograph of an overseas listener, it was noticed that one of the prize-winners was shown listening to a seven-year-old G.E.C. radio set. The makers, The General Electric Co., Ltd., wrote immediately to congratulate the prize-winner, Mr. Maxwell, a Nyasaland planter, on his good fortune, and took the opportunity to mention the enormous strides they had made in short-wave radio design since his receiver had been produced.

A reply has been received by the firm mentioned reporting that the letter sent to him had induced him to purchase the latest G.E.C. all-wave set. He had just decided, he said, to buy a new set, and the letter that he had received convinced him that a firm so quick off the mark must produce the goods.

INTERESTING and TOPICAL NEWS and NOTES

London Pride

LONDON during its long history has received many tributes from distinguished visitors. D. F. Aitken, an author who has written several programmes for the B.B.C. Empire Station, has conceived the novel idea of compiling a programme based on the tributes paid by these travellers to the Metropolis, its buildings, and its people.

Of necessity some limitation of period had to be made. The author has chosen the Elizabethan and Carolean periods, the latter part of the eighteenth century and the years immediately following the Napoleonic period—that is, the period immediately preceding Queen Victoria's accession. As a contrast, the programme, which will be broadcast from the National transmitter, will begin and end in modern London.

Reginald Purdell, the well-known comedian of the stage, screen and radio, tunes in his favourite programme on a Marconiphone table-grand during a rest from film work at Warner Bros. Studios, Teddington.

Western Pantomimes

EXCERPTS from two West of England pantomimes will be broadcast on January 13th; "Mother Hubbard," produced by Percy Dunsford, at the Theatre Royal, Exeter; and "Mother Goose," produced by Reg Maddox, at the Theatre Royal, Bath.

A Unique Broadcast

AN event, unique in the history of broadcasting, took place recently in Cairo when the voice of the Sheikh el Azhar (the Rector of the University of Islam) was heard in a religious talk broadcast from a Cairo mosque in the presence of King Farouk I. The occasion was Ramadan, the holy month of fasting, in which all good Moslems abstain from food and drink during the day, and thoughts are turned to the more serious aspects of their daily lives.

Organ Recitals

THE fourth of the present series of B.B.C. Organ Recitals will be given on January 23rd before an audience in the Concert Hall, Broadcasting House, by Marcel Dupré, the famous French organist, who will be heard in a programme of French organ music. On January 19th Maurice Vinden will give a recital from St. Mark's, North Audley Street, in a new series "Round the London Organs."

Duettists

HUGHES and Lever are to sing their own songs in a programme for Midland listeners on January 10th. They write both the music and lyrics themselves. Before being discovered by the B.B.C. they ran a greengrocery business in Northampton. Both have done a good deal of film work and have appeared in television programmes.

"The Sleeping Beauty"

"THE SLEEPING BEAUTY," presented by Prince Littler, will be broadcast on January 11th from the New Theatre, Cardiff. Margaret Morgan will play Principal Boy and Gwen May will take the part of the Sleeping Beauty.

Light Music

"THEATRE TIME" will be the title of the programme with which a section of the B.B.C. Northern Orchestra conducted by H. Foster Clark, will turn to lighter music when it broadcasts on January 9th. This marks a new departure in music from the North, and it is probable that the broadcast will begin a series of light programmes by a section of the North's studio orchestra—apart, of course, from the full orchestra's regular broadcasts.

B.B.C. to Broadcast in Arabic

THE B.B.C's. first news in foreign languages was broadcast last week in Arabic on a wave-length of 31.32 metres.

SOLVE THIS!

PROBLEM No. 277.

Atkins had a commercial superhet of the A.C. mains type which had given good service. One day, when he switched on, signals were poor and he noted that certain distant signals faded. As soon as he tuned down to the lower end of the medium-wave band the receiver burst into oscillation. What would be the most likely trouble to have produced these effects? Three books will be awarded for the first three correct solutions opened. Address your envelopes to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Envelopes must be marked Problem No. 277 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, January 10th, 1938.

Solution to Problem No. 276.

The trouble in Jarvis's set was that a decoupling condenser had broken down and was short-circuiting to earth. Consequently the decoupling resistor was overloaded and the excess current caused the H.T. drop which was measured on the mains section.

The following three readers successfully solved Problem No. 275 and books have accordingly been forwarded to them: W. S. Wilkinson, 199, Olton Boulevard East, Acock's Green, Birmingham. A. Pruden, 25, Germain Street, Chesham, Bucks. T. R. Dobson, 461, Abbey Lane, Sheffield 8.

The Amateur Set Designer

Mains H.F. Filtering, Pick-up Arrangements, and Receiver Layout, are Amongst the Subjects Dealt With in this Concluding Article of the Series

(Concluded from page 426, December 25th issue.)

If the total H.T. current consumption of the valves fail to give quite the necessary degree of field energising, a resistance of suitable value could be connected across the smoothed H.T. (i.e., in Fig. 69, between the points marked H.T. plus and H.T. minus). An alternative method is to use a speaker with a field resistance considerably greater than the average A.C. case, and to connect this winding between cathode of rectifier and chassis. Something greater than 6,000 ohms should be considered reasonable for such a case. With this method the speaker field winding is across the H.T., so it will be necessary to use a smoothing choke in series with the positive H.T. line.

As regards the smoothing condensers, these should be of as large a capacity as can be permitted, having due regard to the welfare of the rectifier. Two of 8 mfd. each represents a normal choice of values.

Dial Bulbs

The simplest way of arranging for dial lighting is to use dial bulbs which have the same current rating as the valves, and to connect them in series with the heater chain. Due allowance should be made in the design for the voltage drop across them.

Mains H.F. Filtering

High frequency surges on the mains can cause considerable trouble if allowed to work into the receiver circuits. In the case of an A.C. receiver a shielded mains transformer primary can be used, but in the case of the A.C./D.C. receiver it is necessary to incorporate some form of mains H.F. filter. An H.F. choke should be employed in each mains lead (see Fig. 69), and the chokes should, of course, be of suitable current carrying capacity, and too much voltage drop should not be permitted. A condenser should be connected across the supply, on the receiver side of the chokes. This condenser must be restricted in capacity, otherwise a heavy drain will be experienced with A.C. operation. Something not less than .02 mfd. and not greater than 0.1 mfd. will be satisfactory. Needless to say, the voltage rating should be adequate, for safety's sake.

Gramophone Pick-up Arrangements

If gramophone pick-up terminals are to be incorporated in a receiver design the designer should, for normal purposes, aim at getting two valves working after the pick-up, i.e., one stage of L.F. amplification followed by the output stage.

If the receiver has an L.F. amplifying stage preceding the output stage, then the grid circuit of the L.F. valve will be the circuit which should contain the pick-up terminals and, in this case, there will be no complications over gramophone bias, because the L.F. valve will be permanently biased correctly either for radio or gramophone.

When the output stage is fed directly from a triode or H.F. pentode detector the pick-up terminals should come into the grid circuit of the latter, and the arrangements must be such that, for gram operation, the valve becomes suitably biased for L.F. amplification, i.e., the change over from radio to gramophone must change the operation of the valve from that of detector to that of amplifier.

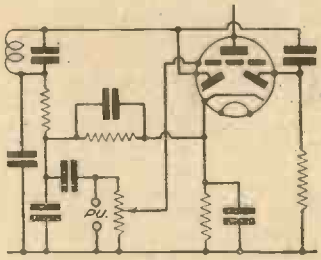


Fig. 70.—The simplest method of connecting a pick-up in a double-diode-triode stage.

A diode detector followed directly by a high slope output pentode or tetrode, which is a system so frequently seen in superhet designs, makes the job a little awkward for the designer. He has got two alternatives, one of which is to use the output valve only after the pick-up, but this cannot be regarded as really satisfactory; certainly it would be necessary to use a pick-up of exceptional sensitivity. The other alternative is to operate the pick-up in the grid circuit of the last I.F. valve, and this will mean arranging for some form of L.F. coupling between the I.F. valve and the output valve, this coupling to come into action only when the pick-up is being used.

The Pick-up with the Double-Diode-Triode

The normal form of double-diode triode circuit lends itself admirably for pick-up operation. The triode section of the valve provides the L.F. voltage amplification that we want, and if the volume control is contained in the grid circuit of the triode (or if the grid input voltage is taken off the volume control) then the ends of the volume control represent very convenient points to which to connect the pick-up terminals (see Fig. 70). With this system there is the advantage that the one volume control operates on both radio and gramophone.

The Pick-up in the Detector Stage

As stated above, it will in some cases be necessary to make the valve which acts as detector on radio perform the function of L.F. amplifier on gramophone.

Fig. 71 shows a useful arrangement for an indirectly-heated triode grid detector, and the same scheme would also be satisfactory with an indirectly-heated H.F. pentode grid detector. The resistance R is a biasing resistance of suitable value to bias the valve for amplification. The grid-leak is returned direct to cathode, so the voltage across R does not bias the valve on radio reception (when the pick-up is disconnected or switched out). When the pick-up is connected to the pick-up terminals the bias voltage comes into action, for, although the grid-leak is still connected to cathode, there is now the much lower resistance of the pick-up's winding between grid and the lower end of R. We are, of course, assuming that an electromagnetic pick-up is being used. If the pick-up is of the crystal type, it will be necessary to have a shunt across it, or to use a transformer.

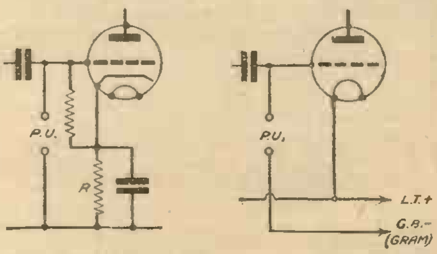
The battery-operated grid detector represents an easy proposition. Fig. 72 shows a simple method of incorporating pick-up terminals in the case where battery bias is employed. The lower pick-up terminal is connected to the grid-bias battery at a suitable tapping for making the valve function as amplifier.

It will be appreciated that a receiver using a volume control which is associated with an H.F. valve will require a separate volume control for the pick-up. It is only in the case where the volume control is on the L.F. side of the receiver that the one control can conveniently be arranged to operate either on radio or on gram.

Using the Last I.F. Valve for Gramophone Purposes

When the output valve directly follows a diode, and it is desired to use the last I.F. valve as pick-up amplifier, some such system as that indicated in Fig. 73 may be used. To make the idea as clear as possible the diode circuits have been omitted from the diagram.

On radio, the pick-up terminals are shorted out by the switch S1, and the switch S2 is open. The resistance R in the anode circuit of the I F. valve functions



Figs. 71 and 72.—Connecting a pick-up in a detector stage — using a mains and a battery valve.

as a decoupling resistance with C as the decoupling condenser.

For gramophone the switch S1 is opened and the pick-up comes into action. The switch S2 is closed, connecting the condenser C1 to the top of the volume control. R and C1 now provide resistance-capacity coupling from the I.F. valve (actually acting as L.F. valve now) to the output stage. So long as the decoupling condenser C is not made too large a capacity there will probably be no necessity for switching it out on gramophone. If it

(Continued overleaf)

THE AMATEUR SET DESIGNER

(Continued from previous page)

is made something of the order of .002 mfd. it should be big enough to give decoupling at the I.F., but not enough to give bad shunting on gramophone.

Care With the Universal Set

With a universal (A.C./D.C.) set it is most important, for the sake of safety, that there should be no direct connection from the pick-up terminals to chassis, and an isolating condenser should be in series on each side of the pick-up circuit. Something of the order of .05 mfd. will probably be suitable. Alternatively, a pick-up transformer could be used.

In some cases condenser isolation cannot be used because of bias difficulties, and the transformer alternative should be used. Such cases are those where the valve bias voltage acts through the pick-up.

"Radio"-"Gram" Switching

There is no absolute necessity for "radio"-"gram" switching in the arrangement of Figs. 70, 71 and 72, provided that the grid pick-up lead is disconnected from the receiver while the latter is operating on radio. There is, however, the possibility of radio signals being heard as interference while the pick-up is in action.

Apart from any special switch arrangements that a particular case may demand, the general idea of "radio"-"gram" switching is to do two things: (1) To switch the pick-up in or out as required, and (2) Cut out radio signals on gramophone. There are various ways in which the latter requirement may be fulfilled. One effective method is to make the switching put a short-circuit across one or more of the H.F. grid circuits. A point to watch is that the short-circuit does not come across any source of bias voltage.

Receiver Lay-out

The designer should take the utmost care over the layout of the components and wiring of the receiver. The nature of the layout may affect the performance of the receiver, and upon it will certainly depend the ease, or otherwise, with which the receiver can be overhauled in the event of breakdown.

One strict rule to follow, and one which will largely determine the placing of the principal components, is that of keeping grid leads as short as possible, and also all leads from coils to coil switches, and from coils to tuning condensers.

In the interests of getting a "clean" layout the designer should make a list of the components that can be arranged more or less anywhere, according to convenience. These will include decoupling, coupling, and voltage-dropping resistances, and most of the L.F. components. An L.F. intervalve transformer, or L.F. coupling choke, may, however, require special placing in a mains receiver.

H.F. decoupling condensers, filter condensers and grid stoppers should be kept as close as possible to the appropriate valveholders.

Gramophone pick-up leads should be kept as short as possible; particularly does this apply to the grid wire which remains connected to grid when the pick-up is switched out, or disconnected, for radio reception. Pick-up leads may be responsible for mains hum on "gramophone," and when there is a long run from receiver chassis to the pick-up (as is frequently the case with a radiogramophone assembly), the leads from the receiver chassis should be taken through earthed metallic sleeving.

Screened sleeving can be very usefully employed for any grid or anode leads which may be responsible for stray couplings. It should not be used indiscriminately, however, as if used to excess there may be too much stray capacity thrown across one or more of the tuned H.F. circuits.

In a mains receiver the possibility of an L.F. intervalve transformer, or L.F. coupling choke, picking up hum potentials from the mains transformer should be kept in mind.

The question of the suitability of the layout for servicing is one that does not always receive the attention that it merits from amateur designers. Admittedly, one does not design and build a receiver with the idea that it is going to give trouble, but, at the same time, the receiver that *cannot go wrong* has not yet been built, and the designer might just as well give some thought to the possibility of future overhauls. The requirements here may be summed up in the one word: accessibility. Good performance and reasonable compactness are first considerations, but the designer should endeavour to prevent any component becoming "buried" in such a way that its subsequent removal for test or replacement purposes will entail considerable dismantling of the receiver assembly.

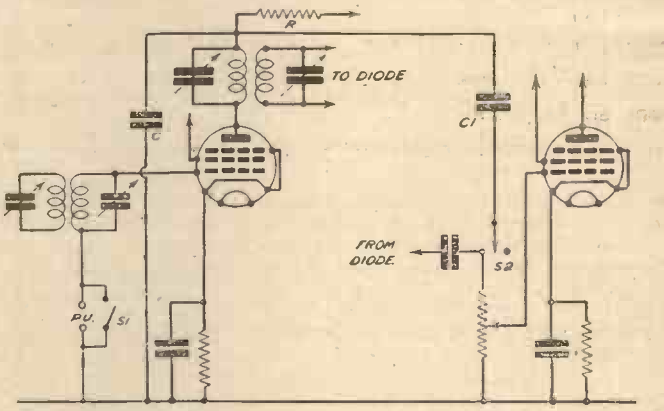


Fig. 73.—It is possible to use an I.F. valve for the first L.F. stage in the circuit as shown here.

Important Broadcasts of the Week

***NATIONAL* (261.1 *m.* and 1,500 m.)**
Wednesday, January 5th.—Cabaret programme.
Thursday, January 6th.—Dance Band programme.
Friday, January 7th.—British Film Music: Orchestral programme with introductory talk.
Saturday, January 8th.—Palace of Varieties programme.

***REGIONAL* (342.1 *m.*)**
Wednesday, January 5th.—Theatre Royal, Cheltenham, a page of theatrical history.
Thursday, January 6th.—An excerpt from the pantomime, "Puss in Boots," from the Alhambra Theatre, Glasgow.
Friday, January 7th.—Variety from the Hippodrome, Boscombe.
Saturday, January 8th.—The Clyde, feature programme.

***MIDLAND* (296.2 *m.*)**
Wednesday, January 5th.—Theatre Royal, Cheltenham, a page of theatrical history.
Thursday, January 6th.—Melodies from the Comedies, orchestral concert.
Friday, January 7th.—An excerpt from "Aladdin," from the New Coventry Hippodrome.
Saturday, January 8th.—Choral programme.

***NORTHERN* (449.1 *m.*)**
Wednesday, January 5th.—New Year's Eve Entertainment from Blackpool, including dance music and organ recital from the Empress Ballroom and variety from the Palace Theatre.
Thursday, January 6th.—Hymn recital from St. Chad's Church, Far Headingley, Leeds.
Friday, January 7th.—An excerpt from "Dick Whittington," from the Gaiety Theatre, Manchester.
Saturday, January 8th.—Choral concert.

***WEST OF ENGLAND* (285.7 *m.*)**
Wednesday, January 5th.—"Cinderella," a pantomime from the Pavilion, Bournemouth.
Thursday, January 6th.—Escape, by John Galsworthy, adapted as a radio play.
Friday, January 7th.—Variety from the Hippodrome, Boscombe.
Saturday, January 8th.—Sing-Song from the Guest Night at the Toc H Area Festival, from the Civic Hall, Exeter.

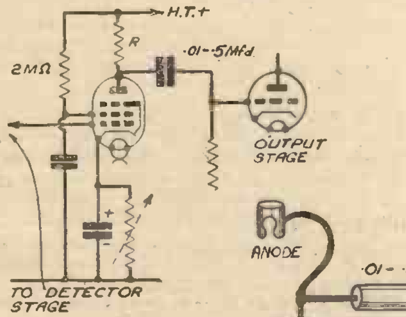
***WELSH* (373.1 *m.*)**
Wednesday, January 5th.—The Past Year: A review of 1937 in word, song, and verse.
Thursday, January 6th.—Organ recital from the Town Hall, Newport.
Friday, January 7th.—"Little Miss Muffet," a pantomime, from the Pavilion Theatre, Rhyl.
Saturday, January 8th.—Orchestral and choral programme.

***SCOTTISH* (391.1 *m.*)**
Wednesday, January 5th.—"Cinderella," a pantomime from the Theatre Royal, Glasgow.
Thursday, January 6th.—Lilting Lays, a Gaelic programme of solos and duets.
Friday, January 7th.—Aul' Eel, a programme of old Yule customs.
Saturday, January 8th.—The Clyde, feature programme.

Experimental L.F. Amplifiers

Although it is Customary to Use Transformer and Resistance-capacity Coupled Amplifiers, there are Many Alternative Types which are Interesting from an Experimental Point of View. The Use of the H.F. Pentode in this Connection is Explained in this Article - - By W. J. DELANEY

THE keen experimenter is always on the look-out for something new to try in connection with standard receiving apparatus, and although "stunt" or original types of circuit are often employed, there are still a number of what might be termed standard circuits which are not used often enough. A glance through the specifications of certain commercial apparatus will reveal many interesting details, many of which have not been published, either because of their specialised use or from a patent protection point of view. One interesting circuit which may be found used in certain public-address equipment is that wherein a screen-grid or H.F. pentode valve is employed in the low-frequency stage. If the modern H.F. pentode valve characteristics are studied it will be found that the valve is supposed to give an amplification of 1,000 or more, but, as every experimenter knows, it is impossible to reach this desirable figure in practice. Apart from the difficulty of providing the requisite load, there are many other factors which prevent the maximum amplification from being obtained, although in a carefully designed and built receiver it should be possible to get at least a step-up of 100 or so. Why not, therefore, use such a valve in the low-frequency stages where such a gain would be of the utmost value?



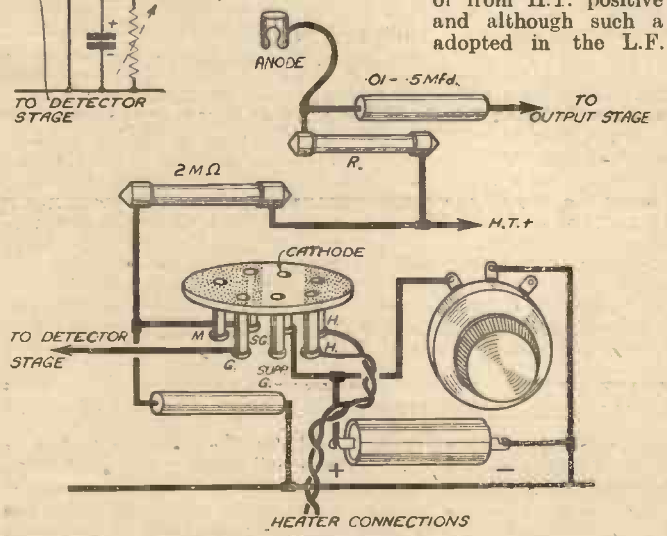


Fig. 1.—The circuit for an A.C. mains amplifier using the H.F. pentode as an L.F. amplifier.

The Screen Voltage

Unfortunately, this is not such a simple matter as at first might appear, as the valve curve is of a rather peculiar shape, and although many difficulties due to H.F. are removed when using the valve in the L.F. stage there are still certain points which have to be attended to, one of the most important of which is that the working point on the curve must be very carefully chosen. In a normal stage it is customary to connect the screening grid to a potentiometer supply across the H.T. battery, or from H.T. positive to H.T. negative, and although such a scheme could be adopted in the L.F. circuit it would be found that the amplification would be poor. As the voltage on the screen is adjusted it will be found that with given values of grid bias the amplification will vary, and in addition certain forms of distortion will arise. Therefore, the first important point in using this type of valve for low-frequency amplification is to arrange for a suitable screen voltage. Experiments show that this may conveniently be carried out by allowing the valve itself to pick out the voltage, or, in other words, not to tie the screen down. To do this, all that is necessary is to connect a resistance between the screen and H.T. positive, and then with the correct value of bias the valve will automatically adjust itself to a suitable working point. A by-pass condenser must, of course, be connected between the screen and earth but the capacity should not be higher than is required for stable and good quality signals. Probably .5 mfd. will be found the highest value for general results, although the type of speaker and the output stage will probably modify this value.

Practical Circuits

In the case of an A.C. indirectly-heated H.F. pentode, a suitable circuit is shown in practical and theoretical forms in Fig. 1 and it will be noted that the biasing resistor in the cathode lead is of a high value. This may be experimented with to find a suitable value, and for experimental purposes it may well be replaced by a variable component. The anode load resistance must be as high as possible, consistent with a good H.T. voltage on the anode, and therefore this will be governed by the H.T. supply which is available. It should be the aim of the experimenter to obtain as nearly as possible the maximum working voltage recommended by the makers of the valve, and therefore the anode resistance could be made as high as 1 megohm if sufficient voltage is available. This will, of course, have to be lowered if insufficient H.T. voltage is available, but in order to obtain the benefits of the valve in this stage it should not be lower than 100,000 ohms (.1 megohm). The coupling condenser to the next stage and the grid leak for that stage may be of standard values.

In the case of the battery receiver, the H.T. supply will have to be increased and it may be found desirable to use a separate H.T. battery in series with the existing batteries in order to permit of a suitable anode resistance. The bias in this case may be modified or varied by using the same arrangement as when the valve is used in the standard position on the H.F. side of the receiver, connecting a potentiometer across a grid battery.

Adjustable Bias

As the bias will be found quite a critical

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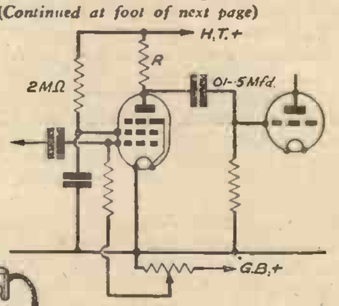

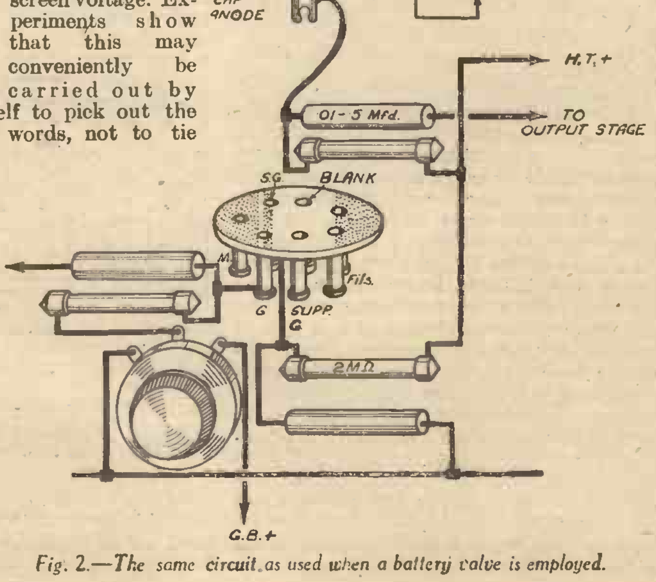

Fig. 2.—The same circuit as used when a battery valve is employed.

VALVES UNTECHNIFIED—1

The introduction to this series was inspired by a chance conversation overheard in a railway carriage, the precis of which is given below.

The Thin Man: "No, I wasn't able to hear it, my set packs up after about ten minutes."

The Man Opposite: "You want a new one."

The Thin Man: "Good heavens no! I've only had it six months. It started to pack up about a month ago and has got worse and worse. The whole thing's rather a mystery; I borrowed a mixed collection of valves and although they weren't quite the right types I got the set to work fairly well. The funny part about it is that I had my own valves tested and the man said they were absolutely O.K."

THIS conversation is a very typical one when a wireless set belonging to a real enthusiast goes wrong; there is always a mystery attached to it. In this case the fault develops after approximately ten minutes, and it is equally apparent that the fault is absent when other valves are substituted. On the other hand, we are given to understand the valves have been tested by a dealer and pronounced O.K. It is not the writer's intention to disparage in any way those gallant gentlemen who make a living in the radio trade. In the first place it is highly probable that when the valves were taken for test the fact that the set behaved itself for ten minutes was quite probably not mentioned. It is an astonishing but nevertheless perfectly true fact that the majority of people sending their valves back to a valve manufacturer for test do not mention the reason for requiring such service. If the trouble is one which appears after forty-five minutes' use, the chances are a hundred to one that the manufacturer will return the valves as O.K.

It is obvious that a test board cannot be monopolised by a valve for an hour or more unless there is reason to believe that such time must elapse before the fault will manifest itself. Similarly, the "thin man" has taken his valves to a dealer who may be very well equipped indeed, but still be unable to find some of the more obscure faults which may be present in a valve. A test board capable of showing every known fault of every type of valve in general use could not be made for £100, and could not be purchased for perhaps double this figure.

Defective Vacuum

It is not in itself difficult to test for vacuum, but it sometimes happens that a valve having a slightly impaired vacuum will so vastly improve after two or three minutes' work that for practical purposes it may be considered satisfactory, but very occasionally a valve is found that is "hard" (i.e., the vacuum is high) but falls off due to an occluded gas being driven off an electrode which is becoming overheated. Obviously such a defect will not appear unless the valve has been run for a sufficiently long time, and under such conditions that its full rate anode current is passing, and adequately high voltages are applied to the various electrodes. A pentode, for example, working with 250 volts on anode and screen passing say 35 milliamps may be decidedly soft under those conditions, but tested with say 100 volts on anode and screen will respond to its test in an entirely satisfactory manner.

This is the First of a Series of Articles Devoted Exclusively to Valves. The Author, a Well-known Valve Engineer, will Explore Every Aspect of this Vital Subject

Grid Emission

Grid emission is, as its name implies, a fault whereby the grid starts to emit electrons due to a rise in temperature. This fault usually appears between ten and thirty minutes after switching on, and causes a falling off of volume which increases rapidly when once started. In the detector stage it may reduce a set to complete silence; in the frequency changing stage it usually stops a set from functioning on a portion of one or other wavebands. In the output stage grid emission causes rapidly increasing distortion accompanied by some loss of volume. Generally speaking there is no cure, but sometimes a cure may be effected by increasing grid bias, decreasing screen voltage, or both, so that the grid does not reach a dangerous temperature under working conditions. Should the fault be present in more than one valve, the voltage across the heater or filament should be suspected of being excessive.

"Hot" Leak

This fault is almost entirely confined to mains valves, and takes the form of a leakage caused by particles between any two or more electrodes, which is only present after the valve has been working for some time and become heated up. The leak actually occurs along the top of the pinch, or along the supports at the top of the valve, and is sometimes difficult to detect as the valve may show a resistance of infinity when it is cold, and resistance between electrodes is extremely difficult to measure when the voltages are applied, thus the fault can only be detected by its effects on anode current, screen current, or by some change in characteristic current to the actual path of the leak. There is no cure for this available to the amateur, but the offending particles can sometimes be burnt off by an expert using high frequency currents applied between various combinations of valve pins.

Zero Screen Current

The normal average screen grid or H.F. pentode valve usually takes a screen current of anything between .2 and 3 milliamps, and by using a series resistance to feed the screen it is possible to break down the main H. T. voltage to the conventional 100 volts, but just now and again a valve that has worked satisfactorily perhaps for a year or more will, in its declining years, take less and less screen current until one day it takes none at all. The valve may be otherwise unaffected, and when tested will show a good slope and normal characteristics. If the testing instrument used has a potentiometer feed to the screen, the valve will have the prescribed 100 volts on the screen and pass the test with flying colours, but when placed back in a receiver with a series feed, will get the full H.T. voltage on the screen, which might be, say, 300 volts, and pass quite fantastic anode current capable of burning out the decoupled resistance, and generally behaving in a most puzzling manner.

The writer has before him at the moment of writing a screen-grid valve of well-known make which should pass 5 milliamps with 250 volts on the anode, 100 volts on the screen, and 1.5 volts grid bias, but when fed from a 300-volt H.T. supply through a series screen resistance and anode decoupling resistance, it passes 47 milliamps until it gets so hot that it must be switched off to prevent total collapse of the electrode assembly. The cure is obviously potentiometer feed to the screen, but where this is undesirable, the only cure is replacement.

EXPERIMENTAL L.F. AMPLIFIERS—*(Continued from previous page)*

factor, it may even be necessary to use a fraction of a volt difference on the grid side in order to obtain maximum results, and therefore, if an ordinary grid-bias battery is employed it is possible by the arrangement shown in Fig. 3 to obtain differences of .5 volt, and this should be borne in mind in this particular connection.

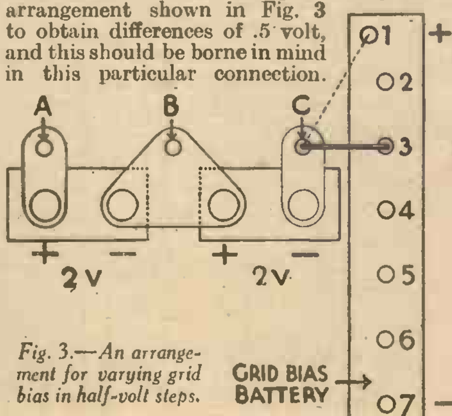

Fig. 3.—An arrangement for varying grid bias in half-volt steps.

For this purpose two 2-volt L.T. cells are used in addition to the 9-volt grid bias battery, and connecting points are made at A, B and C. The following table gives the voltages which may be obtained by this means, and the experimenter will no doubt find this hint of value also in other experiments he may wish to carry out. In order to obtain maximum results from this L.F. circuit, the bias batteries should not be employed at the same time for the H.F. stages, and therefore separate switching may be necessary in order to avoid the batteries from being discharged when the receiver is not in use.

B and 2 give	½ volt.	1 and 3 give	3 volts.
A ,, 1 ,,	1 volt.	B ,, 4 ,,	3½ volts.
1 ,, 2 ,,	1½ volts.	A ,, C ,,	4 volts.
A ,, B ,,	2 volts.	1 ,, 4 ,,	4½ volts.
A ,, 2 ,,	2½ volts.	B ,, 5 ,,	5 volts.

A and 4 give 5½ volts.

This may be continued up to the total of 9 volts delivered by the grid-bias battery, and if it is desired to go above this the lead from point C may be shifted to the positive socket of the grid battery, and additional voltages up to 13 will then become available. Do not use the screened type of valve for the L.F. stage mentioned, and the variable-mu type of valve should not be used—only the "straight" type, such as the MS/PEN in the mains class and the 210 SPT in the battery class.

On Your Wavelength

By Thermion

AS an old journalist I think, and I hope I may be allowed to say it with all modesty, that the history of this journal is without parallel in the annals of Fleet Street. When it was launched just over five years ago it was one of many competitors. It was the *last* in the field, but it still survives with all its old vigour, when others have disappeared, but it is interesting at this time of the year to look back upon those early issues and endeavour to perceive the reason why right from the start PRACTICAL WIRELESS leapt into the lead, and has kept there ever since.

It had been the custom prior to publication of this journal for designers to specify a vast number of alternatives for each item in the specification. There were probably excellent reasons for this, for if a reader could not obtain a part of one particular make, he could use another. Thus, instead of having to order the part he could proceed with the construction straight away.

This journal, however, based its policy on that of specifying only the parts which were used in the original receiver — no alternatives! The reason for this is that the Editor could not foresee how it was possible to guarantee results unless every permutation of an alternative specification was tried. In some of the sets described in contemporaries a certain selection of components would not have gone on the baseboard or chassis selected. In others the various parts attached to the panel could not have been fixed. In some cases the set could not have worked. The policy, then, was to experiment with the receiver in our laboratory, and once the performance had been standardised in accordance with the object in mind the blueprint was prepared. Thus, when a reader encountered difficulties it was possible to tell him exactly where he was wrong. Where postal advice did not remove the difficulty we could have the receiver here and test and adjust it according to the original standard. That policy alone, whilst it might have certain drawbacks, chiefly in connection with the obtaining of parts locally, placed this journal ahead of its competitors, as is proved by its consistently maintained sales.

We like the reader to feel that we are behind him with every set which he constructs from our pages. That brings me to the second point in our policy. We make no charge to regular readers for technical advice. I believe it was the policy of most papers to make a charge. When this journal started there was a paucity of literature for home construction. The Editor thereupon set about the task—almost Herculean—of producing a series of volumes to fill that omission. "The Wireless Constructor's Encyclopædia" alone has broken all records for the sale of technical books. It is the standard work in all English-speaking countries. Another feature which the readers have appreciated is the promptitude of our query service. I need say nothing of the high standard of quality of the editorial contents which have been maintained throughout. Now that we are alone in the amateur field, we shall continue to develop a policy which constructors have so much appreciated. There is a friendly atmosphere between readers, Editor and staff, and with the exception of the present writer they are known personally to some thousands of constructors. Busy though the Editor is, he has never failed to attend the Wireless Exhibition regularly for several hours a day with the one object of meeting his readers, listening to their difficulties, and chatting with them on radio generally. Personal contact is far better than correspondence. I have served either as a contributor or as a member of the staff of most of the technical journals. It has been a matter of reproach on the part of some readers that I have never disclosed my identity. I am a modest individual withal, and do not seek personal publicity. I express my views in all sincerity, even though some of you may not always agree with them. I hope it will be my privilege to continue to write for this journal during the long and useful career it has before it.

NEWNES' TELEVISION AND SHORT-WAVE HANDBOOK
2nd Edition
By F. J. CAMM
Price 3/6 or 4/- by post from the Publishing Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Songs You Might Never Have Heard

THE B.B.C. tells me that 11,189 listeners voted for the three songs which they liked best in the final programme of the series called "Songs You Might Never Have Heard." The most popular songs and the votes they obtained are as follow:

1. "Snowbird," 1,910.
2. "Bells at Eventide," 1,128.
3. "City of a Million Dreams," 1,079.

I hope the B.B.C. will now run a contest asking readers which three songs they *hate* most.

Are You Interested?

A GOOD SAMARITAN, W. E. F., of Sidcup, has some parts which he would like to dispose of to a club or other organisation. I should be glad to consider applications.

Many Thanks

MY thanks and reciprocal greetings to those many readers who have been kind enough to send me Christmas and New Year Cards. I received one from the Italian Broadcasting System and Station 2RO which said:

"A radio station in Rome,
'Cross the hills and the plains and the foam,
Sends you greetings galore,
Hopes you will tune in some more,
Whilst content in the glow of your home."

Exide Calendars and Diaries

IF one is blessed with a philosophical turn of mind, there is usually something to smile about in the most aggravating of human situations, and in the scrum of everyday life we are gradually developing a sense of appreciation for the humour behind our workaday existence, even if the laugh is against ourself.

Mr. Gilbert Wilkinson, the famous character artist, obviously enjoyed himself immensely while executing the Exide and Drydex Calendar commission. His twelve studies, humorous, whimsical, are unmistakably drawn by an artist who not only knows his types, but also possesses the rare quality of humorous sincerity. Each drawing is a story in itself.

Exide and Drydex advertising has been cut down to an absolute minimum, a point that will increase the intrinsic value of the Calendars. Exide Diaries for 1938 are also ready.

New Year Radio-dramas

LISTENERS who enjoy radio-dramas will be interested to know that several new plays specially written for the microphone are included in the radio-drama schedule from January to March, besides such classics as Shakespeare's "Hamlet," and six Experimental Hour programmes. Among the latter will be subjects as diverse as T. S. Eliot's "The Waste Land," which will be prepared and produced by D. G. Bridson and Felix Felton; a radio adaptation of Charles Swinburne's "Atalanta"; and "Saint Louis Blues," a programme by Irving Reis, of the Columbia Broadcasting Company of America.

Another play of outstanding importance will be a translation into vivid and dramatic English verse by Humbert Wolfe of Rostand's "Cyrano de Bergerac." Ernest Thesiger joins the ranks of radio-dramatists with a slight but amusing sketch, entitled "The Elixir of Count del Bosco." Other newcomers include E. Dunning Gribble with a fantasy entitled "Scarecrows"; J. A. la Bern with "Girl Missing"; and René Fauchois' "Nocturne," translated by Marianne Helweg. Norman Edwards has written a new social comedy with a surprising dénouement, which he has called "The Case of Lady Talond," and Eden Phillpotts will be represented by a radio-adaptation of "Jane's Legacy."

"The Count of Monte Cristo," perhaps Alexandre Dumas' most thrilling romance, will be heard as a serial throughout the present quarter. It has been adapted by Patrick Riddell, who will be remembered for his treatment of "Twenty Years After," "The Three Musketeers," "The Man in the Iron Mask" and "The Transmutation of Ling." Other authors who are represented include Patrick Hamilton, A. A. Milne, James Bridie, J. B. Priestley and G. K. Chesterton.

Impedance-matching Transformers

A READER recently erected a dipole aerial, to reduce interference which he was experiencing, and connected this to his receiver through ordinary twisted flex. He notices that interference is reduced, but signal strength is also down, and he wonders whether an impedance-matching transformer would help matters. The idea of the twisted feeder is that it will not pick up either signal or interference, and thus the aerial may be erected in a place clear of interference. If, however, the feeder is of any great length, there will be a loss of signal strength compared with an ordinary aerial and lead-in of the same length, and the effect is just the same as reducing the aerial. An impedance-matching transformer will, however, overcome the losses introduced by a long feeder—either of the twisted or the screened type.

Quality Alterations

SEVERAL instances have occurred recently where readers have endeavoured to modify one of our designs in order to obtain higher quality, but have met with failure. They have obtained, perhaps, new L.F. transformers, or higher efficiency output valves, but after fitting them have been unable to detect any difference. It should be emphasised that when a design is published, a certain type of loudspeaker is recommended, and the general L.F. design of the receiver is adjusted to a certain standard. Therefore, to improve upon this, it is not always just a matter of altering the L.F. components. The loudspeaker, for instance, may not be suitable for giving any improvement in the higher frequencies, and thus although the circuit alteration may result in an increased top-note response it may not be delivered by the speaker and it may be necessary to add a tweeter in order to hear the improvement. Similarly, a new output valve or valves may be fitted and take more current than can be provided by the battery or mains unit and this will also account for failure.

Trimming Condensers

THE experimenter often finds that he needs a very small variable condenser—either for balancing out some stray capacity or for some similar purpose during experimental work. When small trimmers or padding condensers are not readily available it should not be forgotten that two pennies or two halfpennies make a very convenient condenser of the type required. A wire may be soldered with the smallest spot of solder to the centre.

Radio in the Bush

THE interesting manner in which radio has been brought into use in the outback district of Australia in order to assist isolated settlers is vividly described in an Australian radio magazine which I have just had passed to me. Most of us have heard something about the Flying Doctor and the sterling service which he and his associates are rendering in bringing to the lonely settlers of the outback the medical comfort and assistance which, by reason of their extreme isolation, they were previously denied. We have heard, also, in a vague sort of way, of hazardous journeys made over hundreds of miles to bring in some badly injured station-hand or stockman to the nearest aerial medical base—where, in the nick of time, a speedy operation has saved his life.

Actually, the Flying Doctor service is no mushroom growth, but is the outcome of some twenty years of gradual and painstaking development.

The prime mover, of course, was the Rev. John Flynn, of the Australian Inland Mission, a man of rare vision, whose practical experience of the dangers, the discomforts, and the utter loneliness of the real outback led to the realisation that many lives were lost unnecessarily because the scenes of accident or illness were hundreds of miles, and many weeks of travel, from the nearest medical aid.

A South Australian engineer, Mr. A. H. Traegar, devised a pedal "transceiver," consisting of a small combined transmitting and receiving set operated by power obtained from a pedal-driven generator.

To-day there are about 120 pedal "transceivers" in use in Australia. They are small, they cost only £75, and every one of them is equipped throughout with Philips valves.

To operate them, and a child can do it, one simply pedals and speaks, and thus, through the magic aid of radio, men and women of the outback can instantly summon the Flying Doctor's aid in times of sickness or accident—or pedal and gossip with their neighbours over a backyard fence that is anything up to a hundred miles away.

Tour the World With an N.T.S. D.X. SHORT-WAVE SET

Japan, China, India, Spain, America and Africa. Listen-in now to the thrilling broadcasts from all these places. Remember—a specially designed N.T.S. Shortwaver guarantees you world-wide reception. BUY NOW WHILE PRICES ARE AT THEIR PRESENT LOW LEVEL.

OVER 75,000 N.T.S. D.X. RECEIVERS IN USE THROUGHOUT THE WORLD

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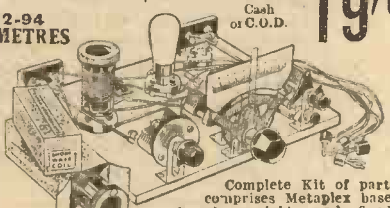
LIST PRICE 35/- BARGAIN 19/6 Cash or C.O.D.

12-94 METRES



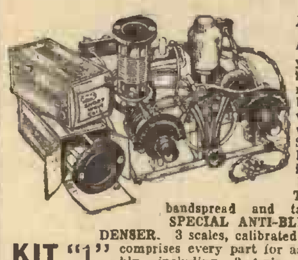
Complete Kit of parts comprises Metaplex baseboard, variable and fixed condensers, switch, valve-and coil-holders. H.F. choke, terminals, slow-motion drive, 3 short-wave coils, connecting wire, and FULL WIRING DIAGRAM. Less valve. Cash or C.O.D. Carriage Paid 19/6, or 2/6 down and 8 monthly payments of 2/6. OR with matched valve and pair headphones. Cash 27/6, or 2/6 down.

2/6 DOWN

"3-in-1" SHORT-WAVE KIT

RECEIVER — ADAPTOR — CONVERTER

List Value 37/6 BARGAIN 25/-



12-94 metres. ADAPTS or converts your battery set for short-wave reception, or may be used as one-valve Short-wave Receiver. Slow - motion bandspread tuning SIMPLIFIES WORLD RECEPTION! Air-spaced bandspread and tank condensers. SPECIAL ANTI-BLIND SPOT CONDENSER. 3 scales, calibrated.

KIT "1" comprises every part for assembly, including 3 4-pin coils, wiring and assembly instructions, less valve only. Cash or C.O.D. Carr. Pd. 25/-, or 2/6 down and 10 monthly payments 2/6.

Kit "2." With 2-volt valve £1/8/9, or 2/6 down and 11 monthly payments 2/9.

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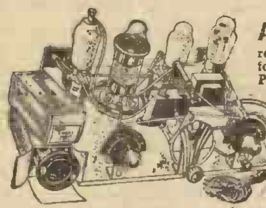
New 4-valve BANDSPREAD Battery SHORT-WAVE KIT

List Value £4:9:6 BARGAIN 42/-



APERIODIC H.F. reacting detector, resistance and transformer L.F. Stages, Pentode Output. Slow-motion bandspread tuning SIMPLIFIES WORLD RECEPTION! Efficient low-loss reaction condenser. Air-spaced bandspread and tank condensers. SPECIAL ANTI-BLIND SPOT CONDENSER. 3 scales calibrated.

KIT "1" comprises every part for assembly including 3-pin coils, wiring and assembly instructions, less valves only. Cash or C.O.D. Carr. Pd. 42/-, or 2/6 down and 11 monthly payments of 4/-. KIT "2," with 4 British Valves, £3/9/0, or 5/- down and 11 monthly payments of 6/6.

2/6 DOWN

2-valve BANDSPREAD S.W. KIT

List Value 59/6 BARGAIN 32/6

ANOTHER amazingly efficient world-wide kit incorporating slow-motion bandspread tuning. Covers 12-94 metres.

KIT "1" comprises every part for assembly, including 3 4-pin coils wiring and assembly instructions, less valves only. Cash or C.O.D. Carr. Pd. 32/6, or 2/6 down and 11 monthly payments 3/-.

KIT "2" with 2 British valves, £2/1/9, or 4/- down and 11 monthly payments 3/10.

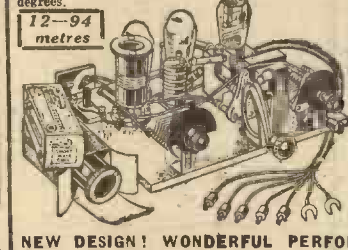
2/6 DOWN

New 3-valve BANDSPREAD SHORT-WAVE KIT

LIST VALUE £3 BARGAIN 37/6

● Det. and 2 L.F. Aperiodic Aerial Circuit Pentode Output. ● Slow-motion bandspread tuning SIMPLIFIES WORLD RECEPTION. ● Efficient reaction condenser. ● Air-spaced bandspread and tank condensers. ● SPECIAL ANTI-BLIND SPOT CONDENSER. ● 3 SCALES calibrated in degrees.

12—94 metres



2/6 DOWN and 11 monthly payments of 3/6

Each kit complete with drawing and instructions.

NEW DESIGN! WONDERFUL PERFORMANCE

The latest Bandspread world-wide tuning system incorporated into an ultra-modern aperiodic aerial short-wave circuit . . . . and this amazing kit is yours at almost half the list value!

KIT "1" comprises every part for assembly, including 3 6-pin coils, wiring and assembly instructions, less valves only. Cash or C.O.D. 37/6, or 2/6 down and 11 monthly payments 3/6.

KIT "2." With 3 British valves, £2/15/0, or 12 monthly payments 5/-.

SHORT-WAVE COILS

These highly efficient coils are wound on a former of low loss material and supplied with 4- or 6-pin bases having 2 and 3 windings respectively.

4 PIN TYPE.

9-14, 12-26, 22-47, 41-94 metres. List 2/9. Bargain 1/9 each. 76-170 metres: List 3/-. Bargain 2/- each. 150-325 metres: List 3/3. Bargain 2/3. 260-510 metres: List 3/6. Bargain 2/6. 490-1,000 metres: List 3/9. Bargain 2/9. 1,000-2,000 metres: List 4/-. Bargain 3/-.

6-PIN TYPE.

9-14, 12-26 metres: List 3/3. Bargain 2/- each. 22-47, 41-94 metres: List 3/6. Bargain 2/- each. 76-170 metres: List 3/9. Bargain 2/9. 150-325, 260-510 metres: List 4/- Bargain 3/- each. 490-1,000 metres: List 4/6. Bargain 3/6. 1,000-2,000 metres List 5/-. Bargain, 3/9. Postage extra.

FROM 1/9 EACH

Short-Wave Tuning and Band-Spreading Condensers. All brass single-end, suitable for ganging. .000025-mfd., 2/6; .000045, 2/8; .00016, 3/6; .0002 (double-end), 3/6.
RESISTORS, Erie, all standard values, ½ and ¼-watt, 4d., 3/6 doz. 1-watt, 5d., 4/6 doz. 2-watt, 8d., 6/6 doz. 3-watt, 9d., 8/- doz.
VOLUME CONTROLS. POTENTIOMETERS. Well-known makes, all values up to 1-meg., 2/-; with switch, 2/6. Varley Power type, 25 watts, all values, 500-3,000 ohms, 3/-.
TRICKLE CHARGER. 2-v. ½-amp., metal rectifier, 10/6.

SPECIAL OFFER!

New light-weight super-type HEADPHONES, recommended for short-wave work and testing. List Value 15/-. BARGAIN 3/6 Postage 6d. extra.

VALVES.—Give your set a tonic and fit new valves. Huge purchases enable us to supply at greatly reduced prices. Long and efficient service guaranteed. Battery, Det., L.F., and H.F., 2/9; S.G., V.M., Class "B" H.F., and L.F. Pentodes, 6/-. Mains Types, A.C., H.L., 5/-. All A.C., S.G., V.S., Pentodes and H.F. Pentodes, 7/-. Octodes and Hexodes, 9/-. Directly heated F.W. rectifiers, 350-0-350, 120 m.a., 5/-, postage extra.

AMERICAN VALVES. Over 150 types in Stock. Glass, Metal and Octal from 3/-. Send list of requirements for quotation by return.

N.T.S. MAINS UNITS

Tapped for SCREEN, DET. and POWER. Output 25 m.a. at 150 volts.

A.C. MODEL Cash or C.O.D.	32/6
D.C. MODEL Cash or C.O.D.	19/6
A.C. MODEL Tappings and output as above but with 2 volt ½ amp Trickle Charger ..	39/6

FREE! N.T.S. General Bargain Lists. N.T.S. Short-Wave Bargain Catalogue describing 5 Amazing New N.T.S. Bargain Short-Wave Kits. Each packed with information and wonderful opportunities.

AMAZING BARGAINS

5-v. A.C. S/HET RADIOGRAM

RECEIVES with wonderful purity of tone, volume and selectivity English and Foreign Programmes between 200-2,000 metres. REPRODUCES with remarkable fidelity and tonal quality 10inch or 12inch records.

LIST PRICE £28 : 7 : 0

BARGAIN PRICE £10:10:0

SPECIFICATION of this marvellous instrument includes a 5-valve A.C. Superhet receiver chassis. 3 watts undistorted output. Latest design 2 band circuit comprising frequency changer, I.F. Amplifier, double diode triode for A.V.C. 2nd Detection and 1st L.F. Amplification, Hi-slope output pentode valves. Combined on-off Volume Control and Wavechange switch. Special clock-face tuning dial. Separate tone control. 3-gang condenser. Screened coils. Mains energised speaker. For A.C. Mains 200-250 volts. 50 cycles. GARRARD Model A.C.4 GRAMOPHONE MOTOR with special tracking device. Automatic start and stop. GARRARD PICK-UP. A beautiful walnut cabinet of tasteful modern design houses this self-contained instrument. A lift-up lid with special stays for retaining at the open position gives easy access to all controls. Overall dimensions 3 ft. high, 2 ft. 8 ins. wide, 16 ins. deep.

Cash or C.O.D. Carriage Paid £10/10/0 or 12/6 Deposit and 18 monthly payments of 13/-.

OR with Garrard Automatic Record Changer 17 Gns. Cash, or 19/6 down and 18 monthly payments of 21/9.

WONDERFUL BATTERY S.G.3 OFFER

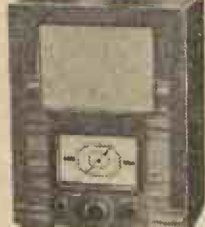
LIST VALUE £6 : 6 : 0 BARGAIN 52/6

Calibrated 200-2,000 metres,

Deposit 5/- and 12 monthly payments of 5/-. Efficient S.G. Det. Pentode Output Circuit. Only 9 m/a H.T. Consumption Concert-Grand Moving Coil Speaker. In beautiful Walnut Cabinet illustrated, or Upright type to choice. State which when ordering. Less batteries. Ready to Play. Chassis only (10ins. x 7½ins. x 8ins. high) with valves, 39/6 or 2/6 down and 12 payments of 3/9. Chasssis, less valves, 19/6. Cash or C.O.D

K.B. RECEIVERS

OFFERED AT ONE-THIRD LIST PRICES. LIMITED STOCK ONLY. ORDER IMMEDIATELY. Shop-soiled only, these sets are offered in thorough working order and ready for immediate use. All models are housed in beautiful upright walnut cabinets and represent unique value for money which will be instantly appreciated by callers. The ideal set for everyday use or in that spare room. Order with confidence.



K. B. MODEL 429. Efficient circuit utilises H.F. Amplifier detector and output pentode valves. K.B. "Foto-tune" dial Wave-range, 200/2,000 metres. Highflex moving-coil speaker. Wonderful volume and selectivity. Provision for pick-up. Less batteries. Housed in walnut cabinet. Overall dimensions. 17½" high, 13¾" wide, 9½" deep.

LIST PRICE £8 : 18 : 6 BARGAIN £2 : 19 : 6 Cash or C.O.D.

or 5/- down and 12 monthly payments of 5/9.

K.B. MODEL 437. Battery Screened Grid 3. Similiar to Model 429 but with Triode Power Output Moving coil speaker. Wave-range, 200/2,000 metres. Special features provide excellent reception of many British and Continental stations. Beautiful walnut cabinet. Less batteries.

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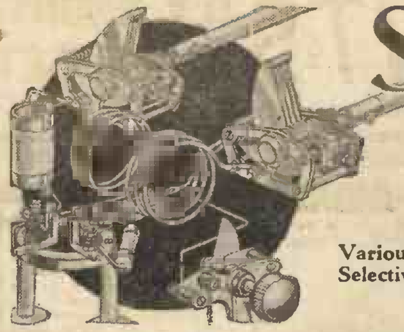


Short Wave Section

SIGNAL READABILITY

Various Circuit Arrangements for Increasing the Selectivity of Short-wave Receivers are Given in this Article by S. C. CLARK.

THERE are many short-wave enthusiasts who are now using American communication-type receivers. The chief reason for this is the ability of these sets to make signals readable under practically any condition. It is, of course, to the amateur transmitter that the communication receiver makes its greatest appeal, though no doubt there must be many short-wave listeners who, at some time or other, have wanted to get a short-wave broadcast station sufficiently clear of interference to obtain a readable signal irrespective of the quality.

The communication receiver's greatest asset is its inherent selectivity, or putting it another way, the ability to discriminate between the desired signal and all forms of interference. Towards this end the I.F. filter is used, and, more important still, the "crystal gate." Fig. 1 shows the principle of the I.F. filter, in which two circuits in a superheterodyne receiver are coupled together by means of a filter designed to pass a certain band of frequencies. But when a quartz crystal is used the filter in actual practice becomes more complex, also the band of frequencies it is desired to pass has to be made variable for different conditions.

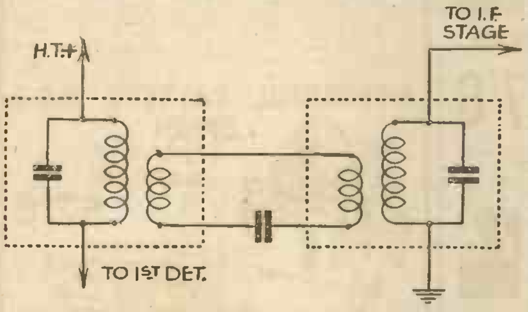


Fig. 1.—Circuit showing the principle of an I.F. filter coupling the first detector to the I.F. stage of a superhet.

It will be understood that the high selectivity of a communication-type receiver reduces the overall frequency response from the loudspeaker, so that the frequency range is just sufficient for intelligibility. This feature naturally makes these sets somewhat costly and, in a great many cases, beyond the reach of the average experimenter. It is possible to add a crystal gate or I.F. filter to an existing short-wave receiver, but this is not always desirable, particularly if the set is not always used for amateur reception; also it would be necessary for the set to be a superheterodyne.

Restricting the Frequency Range

The problem of better signal readability can be tackled from the speaker end of the receiver, by deliberately restricting the frequency range of the loudspeaker and its associated output transformer. Here it is necessary to consider for a moment the types of interference that appear when listening, say, to American amateur 'phone stations in the 20-metre band. Heterodyning by other stations on adjacent channels causes the most trouble, of course, also a high "mush" level, and car ignition interference can do a lot to reduce the readability of the signal. If there is a tone control on the set this may help a little, but it seldom makes a signal more readable, and this particularly on the American voices, which, for some reason, are lower pitched than our own.

It is therefore necessary to cut off the bass end of the frequency response, as well as the top, to give a balanced tonal output. The circuit of Fig. 2 indicates how this can be done. A series capacity is introduced between the secondary of the output transformer and the loudspeaker. By way of interest, it may be noted that the secondary of the transformer, and the speaker, form a filter circuit similar to that of Fig. 1.

This filter circuit is of low impedance in the case of the majority of moving-coil speakers, so that the condenser C can be of a comparatively large capacity. Two microfarads will give the effect of a very sharp bass cut off. In the same way the condenser across the primary of the output transformer will cut off the top, restoring the balance again, only over a smaller frequency range.

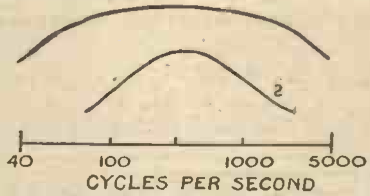


Fig. 3.—Showing what happens to speaker response when frequency range is restricted.

The switch S should be a single-pole double-ended Q.M.B. switch. One pair of contacts being wired across the condenser C and the other pair in series with the condenser C1 across the primary of the transformer. So that, with the switch in one position, capacity C is short circuited, with C1 left open, giving full speaker range, and in the other position C is put into circuit with C1 shorted across the primary, giving a restricted frequency response.

Condenser Values

The values given in the circuit diagram will be found suitable in a great many cases, but it must be remembered that various speaker impedances together with the overall frequency response will require different values of capacity, therefore it is well worth while carrying out a little experiment in this direction. The value for condenser C should not be less than 1 microfarad, and not more than 8 microfarads, while C1 may be varied between .001 and .25 of a microfarad. Again, the values depend upon just how much it is desired to "cramp" the frequency response. Fig. 3 makes the meaning of this perfectly clear. Curve 1 shows roughly the speaker output response (minus individual resonances), while curve 2 shows what happens when the condensers are put into circuit.

Amateurs who may be interested in experimenting with the frequency response of a receiver in the above manner will find, in actual practice, that extreme values in series and shunt capacity have to be used before the speech becomes in any way distorted. Also, when switching from full to restricted speaker range, there is a considerable drop in the output amplification

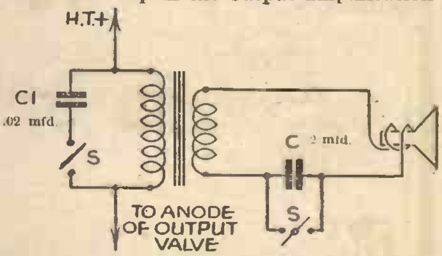


Fig. 2.—Circuit for restricting frequency range to improve signal to interference ratio.

Where a speaker is very well baffled this will appear worse than it really is, as it is the higher and lower frequencies which give the "sensation" of loudness. This is not a great drawback, as most receivers have sufficient amplification in hand to draw on. The main point is that "mush," heterodynes, car ignition, and static noises generally, are reduced in ratio to the signal, giving better readibility.

Peaked Amplification

When switching over to the restricted response it may be found worth while to slightly retune the received signal, as it will be understood that the receiver output is peaking over a limited band of frequencies, hence the advantage will be apparent in tuning the input to that part of the resonance curve. Some of the more experienced experimenters will know that peaked amplification was popular in America some years ago, but the peaking was brought about in the audio stages of the receiver, and on one particular frequency for morse telegraphy reception. The frequency range can be modified in the receiver L.F. stages, but many short-wave enthusiasts will not want to alter the "innards" of the set. In the scheme outlined above, the speaker and its transformer are usually easy to get at. The same thing applies to commercial receivers of the all-wave variety, when used for the reception of amateur stations, or for that matter in the overcrowded 19-

(Continued on page 484)

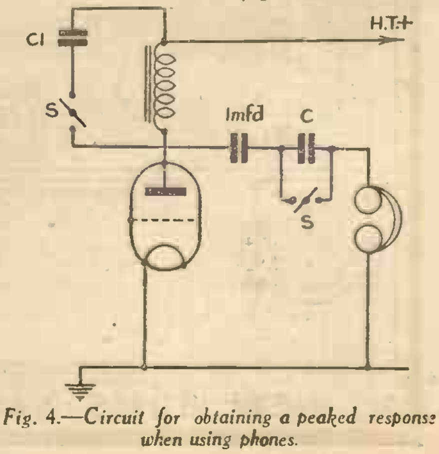


Fig. 4.—Circuit for obtaining a peaked response when using phones.

A PAGE OF PRACTICAL HINTS

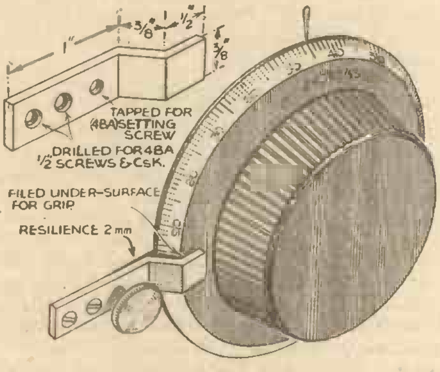
READERS WRINKLES

SUBMIT YOUR IDEA

THE HALF-GUINEA PAGE

A Simple Dial-locking Device

IN frequency monitors, oscillators, and similar instruments it is often necessary to retain a certain reading by locking the dial at that setting, and having had occasion to do this with my own oscillator, I made the simple device illustrated in the accompanying sketches.



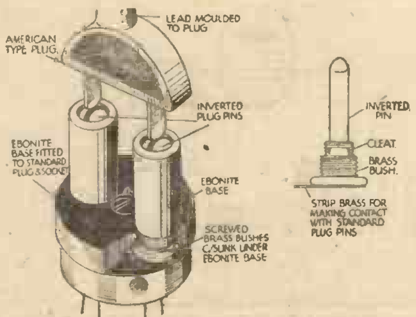
An effective dial-locking device.

The knob in use is a large one, permitting exacting adjustment, and has a diameter of 4in.; thus I had plenty of room for the fitment, which is detailed in the inset drawing. The locking screw, which I found in the junk box, was originally part of a pair of earphones. It answered the purpose well and, as will be seen, the resilience I allowed was 2 millimetres, this being ample for the locking and clearing movement. The brass locking-bar must, of course, be tapped to take the locking screw, the end of which presses against the face of the panel. Extra binding is attained by filing the under-surface as indicated in the sketch.—N. S. MARTIN (Manchester).

Adaptor for American Plugs

AMERICAN plugs can easily be adapted for standard plugs and sockets, as shown in the accompanying sketches. By inverting the pins of some large plugs, and screwing the cleat into a brass bush at the bottom, an adaptor of great efficiency is made.

The flat pins of the American plugs fit, and are lightly clamped in the split jaws of the inverted pins when pushed into position. The fitment is attached to the standard plug by means of a screw passing right through the adaptor base, the plug contact being made by a small piece of strip brass attached to the brass bush shown in the smaller sketch.—T. GURNEY (Leeds).



Adapting American plugs for standard plugs and sockets.

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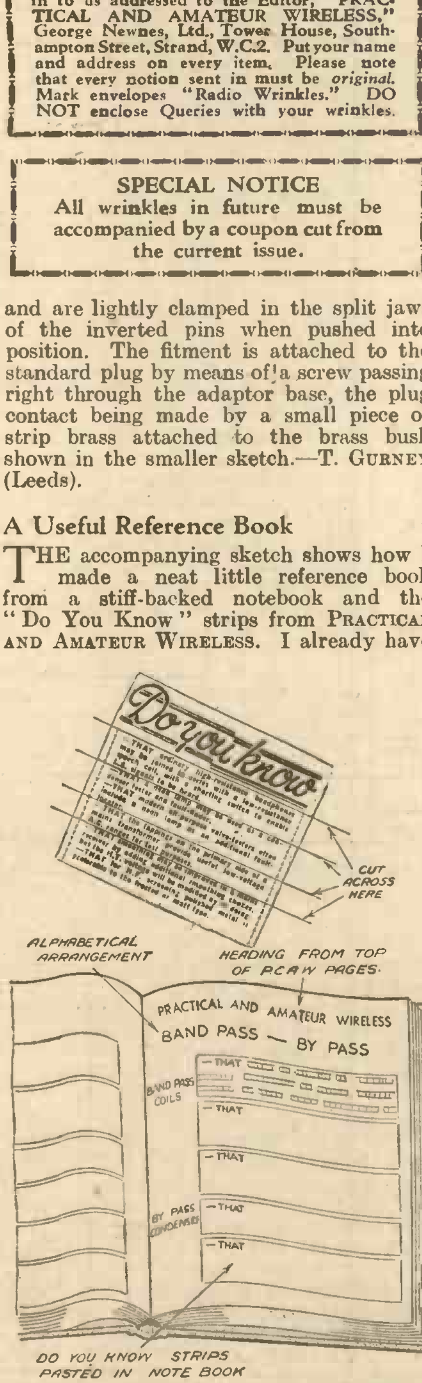
A Useful Reference Book

THE accompanying sketch shows how I made a neat little reference book from a stiff-backed notebook and the "Do You Know" strips from PRACTICAL AND AMATEUR WIRELESS. I already have two such books and would emphasise the fact that they are gold mines of information. Whether it's "A.V.C." or "Condenser Capacities," or "Aerial Insulators," these little books supply the information right away.—F. L. NEWALL (Liverpool).

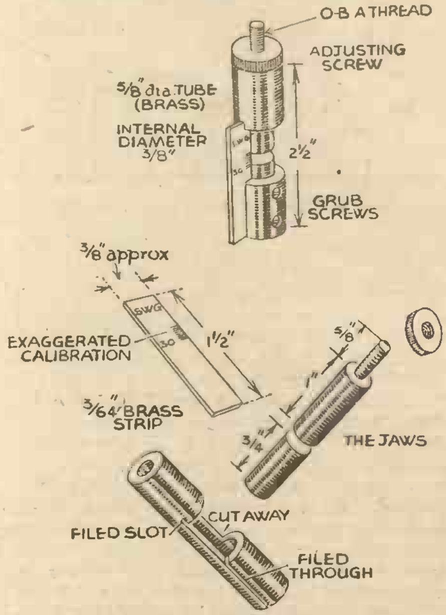


A useful reference book compiled from strips cut from our "Do You Know" panel.

A Handy Wire Gauge

MANY times I have been handicapped by not having handy a micrometer for checking the gauge of various pieces of wire, so I decided to design a simple makeshift micrometer which would give a fair degree of accuracy. The sketches show how the gauge is made.

The calibrations shown are for 30-16 s.w. gauge bare copper wire measurements, and to prevent confusion I have provided myself with three models giving the most useful range of gauges in bare copper, enamelled, and cotton-covered wire. The designations were scratched on to the calibration strip, using a steel rule for accuracy, and filling in with Indian ink. The adjustment is made by preventing the 0-BA screw from turning by pressure of the thumb, turning the adjusting screw until slight resistance of the wire is "sensed" or "felt." This may be improved by a "pin and slot" action, but this is optional.—A. E. J. WATTS (Edinburgh).



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Systematic Fault Finding—1

In this First Article of a New Series, the H.F. Stage, General Testing Methods and Valves are Dealt With

THERE must be many constructors who have a range of testing instruments at their disposal (several having been described in our columns), and the purpose of this series of articles is to instruct constructors in the use of these instruments in order to enable them to undertake the most difficult service work and locate very obscure faults.

The instruments necessary for this class of work are a combined meter reading D.C. volts and amps., A.C. volts and ohms (or separate meters may, of course, be used),

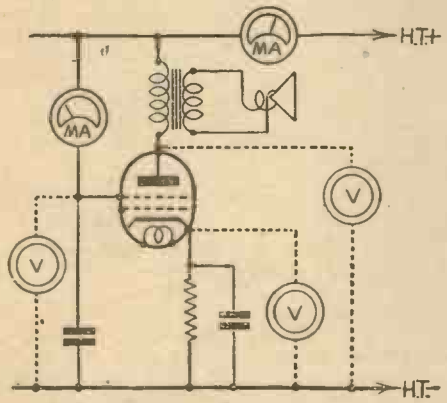


Fig. 1.—Testing a mains output pentode.

and, if possible, a modulated H.F. oscillator with one range of audio-frequency output. Suitable instruments would be the Ferranti A.C./D.C. test set, and the Wearite modulated oscillator. A suitable R.F. oscillator was described in our issue of March 14th, 1936.

In the first place, a great deal can be done by common sense and intelligent deduction. For instance, if one of the valves refuses to warm up, it is no good suspecting that the receiver is improperly ganged. It is obvious that either that particular valve is faulty, or else that there is a fault in the heater circuit. Always make your tests systematically—never in a haphazard manner, for the whole secret of quick and successful location of a fault is in the isolation of that particular portion of the receiver in which the fault has been developed.

Methods of Testing

The method is to ascertain that each stage of the set is working correctly, and this is usually best done by working from the loudspeaker, and gradually working towards the aerial. The various methods of testing each stage in a receiver will be dealt with in turn.

The first test to be made is to see that all the valves are working in a satisfactory manner, and this consists of measuring the H.T., L.T. and G.B. volts, and the anode and screen current. In Fig. 1 is shown a mains output pentode valve, and the first thing to do is to measure the volts on the anode, screen, and cathode by connecting a volt meter in the positions shown by "V," making sure, of course, that the meter is set to an appropriate range in each case. A milliammeter (again set to an appropriate range) is then connected in the positions marked "mA." The results thus obtained can then be compared with the valve-maker's published data. A rough indication of the current taken by various classes of valve is given in the table, but these figures are only intended as a rough guide. If the current taken by the valve is well below the rated value, then the valve has lost its emission and the cause of the faulty reproduction is obvious. If the current is high it is well to look for a broken bias resistor or a leaky by-pass condenser.

With a mains valve, there is little need to measure the heater volts. That these are correct will be obvious from the way the valve warms up. In Fig. 2 is shown a variable-mu H.F. battery pentode, showing how the voltmeter and milliammeter are connected when taking measurements. Note the voltmeter across the filament for measurement of the L.T. volts. The volume control should be set at maximum in the first instance, and the change in

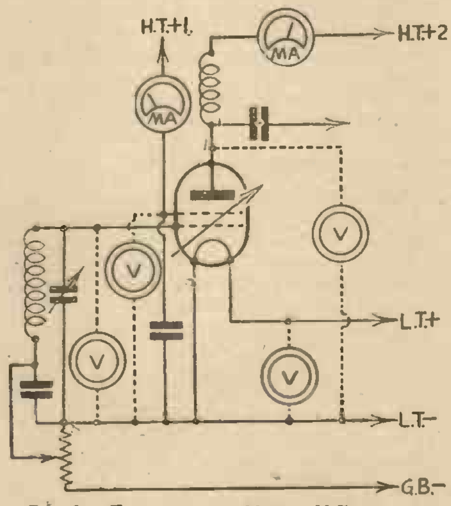


Fig. 2.—Testing a variable-mu H.F. pentode or screen-grid valve.

anode current noted as the control is rotated to increase the bias. Incidentally, this is a good opportunity to test the volume control. If there are sudden changes in the anode current, then the control is faulty. Perhaps it does not make correct contact at certain points, but these will be shown up when the above tests are carried out.

When testing valves it is always advisable to connect the test prod on to the actual valve leg and not, as when measuring, say, the screen volts in Fig. 2, on to the battery or the by-pass condenser.

If in either of the above hypothetical cases no volts were available at any one of the points indicated, then the cause of the trouble is obvious, and that particular H.T. line should be tested backwards to the source until the faulty component is located. In Fig. 1, for example, suppose no volts were obtained on the anode of the valve. The voltmeter should then be transferred to the other side of the output transformer and so on right back to the actual rectifier. If the volts are low, and the current normal, it is probably a faulty resistance or a broken-down by-pass condenser, and these components should be tested as described in a later section of this series.

Locating the Faulty Stage

We will assume that all the valves in the receiver have been tested and found approximately correct and yet the fault, whatever it is, still remains. To discuss generally the methods to be adopted is a matter of some difficulty. In fact, it might be said that every service job has to be tackled in a different manner. The first thing to do, however, is to locate the stage in which the fault has developed.

If a pick-up is available, it should be connected to the grid of the output valve, through a condenser to the anode terminal of the intervalve transformer and finally to the grid of the detector valve. If results are satisfactory right up to the latter point, then the fault must be in the H.F. stage. Supposing results are obtained when the pick-up is connected to the grid of the output valve, but not when connected to the primary of the intervalve transformer. The obvious thing is to test the transformer for continuity of the windings. If there is a break, it will most probably be at the actual connection of the winding to the terminals and if so is easily repairable.

A better method is to use an audio-frequency oscillator and an output meter. If the output of the oscillator is known in microvolts, then the output as registered on the meter can be checked by calculation from the stage gain of each stage. This method not only allows a service engineer to locate a fault in the output stages,

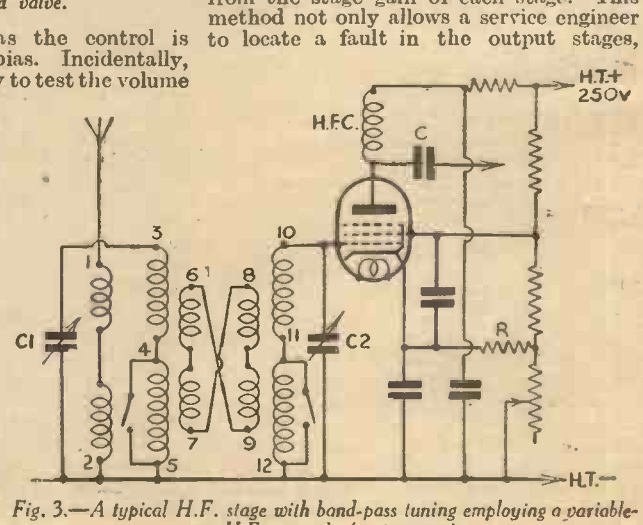


Fig. 3.—A typical H.F. stage with band-pass tuning employing a variable-mu H.F. pentode (mains type).

but, of course, also gives him a definite check on the performance.

Having definitely located the fault in the H.F. stage, we can proceed to test the various components more fully. A typical circuit is shown in Fig. 3, where a band-pass tuning unit precedes the H.F. valve which is choke-capacity-coupled to the detector stage.

We will assume that H.T. volts, anode current, etc., have been tested, and that the valve has been proved to be in efficient order. If not, these tests must be carried out straight away. There are now four faults which may be encountered :—

(a) The circuit may not work at all.
(b) The circuit may work on one waveband only.
(c) The performance may not be up to standard.
(d) The H.F. stage is unstable.

(*a*) *The circuit does not work.*

The first thing to do is to make sure that the aerial and earth are connected. On one occasion the author was called in to service a receiver which gave good reproduction on gramophone but no results on radio, only to find, after, it must be admitted, spending some considerable time trying to locate a mythical fault, that the aerial was not connected. Needless to say, this only occurred once. It is now the first thing he looks for.

Next switch off the set, and search for a broken connection or a faulty joint, clean up the valve legs, and test the coil, connections between the valve legs, and valve-holder, etc.

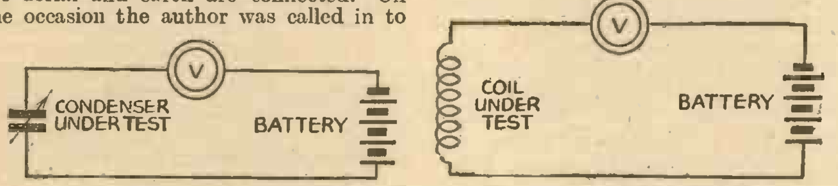
Connect the ohmmeter across terminals 1 and 2, 3 and 4, 5 and 6, 6 and 7, 8 and 9, 10 and 11, 11 and 12, in turn, and measure the resistance of the various windings comprising the band-pass coil assembly. The following approximate readings should be obtained, although various makes of coil vary considerably :—

		ohms.
1 and 2	Aerial coupling ..	0.5-4.5
3 and 4	Band-pass coupling	Very low
5 and 6	Medium-wave tuning	2.5-4.5
6 and 7	Long-wave tuning ..	15.0-30.0
8 and 9	Band-pass coupling ..	Very low
10 and 11	Medium-wave tuning	2.5-4.5
11 and 12	Long-wave tuning ..	15.0-30.0

Failing the use of an ohmmeter, an L.T. accumulator and a low reading voltmeter should be connected in series with each winding in turn, as shown in Fig. 5. This is simply a continuity test, and cannot always be relied upon as a winding could be completely shorted due to insulation breakdown. Even so, the voltmeter would read O.K., and the coil would be taken as being in order, whereas an ohmmeter would show zero resistance, thus indicating the fault.

The tuning condensers C.1 and C.2 should be tested for shorts by applying a voltage across the plates and connecting a voltmeter in series. Rotation of the vanes would indicate whether or not shorts occurred as a momentary reading of the voltmeter would be obtained. Also test the trimmer condensers for shorts to the moving plates. This is a fairly common fault, especially where considerable time has been spent in trimming a receiver. The connections for testing a condenser are shown in Fig. 4. The cause of the trouble is not likely to be mismatching of the various sections of the gang condenser, and we would emphasise at this point that no attempt should be made to bend the end segments of the sections as these are set by the makers to match up. Strictly speaking, if a condenser is found to be faulty, it is better to return it to the makers, who have the necessary apparatus to ensure that the sections are correctly matched after repairs.

Now switch on the set and connect the aerial to terminal 10 (*i.e.*, direct on to the grid of the H.F. valve), and then to terminals 8, 3, 5, and 1 in turn. Signals received at one of these points would soon indicate the particular section at fault. If, for instance, terminal No. 3 (and, therefore, 10 6, and 8) gave satisfactory results, whereas no signals could be received with the aerial connected to terminal No. 1, and yet the coupling coil had been proved in order by an ohmmeter or continuity test, it would be safe to assume that the coupling was much too weak or that the coupling coil was connected the wrong way round. The remedy is obvious.



Figs. 4 and 5.—Circuit diagrams for testing a condenser, and a coil, respectively.

The wave-change switches are liable to give trouble due to high-frequency contact resistance which cannot be measured by an ohmmeter. In fact, wave-change switches and volume control rank by far the highest in the list of faulty components, probably because they receive much more rough treatment. The only remedy is to clean all the contacts of the switch with very fine emery cloth. Test also for shorts between the various arms of the switch.

Another cause of no signals is likely to be a short to earth through screening, especially in the valve anode or grid leads. Make sure that no components, such as metallised resistances, are touching the chassis if a metal one is in use.

(b) *The circuit works on one wave-band.*

This is probably due to a broken coil winding, but more probably to a wave-change switch. Test as explained above. Sometimes, however, only one aerial coupling is used for both wavebands so that, although the coil is suitable for one range, it does not suit the other. Such a fault, however, would probably allow of some signal strength, although in severe cases it may result in entire absence of signals.

(c) *Performance is not up to standard.*

This is the most difficult type of fault to locate, and may be due to many things. Assuming that the L.F. and detector stages and the H.F. valve itself have been tested and found up to standard, there are still a number of components associated with the H.F. stage which can introduce severe high-frequency losses. Chief of these are condensers. Never use a bakelite dielectric tuning condenser for example, and always use mica dielectric grid condensers. The losses in a bakelite dielectric condenser are very high and make it entirely unsuitable for H.F. tuning. Similar H.F. losses occur in valve-holders where the insulation is low. Another fruitful source of low stage gain in the H.F. stage is a faulty H.F. choke and coupling condenser (HFC and C in Fig 3). If the H.F. choke is of an inefficient type, then the amplification of the stage will be reduced, since the low impedance to H.F. currents will allow some of them to pass into the H.T. circuits, and only a small proportion of the total available amplification will be developed. A faulty H.F. choke, however, is usually shown up by low-frequency growling, and distortion as the volume control is increased, due to H.F. currents getting into the L.F. stages. Larger values of condenser C may be tried, but this may result in loss in selectivity.

Details for checking chokes, condensers, etc., will be given in a later section.

Check for correct coupling between the aerial and the tuned circuit as explained in section (a).

If selectivity is poor it may be that the aerial is too long, or that it does not suit the coupling coil. The inclusion of a small, fixed condenser (.0001-.0003 mfd.) in the aerial lead will usually improve this.

(d) *The H.F. stage is unstable.*

Provided the circuits are efficiently screened, instability should not arise, as the effects of stray coupling would be removed. A fruitful source of coupling, however, is the anode, screen, and cathode by-pass condensers. These should be of about 0.1 to 0.5 mfd. capacity, and of the non-inductive type. Of these condensers, the screen by-pass usually gives the most trouble and ordinary 1 or 2 mfd. paper condensers should not be used at this point, but substituted by the non-inductive type if instability is encountered. Note that it is preferable to connect the screen by-pass condenser to the cathode and not earth, in many cases.

(*To be continued*)

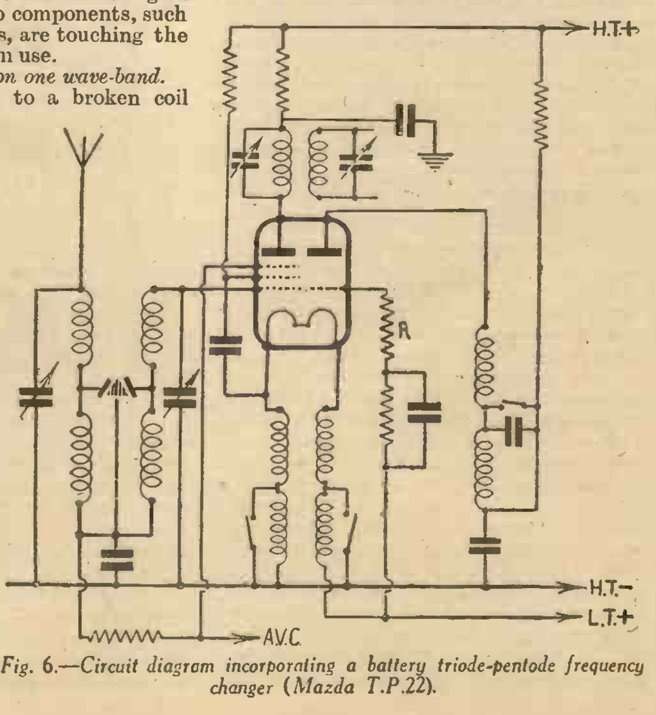


Fig. 6.—Circuit diagram incorporating a battery triode-pentode frequency changer (Mazda T.P.22).

Practical Television

January 8th, 1938. Vol. 3. No. 82.

A New Dispute

IT would appear that the B.B.C. and the Cinematograph Exhibitors' Association are having some big differences which only a good deal of careful negotiation will straighten out. First of all, the broadcast relays of the variety shows at cinemas which had been planned to extend over a long period is to be stopped because the exhibitors claim that this is causing a marked decrease in cinema attendances on the nights when the broadcasts take place. Quite naturally this has upset all the preconceived plans of John Watt, and robbed the B.B.C. of an excellent scheme for providing listeners with some really first-class variety artists. On the other hand, there is the "threat" that the cinema industry are anxious to invade the B.B.C. territory in so far as this is represented by television transmissions. The excellent results shown on large television screens recently has inspired the cinema industry with the idea of installing these screens in selected cinemas so that their audiences will have an extra inducement to patronage as a result of the undoubted novelty appeal still held by showing television pictures. The cinemas are not so concerned with the studio programmes but look to such outside features as the Derby, boat race, and other sporting events as being ideal for instantaneous portrayal to their audiences. Unfortunately, the B.B.C. own the public performance rights of such television programmes, and questions of copyright infringements make their appearance. Summing up, therefore, it is seen that each side of the "warring" factions want something possessed by the other, so it is possible that the correct give and take attitude will bring about a satisfactory settlement at an early date. When the question of cinemas showing television was raised in Parliament the other day a very non-committal answer was given, and no doubt the Government is hoping that the sections concerned will settle their differences without any attempt at intervention or arbitration.

Good News

The Government have now announced quite definitely that the Treasury are satisfied, on representations from the B.B.C., that an increase on account of the television service, in the percentage of net wireless revenue to be allocated to the Corporation, will be necessary. For this purpose a supplementary estimate will be presented in the spring but no indication of the amount involved was forthcoming. Conjecture has given the figure as something between £100,000 and £500,000, but until a definite amount is stated all the plans for an extension of programme hours must proceed with caution. The tardy recognition of the needs of television is very heartening, however, and now the Radio Manufacturers' Association has issued a statement to the effect that the early obsolescence of television receivers will not occur. This has been done to restore public confidence, and assure those potential viewers who were waiting for some form of stability before purchasing that their hesitation was misconceived. An association of this standing would not issue a statement of this nature without being quite sure of the facts, and the response in the form of increased receiver sales has been most gratifying. At the same time the R.M.A. alluded to the anticipated increase in programme time and said also that there was little hope that the prices of television sets would fall for some time to come. Bearing in mind the amount of equipment housed inside a receiver cabinet this is quite justifiable, and if big pictures in the home are desired, then the price paid must be commensurate with the amount of apparatus and labour involved to meet these requirements.

European Developments

At intervals news comes to hand concerning the television activities of various European countries, and the latest information from Poland is to the effect that a service will soon materialise in that country, for the Ministry of Posts and Telegraphs have now ordered their initial apparatus from Britain. Russia is now well ahead with their plans, while the efforts of the French have been detailed in these columns quite recently. Italy, primarily through the efforts of the Safar organisation, are making big strides. In every case, however, there is a tendency to spend considerable time in experimenting with different transmitting standards. From information that has become available it would seem that other countries exhibit a preference for the employment of synchronising pulses, which by test in England have shown themselves as quite inadequate from the dual standpoint of amplitude and time duration. This has brought about a reduction in the degree of tolerance which can be provided in the designs for the initial television receivers. After a long period of test it seems certain that the limits now used by the B.B.C. for their picture standard are to be preferred to any others which would bring about a tendency to destroy the marked picture steadiness characterising most British manufacturers' sets. Furthermore, with the background illumination being transmitted directly, that is the incorporation of D.C. light, there is a definite level for real black in the picture and also for the frame- and line-synchronising pulses. As readers know, the synchronising pulse level corresponds to zero radiated power from the transmitter at Alexandra Palace, and in consequence the tops of these pulses remain at a definite voltage level in the receiver detector output circuit. The net result of this is that to separate the picture components of the signal from the synchronising pulses, only a simple type of amplitude filter circuit becomes necessary. The cost of the apparatus is therefore reduced to a lower level than would operate if the reverse process was to occur.

Camera Equipment.

When electron cameras first made their bow as a satisfactory means for televising studio scenes the equipment associated with each unit was of a very experimental and complicated character. Continued research has altered this very materially, however, and the engineers charged with their operation have found the apparatus now employed both neat and easy to handle. As an example of what is necessary reference can be made to the accompanying illustration, which shows one form of electron camera complete with movable tripod mounting, panning handle, and double lens assembly for focusing purposes. As indicated, the equipment is admirable for portable demonstration work and, apart from the camera, is seen to comprise two main racks. Inter-connection is undertaken by suitable jumper leads, and the purpose of the racks is to provide the

(Continued on page 480)

A typical example of continental television practice showing the electron camera and associated racks used for operating purposes.

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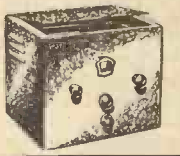

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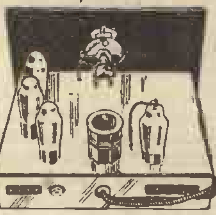

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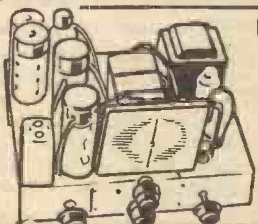

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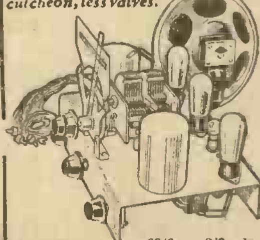

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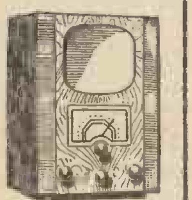

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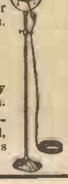

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PRACTICAL TELEVISION

(*Continued from page 478*)

camera with frame-and-line-deflecting pulses, electron focusing potentials or currents and electron accelerating voltages. Each of the units in the racks is adequately screened, and only the essential controls are brought out to the symmetrically arranged panels for easy manipulation by the engineers. The large armoured tubing passing to the camera accommodates the multiplicity of leads, being made up in this form to give adequate protection against possible damage while using the whole outfit under service conditions.

Colour Television Details

Mr. Baird has now given a brief outline of the scheme he is using in connection with the colour television developments to which readers' attention was drawn recently. It is a mechanical system, but an enormous improvement on the crude, flickering, thirty-line coloured pictures which he showed in 1928 to the British Association meeting in Glasgow. Blue, green and red filters are employed at the transmitting end where the subject is scanned by a combination of mirror-drum and disc-exploring devices. The fundamental scanning definition is 20 lines, but by multiple interlacing to overcome the effects of flicker, the final picture definition is 120 lines, which is sufficient to bring it just within the category of high-definition television. At the receiving end the light sources must be capable of furnishing the three primary colours mentioned, the picture being traced out by intermeshed lines having the proper colour combination. Very delicate triggering and synchronising equipment is necessary to ensure that the proper colour is portrayed on the receiver screen at the identical moment that the appropriate filter is in use at the transmitting end. Only one high-frequency carrier-wave channel is required to take the picture signal, and so far the results shown give a picture which is vivid in its colour portrayal on the 12ft.-wide screen. When asked whether colour television pictures would be possible on a home television receiver using a cathode-ray tube picture reproducer, Mr. Baird said that he thought it would be some years before the present monochromatic results were replaced by colour. One suggestion for this purpose was to use three projection type cathode-ray tubes, each having a screen colour response different from the other two and super-imposing these pictures on a remote screen to give a colour-blended picture Technical difficulties and cost, however, make this too ambitious a proposal to bring into effect at the moment, quite apart from the many intricate considerations at the transmitting end.

A German Viewpoint

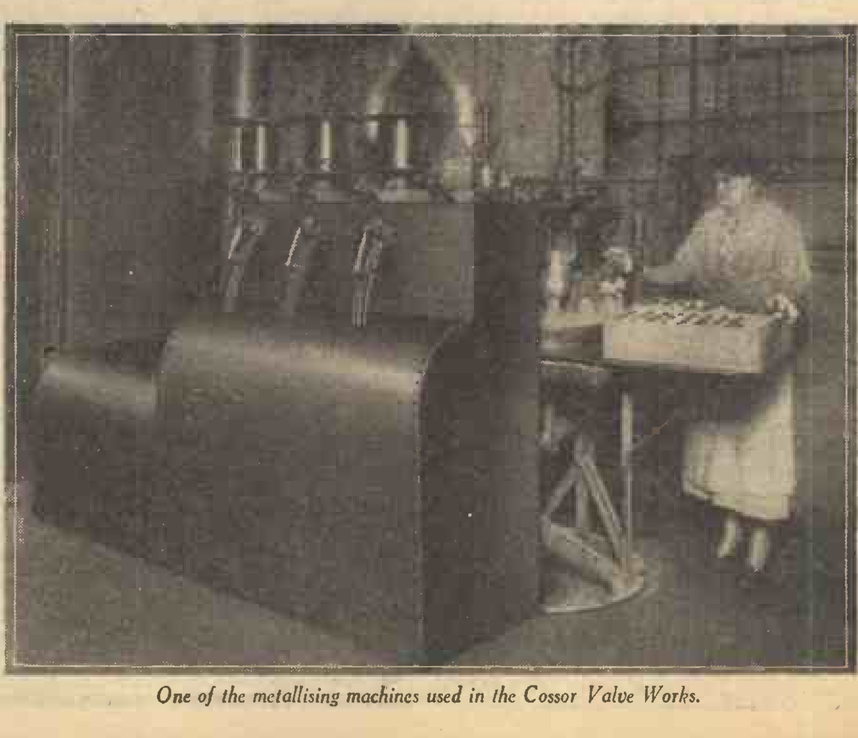
When the various forms of electron camera had been developed to a high degree of perfection the general impression among many television technicians was to the effect that the intermediate-film process had been completely superseded. That this view is not held in Germany is borne out by recent events, for equipment using this system has been shown, and the results are claimed to be of a very high standard. For example, Fernseh A.G., of Berlin, put forward the claim that the intermediate film process is an extremely desirable and very important supplement to the present type of direct pick-up camera. This is based not only on the fact that pictures using this process are good even when the illumination in the studio or with exterior scenes is comparatively low, but also upon the desire in many cases to retain records of the scenes for subsequent reproduction at suitable times. Gramophone records have not been supplanted by radio, but are looked upon as a welcome auxiliary, so the intermediate film process will acquire the same significance. In many cases, the fundamental drawback to the system—that is, the lapse of time between the exposure to the scene and its resultant conversion to a television signal—is important, and research has reduced the interval to a value of only a few seconds. The same thing could be done with both an electron camera and a film camera, but this means double equipment, whereas the intermediate-film process does both actions with one lot of apparatus. The new German intermediate-film apparatus is a great improvement on its predecessors for the external dimensions are only 4½ft. by 4ft. by 2ft. This marked reduction in size has been brought about first by the shortening of the proto chemical processing of the film so that the developing fixing, washing, and drying compartments are much smaller. Coupled with this is the second important improvement, namely, the use of an image dissector tube in lieu of the previous disc scanner. This was a logical choice because of the necessity for making the equipment easily movable. The associated amplifiers are also divided into portable units, together with an ample margin of distance between the I.F. camera itself and the mobile unit housing the amplifiers, etc. On the camera equipment a turret head facilitates the changing of lenses of differing focal lengths, while to assist the camera-man a mirror reflex device has been introduced to make scene focusing easy. No doubt subsequent events will prove the correctness or otherwise of the German attitude towards this television process, but bearing in mind that developments in that country are under the auspices of the Government there may be a special significance in the attitude they have adopted.

METALLISING

THE metallised valve is so commonplace to the constructor, and apparently is so simple of achievement, that few bestow upon it even a passing thought, yet, like most things that appear simple, metallising is a complicated process. It is interesting to record that metallising did not emanate from America, as even to-day it is not a regular practice among American manufacturers. The idea that metallising is a form of silver paint is, of course, quite absurd, as the chief feature of metal screening must necessarily be high conductivity over the surface of the metal employed, which could never be achieved by any painting process.

Atomised Metal Vapour

Metallising is pure metal fused, atomised and driven on to the bulb by a special type of gun. In order that this atomised metal vapour may adhere satisfactorily, it is necessary that the surface be rough. Some manufacturers sandblast the bulbs, while others use black varnish or gelatine, this latter alternative having the advantage of coming between the metal coating and the glass, and thus avoiding the mirror effect, which would prevent the escape of heat by radiation which is desirable, as the valve should run with its electrodes as cool as possible. The metallising gun is really an elaborate form of blow-pipe, and is fed by metal in the form of wire made of zinc alloy or other suitable substance. The mechanism of the gun forces the wire forward to the front of the gun, where the wire is atomised by an oxy-hydrogen, or oxy-coal-gas flame fed at a pressure of some 25 to 30lbs. per square inch. These heated gases and metal vapour are combined with the compressed air jet, so that the metal particles are projected forward with tremendous speed. The atomic metallising gun, shown in the accompanying illustration, actually propels the atomised metal at a speed of 1,200ft. per second.



One of the metallising machines used in the Cossor Valve Works.

AN EXPERIMENTAL A.C. POWER UNIT

In This Article The Experimenters Give Practical Details of Two or Three Different Circuit Arrangements for H.T. and L.T. Units Suitable for Operating Mains Sets from the A.C. Mains

by The Experimenters

WE mentioned recently that several of our reader-friends have protested against our giving—as they consider—too much attention to the battery user, and too little to the man who prefers to operate all of his apparatus from the mains. Since we mentioned the matter, and asked readers to give us their views, there has been a regular stream of letters and postcards from those who are strongly in favour of mains operation. It is evident, therefore, that we must cater for their needs. At the same time, let us make it perfectly clear that we are satisfied that the greater proportion of the readers of this section use batteries.

In future, we propose to attempt to give articles for battery and mains users in proportion to our estimated percentages of the two. In the meantime, we shall be glad to have the views of more and more readers, so that we can, if necessary, alter our estimates. As we have stated several times before, we favour the mains set, and a large proportion of our experiments is in connection with A.C.-operated equipment. Our view is that it is easier and less expensive to make a high-grade receiver of the mains type than it is to build a satisfactory one for battery operation. Additionally, there can be little doubt that running costs are appreciably lower when the set is fed from a mains supply.

Dissenters

We do not overlook the fact that a small number of readers live in houses not wired with electricity, nor do we forget that many have a D.C. supply which will, sooner or later, be changed for A.C. Additionally, there are those who are somewhat nervous or apprehensive when using mains-operated apparatus, and there are far more than some of you would imagine who have a "down" on mains receivers. In many instances the reason is that they have heard old-fashioned mains sets—sometimes of bad design—that do not give very good reproduction or that do produce far more hum than is desirable.

To the doubters and sceptics we can say definitely that a well-designed mains set using up-to-date parts can be made completely free from hum. What is more important, the quality of reproduction from a mains set is far superior to that of the average and inexpensive battery set, when a good volume is required. We know in advance that many of our readers will challenge this statement, but we make it after having had a considerable amount of experience with all types of receiver.

Preliminary Questions—

But it is time that we settled down to the subject of this article, as indicated by the title. One of the difficulties of using mains-operated equipment for experimental purposes is that some kind of power-supply unit is necessary—and it must be one that can be adapted for all types of receiver, amplifier and unit. With battery-operated sets experiments can quickly be put in hand by merely connecting a couple of dry batteries and an accumulator.

The first difficulty can be overcome easily enough by making an experimental power unit of a type suitable for use with an A.C.-operated radio unit. But what form must the power-supply unit take? Shall it be designed to give a maximum H.T. output of 500 volts, or only 200 volts? What L.T. supplies should be available? Shall the unit include a power-output valve, or shall it embrace an energised loudspeaker? And so you could go on asking yourself all manner of questions.

—And Answers

We have found that if you make a unit to give up to 350 volts at 120 mA, along with 4 volts A.C. up to about 5 amp. (for the heaters of up to five indirectly-heated valves) and 4 volts, 2 amp. (for a directly-heated output valve), it will cover the majority of requirements. It is rare that more than 350 volts is required for the normal type of receiver, and the voltage can be cut down to 250, if necessary, without very much trouble.

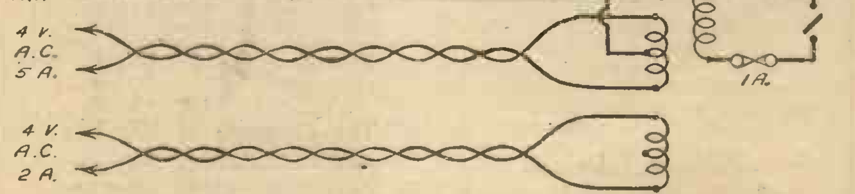
The circuit given in the illustration shows the basis of the idea that we have just outlined. There is a mains transformer which feeds into an indirectly-heated rectifying valve, the output from which is smoothed by a 15-henry, 100 mA choke and a pair of 500-volt-working electrolytic condensers. Additionally, there are two 4-volt A.C. windings of the ratings mentioned above.

It is suggested that the H.T. secondary winding of the transformer should be rated at 350 volts 120 mA, and that the valve should be one such as the Osram MU12, which has a maximum output of 350 volt 120 mA and a heater taking 4 volts at 2.5 amp. The choke can be of any good make, and its D.C. resistance will be in the region of 500 ohms—thus it will "drop" 60 volts when passing 120 mA. This will limit the available H.T. voltage to about 300.

Additionally, there is a load resistance connected so that it may be put in parallel with the main output by means of a Q.M.B. switch; when it is in circuit the available output is reduced to about 320 volts at 60 mA. This arrangement is better and often more convenient than that of inserting larger voltage-dropping and decoupling resistors in the set. The resistance should have a wattage rating of not less than 20.

Tapped Secondary

Another method of cutting down the output is indicated by broken lines in the accompanying diagram. The H.T. secondary winding of the transformer besides having terminals for 350-0-350 volts has two additional tappings for 250 volts. When using the two tappings in conjunction with the centre tap the output (with the load resistance out of circuit) is about 220 volts at 60 mA. This is a better method than that of using the load resistor, since it allows the rectifier to work on "light load." The difficulty, as far as we have been able to trace, is that there are few transformers made as standard with tappings such as these. Among those which are available are the Pye and Wearite special transformers.



Theoretical circuit diagram of the A.C. power unit outlined in this article.

If it were proposed to use an energised speaker in conjunction with the power-supply unit, the field winding would replace the smoothing choke shown, and would therefore be responsible for an increased voltage drop. The rectifier suggested gives a voltage output of approximately 400 when fed from a 350-0-350-volt supply and when

(Continued overleaf)

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AN EXPERIMENTAL A.C. POWER UNIT

(*Continued from previous page*)

the current drain is only 60 mA. And at 60 mA a 2,500-ohm speaker field "drops" 150 volts. Thus, by using the circuit shown with an untapped 350-volt secondary, and without the load resistor an output of 250 volts 60 mA could be obtained if the smoothing choke were replaced by the speaker field winding. In many respects, this is the best system of all, for a speaker field coil is somewhat more effective than the usual choke. Besides this, an economy can be effected in two directions; the cost of the choke can be saved, and an energised speaker is rather cheaper than its permanent-magnet equivalent.

The "Pictorial"

We do not propose to give a layout and wiring plan, since this will vary appreciably, according to which of the methods that we have outlined is adopted by the individual reader. No particular makes of components are indicated, for they are not important, provided that all are of good quality and made by a firm of repute. We do strongly deprecate the idea of using "junk" parts, or those bought from "clearance" stores which are not branded with the name of a well-known manufacturer. Many of these are taken from commercial sets that have been dismantled and were never intended for home-constructor use. Some more-experienced readers might sometimes use them with success, but the gamble is not worth while when parts especially made for constructors are now priced so reasonably.

It is a good plan to mount the parts on a steel chassis, which can be made from sheet, and to make some kind of cowl to cover all the parts. It need not be enclosed at the ends, like a box, but might simply take the form of an inverted U-shaped sheet. This will allow easy air circulation round the rectifying valve, transformer and choke, and at the same time act as an efficient low-frequency screen. Care must be taken that all parts are properly insulated, but those who are accustomed to mains-operated sets will do this as a matter of course.

Meters

If you wish to elaborate the unit, you might well include a 0-200 mA meter in series with the positive lead from the transformer to the smoothing choke. It is also worth while to connect a high-resistance 0-500 volt meter across the output terminals with a push-button switch in series with the negative lead. The connections would be the same as those for the load resistor shown in the diagram, although the Q.M.B. switch would be replaced by a push-button. With the meters in circuit it is an easy matter to check the conditions under which any set attached to the unit is working.

We understand from letters received that a few readers already have power supply units similar in principle to that described. It would be interesting to have details of these, especially if any special features have been incorporated. So please send us the circuit of your unit, so that details can be passed along to other readers.

That's all this time. More letters, please, if we are not being too greedy.

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Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Wearite Ceramic Switches

MESSRS. WRIGHT AND WEAIRE announce that they have now introduced a new gang switch made from ceramic material and designed especially for wave-change switching with a minimum of loss. It is available in three types, Type A 28 which is a 2-pole 4-position unit, Type B 212 which is a 2-pole 6-position unit and Type C 312 which is a 3-pole 4-position unit. The list price of the switch, with one wafer complete with knob is 5s., and it is possible to add additional wafers, or plates up to six sections. The price of the separate wafers is 3s. This switch is absolutely rigid, has a low co-efficient of expansion, is non-absorbent and has an extremely low power factor at high frequencies. It is, of course, ideal for use in the construction of an all-wave receiver.

Webb's Radio Globe and Map

LONG-DISTANCE listeners should make a point of obtaining either the map or globe supplied by Webb's radio for radio amateur use. The map is a "flattened" reproduction of the globe, drawn on the "great circle" or "shortest distance" projection, and is engraved in the same manner as the globe. In this, the world is divided into radio continents as recognised by the International Amateur Radio Union, and the call letters of each part of the world are clearly shown. In addition, the map is divided to show time relationship from Greenwich and thus the time in any part of the world may instantly be calculated. On the globe a small disc is attached to the upper suspension point and gives a similar indication. The compass points are clearly indicated on the map and it is a very simple matter, with either the map or the globe, to ascertain a station direction when using a directional aerial or for any similar purpose. The map may be obtained either in paper or linen, and the price is 4s. 6d. in paper, 10s. 6d. in linen—rollers being fitted to this model. The cost of the globe, which is 12ins. in diameter and very well made and finished, is 27s. 6d.

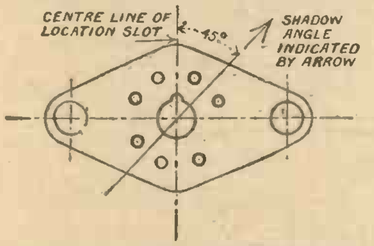
The Radio Globe which is reviewed above, and which may be obtained from Webb's Radio.

Bulgin Lock-switch

ALTHOUGH primarily designed for use with a radio receiver, the lock-switch supplied by Messrs. Bulgin will be found of the utmost value for numerous purposes. In the main it consists of a standard toggle switch, rated to break 250 volts at 3 amps., but in place of the usual dolly or control knob it is operated by a Yale-pattern key. The slot is so arranged that it is not possible to place a screwdriver or other flat instrument in and operate the switch and it thus affords maximum protection from unauthorised use. It may be fitted to a receiver or any other apparatus which it is desired to keep for special purposes, and, as already mentioned, there will be found dozens of such purposes amongst which may be mentioned the control of extension listening points, car radio receivers, or even for the ignition on old pattern cars which have no such fitment already provided. The price is 3s., and spare keys may be obtained at 6d. each. The makers are Messrs. A. F. Bulgin.

New G.E.C. Tuning Indicator

THE General Electric Company announces that a new pattern of the cathode-ray tuning indicator is now available, designed to give greater brilliance at lower voltages. The type number is Y.64 and it is claimed that it is similar in all other respects to the existing model Y.63, but may be used with H.T. supplies down to 80-90 volts. This model will, of course, be found of great value for addition to receivers in which the H.T. available is on the low side or where a mains unit is now fully loaded. In this connection it might be mentioned that when mounting the holder for the indicator, if the average shadow area is desired at the bottom or top, the holder will have to be placed at an angle. To enable the best position to be found, we attach a sketch showing the holder and the mean shadow angle on both Y.63 and Y.64. Both of these are, of course, of the International Octal type and require 6.3 volts for the heater supply.



This diagram shows the relative shadow area of the G.E.C. Tuning Indicator in relation to the pin positions.

THE WEEKLY FOR THE AMATEUR

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THE BRITISH LONG-DISTANCE LISTENERS' CLUB

Directional Aerials

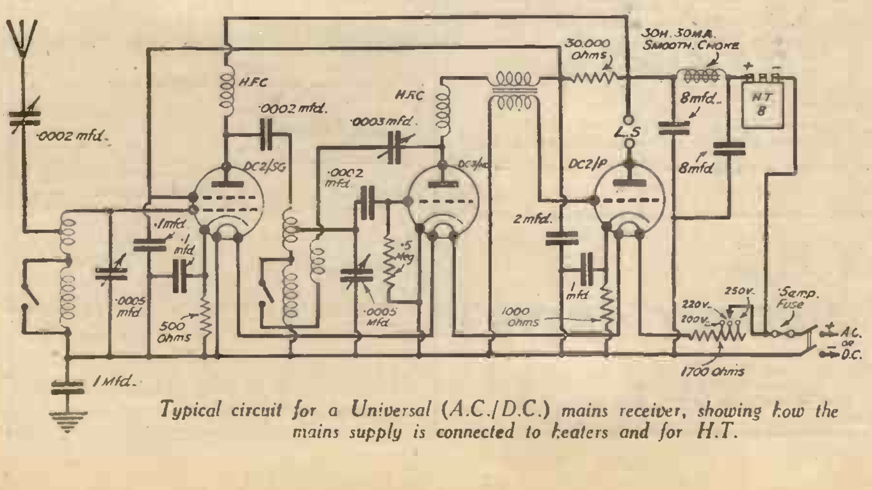
THE advantages of a directional aerial have previously been explained in these columns and we now give some further information which has been received from the inventor of the Variable Directional Aerial, Mr. A. W. Mann, which we are sure will be found of great interest to other experimenters.

"Some time ago, a letter of mine dealing with directional aerial experiments was published in this journal, and from correspondence received evidently caused considerable interest. Since then further experiments have been carried out using a simple band-spread two-valve receiver, in conjunction with a Model B1 Variable Directional Aerial. In these experiments special attention was paid to amateur-band reception from 10 metres to 160 metres, because of the many discussions heard over the air on 40 metres, and the apparent amazement concerning the use by American amateurs of directional aerial systems which provided highly satisfactory results. It is admitted that there is no reason why a properly constructed transmitting aerial should not prove equally efficient as a receiving aerial, and the reports heard respecting the special arrays, etc., used in the States, confirm this. As the writer has experimented with directional receiving aerial systems for more years than he cares to remember, amateur discussions on the subject proved most interesting. For three months consistent listening was carried out on 20-metre W 'phones, using directional systems for transmission and reception, and from details given it was found that in all instances such arrays were of gigantic proportions, complicated to erect, and requiring considerably more space than the average amateur has available.

Opinions are divided, according to club discussions and reports, as to the suitability of the 40-metre band for directional tests during field days. The writer has proved to his own, and the satisfaction of others in this country, and abroad, that there is nothing wrong with this, or any other band, for whilst reception conditions and phenomena play an important part, success depends largely on the use of suitable apparatus. It was decided to tune the aerial system by means of a tapped coil tuner; use a special directional map and compass for checking purposes, and concentrate on 10, 20, 40, 80 and 160 metres, according to existing conditions on the individual bands. Using an untuned aerial it was found that gain varied considerably on 40 metres, according to conditions, and due to a broad peak-point effect most apparent on strong signals. With the series aerial tuner in circuit, and the aerial tuned to resonance, considerable improvement was noticed. Careful attention to the correct tapping point on the tuner-coil to which the lead-in was coupled was found to be important, and the correct procedure is to tune in the desired signal on receiver, and tune aerial tuner to absorb the signal striking the centre point. By following this procedure complete stability is assured, and all that is necessary is to re-tune to the desired test signal. Once the correct aerial tuner adjustment is made, all that is necessary is to tune over the band and rotate the aerial system. Tests carried out over a period of six months prove that it is possible to peak any 40-metre 'phone signal at will, and obtain considerable gain, sufficient in most instances to cause spill-over of the detector valve if adjusted to maximum gain on G, GM, EI and other strong European stations. The same applies to weaker signals. On 20 metres peaking is much sharper, whilst on 10 metres the writer rotates the aerial system for gain as fading takes place, and finds it far more satisfactory to compensate in this way than by using the reaction control. Using the same tuner unit, signal gain is also obtainable on 80 and 160 metres. The experiments outlined prove conclusively that elaborate and complicated arrangements requiring considerable space are unnecessary, so far as the directional reception of short-wave signals are concerned. I trust that these observations will prove of interest to amateurs and experimenters generally."—A. W. MANN (Middlesbrough).

A.C./D.C. Sets

A member who has only recently taken up radio construction cannot understand how a set can be used on either A.C. or D.C. mains without altering something on the mains side. This is, of course, quite a fascinating problem, but it must be remembered that the apparatus is specially designed for this purpose in the following manner. Firstly, the valve heaters (or filaments) are of a type which may be run in series direct from D.C. mains. They do not, therefore, have a heavy current consumption such as in A.C. valves. The latter are rated at 4 volts 1 amp., whereas the D.C. or Universal type of valve is generally of the 20 or 30 volt .2 amp. type. Consequently, in an A.C./D.C. receiver the filaments will be wired in series with a small adjustable resistance in the lead to enable the correct current to be passed. The H.T. is usually obtained by using a half-wave receiver in connection with one of the heater leads (that which would be joined to the positive lead of the main on D.C. supplies). When used with an A.C. supply, therefore, this will rectify the supply and deliver a suitable H.T. voltage which is smoothed in the usual manner. On a D.C. supply the rectifier acts merely as a resistance, and could, if desired, be eliminated entirely, retaining the smoothing circuit in the interests of hum-free reception. The attached circuit is a simple three-valver of the all-mains type which will serve to illustrate the points mentioned.



Typical circuit for a Universal (A.C./D.C.) mains receiver, showing how the mains supply is connected to heaters and for H.T.

SHORT-WAVE SECTION

(Continued from page 474.)

and 31-metre bands, when signal readability is of major importance. The frequency response changeover switch can be mounted on the speaker baffle, or some other position convenient to hand.

It is believed that for short-wave reception there are still many of the smaller type of receivers used, with two or three valves, such as the detector and L.F. or H.F. det. and L.F. In this case headphones are often used for reception, with a choke output stage. Fig. 4 shows how the frequency response can be altered here, to get a better signal to noise ratio. The output condenser for headphone reception is usually not more than 1 microfarad. Again a series capacity C is used to cut the lower frequencies, while a shunt capacity is used across the output of the choke C1. This in itself, as well as cutting the top frequencies, has the effect of tuning the choke over a certain frequency range, therefore the most suitable capacities in both instances will have to be determined experimentally. The series condenser C can be as low as .0003 microfarads.

With the above circuit arrangements, the selectivity of the receiver is not in any way altered, but the output response is similar to that of a high selectivity communication receiver, therefore achieving to a certain measure the same practical results minus the drop in amplification. However, is it not better to receive a weak signal 100 per cent. readable than not at all through "mush" and interference? In contacting telephony stations over a long period the writer has found the answer is very much in the affirmative.

EVERYMAN'S WIRELESS BOOK

By F. J. CAMM

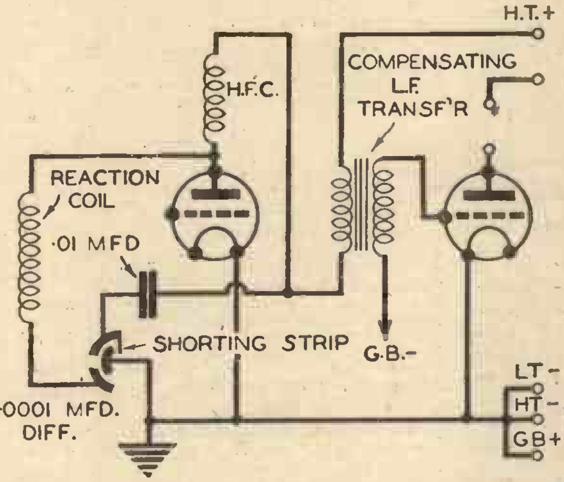
Wireless Principles and Fault Tracking simply explained.

3/6 or 4/- by post from Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

A Quality Tip

SIR,—I have been interested in the recent correspondence regarding quality and distant reception, and the following is how I managed to convert my set so that I could obtain better quality on the local stations, without going to the trouble of making a special quality set. I bought up an old pattern tone-control L.F. transformer and cut a small piece of brass which I fixed to one terminal of the fixed plates of the differential reaction condenser I was using. As will be seen from the diagram which I send, the reaction condenser may be used in the usual way for distant logging, but when turned to the maximum in the opposite direction a small arm soldered to the moving spindle comes into contact with the piece of brass just mentioned and this gives no reaction, but a measure of tone control with the special transformer in question. I tried different values of fixed condenser between anode and reaction, and the .01 mfd. suits my speaker best. No doubt the idea will be of use to other readers.—J. PRIMROSE (Hendon).



This diagram shows the tone-control arrangement suggested by Mr. Primrose.

Battery versus Mains Sets

SIR,—Whilst I agree with some of the remarks made by E. R. J. Robbins (Hounslow) in a recent issue of PRACTICAL AND AMATEUR WIRELESS, I disagree with his contention that battery sets are superior to mains sets from a quality point of view. He quotes as his ideal, a good Class A receiver (battery), and by this I take it he means a straight set and built by a constructor who has taken pains to get the best from it. I agree that if properly constructed, fair results can be obtained from a set of this description. He has compared a number of such sets against mains sets. He does not say that he has compared them against Class A mains sets, built by constructors who have also taken pains to get the best from them.

I think it is generally agreed that the first link is a good speaker. I prefer a good six-volt energised speaker myself, and next to that I have found that a large output valve, PX25 or PP5/400, properly fed is required for real quality. Has he compared against either of these valves? He must bear in mind that manufacturers have to build to suit the public, who generally require quantity before quality. I advise him to construct a quality mains set, and I think he will change his opinion. The cost of such a set is quite reasonable.—HARRY BRADBURN (Warrington).

SIR,—PRACTICAL AND AMATEUR WIRELESS is very interesting at present, perhaps more so than usually to me, owing to the prominence at the moment of the "Quality from battery valves" question. We "battery valve" fellows seem to continually read, "Quality can only be obtained by using mains valves," because those big "output watts" are necessary. Some of us have got used to constructing battery sets, and don't like to scrap our faithful "eliminators," and besides, how many of us have listened to all the mush and stuff most of the mains sets produce owing to their high H.F. amplification. Referring to page 302, PRACTICAL AND AMATEUR WIRELESS, dated November 22nd, Mr. Savegar's so-called "Novel quality coupling," and Fig 2, Mr. Clarke's similar L.F. coupling, caused me to wade back through my stacks of old PRACTICAL AND AMATEUR WIRELESS and old *Amateur Wireless* to AW, Vol xxvi, No. 657, page 34, to an article by Mr. Noel Bonavia-Hunt and his quality battery L.F. circuit. Truly a quality L.F. circuit for the battery user. It gave me many hours of pleasant listening until I constructed a battery version of the High-quality Amplifier given in PRACTICAL AND AMATEUR WIRELESS, Vol. ix, No. 223. This has proved a fine job, and many critics among my friends have expressed their admiration of this amplifier for gramophone records. In conclusion, my expression of thanks to the Editor for his weekly PRACTICAL AND AMATEUR WIRELESS sold at 3d., and surely worth an untold amount to those who must derive immense joy from the results obtained from PRACTICAL AND AMATEUR WIRELESS sets.—FRANK B. HORSFALL (Leeds).

A Good 10-metre Log

SIR,—Having seen several 10-metre reports in your paper, I thought that mine might interest some readers. These stations were received during December.

Ten-metre 'phone stations: SV1RX, SV1CA, SP1HH, YL2BB, LY1J, G5ML (Europe); ZT6J, ZU6P, ZE1JR, ZS6AJ, CN8AJ (Africa); YV5AA, YV5AK, K4EMG (South America); VU2CQ (Asia); W6JJL, W6HX, W6KJU, W6MGC, W6JPX, W6BKW, W7DVY, W7FDL, VE3ANS, W7UHL, VE1DC, and IR5TY.

The receiver is an 0-v-1 (modified "Simplest Short-waver"), with a 66ft. sloping antenna pointing due West. I would like to see other 10-metre logs published from this district, and from any other part of the country.—A. ROZIER (Stow-on-the-Wold).

From a Belfast Reader

SIR,—I am a keen short-wave listener but expense has held me from the full enjoyment of the higher frequencies. However, from tips gleaned from your paper I have built a two-valve set very cheaply. Last week I heard a station on 31.28 metres, call-sign "Radio Martinique, French West Indies."

There were two announcers, a man and woman. The woman spoke in English and the man in French. On one evening, W1XK, Millis, Mass., relaying WBZee, was a very strong signal at 4.45 p.m. When I tuned it in a woman was singing "The Santa Claus Express."

Zeesen, Moscow, Schenectady, Rome, Lisbon, CS2WA, Daventry, etc., are all strong signals when operating. Thanking you for an instructive and interesting weekly.—FRED G. BIRTWISTLE (Belfast).

An Empire Set!

SIR,—I am writing in support of one or two other overseas readers who ask for an "Empire set," which should be something worth while. It will be necessary to tune to thirteen metres to enable us to hear Daventry in daytime.

Please accept congratulations for your fine paper, which is much enjoyed here.—J. THOMPSON (Cape Town, S. Africa).

CUT THIS OUT EACH WEEK.

Do you know

—THAT small brass radio parts may easily be silver-plated at home for use in short-wave equipment.

—THAT if a pig-tail connection is added to a condenser for short-wave work it should be made from covered wire to prevent erratic tuning effects.

—THAT the capacity of a variable tuning condenser may be reduced by including a fixed condenser in series with it.

—THAT modulation hum may often be cured by connecting two fixed condensers between the anodes of the rectifier and H.T. negative.

—THAT when a top-cap grid type of valve is used, especially in a superheterodyne, the lead should be kept as short as possible, as it will otherwise act as an aerial.

—THAT dust of a metallic nature in the gap of a moving-coil speaker will not only reduce efficiency but may also give rise to background noises.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL AND AMATEUR WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Practical and Amateur Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS.

CRYSTAL SETS.

	Date of Issue.	No. of Blueprint
Blueprint, 6d.		
1937 Crystal Receiver	9.1.37	PW71

STRAIGHT SETS. Battery Operated.

	Date of Issue.	No. of Blueprint
One-valve : Blueprint, 1s.		
All-wave Unipen (Pentode)	—	PW31A
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B
The Signet Two	29.8.36	PW76
Three-valve : Blueprints, 1s. each.		
The Long-range Express Three (SG, D, Pen)	24.4.37	PW2
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	18.8.34	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-mark Three (SG, D, Pow)	12.6.37	PW41
Hall-mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	June '35	PM1
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
All-Wave "Corona" 4 (HF Pen, D, LF, Pow)	9.10.37	PW79

Mains Operated.

	Date of Issue.	No. of Blueprint
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	5.12.36	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
A.C. All-Wave Corona Four	6.11.37	PW81

SUPERHETS.

	Date of Issue.	No. of Blueprint
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	13.7.35	PW52
F. J. Camm's £4 Superhet	—	PW58
F. J. Camm's "Vitesse" All-Waver (5-valver)	27.2.37	PW75
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73

SHORT-WAVE SETS.

	Date of Issue.	No. of Blueprint
Two-valve : Blueprint, 1s.		
Midget Short-wave Two (D, Pen)	—	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2LF (RC and Trans))	7.8.37	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68
F. J. Camm's Oracle All-wave Three (HF, Det, Pen)	28.8.37	PW78

PORTABLES.

	Date of Issue.	No. of Blueprint
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	19.6.37	PW77
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl.B)	15.5.37	PW12

MISCELLANEOUS.

	Date of Issue.	No. of Blueprint
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.

	Date of Issue.	No. of Blueprint
Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

	Date of Issue.	No. of Blueprint
One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver	—	AW387
Twenty-station Loudspeaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det., Pen)	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher; Baseboard Model (SG, D, Pen)	—	AW417
1934 Ether Searcher; Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen)	June '33	WM327
Economy-Pentode Three (SG, D, Pen)	Oct. '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	Mar. '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	—	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	June '35	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	Oct. '35	WM400
All-wave Winning Three (SG, D, Pen)	Dec. '35	WM396
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402
2HF Four (2 SG, D, Pen)	—	AW421
Crusader's A.V.C.4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class B Outputs for above: Blueprints, 6d. each)	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B)	Aug. '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	Feb. '35	WM381
The H.K. Four (SG, SG, D, Pen)	Mar. '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	Apr. '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	May '33	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	Dec. '33	WM344
New Class-B Five (2 SG, D, LF, Class B)	Nov. '33	WM340

Mains Operated.

	Date of Issue.	No. of Blueprint
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home-Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen)	23.6.34	AW439
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	Jan. '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All-Metal Four (2 SG, D, Pen)	July '33	WM326
Harris Jubilee Radiogram (HF Pen, D, LF, P)	May '35	WM386

SUPERHETS.

	Date of Issue.	No. of Blueprint
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
Varsity Four	Oct. '35	WM395
The Request All-Waver	June '36	WM407
1935 Super Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	—	AW425
Heptode Super Three A.C.	May '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	Apl. '35	WM385

PORTABLES.

	Date of Issue.	No. of Blueprint
Four-valve : Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	June '34	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367

SHORT-WAVE SETS—Battery Operated.

	Date of Issue.	No. of Blueprint
One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (Price 6d.)	—	AW329
S.W. One-valve for America	23.1.37	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG det., Pen)	Feb. '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver (SG, D, Pen)	Jan. 19, '35	AW463
The Carrier Short-waver (SG, D, P)	July '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-Beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-Waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	Mar. '35	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-waver Super	Nov. '35	WM397

Mains Operated.

	Date of Issue.	No. of Blueprint
Two-valve : Blueprints, 1s. each.		
Two-valve Mains short-waver (D, Pen) A.C.	—	AW453W
"W.M." Band-spread Short-waver (D, Pen) A.C.-D.C.	—	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	Aug. '35	WM391

MISCELLANEOUS.

	Date of Issue.	No. of Blueprint
Enthusiast's Power Amplifier (1/6)	June '35	WM387
Listeners' 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v) for WM392	Nov. '35	WM398
Harris Electrogram (battery amplifier) (1/-)	Dec. '35	WM399
De-Luxe Concert A.C. Electrogram	Mar. '36	WM403
New Style Short-Wave Adapter (1/-)	June '35	WM388
Trickle Charger (6d.)	Jan. 5, '35	AW462
Short-Wave Adapter (1/-)	Dec. 1, '34	AW456
Superhet Converter (1/-)	Dec. 1, '34	AW457
B.L.D.L.C. Short-wave Converter (1/-)	May '36	WM405
Wilson Tone Master (1/-)	June '36	WM406
The W.M. A.C. Short-Wave Converter (1/-)	—	WM408

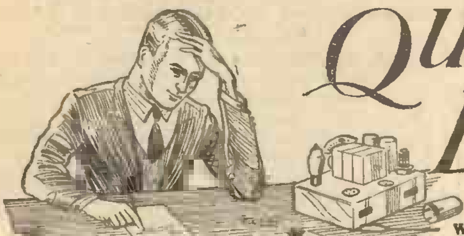
These Blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices, *which are additional to the cost of the Blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Issues of			
Practical Wireless	4d.	Post Paid	
Amateur Wireless	4d.	,,	,,
Practical Mechanics	7½d.	,,	,,
Wireless Magazine	1/3	,,	,,

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: thus PW refers to PRACTICAL WIRELESS, AW to *Amateur Wireless*, PM to *Practical Mechanics*, WM to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.



QUERIES and ENQUIRIES

A Chemical Charger

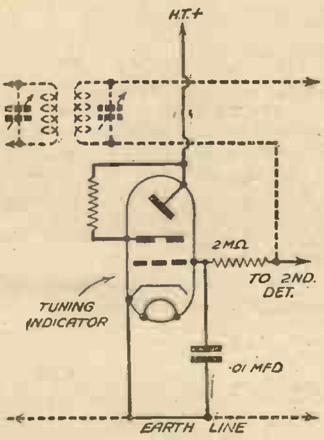
"I made a tantalum charger and tried to get it to work, but failed. I have now bought a Westinghouse rectifier, style L.T.4, and made this into the circuit published by the makers, but even this one won't work. Do you think the transformer is at the root of the trouble, it is a 2s. 5d. bell transformer, 3v., 5v., 8v., 1 amp?"—R. J. (Pontypridd).

IT is quite possible that your transformer has been responsible for the trouble. With regard to the rectifier which you have now bought, this requires an input of 11 volts 1.5 amps. and thus your input is insufficient to enable the rectifier to deliver the rated 6 volts 1 amp. We would suggest, therefore, that you obtain a suitable transformer from your local radio dealer, or direct from Messrs. Heayberd, 10, Finsbury Street, E.C.2.

Visual Tuning Indicator

"I have built a superhet (mains operated) and now wish to include a really good visual tuning indicator. I should like, if possible, to use one of the eye tuners, but am uncertain whether this can be included in my set, which is H.F., frequency changer, I.F., D.D.T. and pentode. If I can fit the device would you recommend a suitable make and give connections, as I am unable to trace any reference to it in your past issues?"—F. R. (Harrow).

THE Magic Eye tuning indicator consists of a small cathode-ray device and may be obtained now as a separate component. It should be wired to the second detector and A. V. C. circuit as shown in the accompanying illustration, which is that which is recommended by the makers of the Osram indicator type Y. 63. This particular indicator requires a 6.3-volt heater winding, and you will thus have to obtain a separate mains transformer for the heater unless your present valves are of the 6.3-volt type.



Connections for the Osram visual tuning indicator.

M.C. and M.B. Connections

"I am building one of your sets from a blueprint and note some points marked M.C. I have also seen M.B. on some of your gift blueprints and should be glad if you would tell me what these terms mean. Do they refer to the speaker or the chassis?"—G. E. (High Barnet).

IN both cases the points indicated are what are known as Earth Return leads. If you follow a theoretical circuit you will note that many points are joined to the earth line, and in wiring a receiver it is unnecessary to take a wire from those points across to the earth terminal. Not only would this lead to complicated wiring, but efficiency might fall off due to the long leads and interaction between them. Consequently, if a metal or metallised chassis is used, this is joined direct to the earth terminal, and those points which have to be earthed are joined to the nearest point on the chassis. A loop is generally made in the connecting wire and this is fastened down by means of a screw or bolt. M.C. means metal chassis, and M.B. means metallised baseboard.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Lack of Bass

"I am using a band-pass circuit, valves V.M.S.4, M.H.4, 244V, PP.3/250. All voltages to valves are correct, and the speaker has an energised field, but I don't seem to get a lot of bass. Can you suggest anything to rectify this trouble?"—T. E. S. (Harrow).

THE trouble may be due to the general circuit design or the L.F. components. A good transformer should be used, preferably parallel-fed, or resistance-capacity coupling adopted. The speaker should be mounted on a suitable baffle or large cabinet, and it must, of course, be matched to the output valve. We cannot advise more definitely without a circuit diagram.

Overseas Receiver

"I am anxious to buy a set for a relative in the East and one of the main difficulties is in obtaining a suitable battery supply. He uses a wind-driven accumulator charger, but there are no mains facilities and the usual battery set is not sufficiently sensitive. Can you recommend any commercial make of set which would be suitable for this particular case?"—H. R. E. (York).

THE General Electric Company have just produced a set of the type you require. This incorporates a vibrator H.T. generator operating from the 6-volt accumulator and it has been designed especially for tropical use. It has a walnut cabinet and all components have been tested and designed for tropical use. A superhet circuit is employed with a tuning range from 13.7 to 555 metres—no long-waveband being included owing to the fact that this is not required abroad and the short waves are the most useful.

Energised Speaker

"I have a speaker of the 6-volt field winding type and have rewound this to enable me to connect it direct to the D.C. mains. It is not nearly so loud now as it was before and I should be glad if you would give me any hints so that I could obtain better performance on it. The quality is good, but sensitivity seems to have gone."—K. P. S. (Leicester).

THE sensitivity depends upon the field strength, and your new winding, although it will carry the mains current, may not be capable of giving the same field strength as the former winding.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

H. H. (Charlbury). The circuit and use was dealt with in our series of articles on Transmitting.

W. B. (Belfast). The Prefect S.W. Three, for which a blueprint is available, would be the most useful set, but for a simpler model we suggest the Simplest Short-Waver. This is a one-valve set.

A. T. (Wakefield). The signal may have been beyond the range of the receiver, but you could modify the reaction by increasing the H.T. on the valve. Perhaps the detector valve is not up to standard and does not oscillate easily.

F. B. (Hammersmith). Your eliminator may be unsuitable, and you require a very high output in order to obtain satisfactory results with a Q.P.P. or Class B stage.

S. C. H. (Cyprus). We have no blueprints of transmitting apparatus. We published a series of articles on Transmitting commencing in November, 1937, and gave certain circuits, but no blueprint has been prepared.

A. T. B. (Seven Kings). You do not give any indication of the power you require. We can supply a blueprint of a 5 watt A.C. amplifier, and in a recent issue described a 12 watts amplifier. One of these would be suitable for your purpose.

F. T. Y. (Hove). You could not alter the set in the manner indicated, and in any case we do not give instructions for modifying commercial receivers.

N. S. O. (Llandudno). We cannot trace the firm in question and it would appear that they are no longer in business. A good local radio dealer should be able to measure the output and test the apparatus for you.

V. J. (York). You cannot modify the meter to obtain a lower reading. It may be used to read higher currents, but you cannot obtain a full scale deflection at a lower current than that for which the instrument is made.

F. W. C. (Bournemouth). The aerial will be very inefficient as shown, and you should cut out the various short lengths. Run straight from the window to the far corner in a N.W. direction as shown on your sketch, and although short, this will be adequate for all normal purposes.

R. B. (Dagenham). A super capacity battery will give adequate current, but the very cheap batteries mentioned will only last a short time and will have to be replaced very frequently, thus costing you more in the long run.

The coupon on page 488 must be attached to every query.

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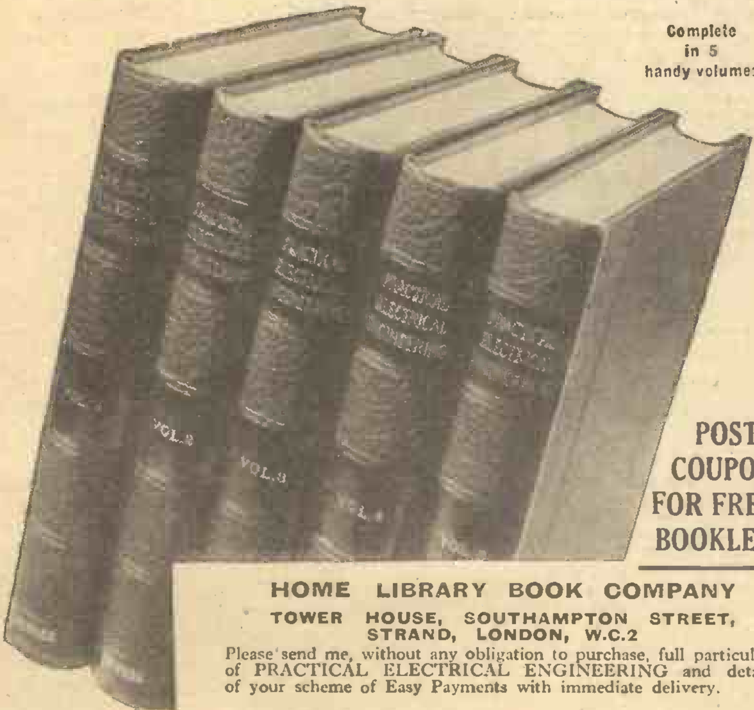

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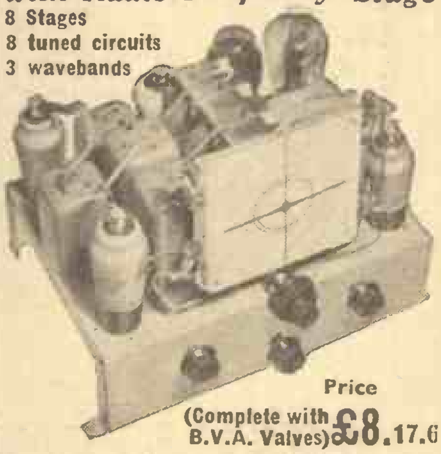

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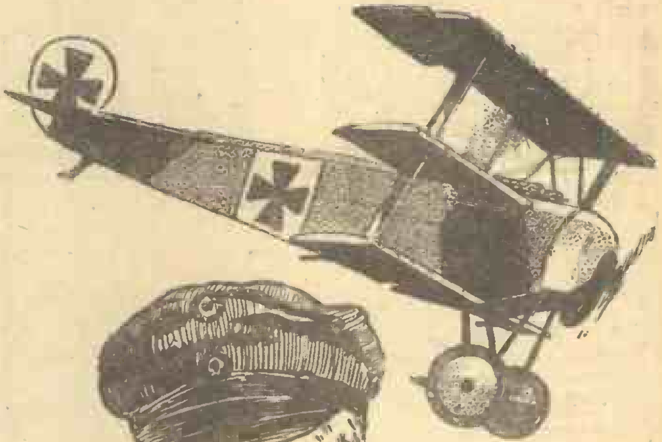

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Silent and unseen, the raiders of the night baffled pursuit with uncanny ease—until the flaming torch of a doomed defender revealed the secret of the Phantom Squadron.

THE GENTLEMAN FROM JAVA
A Hawker Hart was the bait in a deadly trap set by Kinley of the Secret Service to lure a killer to its doom.

BREECHES OF DISCIPLINE
There are occasions when even Staff Officers need more than Brass Hats to preserve their dignity.

SPECIAL AIR FEATURE:—

FAMOUS 'PLANES OF THE GREAT WAR

IN THE FEBRUARY

AIR STORIES 7D.

At all Newsagents and Bookstalls, or by post 9d. from the Publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

George Newnes, Ltd.

Towards Valve Standardisation—See Page 493.

ROUND *the* WORLD *of* WIRELESS

That Old Set

ALTHOUGH many amateurs prefer to dismantle an old set and build a completely new model, there are many reasons why it is often found desirable to retain an old model and simply modernise it, or modify it in some small way. One of the main reasons is that of expense, and many listeners find that the receiver fulfils its purpose in many different directions and requires only some slight modification—such, perhaps, as slight additional amplification. Although in some cases such modification might be a simple matter, there are many pitfalls for the unwary, and on page 500 this week, we deal with the subject of improving an old set and give several instances where simple alterations may be made and outline the difficulties which may be encountered. It should be emphasised again here, that it is not generally a simple matter to convert an ordinary simple battery set into an all-mains model. Although at first sight it might appear only necessary to exchange the battery valves for mains-type components, there are many other changes which will have to be introduced. For instance, the higher voltage at which mains valves operate will probably render it necessary to replace many fixed condensers owing to the fact that the working or test voltages of those components will be too low. Resistors may also have to be replaced, and, furthermore, the general design of the set may result in instability setting in when the more efficient mains valves are used.

A Listener's Trophy

WE recently published a letter from a reader who had won an American trophy for the most meritorious listening during a period of 30 days. He had a bag of 247 stations, of which no fewer than 152 verifications had been received. As a result of his efforts he has now been offered a post with Messrs. Peto-Scott, and full details will be found on another page in this issue.

New B.B.C. Governor

THE King has approved the appointment of Miss Sara Margery Fry to be a Governor of the B.B.C. for a period of five years from January 1st, 1938, in place of Mrs. Mary Hamilton, whose term of office expired on December 31st, last.

An Echo of Olympia

MANY visitors to the Radio Exhibition at Olympia were intrigued by the performance of Mr. Fred Archer, referred to as the "living dummy." Those who saw him will remember his post on the H.M.V. stand where he sat motionless for considerable spells and caused much comment as to whether or not he was a human being or a waxwork model. He recently repeated his performance in the window of a Glasgow radio dealer and succeeded in attracting attention and trade.

On Other Pages

American Television

A MOBILE television station has been delivered to the N.B.C. of America, based on somewhat similar lines to the B.B.C. outfit. A trolley aerial is fitted on one of the vans, whilst the other has a special platform on the roof for the camera floodlights and other essential apparatus.

KDKA's New Aerial

THE new aerial mast at KDKA, Saxonburg, near Pittsburgh, is now claimed to be the tallest in the world. With a total height of 718ft., and weighing 60 tons, the top is often obscured by clouds, and it is claimed that great improvements have been effected in radiation with this new aerial. The mast is composed of 32 three-cornered welded steel sections, and it rests in a ball-and-socket joint of a single large porcelain insulator.

B.B.C. Foreign News

WITH the introduction of the news broadcasts in Arabic on January 3rd a new series of news bulletins is to be instituted. It is stated that in addition to Spanish and Portuguese, other languages will later be introduced, and it is hoped to counter some of the foreign propaganda broadcasts by giving the strict news item as broadcast from the English stations.

New English P.A. Development

A DEVELOPMENT of far-reaching importance has been announced by the well-known English Tannoy Company. It is claimed that a new microphone which they have produced enables, without the use of an amplifier, an output from 8 to 10 watts to be obtained from a standard P.A. loudspeaker. The only other item needed (in addition to mike and speaker) is a 6-volt accumulator capable of delivering from 4 to 5 amps.

New Aerial Yearly?

AT a meeting in U.S.A. recently the service manager of one of the largest radio companies announced that aerials should be renewed annually. He said that no matter how good an aerial array was, it was bound to deteriorate at the joint and other points and give adverse results. The trouble is particularly noticeable when an efficient modern receiver is employed.

Dudley's First Broadcast

ON January 20th the Midland transmitter will radiate for the first time an outside broadcast from the Town Hall, Dudley. The occasion is a concert by the City of Birmingham Orchestra, conducted by Harold Gray, and Tom Bromley will be the pianist for the Rachmaninoff C Minor concerto.

R.A.F. Re-union Dinner

ROYAL AIR FORCE, Electrical and Wireless School (one time No. 1 "T" Farnborough and Flowerdown) Officers' Re-union Dinner. R.A.F. Club, 128, Piccadilly, 7 p.m. for 7.30 p.m., Saturday, January 22nd. Those interested please write—F.Lt. F. S. WAINSCOT, Cranwell, Lincs.

ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL NEWS and NOTES

Broadcast by Redskins

WE are informed that arrangements have been made in Canada for a series of broadcasts by members of red-skin tribes. The talks have been written by the Indians themselves, and will deal with the status and the future of the Iroquois, the Crees, the Sioux and the Blackfeet Indians. These thrilling names will be familiar to all listeners who have read Fenimore Cooper.

Television Reception at 100 Miles

IT is reported that twenty people in Norwich, 100 miles from London, looked-in to a television programme from Alexandra Palace on Christmas night. This is a record, as television reception is seldom obtained over a distance greater than forty miles from the Alexandra Palace, though in a few instances, notably Brighton and Cambridge, good results have been had up to fifty or sixty miles.

Poland's Scheme for Increasing Number of Listsners

IT appears that the Polish Broadcasting authorities are running a competition designed primarily to increase the numbers of listeners in that country. All registered listeners are eligible to compete, and prizes will be awarded for the best short articles on such subjects as "Why I Became a Listener," etc. The prizes include motor cars, cash prizes of from £2 to £40, and gold and silver watches.

Big Circus Broadcast

ONCE again Northern listeners will hear a broadcast from a circus. The programme is called "Allez 'oop," and it will come on January 22nd from the circus at Belle Vue, Manchester, where the equestrian director is the popular George Lockhart.

Doctor's Instructions by Radio

WHILE waiting for a boat recently to carry him a distance of eighteen miles through stormy seas to a woman taken seriously ill on the Shetland Island of Foula, a doctor wirelessed instructions to those who were fighting for her life.

Midland Theatre Music

ALFRED REYNOLDS will be the guest conductor of the B.B.C. Midland Orchestra in a programme of theatre music of his own composition, on January 19th. It closes with a selection from "1066 and All That," which is again the Christmas play at Birmingham Repertory Theatre.

Men's Hockey Broadcast

ON January 15th, in the Midland programme, there is a recorded summary of Cedric Johnson's commentary on the men's hockey match, North v. Midlands, at Nottingham. Mr. Johnson played at various times for Worcestershire. He has acted in Midland plays and was for a time relief announcer in Birmingham.

Concert from Leeds University

AUBREY BRAIN (horn) and Harold Bradbury (tenor), with Edward Allam at the pianoforte, will be the artists of the Leeds University Midday Concert which is included in the main Regional programmes of January 13th.

Miss Margery Fry, who was recently appointed to the post of governor of the B.B.C.

SOLVE THIS!

PROBLEM No. 278.

Jackson visited a surplus radio store and obtained some I.F. transformers, superhet coils and a superhet ganged condenser, with which he constructed a 5-valve superhet. He found great difficulty in ganging, and accordingly had the I.F. transformers adjusted by a dealer to the correct frequency, but still found that when adjusted at one end of the waveband it was necessary to adjust the trimmer on the oscillator section of the ganged condenser when tuning to the other end of the scale. What was the most likely cause of this trouble? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 278 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, January 17th, 1938.

Solution to Problem No. 277.

The cause of the trouble in Atkins' set was a defective bias resistor in the frequency changing stage which varied in value and thus caused instability owing to the resultant change in the anode current of the valve.

The following three readers successfully solved Problem No. 276 and books have accordingly been forwarded to them: R. E. Hill, 130, Drove Road, Biggleswade, Beds.; T. F. Bugler, North Street, Beaminster, Dorset; D. Sefton, 49, Clifford Avenue, East Sheen, S.W.14.

Dance Cabaret

CABARET artists in a programme from the Royal Bath Hotel Ballroom, Bournemouth, on January 19th, will include: Three in Harmony, "Elva, Yolande and Dorothy"; Tollefsen, "The Wizard of the Accordion"; Lina Menova, "The Russian Cabaret Star"; Leslie Weston, "Entertainer"; and dancing to Billy Bissett and his Canadians, with the Canadian Capers and Alice Mann.

New Greek Stations

ACCORDING to a recent report, the new Athens station began its regular transmissions on January 1st, using a wavelength of 499.2 m. (601 kc/s) and a power of 15 kW, which is later to be raised to 100 kW. The Thessaloniki station has been broadcasting regularly for some time on 225 m., using a low power, but the Greek Government is also erecting a new high-power station to take its place.

Organ Recital

THE fourth of the present series of B.B.C. Organ Recitals will be given before an audience in the Concert Hall, Broadcasting House, by the distinguished French organist, Marcel Dupré, on January 27th. Marcel Dupré is organist at the Church of St. Sulpice in Paris, and Professor at the Paris Conservatoire.

In Memory of Maurice Ravel

WE understand that, as a tribute to the memory of the distinguished French composer, Maurice Ravel, whose death was recently announced, his "Pavane for a dead Infanta," as well as his "Bolero," originally included in the programme, will be played at the concert to be given by the B.B.C. Symphony Orchestra, conducted by Sir Adrian Boult, at the City Hall, Newcastle-upon-Tyne, on January 12th.

Wins Trophy, and a New Job

THE performance at the Edmonton Empire was recently interrupted for an unusual ceremony when a local man, known to his friends as the "Ear of Edmonton," received from Mr. F. A. Broad, M.P., a trophy in recognition of his achievements as the world's champion radio listener. He is Mr. Fred Lanaway, of 49, Granville Avenue, Edmonton, whose effort consisted of receiving in August, 1936, no fewer than 247 short-wave foreign broadcast transmissions, 152 of which verified his receptions.

Mr. Lanaway is the first person outside the continent of America to win the trophy, which is one of a series awarded monthly by a New York magazine. The set he used was a two-valve instrument built by himself.

Until this event Mr. Lanaway had been unemployed, but the merit of his performance attracted the attention of a firm of radio manufacturers, Messrs. Peto-Scott Co., Ltd., of High Holborn, W.C., who have given him a position in which he can turn his hobby to good account.

Mr. Lanaway helped to win another kind of cup in his school days when, playing in a team which included Fred Channell, the ex-Spur, he scored the goal which secured victory for Lancasterian Old Boys in Tottenham schools' football.

Systematic Fault Finding—2

Further Notes on the H.F. Stage, the Detector Stage, Instability, and Lack of Selectivity are Dealt With in this Second Article of the Series

THE following leads, etc., should be screened—all coils, the H.F. valve, anode, and grid leads, the H.F. choke and, in severe cases, the leads to the tuning condenser, and that from the anode of the valve (including the coupling condenser C), to the detector coil.

If tuned anode coupling is in use, convert to the parallel feed method, using a good H.F. choke and mica coupling condenser. Tuned anode coupling is notoriously unstable, and very often difficult to control.

If the valve oscillates as the sensitivity is increased, the standing bias should be raised by increasing the value of the bias resistance (R in Fig. 3).

Superhets

For the purposes of these articles, we will include the frequency-changer and I.F. stages of a superhet under the heading of an H.F. stage, for the same remarks regarding poor performance, instability, etc., arise. In Fig. 6 is shown a typical battery triode-pentode frequency changer.

The screen voltage is usually very critical, and may be lowered slightly if instability occurs. A further cause of instability may be due to interaction between the grid and anode leads of the triode section, and an anti-parasitic resistance R (500 to 2,000 ohms) should be included in the grid circuit. Both anode and grid leads may be screened.

The use of screened leads, non-inductive by-pass condensers, etc., as outlined above is equally necessary in a superhet; in fact, often more so, and the usual tests of coils, condensers, etc., should be carried out according to the fault.

Generally speaking, however, the faults encountered in a superhet are due to overloading the frequency or I.F. valve and ncorrect ganging.

It is very important to get the ganging strictly accurate, and this is carried out by means of an oscillator and output meter. Switch the receiver to medium waves, with the tuning condenser at minimum and the volume control at maximum. Short out the oscillator grid coil by connecting an 0.1 mfd. non-inductive condenser across it. Connect the oscillator to the grid (top cap) of the frequency-changer valve and earth, and the output meter across the output transformer. Inject a signal of the correct I.F. (110 kc/s or 465 kc/s, as the case may be) and trim the I.F. transformers for maximum output as measured on the meter, using a minimum of signal and reducing this as the circuits come into line in order to reduce the A.V.C. action. Now transfer the oscillator to the aerial and earth terminals and remove the shorting condenser. Tune the receiver and oscillator to 214 metres and adjust the aerial, H.F. and oscillator trimmers for maximum output. Turn to long waves, inject a signal of 1,000 metres and adjust the long-wave padding condenser. The set is now accurately trimmed, and whistles which may previously have appeared all round the dial, and have been put down to instability, will most probably have disappeared. If not, then they are due either to valve overloading by the local station, and the strength of this should be cut down by means of a wave-trap (fuller details of this will be found in our recent article, "Eliminating Second-channel Interference"), or else I.F. instability, when a stopping resistance should be included in the grid circuit of the I.F. valve.

Insufficient gain in the frequency-changer stage may be due to failure of the valve to oscillate. To test this, connect a milliammeter in the anode lead. If the valve is oscillating correctly, and this test should be carried out at various points of the dial, a large change in anode current occurs if the grid is touched by the hand. If the valve does not oscillate, it means that the reaction winding is not correct. First try increasing the oscillator anode volts, and then reversing the oscillator anode and grid coils.

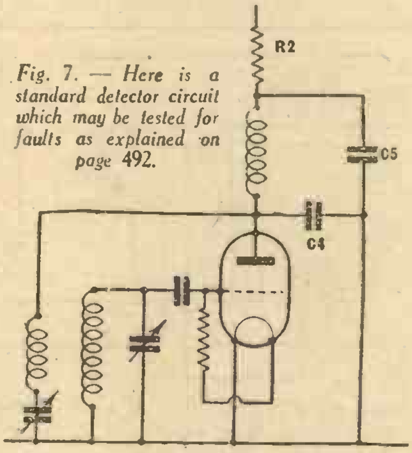


Fig. 7.—Here is a standard detector circuit which may be tested for faults as explained on page 492.

Further, adequate by-passing of screen, anode, cathode and oscillator anode, is essential by means of non-inductive bypass condensers.

These are the general points in a superhet which require special consideration. The general tests of H.F. stages, should, of course, be also carried out.

The detector is probably the most vulnerable part of a wireless receiver, and is prone to many curious faults, more especially if it is of the leaky-grid type where reaction is employed.

As explained in the first article, it is necessary first of all to test the H.T., L.T. and bias supplies and the current consumed by the valve, and also to test any coils connected in the grid circuit, or chokes and resistances, etc., in the anode lead.

Once these tests have been carried out and the valve proved to be in working order, we can proceed to locate the fault definitely.

The more usual troubles with a triode detector are:—

(a) Distortion due to overloading.
(b) Instability.
(c) Faulty reaction.
(d) Bad selectivity.

(a) *Distortion due to overloading.*—Detector distortion is often accompanied by an accentuation of the sibilants and upper frequencies, and sometimes by double-hump tuning, the receiver tuning to a particular station at two distinct points quite close to one another. The remedy is to reduce the input to the detector circuit or else to increase the anode voltage. The peak signal which a leaky-grid detector will handle without overloading is approximately equal to the grid bias which is required to operate the valve as an L.F. amplifier under the particular high-tension conditions. Suppose, for instance, the anode voltage applied to the detector valve is only 40 and that, when used with this voltage as an L.F. amplifier, a grid bias of 1 volt is required for correct operation. When the incoming signal to the detector exceeds 1 volt H.F., it is

(Continued overleaf)

SUMMARY—1

Stage.	The circuit does not work.	Circuit works on one waveband.	Performance is not up to standard.	Instability and distortion.
H.F. amplifier	Open or shorted coil. Dirty switch contacts. Shorted tuning condenser. Shorted screening. Faulty resistance or condenser in anode.	Faulty wavechange switch. Broken coil winding. Wrong aerial coupling.	Dirty plates on tuning condensers. Faulty H.F. choke. Leaking anode, screen, or cathode bypass condenser. Losses in valveholders. Faulty coupling condensers.	Faulty anode, screen or cathode bypass condenser. Unscreened leads. Use of tuned-anode coupling. Shorted bias resistance or too low a value. Overloading due to use of too long an aerial.
Frequency changer	Open anode resistance. Faulty oscillator coil. Shorted oscillator condenser. Faulty I.F. transformer. Shorted screening.	Faulty wavechange switch. Broken coil winding. Faulty padding condenser.	Valve not oscillating. Too low screen or oscillator anode voltage. High resistance contacts to oscillator coil. Leaking bypass condensers. Circuits not trimmed.	Faulty shielding. Faulty bypass condensers. Circuits not trimmed. Faulty grid condenser. Faulty bias resistance.
I.F. stage	Open or shorted I.F. transformer. Shorted screening.	Check H.F. stage.	A.V.C. network faulty. Shorting trimmers. Circuits not trimmed. Open grid condenser. Too high value for grid stopper.	Faulty shielding. Faulty bypass condensers. Faulty bias resistance. Circuit out of alignment.

The above tests assume that the valves have in each case been tested and proved in order.
Approximate current taken by valves: Battery S.G.—1 mA. Battery H.F. pen.—3 mA. Battery triode—2mA. Mains S.G.—11 mA. Mains H.F. pen.—10 mA. Mains triode—4 mA. Battery power—10 mA. Battery pentode—12 mA. Battery frequency changer—2 mA. Mains power—48 mA. Mains pentode—40 mA. Mains frequency changer—10 mA.

SYSTEMATIC FAULT FINDING

(Continued from previous page)

obvious that the detector will be overloaded. On the other hand, if the anode voltage could be increased to 60 volts, when the required grid bias as an L.F. amplifier would be, say, 3 volts, then the signal handling capacity of the detector has been materially increased.

The use of a higher anode voltage necessitates the use of lower values of grid leak and condenser, and values of .0001 mfd and 100,000 ohms should be used with large anode voltages.

The obvious test for detector overloading is a milliammeter in the anode circuit, when kicks in the reading will indicate overloading.

The input may be lowered to the detector by reducing the amplification of the H.F. stage or using a lower value of coupling condenser if tuned-grid coupling is employed.

(b) *Instability.*—The detector valve anode circuit is the one which usually calls for most decoupling, as it is here that the H.F. currents are "sorted out" from the required L.F. ones.

Extra decoupling should be added without, if possible, altering the anode voltage applied to the valve, and this is most easily carried out by adding another decoupling condenser in parallel with C5 in Fig. 7. It may also be necessary to increase the value of the decoupling resistance R2 or to add another in series with it if the resistance is used for coupling purposes, but this should be done with great caution because the anode voltage will be thereby reduced. In the case of a resistance-capacity coupled amplifier it is often possible to add extra decoupling by reducing the value of the coupling resistance and then adding another resistance in series to bring the total resistance in the circuit back to the previous value, and joining a large capacity condenser between the junction of these two resistances and earth.

The presence of H.F. currents in the detector anode are often a frequent source of instability and distortion, and the H.F. choke, the by-pass condenser C4 (Fig. 7), and the reaction circuit should be tested for continuity and/or leakage as the case may be. An easy method of ascertaining whether the presence of H.F. currents is the cause of the instability is to feed the detector valve grid direct from a pick-up. If the quality of reproduction is good and free from distortion, it is a good indication that the instability on radio is due to the presence of H.F. currents in the detector anode circuit, and therefore in the subsequent L.F. stages of the receiver.

Under the heading of distortion and instability we must include microphony. This consists of the building up of a low-frequency howl due to the use of a valve whose electrodes are not firmly fixed. The only real remedy is replacement of the valve, but a cure may sometimes be effected by removing the loudspeaker from the cabinet, or by wedging the valve in some way.

(c) *Faulty reaction.*—Reaction faults were fully discussed on pages 783 and 784 of our issue of March 7th, 1936, and attention is directed to that article. They may be briefly summarised, however, as follows:

Insufficient reaction.—This is probably due to the use of too low a value of H.T., too high a value of by-pass condenser, too low a value of reaction condenser, faulty H.F. choke and decoupling condenser, or wrong values of grid leak and condenser.

Reaction too fierce.—The probable causes of this are too high a value of H.T., too low a value of by-pass condenser, too high a value of grid condenser, or may be sometimes cured by the inclusion of a small non-inductive resistance of about 250/500 ohms in series with the reaction circuit.

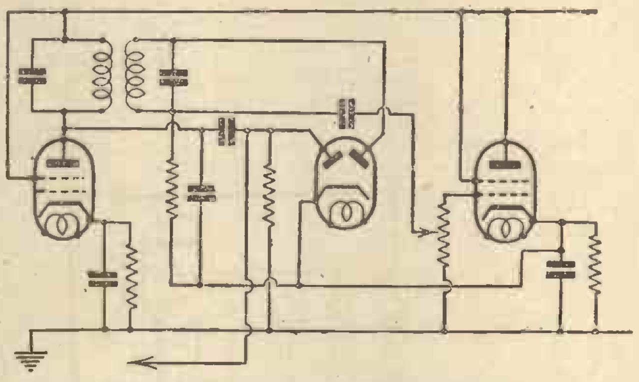


Fig. 8.—The A.V.C. circuit of a superhet receiver which may be tested as described in this article.

Reaction only effective on one waveband.—This should be treated for as described for insufficient reaction, but if then found to be too fierce on the other waveband, a small stopping resistance should be included and the value of this adjusted to give smooth reaction on both wavebands.

Reaction only effective over part of a waveband.—Increase the H.T. slightly and try different values of by-pass condenser.

Reaction flattens tuning.—Reverse connections to the reaction coil or connections to the two sets of fixed plates if a differential condenser is in use.

Hand-capacity effects.—Connect reaction condenser between the "earth" side of the coil, or, if this is already done, make sure that there is a good connection to the H.T. negative line and that the receiver is effectively earthed.

Reference should be made to Fig. 7, which shows the steps to be taken should reaction prove faulty in any way.

(d) *Bad selectivity.*—This may be caused by overloading, giving rise to double-hump tuning, reverse connections of the reaction coil, too large a value of grid coupling condenser, or too large a value of grid condenser. The coupling condenser and the grid condenser may both be tapped down the coil, often with very improved results.

SUMMARY—2

Fault.	Triode detector.	Diode detector.
Complete failure	Shorted coil or condenser. Shorted H.F. choke. Shorted tuning condenser. Shorted by-pass condenser.	Open or shorted diode resistance. Open volume control.
Intermittent failure	Leaky grid condenser. Faulty grid leak. Leaky anode condenser. Loose connections on coil.	Defective volume control. Leaking by-pass condenser. High resistance in I.F. secondary. A.V.C. network defective.
Instability	Faulty grid leak or condenser. Faulty reaction circuit. Faulty H.F. choke. Leaky by-pass condenser. Insufficient decoupling.	I.F. out of alignment. Faulty A.V.C. network. Defective load resistance.
Distortion	Valve overloading. Double-hump tuning. Faulty anode resistance. Faulty H.F. choke.	Leaky coupling condenser. Leaky by-pass condenser. Load resistance too high. Faulty A.V.C. network.

When ganging a straight receiver employing a triode detector and reaction, it is essential to do so with the H.F. amplification reduced to a workable minimum and the reaction control advanced so that the detector is on the verge of oscillation. Under such conditions, the detector circuit is in its most selective state and it is possible to get the trimming very exact. Bad selectivity is often a direct result of trying to gang the receiver with maximum H.F. amplification and no reaction, resulting, more often than not, in double-humped tuning and badly mismatched tuning circuits.

Diode detectors and A.V.C.—All diode detectors are subject to the same faults, at least as far as detection and A.V.C. are concerned, and only differ in that some are used simply as detectors and others incorporate an amplifier. For the sake of simplicity we will consider here a double-diode circuit, as shown in Fig. 8. It will be noted that no H.T. voltages are used, and the first steps must be to check the L.T. and the delay voltage applied to the cathode.

We will assume that the I.F. valve is tested and passed O.K. and that the I.F. transformer is in good order and correctly set. The easiest method of testing a diode detector where A.V.C. is in use is to insert a milliammeter in the anode circuit of one of the controlled valves or a voltmeter across a cathode resistance. An observation of the changing anode current or bias volts will enable the actual control bias to be read off and hence will show whether the diode detector is functioning properly. Should it not be, tests should be made on the resistances and condenser comprising the A.V.C. circuit.

It is probable that a fault in the A.V.C. circuit will have no effect other than to remove the control, but it is possible that a faulty resistance will isolate the grids of the control valves from the earth line, and result in severe hum and/or distortion due to a controlled valve or valves having a free grid.

Checking the A.V.C. action of a diode detector is practically the only method for an amateur to test that stage.

Some time ago, the author had occasion to service a very well-known make of superheterodyne receiver with diode detector and delayed A.V.C. The trouble was a sudden falling off in volume and severe distortion. Naturally, the output stage first received attention, but this was found to be in good order. A test of the H.F., frequency changer and I.F. stages proved that all valves were functioning properly, and it was not until a milliammeter was inserted in the anode of one of the controlled valves that it was noticed that there was no change in anode current even when a very strong signal (the local station) was tuned in. This directed attention to the last valve to be suspected—the simple diode detector—and a test of this valve showed that one of the anodes had sagged and was shorted to the cathode. The substitution of a new valve effected a speedy cure, and this example is given to show that, even with the limited tests available, faults in a diode detector may easily be located.

(To be continued)

Towards Valve Standardisation

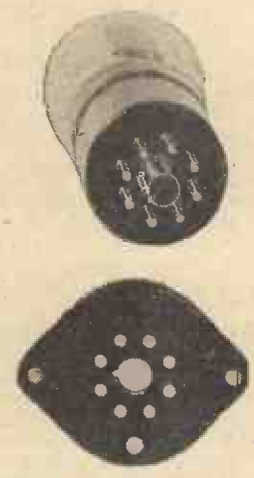


Fig. 1.—The base and holder for an octal valve.

This Article Refers Particularly to the "International" Series of Octal-based Valves, but Suggests that Greater Uniformity of Valve Bases and Connections is Urgently Needed

By FRANK PRESTON

THE number of different types of valve available is bewildering to the technician who is daily in touch with them. How much more so to the average constructor? It is not only that there are so many varieties, such as pentagrids, variable-mu pentodes, screen pentodes, triodes, low-frequency pentodes, tetrodes, and rectifiers—to mention just a few—but that there is such a multiplicity of valve bases and systems of connection. Additionally, there are ranges of valves for operation with filament or heater voltages of 2, 4, 6.3, 13, 20, 26, 35, 40, and mains voltages. Valves of these ratings are actually made and used in this country, but if those used in other countries were included the variety would be still more confusing.

Infinite Variety

Until comparatively recent times, even British battery valves were made for filament voltages of 2, 4 and 6; some valves with the latter ratings are still to be obtained although not generally listed as standard. Fortunately, valves for battery operation are nearly all now made for 2-volt filament operation, and the passing of the other obsolescent types is to be applauded. Manufacturers have apparently been able to draw up certain standards in this respect and agree to co-operate to maintain them. Is it, then, too much to hope that it will eventually be found possible to standardise a particular form of base with a certain number of pins or other means of connection? Such a step would be greatly in the interests of home construction, and would simplify replacement to a considerable extent.

A "Standard" Base?

As it is, we have four-pin, seven-pin, and nine-pin valves in regular use. It should not be difficult to have a fixed number of pins for valves of all types; some of the pins would not be used in many cases, but the constructor could soon memorise the connections if pins in certain positions were invariably used for filament or heater, cathode, control grid, screen grid, anode, etc. It should not be out of the question, for example, to have two adjacent pins in a set position for the filament or heater connections; then, running round the holder in, say, a clockwise direction, to have the next pin for the cathode (when used), next for the second grid—going outward from the cathode, next for the third grid and the next for the anode; the control grid, or first grid, would, for preference, be joined to the top cap.

Very probably there are objections to the arrangement exactly as described, but it would appear that the principle could be adopted without any insurmountable technical difficulty. Unfortunately, a number of years would have to elapse before valves of this type could be used on a large scale, since receivers already built would require replacement valves for some time.

Such an objection would not be very pronounced as far as the constructor is concerned, however, for he would find little trouble in fitting suitable holders and modifying the connections as and when valve replacement became necessary. Before a scheme such as that outlined—somewhat baldly—could be put into operation it would be necessary for valve manufacturers throughout the world, or, at least, those in this country, to agree to a "standard." But the end should fully justify the means.

Whether a system of this nature can or cannot be adopted, it is evident that many alterations will have to be made before the science can be fully developed. And if any one valve base could be adopted that could be used for every type of valve, battery and mains, a great and valuable step would have been taken.

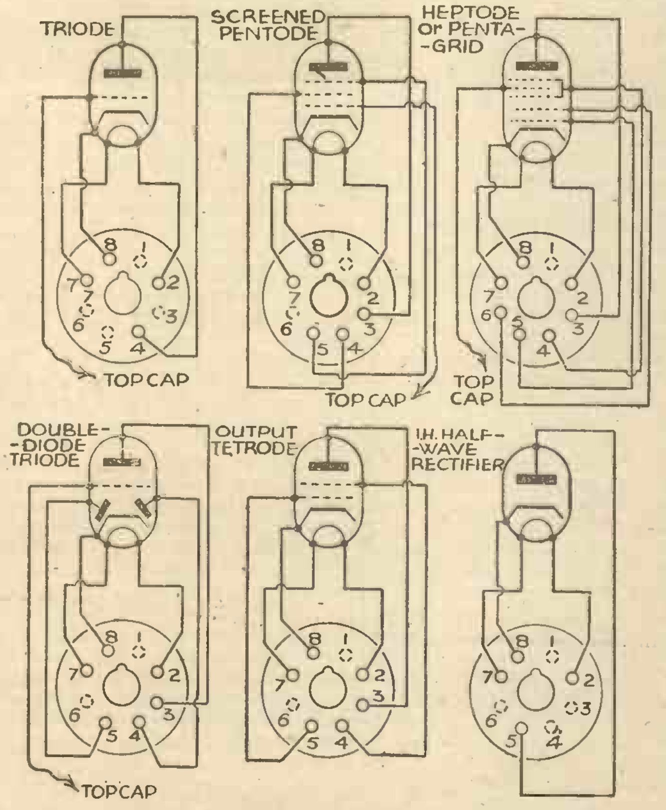


Fig. 2.—Under-base connections for a few typical "International" octal valves.

Octal-base Valves

It is freely admitted that the suggestions made above are not entirely original, for the recent introduction into this country of the so-called "International" range of valves with octal base follows roughly the principle described. As yet, this range of valves is not particularly well known to constructors, many of whom will find it deserving of consideration. Briefly, the idea is that every valve in the range has an eight-pin base of the type illustrated in Fig. 1, and that the method of electrode connection is substantially the same throughout the range.

It will be seen that, in addition to the pins, there is a central projection which is circular in section, but provided with a projecting key to correspond with a shaped hole in the centre of the valve-holder. As the centre projection extends beyond the pins the valve cannot be inserted into the holder incorrectly, and the accurate location of the pins with the sockets can be effected without any difficulty whether or not the holder is clearly visible.

The next important point concerning these valves is that they each have an indirectly-heated cathode, and the majority have a heater rated at 6.3 volts. As a result, they can be used in a set for battery, A.C., D.C., or A.C./D.C. operation.

Originally developed in the U.S.A., these octal-based valves were intended principally for use in car-radio sets—the majority of American cars have a 6-volt battery. Although rated at 6.3 volts, they operate efficiently on voltages between about 5.5 and 6.3.

Complete Ranges

A full range of valves requiring a heater current of .3 amp. is obtainable, from a heptode frequency-changer to an output tetrode and rectifier. This means that they can conveniently be used in a D.C.

TOWARDS VALVE STANDARDISATION

(Continued from previous page)

or A.C./D.C. receiver, especially since there is a wide range of .3-amp. barretters. In this case, however, the output tetrode has a 26-volt heater, the rectifier having a 39-volt heater. This does not complicate matters in the slightest when the heaters are connected in series.

There is also a full range suitable for A.C. or battery operation. All except rectifier can be had with a 6.3-volt heater, the rectifier having a 5-volt heater. In this case, however, the heater-current ratings vary, since the output tetrode requires .7 or 1.27 amp., according to the particular valve chosen. If the receiver were being operated from a car battery the rectifier would probably not be used, high-tension being derived from a vibrator unit, and if the set were for A.C. operation a separate transformer winding would in any case be required, and this could be designed for 5 volts as easily as for any other figure.

It will be seen, therefore, that these "International" octal-based valves have a wide range of application. In general, their characteristics are not quite as good as those of the better-known A.C. and Universal valves, but this is not necessarily a disadvantage. In one respect it is a decided advantage, due to the fact that the valves of similar type can be turned out of the factory with more uniform characteristics. Additionally, the design of a receiver using them is somewhat simplified because stability is more easily ensured. The slightly lower overall amplification provided by each valve in the set results in reduced likelihood of instability and makes it possible to use more highly efficient coupling components.

Connections

Fig. 2 shows the connections, on the underside of the valveholder or valve base, for a few types of octal valve. From these it will be seen that in every case the heater is joined to terminals 2 and 7, the control grid to the top cap, and the screen grid (except in the case of the triode) to terminal 4; the anode is joined to terminal 4 in the triode. Little difficulty will be found in memorising the connections if it is remembered that pin number 1 is above and just to the right of the key on the centre projection, and that the pins are numbered from 1 to 8 in a clockwise direction when looking at the underside of the valve base or holder. The connections then are: 1. metallising (when provided); 2. heater; 3. anode; 4. screen-grid or diode anode; 5. oscillator grid, suppressor grid or diode anode; 6. oscillator anode; 7. heater; 8. cathode. There are, as can be seen, one or two slight exceptions, but these apply only to valves not fitted with a top cap.

The Hivac Harries All-Stage Valve, although not quite on the same lines as ordinary modern valves does, of course, tackle the problem successfully from a different angle.

THE WIRELESS CONSTRUCTOR'S
ENCYCLOPÆDIA
By F. J. CAMM
(Editor of "Practical and Amateur Wireless")
4th Edition 5/- net
Wireless Construction, Terms, and Definitions explained and illustrated in concise, clear language.
From all Booksellers, or by post 5/6 from George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

A Radio-equipped Ambulance

In the majority of hospitals and nursing homes, wireless sets are already installed, but an advance on this has been made by the No. 44 (Acton and Hammersmith) Division, St. John Ambulance Brigade, which, under the command of Superintendent T. S. Appleton, has had installed in their Vauxhall 27 h.p. ambulance, a standard Philco single unit car radio receiver with built-in loudspeaker in the driver's cabin, and an extra loudspeaker installed inside the ambulance. This is shown in the top left of the accompanying illustration, Fig. 2, and has a special switch to enable it to be controlled from inside the ambulance.

The radio is an endeavour to relieve the monotony of convalescent patients when conveying them on long journeys, and it will also provide relaxation for the driver and attendants during the many hours of waiting necessary in their sphere of activities. In cases of national emergency, ambulances so equipped will prove most useful. The expense of the installation has been met by Sergeant J. R. Appleton, and three of his colleagues of the 44th Division Transport Section.

It is interesting to note that Superintendent T. S. Appleton was the Officer-in-charge of the St. John Ambulance Brigade stretcher party which conveyed the late King George V from Buckingham Palace to Bognor during his serious illness of 1933.

Fig. 1.—(left) A radio-equipped ambulance, and Fig. 2 (above)—a view of the interior.

D.C. Eliminators and Modern Receivers

Modern battery receivers are very economical in high-tension consumption, so economical in fact that the average three-valve straight set consumes only about seven to eight milliamps, and many three- and four-valve superhets take less than ten milliamps.

This is very desirable from the battery user's point of view, but often gives rise to trouble when the high-tension supply is taken from D.C. mains. The ordinary D.C. eliminator is simply a smoothing system and a voltage-dropping resistance; therefore it follows that the output voltage to the receiver is inversely proportional to the current.

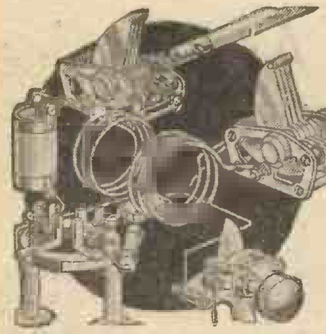
Reducing Applied Voltage

The average good class D.C. eliminator has an output of about 120 volts at 20 milliamps when working on a mains voltage of 240. A simple application of Ohms Law will show that if the output current is reduced to ten milliamps the voltage will rise to 180. Since the set will take more current if the H.T. voltage goes up, the voltage will not rise quite so high, and will probably settle down at, say, 13 milliamps at 160 volts.

The modern receiver is a sensitive device—particularly the superhet—and cannot be expected to remain stable at the excessive H.T. voltage of 160 or so; instability or self oscillation is the result. A reduction in the applied voltage is the obvious cure, and there are two ways of bringing about this reduction: (1) By inserting a suitable resistance in series with the maximum tapping, an arrangement which has the advantage of economy of current consumption, but the disadvantage that it increases the external anode circuit impedance and makes voltage regulation more imperfect; (2) By connecting a resistance from the maximum tapping to H.T.—having a value that will pass the difference between the nominal eliminator output and the current consumption of the receiver.

An example will make the procedure quite clear. If the receiver consumes 10 mA and the nominal eliminator output is given as 20 mA, the resistance should be 12,000 ohms—2-watt rating.

A similar difficulty may be met with when using certain types of A.C. mains unit in which low-voltage tappings are provided by means of series resistances. The current ratings at these points should be carefully studied, as they act in a similar manner to the series resistance mentioned above in the D.C. unit.



Short Wave Section

MAKING THE L.-F.-AMPLIFIER UNIT.

In this Concluding Article of the Short Series, "The Experimenters" Give Constructional Details of an Amplifier Unit to Complete the Battery-operated Short-wave Superhet that has Formed the Subject of Previous Articles.

by The Experimenters

BEFORE we settle down to our task of describing a few suitable types of L.F.-amplifier unit we want to take to task the draughtsman who prepared the drawings for our article in the issue dated December 25th. We can only conclude that he was imbued with the festive spirit when he drew Figs. 5 and 6, for he showed the by-pass condenser for the A.V.C. decoupling resistor connected between the wrong end of that resistor and earth. Up to the time of writing we have not received any letters of complaint from our readers, so perhaps they were too interested in turkeys and pudding to give their minds to such mundane matters as constructional radio.

If you turn back to the two figures in question you will see that the .1-mfd. by-pass condenser is virtually short-circuiting the load resistor, and therefore "absorbing" the rectified output from the "Westector." This condenser should, of course, have been joined between the lower end of the resistor and the earth line; the other corresponding by-pass condensers are correctly connected to act as by-passes across the resistors concerned. Forgive the slip and refrain from writing those abusive words that might have been on the tips of your pens.

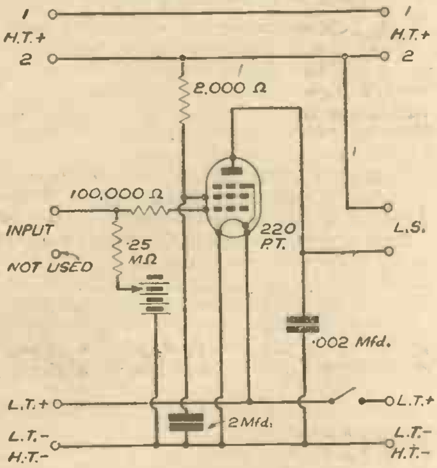


Fig. 1.—Circuit for a resistance-coupled pentode amplifier.

Choice of Circuit

So much for that—and now the question of the final unit. What type of amplifier do you prefer: a resistance-coupled pentode, a pentode with transformer coupling, or a two-stage triode amplifier with resistance coupling? Any of these can be used suitably, and circuits for each are given in Figs. 1, 2 and 3. All are of perfectly simple form, and all are standard in most respects. The resistance-coupled pentode is the least expensive to build and will provide a fair output. If you generally use 'phones for DX work it is probably the best, but it will not give particularly good speaker reception of the more distant transmissions.

The transformer-coupled pentode (Fig. 2) will give a similar output to that obtained by employing a couple of R.C. triodes, but it is a little more "ticklish," perhaps. Any small transformer can be used, due to the fact that it is resistance-fed by the load or anode resistance (according to whether you used a valve or "Westector" as second detector) and the .05-mfd. grid condenser in the detector unit. A ratio of 1 to 5 will provide the greatest volume, but the difference between that and a ratio of 1 to 3.5 is not great in practice.

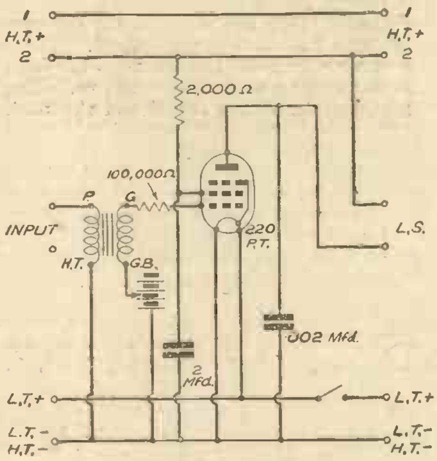


Fig. 2.—How a resistance-fed transformer can be used in a circuit similar to that in Fig. 1.

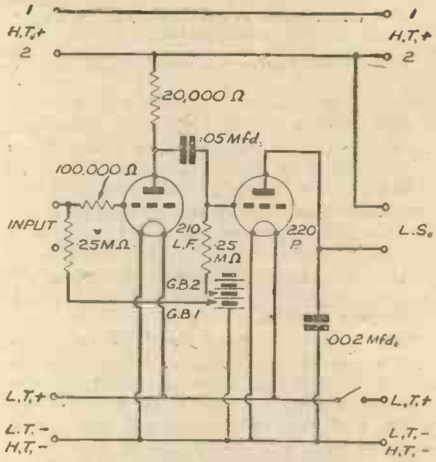


Fig. 3.—A two-triode amplifier in which both stages are resistance-capacity coupled.

Decoupling

We must confess that our experience of transformer-coupled output pentodes in short-wave receivers has not been particularly satisfactory. This has been mainly because there has often been a form of L.F. instability, which has not always been removed by connecting a by-pass condenser between the anode and earth and shunting the H.T. supply with a 2-mfd. condenser. However, we have found the circuit shown in Fig. 2 perfectly satisfactory in conjunction with the previous units described. You will see that in both pentode circuits we have shown the auxiliary grid as being decoupled by means of a 2,000-ohm fixed resistor and 2-mfd. by-pass condenser. Additionally, we have indicated a .002-mfd. fixed condenser between the anode and earth, as well as a 100,000-ohm "stopper" resistor in the grid circuit.

The object of both of the latter is to prevent H.F. from causing unstable working. The "stopper" resistor tends to prevent any H.F. in the low-frequency output from the second detector from entering the amplifier, whilst the by-pass condenser serves to provide an easy leakage path to earth for any stray H.F. that escapes. You might think that we are being over-fastidious in employing both of these; if you do, try the effect of omitting one or both. There might appear to be little or no difference in results, but it is better to be cautious than careless when dealing with short waves.

Wiring

Fig. 4 shows the practical connections and component arrangement of the circuit shown in Fig. 1, and from this you will notice that a grid-bias battery is mounted in a pair of clips on the chassis. This saves the necessity for adding to the terminal-socket connectors, besides making the battery readily accessible when adjustments are being made. It will also be seen that a Q.M.B. on-off switch is included in the L.T. positive lead. The switch is operative on all of the units due to the L.T. current having to pass through the L.F. unit before it can reach the preceding stages.

We do not show the practical connections for circuit Fig. 2. They will be obvious from Figs. 2 and 4, since they resemble very closely those shown in Fig. 4. The only major difference is that the .25-megohm grid leak is replaced by the

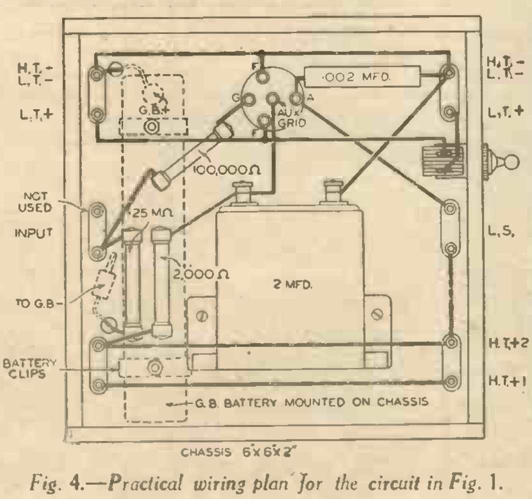


Fig. 4.—Practical wiring plan for the circuit in Fig. 1.

(Continued overleaf)

SHORT-WAVE SECTION
(Continued from previous page)

transformer. The few components required can be of any standard type, the condensers being tubular for the .002-mfd. and ordinary "paper" type for the 2 mfd. Resistors should be of the metallised or composition type, and may be rated at either 1 or ½ watt. The latter are cheaper, but are not always as readily obtainable. It can be seen that the terminal-socket strips are arranged in exactly the same positions as on the other units, so that they "line up."

Pentode Types

One point that might not be perfectly clear is that two different pentode types are shown for the two circuits. That for the resistance-coupled circuit is of the so-called high-efficiency type which gives a high degree of amplification without having a very great "handling" capacity, whilst that used after a transformer gives slightly less amplification, but is able to deal with the larger input produced by the transformer, and has a greater maximum undistorted output. For the Fig. 1 circuit, a pentode such as the Cossor 220 H.P.T. is suggested, and for Fig. 2 we suggest a valve of the class represented by the Cossor 220 P.T. If you wish to use the more modern tetrodes you can choose an Osram K.T. 21, or a Hivac Y 220 in place of the 220 H.P.T. There is no Osram equivalent of the 220 P.T., but the Hivac Z. 220 has similar characteristics.

Connections for all of the valves mentioned are the same, and as shown in Fig. 4, although there is no suppressor grid in the tetrodes; in the pentodes this is internally joined to the filament and so can be ignored for purposes of wiring.

H.T.-Current Requirements

It is important to remember the anode-current requirements of the various valves, for they differ rather widely. At 150 volts H.T. the combined anode and auxiliary grid current and appropriate G.B. voltage for the valves referred to are: Cossor 220 H.P.T., 9.5 mA and —4.5 volts; 220 P.T., 23 mA and —9 volts; Osram K.T.21, 6.4 mA and—2.5 volts; Hivac Y.220, 11.8 mA. and —4.5 volts; Z.220, 20.1 mA. and —6 volts. These figures will, of course, be modified to a certain extent if the more usual H.T. voltage of 120 is employed.

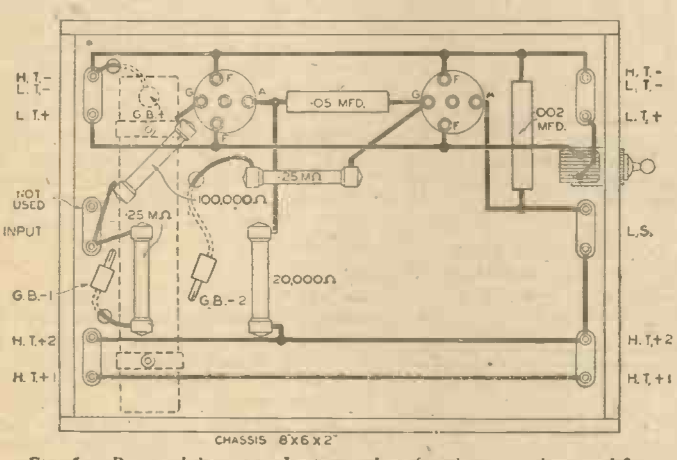


Fig. 5.—Practical layout and wiring plan for the two-valve amplifier shown in theoretical form in Fig. 3.

Two Triodes

If you have no objection to the use of two L.F. valves, the circuit shown in Fig. 3, will be found very satisfactory. The output will not be quite as great as that obtained from the transformer-coupled pentode, assuming a fairly high input, but it will probably be rather greater when using the "Westector" as second detector. In addition, quality will often be found slightly better. Another important consideration is that there will be far less likelihood of instability or "howling," due to the lower step-up provided by each of the valves. It is also better when pick-up connections are to be provided. Consequently, if you can spare the extra .1 amp. required from the L.T. supply, we should be inclined to recommend this circuit.

It includes the "stopper" resistance and anode by-pass condenser used in the other

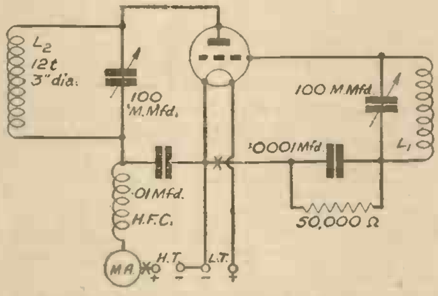


Fig. 6.—Circuit of the inexpensive transmitter described in a letter from Mr. V. H. Thomas.

two circuits and requires an L.F. valve and a small power valve. Suitable types in the Cossor range are 210 L.F. for the first stage and 220 P. for the second. There are many other valves of all makes that can satisfactorily be used as alternatives. When employing the valves mentioned the total anode-current consumption with 150 volts H.T. will amount to about 13 mA when the first is given 1½ volts G.B., and the second, 7½ volts. By reducing the H.T. voltage to 120 and cutting down the voltage to G.B.2 to 4½ or 6 the total consumption of H.T. can be brought down to below 10 mA.

Connections and a suitable chassis layout for this circuit are shown in Fig. 5; in many respects the details are similar to those shown in Fig. 4.

That completes this particular series of articles, which we believe has created a good deal of interest. We only hope that those who make the units will find them successful; whether they do or not we shall be glad to learn of the results obtained, and to offer any further advice that might be desired.

Inexpensive Transmitter

A subject that will occupy our attention for the next few weeks is that of simple transmitters and, particularly, of an easily-made transceiver. We have received many requests for articles on this subject, and it is one in which we have been keenly interested for a long number of years. So if there are any aspects of it that interest you, write and tell us. If you have carried out any interesting experiments along these lines, tell us about them so that we can pass along the information to fellow readers.

In the meantime, we will refer to a very interesting letter received from Mr. V. H. Thomas, of Aldershot, who has an "artificial" licence used with the letters 2CUR. He writes: "Perhaps some of the readers . . . would be interested in a circuit of a transmitter that is in use here. The circuit is shown on the attached sheet." We reproduce Mr. Thomas' diagram in Fig. 6. One of the most interesting features is that the outfit was built at a total cost of 10s. 8d. —can you beat that ?

A few of the details culled from our correspondent's letter are as follow: Coil L1 is wound on a valve base, and consists of 12 turns of 22-gauge enamelled wire; valve can be any battery power valve; jacks can be inserted at X;—X in the H.T. lead is for a key, and X in the grid lead is for the secondary of a microphone transformer; the note of C.W., if the grid is slightly detuned, is almost as good as when using a crystal; eight watts can easily be put on the plate.

Unfortunately the space at our disposal does not permit of our giving all of the details supplied by Mr. Thomas, but if any readers require more complete particulars we shall be glad to forward them.

Please don't forget, you "hams," that we shall be glad to hear from you. 73's; dah-de-dah.

NEW B.B.C. STATIONS

WE are informed that sites have now been purchased for the two new B.B.C. transmitting stations, one of high and one of medium power, which are to be constructed to radiate a Regional programme to the South Coast and South-West of England.

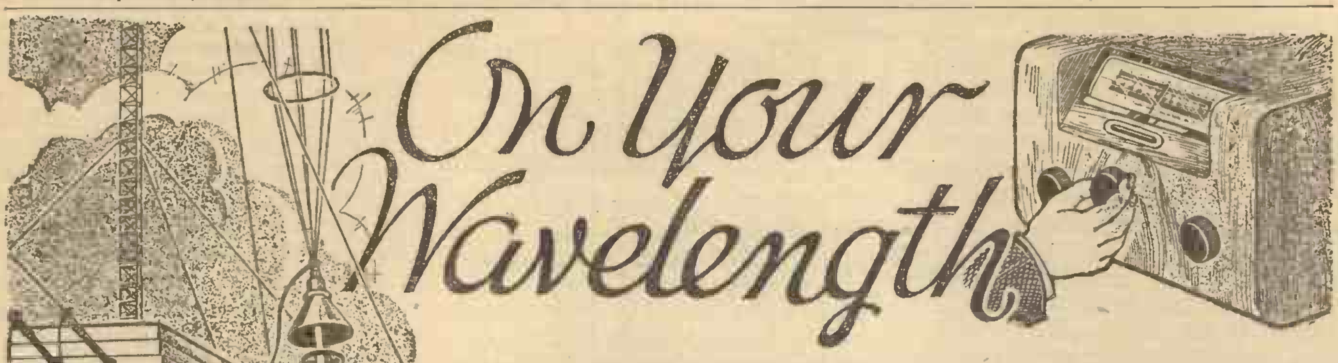
The high-power station will be situated in South Devon, near Start Point. The power used will be 100 kilowatts on a wavelength of 285.7 metres (1,050 kilocycles per second), temporarily in use by the West of England Regional transmitter at Washford. There will be two masts, each 500 feet high, one used as the aerial and the other as a reflector to reduce the strength of radiation over the sea to the south, and to give a corresponding increase in other directions. It is anticipated that the area served will include coastal districts from the south-west of Cornwall to Sussex, as well as Dorset and the southern parts of Cornwall, Devonshire, Hampshire and Wiltshire.

The building will be similar in design to that at Stagshaw, near Newcastle, and the station will be known as Start Point. Preliminary constructional work has begun, and it is hoped that the station will be completed early in 1939.

The other station radiating the same programme will be of medium power, and situated near Clevedon, in Somerset. It will serve areas around Bristol and the northern and western parts of Somerset which cannot be covered by Start Point.

This station, which will be called Clevedon, will, it is hoped, be ready about the same time as Start Point, and will use the wavelength of 203.5 metres (1,474 kilocycles per second), at present shared by the transmitters at Plymouth and Bournemouth. These two transmitters will be closed down when Start Point opens, the small areas they serve being adequately covered by Start Point.

TELEVISION AND SHORT-WAVE HANDBOOK
By F. J. CAMM
3/6, or 4/- by post from
George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.



By Thermion

A Set for Everybody

F. L. N., of Liverpool, opines that "The Experimenters" have been assailed for so many different kinds of sets—some want quality, some great power, others all-wave superhets, others don't quite know what they want—that to please everyone he suggests that we build a set like the one shown in the sketch. Builders could then have their photographs taken and the result published. This reader forgets that all genuine constructors are like the Irishman: give him what he wants, and he doesn't want it.

Jokes

THIS one from R. B., of Ferryhill:

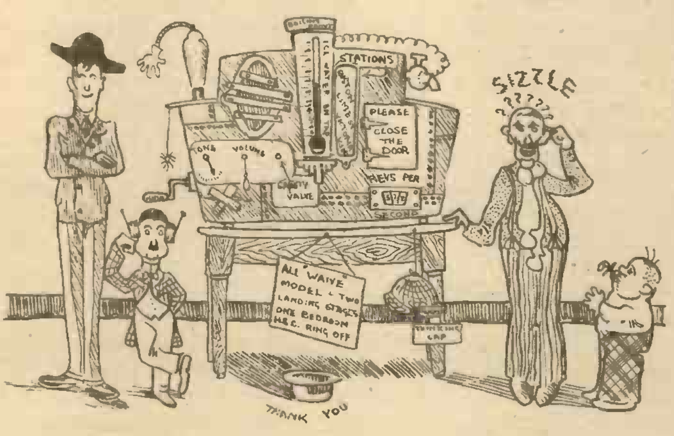
"I had just begun to get interested in short-wave wireless, when a friend, learning of this, asked me to have a look at his set which had developed an annoying rattle when any volume was turned on. Going down with an air of the professional service man, I began to test the set (with the aid of Newnes' 'Constructors' Encyclopædia.') After struggling on for a short time I decided to get down to brass tacks, and began shifting the articles from the sideboard; meanwhile, I left the set full on (with the rattle continuing). On shifting an old mouth-organ top from the former, hey, presto! it worked wonders, and I returned home more sober (in mind)."

G.P.O. Radio Relays

SIR WALTER WOMERSLEY, the Assistant Postmaster-General, recently announced in the House of Commons that the Government propose to introduce a broadcast relay service at Southampton during 1938. This service is to form part of the practical experimental work in wire distribution of broadcast programmes with which the Post Office was entrusted, under the recommendations of the Ullswater Committee on broadcasting in 1935.

It would seem that the Post Office intends to give subscribers a choice of four programmes—probably the National and Regional, and two foreign programmes, whereas most of the present private relay systems provide only two alternative programmes. I also learn that the Post Office intends to try the experiment of distributing these programmes on to the telephone system without interference with the normal telephone service. The probable cost is 1s. 6d. a week, and a small initial payment for the installation. The subscriber will provide his own loudspeaker. The service will probably be opened some time during the next autumn.

Does this sound the death knell of the private relay system? Does it mean the end of commercial wireless apparatus? It would seem so, if the Post Office carries out its intention of selling wireless in the same way as it now sells telephones. Personally, I hope that the greatest opposition will be raised against this absorption of the private enterprises. You will remember that a few weeks ago I wrote my views on this question of the centralisation of commercial undertakings of which the Grid System was one of the first. The public seldom cares two hoots about their liberty until it has been taken away from them. The electrical undertakings have really been nationalised. Wireless has been grabbed by the Government as far as broadcasting is concerned, and now they wish to butt in on the supply of apparatus, or, alternatively, to supply a service which will render the purchase of a wireless set unnecessary. This must eventually connote an increase in taxation, particularly on earned income, for if fewer people are earning money, those in work must pay more. It is a scandalous thing for the Post Office and the B.B.C. to compete with commercial undertakings. The Government is now in the publishing and electrical trades, as well as a number of others. Where is it all going to end? I have no doubt that the Radio Manufacturers' Association will have a great deal to say about this proposal, which you perceive is going to be tried out on the South Coast, where little local opposition is likely to be raised. Thus, having inserted the thin end of the wedge in a number of outlying districts, the system will converge upon busy centres like London until before we know where we are we shall be compelled to instal wireless in the same way as we now have the telephone installed. Quite frankly I do not like the idea. It will throttle individual enterprise and invention, and we shall be compelled to listen to carefully-devised programmes probably of a propaganda nature. If you think as I do about this the proper thing to do is to write to your Member of Parliament and express your views, instructing him how to vote and to raise the matter in Parliament.



A set that will please every reader, according to F. L. N., of Liverpool.

Another Joke

N. J. T., of London, E.2, sends me the following : " The other day whilst mending a friend's set I stood back in bewilderment and scratched my head. ' Stuck ? ' asked my friend. ' No ! Technical (h)itch,' I replied." Here are two more from A. M. W., of Wallasey :

" A ' trade ' man, when installing a midget American set, was asked by the rather elderly lady of the house, whether she would be able to get the whole of an orchestra in at one time as the set, being so small, might not accommodate them ! ! The other, also about a midget receiver, I heard recently but cannot vouch for its truth. The little set had been rather ' ill,' and needed a new valve. When this was inserted, the dealer stood the set on the table for the ' try-out.' ' Oh, no, it doesn't go there,' he was told. ' We hang it up at the top of the window which we leave open so that it will get more waves into it, because it's such a small set.'

" Gravitating from the less to the more serious things of this world I would like to express my complete joy at the fate of the crooner depicted in the stew-pot. I wonder if he still said, ' I are stew,' as he usually does when he wants to convey the idea of ' I asked you ' ? Not that it's quite grammatical, but what can you expect from a crooner ? I would not go so far as to say that the dance music should accompany him to his sticky end, as some of it is very good. There we are in slight discord, but there is harmony again on the subject of television, and on the component question. I mentioned a scheme whereby the half-hearted dealer could be stimulated to carry a large stock of modern components, or snuffed from business altogether, but nobody seems to have had any opinions about it. All the main dealers in Liverpool restricted their sales to commercial sets only long ago, and now sell mostly furniture, while proudly displaying flashing neon and mercury vapour signs, to the effect that they are ' sound and vision experts.' The easy instalment system and the combined cheapness and high efficiency of modern commercial sets are slowly damping the home constructor's spark of enthusiasm, so, Thermion, see what you can do about the production of much cheaper components."

" Phew ! "

" WHAT about this one ? I can assure you it's true," says E. H. S., of Malta. " A fellow here was working on a chassis adjusting and ganging up some circuits, when a bead of perspiration dropped from his nose and trickled neatly against the end of a resistance in the H.T. circuit, thereby shorting his H.T. to fil. pos. and fusing the valve filaments. Rather an expensive event for him ; consequently said chassis is now back in the junk-box. He's an unlucky fellow. He was adjusting a transmitter yesterday and touched the aerial condenser contact accidentally, and was flung right across the room, lacerating his arm, and now he's so nervous of electricity that he's afraid to test a 120 v. battery with his hands. I don't blame him either.

" Well, cheerio, Thermion. By the way, why do you use a combination of heat and positive elements for your nom-de-plume ? "

Extra Mains Windings

A RECEIVER was recently serviced and put into working order, after which the user decided to modify the set to obtain the advantage of a further L.F. stage. The heater winding on the mains transformer would not deliver an additional 1 amp. without a rather severe drop in the voltage output, and this gave reduced efficiency. This trouble was overcome by winding a new 4-volt winding over the existing transformer, only 32 turns being needed and these being wound over the core and windings as a simple hank. The result was an improvement on that obtained when the existing heater winding was employed to run all the valves, and it is worth while remembering that whenever a slight additional voltage is needed in an A.C. receiver, this method of obtaining the additional volts may often be employed. It should not, however, be adopted when voltages higher than about 10 are needed, and the insulation should be given particular attention.

Speakers In Phase

WHEN using two speakers of the cone type in tandem it is essential that the two cones should move in and out together, otherwise there is a cancelling-out effect. Many amateurs find difficulty in seeing the movement sufficiently well to decide whether or not they are in step. To overcome this difficulty the speakers should be disconnected from the receiver and connected to a 1.5-volt cell (from a flash-lamp or grid-bias battery), and when the connection is made and broken, the cone will make a single movement in either direction, thus simplifying the matter. If the speakers are not in step, the connections to one of the speech coils should be reversed.

Mathematical Accuracy

IN many radio calculations accuracy is essential, but there are many instances where only a rough approximation is quite satisfactory for all normal purposes. In the matter of wavelengths in metres and frequency there is no need for perfect accuracy unless a very accurately laboratory-calibrated instrument is being used, such as a wavemeter. Then, in order to obtain an exact conversion from frequency into wavelength it should be remembered that the usual rule of dividing the frequency in kilocycles into 300,000,000 is only approximate. If an exact conversion is required the figure to employ is 299,820,000, and for changing wavelengths into frequency the same figure is divided by the number of metres.

A Gas Set

HAVING sold a dear old lady the most expensive radio-gram. in the shop, the assistant was visually spending the commission when the purchaser brought him to earth with the remark : " Oh, there is one little thing I forgot to tell you. I have not got the electricity in ; will you have it converted for gas ? "

Sunday Television

IT is said that Sunday television will start towards the end of this month, and my reason for thinking so is that the television staff have been notified that they will be required for duty on Sundays. There is, also, the possibility of an extra hour a day in addition to the present three hours. I hope that 1938 will see television placed on a sound footing and developed to an extent that the present highly advanced state of the science warrants.

Visual News Tape

AN American inventor has started a Television News Service which transmits visual messages by wire. News items are typed on a transparent ribbon which is scanned by a lens disc and photo-cell arrangement. The electrical impulses which result are transmitted by wire to the subscribers and thrown on to screens 3ft. long by 6in. wide by a mirror drum process.

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A PAGE OF PRACTICAL HINTS

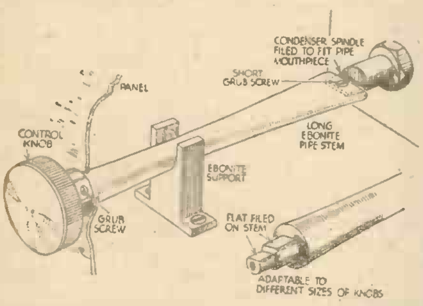
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

An Improvised Extension Rod

THE ebonite mouthpiece from an old pipe (long type) was utilised for this extension rod. After filing the condenser spindle to fit the long slot in the end of the mouthpiece a hole was drilled through both,

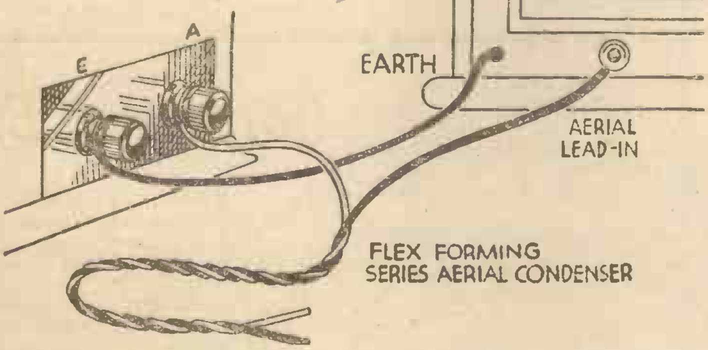


An improvised extension rod made from an old pipe mouthpiece.

and a grub screw inserted. Then, after a rummage in the junk box, an ebonite bracket was found, and this made a support for the extension rod. A knob is attached either on the small or large portion of the mouthpiece, as shown in the inset drawing.—GEORGE THOMSON (Macclesfield).

An Aerial Condenser Dodge

I RECENTLY tried out a new short-wave set but found that reaction was not effective. As a result of a query sent to you I decided to try the effect of modifying the aerial but did not wish to cut it in any way. As I had no spare condensers I obtained the desired effect by using a short length of wire between the aerial terminal and the aerial lead-in, twisting these together for about 3ins. The degree of twist was found quite critical and I now have an adjustment which gives good reaction control throughout the range covered by the coil in use. The accompanying illustration should make the idea clear for those who wish to try out the scheme. —D. CRUST (Harrow).



This simple dodge for providing a series aerial condenser is useful when no spare condenser is at hand.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." DO NOT enclose Queries with your wrinkles.

SPECIAL NOTICE

All wrinkles in future must be accompanied by the coupon cut from page iii of cover

A Vertical Aerial Anchoring Hook.

WHILST fixing up a new vertical single-wire aerial at the back of my house recently, I came up against a snag which I was able to overcome by utilising three iron meat hooks, as shown in the accompanying sketch. Having procured the meat hooks, I ascertained the thickness of the concrete runway, and with a piece of chalk marked out a square (d)—shown dotted—then with a large cold chisel I hacked away the area in the dotted lines, and proceeded to make a suitable block of wood for the anchoring base. The next operation was to drill a suitable hole in the block and work the three hooks into position; having done this, I placed each hook in the vice, having slipped the block along the shanks, and with a hammer, bent the ends over to form the anchoring feet. Placing the whole fitment into the vice, after having slipped the block down into position again, I bound the hooks with steel wire near the heads, and at the base. Finally, I replaced the whole fitment in the hole in the concrete and re-cemented it into position, leaving it to set before fixing the aerial.—G. J. DOUGLAS (Hythe).

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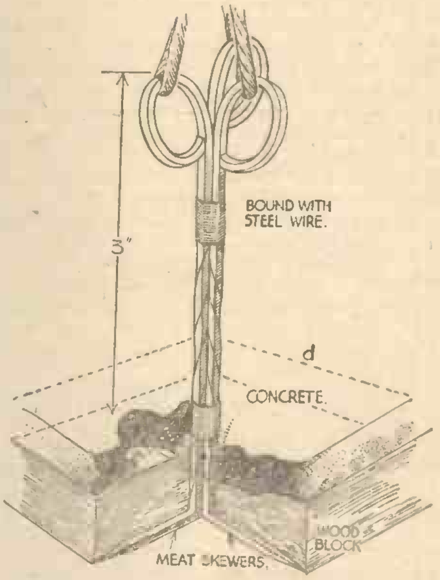
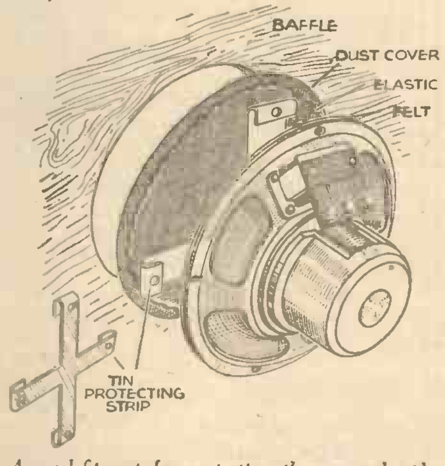


Method of arranging an anchoring hook for a vertical single-wire aerial.

A Novel Cone and Spider Protection Fitment

TWO or three times recently I have had the request to mend speakers damaged by children forcing the brocade to such an extent that this gives, with obvious bad results. Consequently, I fashioned a number of protection strips, as illustrated, and have found these to be an admirable solution to this difficult problem.

Thin tin sheet is all that is necessary, this being cut to the size required. It can be ascertained, after leaving sufficient overlap at the end of each arm, how much pliability will be necessary to clip the arms into position prior to placing the dust cover—which can be of the type shown in the sketch, or of the completely enshrouding type.—N. E. WILSON (Bradford).



A novel fitment for protecting the cone and spider of a loudspeaker.

IMPROVING T

Some Suggestions for Modern Manner and with the Minimum

THIS is the time of the year when many amateurs are considering the renovation of their existing receivers—either to enable them to use up some components which they have received as Xmas gifts or which they have obtained during the past season. Unfortunately, although it often appears a simple matter to add odd parts to an existing set there are often many unseen points which will introduce difficulties and therefore before going to the trouble of rebuilding or remodelling a set, the following points should be considered. Adding new valves is, in most cases, a simple matter, but it is essential to consider the H.T. consumption, especially when the receiver is operated from a mains H.T. battery eliminator. The same remarks will, of course, apply if it is intended to add another stage to a receiver. If the set is of the battery-operated type and is to be converted for all-mains working, there are other points which must be considered, and in many cases it will be found that the set will have to be completely redesigned. Let us therefore go through those types of conversion most suitable for battery sets and see what can be done with an existing set in order to obtain better results than those now being experienced.

Changing Valves

If the receiver is of the simple type with a triode output valve it will be quite possible

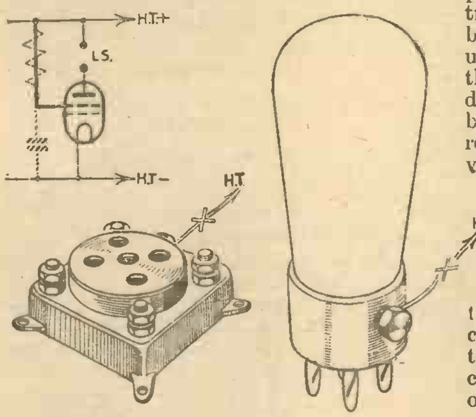


Fig. 1.—An output triode may be replaced by a pentode or tetrode as shown here. In some cases it may be preferable to include a resistance in the additional H.T. lead as shown in broken lines and by the " X" in the above sketch, joining a 2-mfd. condenser to earth, as shown.

that the changing of the output valve for a pentode or more up-to-date tetrode will give a big increase in signal strength. The method of changing is quite simple, all that is necessary being to replace the existing 4-pin valveholder by a 5-pin component, the additional terminal on this being joined direct to the H.T. positive terminal on the set (or the L.S. positive terminal if battery leads are used). If you happen to have one of the 4-pin pentodes available, with a side terminal, it will not be necessary to change the valveholder and the side terminal is simply joined to the H.T. positive point as in the previous case. If you prefer, you may connect a small resistance—say 2,000 ohms between the terminal or side contact and the H.T. positive point to make certain that the screen does not receive more H.T. than the anode (due to the voltage drop through the speaker winding). Unfortunately, a simple change of this type is not all that has to be done as, to obtain maximum amplification and quality the load in the anode circuit has to be matched to the valve and the pentode and tetrode valve require a much higher load than a triode. Therefore, if the speaker is provided with a "universal" type transformer, the tapping will have to be adjusted to provide the higher impedance, but if a single type of transformer is used, it may be necessary to obtain a new speaker to obtain maximum benefits from the change. The tone will probably be higher-pitched than when the original triode was in use and therefore a tone-corrector circuit should be added across the loudspeaker terminals. A .01-mfd. fixed condenser in series with a variable 10,000-ohms resistor is all that is needed and they are joined as shown in Fig. 2. Remember that there will be an additional drain on the H.T. supply when this type of conversion is made, and in addition to the anode current there is also the screen current, bringing the total to a figure round about 9 milliamps compared, perhaps, with 3 or 4 for the simple triode, and therefore a larger capacity H.T. battery should be used, and if a mains unit is in use, there may be a slight drop in the voltage given by it due to this extra drain, and adjustments should accordingly be made. Obviously, also, the maker's recommendations regarding the G.B. for the valve should be carefully adhered to.

The H.F. Stage

If the receiver is of the type having a simple H.F. stage with an S.G. or H.F. pentode valve, you may desire to modify this so as to make use of the variable-mu control feature and thus be able to control the volume on the local station. Such a change is very simple, it being necessary only to fit a potentiometer on the panel in an easily accessible position, and to connect the arm of this to the grid terminal of the H.F. valveholder—changing the valve, of course, for one of the variable-mu type. To prevent the bias from being short-circuited a condenser will have to be included in the grid circuit, and thus for the complete change-over you will have to

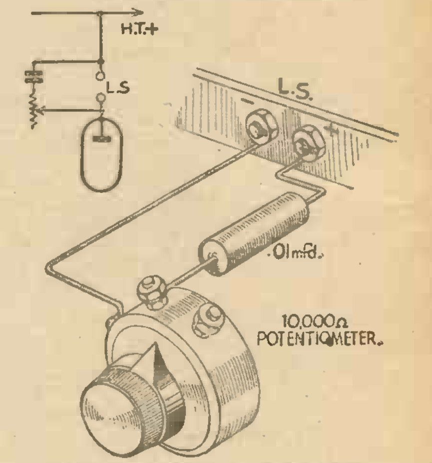


Fig. 2.—A tone control will generally be found advisable with a pentode output valve, a .01-mfd. fixed condenser and a 10,000-ohm volume control being used for the purpose. They are joined across the L.S. terminals, as shown here.

disconnect the wire at present joined to the grid terminal, connect a .0002-mfd. fixed condenser between the lead and the terminal, and then add a grid-leak—say 2 megohms, between the grid terminal and the arm of the control. One terminal on the control should be joined to the earth

Important Broad

NATIONAL (261.1 m. and 1,500 m.)

Wednesday, January 12th.—Symphony Concert.

Thursday, January 13th.—Ca c'est Paris, a comedy production.

Friday, January 14th.—Orchestral programme.

Saturday, January 15th.—A running commentary on the International Rugby Union Football Match, Wales v. England, from Cardiff Arms Park.

REGIONAL (342.1 m.)

Wednesday January 12th.—Variety programme.

Thursday, January 13th.—Royal Philharmonic Society's Concert, from the Queen's Hall, London.

Friday, January 14th.—The Princess of Paraphernalia, a piece of nonsense for all children under a hundred.

Saturday, January 15th.—Chamber Music.

MIDLAND (296.2 m.)

Wednesday, January 12th.—Pantomime excerpts from Red Riding Hood, from the Grand Theatre, Wolverhampton, and Dick Whittington and his Cat, from the New Theatre, Oxford.

Thursday, January 13th—Choral singing in the Midlands, a talk.

Friday, January 14th.—The Princess of Paraphernalia, a piece of nonsense for all children under a hundred.

Saturday, January 15th.—Sibelius: Orchestral programme.

NORTHERN (449.1 m.)

Wednesday, January 12th.—Variety from the Lyceum Theatre, Sheffield.

Thursday, January 13th.—Midland Parliament: Trade Unionism and Industry, a round table discussion.

Friday, January 14th.—Variety from the Alexandra Theatre, Hull.

Saturday, January 15th.—Choral programme from the City Hall, Newcastle.

HAT OLD SET

ng an Old Set in the Simplest

f Expense - - By W. J. DELANEY

line (H.T. and L.T. negative) and the other terminal to the end tapping of a 9-volt grid-bias battery. You can use the same battery as is employed for the L.F. stages

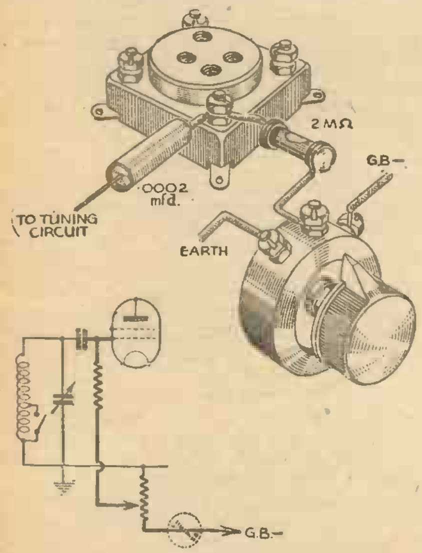


Fig. 3.—The simplest way to convert a "straight" S.G. or H.F. pentode valve into a variable-control stage is shown above. To avoid the grid bias battery discharging through the volume control an on-off switch may be joined in the G.B.— lead, as shown in broken lines, or the modification shown in Fig. 4 may be adopted.

if you prefer. When the set is switched off, the lead should be taken out of the G.B. battery to prevent it from discharging through the volume control, or alternatively, add an on-off switch in the lead as shown in broken lines in Fig. 3. If you wish to make the conversion more effective you can take out the present two-point on/off switch and fit a three-point switch, joining two of the contacts as in the case of your original switch and connecting the third point to the G.B. positive lead, disconnecting this, of course, from its original position. The scheme is illustrated in Fig. 4. If you should purchase a new valve for this change-over, make certain that you obtain one with the anode joined to the top cap, as in the case of your present valve, as modern H.F. valves are now made with either the anode or the grid joined to that point.

Adding a Stage

In the case of some receivers it may be found that an extra stage—either H.F. or L.F.—is required, and these may be built-up on small baseboards and connected to the existing receiver, but there are several important details which will have to be considered for such a change. Firstly, the tuning for an added H.F. stage will necessitate a further tuning condenser, and unless a coil to match the present one can be obtained two tuning controls will have to be used. If a ganged tuning condenser is required matched coils must be used, and to keep wiring from upsetting the balance between the coils it may be necessary to rebuild the set. Similarly on the L.F. side, the addition of another stage may result in some difficulty in controlling the output on the local station and the output valve may be overloaded, with resultant distortion. Add-on units for H.F. and L.F. purposes, will, however, be described in subsequent articles in these pages, and these difficulties will be dealt with in a suitable manner.

Converting to Mains

The H.T. battery trouble may easily be overcome where D.C. or A.C. mains are available by using one of the many battery eliminators which are now available. It must be remembered, however, that these units are rated to deliver a certain current, and you should carefully calculate or measure the current taken by your set before you obtain the unit, as an over-run unit will give rise to hum and other difficulties. Similarly, because there is a socket or terminal on the unit marked Det. or S.G. do not imagine that you can simply connect your detector or S.G. battery lead to that socket and expect things to be perfect. In some receivers, the detector or S.G.-H.T. lead may provide other voltage supplies to the circuit, and with an H.T. battery this may be quite satisfactory. With a mains unit, however, the voltage at that point may be obtained by some internal voltage-dropping arrangement which, if used to feed two points in a receiver may cause motor-boating or other instability. This may, of course, be overcome by modifying the H.T. wiring in your receiver, and you should therefore make quite certain that your S.G. or detector leads feed only the screening grid or the detector stage. Other cases of instability should be met in a similar way.

You cannot dispense with your accumulator and use the mains to operate battery 2-volt valves. We are often asked for details as to how to drop the H.T. voltage to run the filaments, or how to get

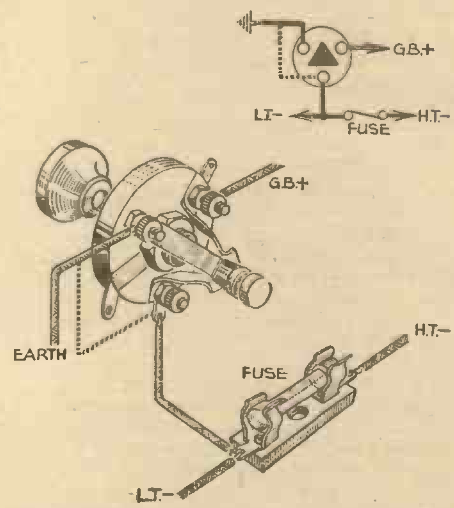


Fig. 4.—When a variable-mu valve is used, as shown in Fig. 3, the existing two-point on/off switch may be replaced by a three-point component adopting the connections shown above. In some cases the H.T.— lead may be joined direct to earth. The original two-point connections are indicated by the broken line.

the necessary 2 volts. The supply for such valves must be perfectly smooth and the current from the H.T. section is insufficient to operate filaments, whilst, even with a low-voltage winding on a mains transformer and a low-voltage rectifier, hum will be experienced in nearly every case. Therefore, the nearest approach to all-mains working which you can obtain is to use a trickle-charger to keep your accumulator in good condition, but remember to take it periodically to the charging station so that it may be inspected and given the necessary "topping-up" and overhaul when required.

asts of the Week

WELSH (373.1 *m.*)
Wednesday, January 12th.—Pembroke Castle, a dramatic feature.
Thursday, January 13th.—Orchestral and instrumental programme.
Friday, January 14th.—A recital of Welsh ballads.
Saturday, January 15th.—Organ recital from the Odeon Theatre, Llandudno.

WEST OF ENGLAND (285.7 *m.*)
Wednesday, January 12th.—Country Voices: Wiltshire, a talk.
Thursday, January 13th.—Mother Goose, a pantomime from the Theatre Royal, Bath.
Friday, January 14th.—A running commentary on the last period of the ice-hockey match, Bristol Bears v. Perivale Rovers, from the Coliseum Ice Rink, Bristol.
Saturday, January 15th.—Home is Like That . . . a talk.

SCOTTISH (391.1 *m.*)
Wednesday, January 12th.—Orchestral concert.
Thursday, January 13th.—Scottish Radio Cartoon (new series—seventh edition).
Friday, January 14th—Inside Information (No. 11); Horse Sense, a descriptive commentary from a Carrier's stables.
Saturday, January 15th.—Stop-Go! A road show of road acts.

NORTHERN IRELAND (307.1 *m.*)
Wednesday, January 12th.—Stop Dancing, a programme of very light music.
Thursday, January 13th.—Orchestral programme.
Friday, January 14th.—Dance Band programme, from the Chalet, Crawfordsburn.
Saturday, January 15th. — Orchestral concert, from the Wellington Hall, Belfast.

The Ekco All-wave Model A.W.88

As soon as the receiver was placed on the test bench, the first thing which impressed us was the pleasing lines of the magnificent moulded cabinet, the model in question being of the walnut finish type, but it is possible to obtain it in black or ivory for the small extra cost of 7s. 6d.

The spin-wheel, volume and wave-changing controls are so cleverly arranged that they merge into the design of the cabinet, while their location is ideal for finger-tip effortless control. To the right of the large illuminated scale is the milled rim of the tuning spin-wheel on the left of which is the wave-change switch, so placed that the thumb automatically rests on it while the forefinger spins the tuning control. A mere flick of the finger or the thumb is all that is necessary to tune in any station or to change the wavebands; a clearly marked scale indicates the position of the switch thus allowing one to see at a glance exactly on which waveband the receiver is operating.

Controls

On the left of the panoramic scale are the on-off switch and volume and tone controls, the volume control being "spin-wheel" operated while the tone is varied by a small lever similar to the wave-change arrangement, its setting being indicated by an elongated triangle—in red—which is visible through the aperture provided. The tuning scale has distinct features. In the first place the makers have been wise enough to make it large enough to allow each of the four—including the television "sound" indication-wavebands—to have a separate clearly marked scale, thus simplifying matters considerably. A vertical white cursor travels horizontally across the scale, which, by the way, is tilted at just the right angle to allow all markings to be easily visible.

When the back of the cabinet was removed, it revealed a neat, sturdy chassis to which is fitted the aerial and earth, loudspeaker extension—low impedance—and pick-up sockets, all being accessible without removing the protective back grille. The built-in loudspeaker is of the new elliptical, exponential, moving-coil type (energised), fitted with the usual dust-protecting cover.

Performance

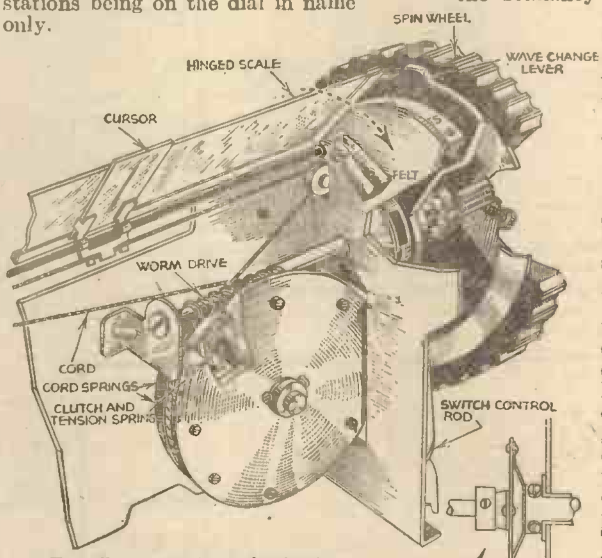
So much for the general description, and here, then, is our report of the results we obtained. We must first of all make it quite clear that these tests are carried out in the very heart of London, and with an aerial arrangement which we have designed to provide slightly less efficiency than the average listener's aerial; therefore, it will be obvious that the receiver was made to operate satisfactorily without being spoon-fed by the aid of a super-aerial arrangement.

On the long waves every station indicated on that section of scale was received at ample strength, it being necessary in many instances to keep the volume control back. Selectivity was good, the only trace of interference experienced being around Kalundborg.

On the medium waves the receiver was most lively, dozens of stations being at the command of one's finger-tips. Selectivity was most satisfactory, while inter-station interference and noise was most notable by its absence. The "spin-wheel" tuning, when combined with a receiver of the efficiency of the one under test, gives one a delightful feeling of ease of control; for example, if the tuning wheel is spun, one hears clear-cut fragments of the programmes from the stations which the cursor passes over during its travel across the scale.

BRIEF SPECIFICATION.—Powerful 8-stage superhet for A.C. 200/250 volt 40/100 cycle mains. All-wave operation covering 900-2,000 metres; 200-540 metres; 16-50 metres; and the television sound band, namely, 7 metres. Spin-wheel tuning, built-in controls, no knobs and a large floodlit panoramic scale, clearly marked in megacycles, metres and station names, visible from all angles.

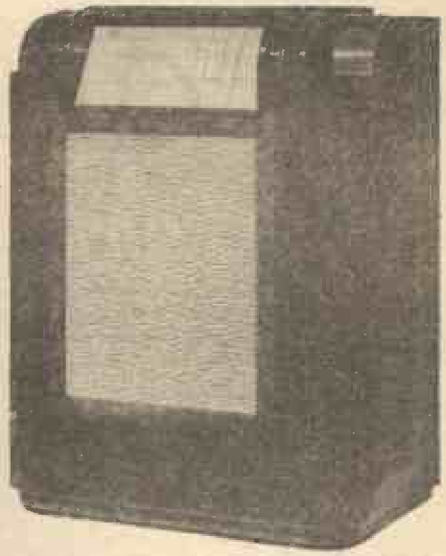
It is pleasing to note that the stations shown on the scale *are* those which can be received at *worth-while* entertainment volume, which is vastly different from stations being on the dial in name only.



This illustration shows clearly the mechanism of the Ekco spin-wheel tuning control.

Silent Volume Control

During these tests, we must admit that we were greatly impressed by the action of the volume control. It is *perfectly quiet*, while its effective range extends from below audibility to—on a powerful station—an output more than sufficient fully to load the loudspeaker. Bearing in mind the location of the test, and our previous remarks concerning the aerial, we were not able to explore the short wavebands as much as we would have liked. It was obvious, however, that that was in *no way* due to the receiver. We had ample proof of its efficiency on the S.W.'s by the strength and quality of the stations we did log; therefore, we have no hesitation in stating that the A.W.88 is definitely a receiver with a *good all round all-wave performance.* Tonal quality is always a matter of individual taste; no two listeners seem to agree as to the amount of "top" or "bottom" which should be present. The variable tone control fitted to the A.W.88 will certainly allow every listener to get the reproduction to suit his or her taste though, in our opinion, the "high" position of the control cuts out a shade of the brilliancy which is so often desirable for certain items, or, in other words, the reproduction is a trifle lower in tone than some of the "high fidelity" listeners might like.



The Ekco All-wave receiver, Model A.W.88, which is fitted with spin-wheel tuning. Note the absence of control knobs.

The Circuit

No report would be complete without a few technical details of the circuit, therefore, here is the maker's specification. Band-pass input, with iron-cored max "Q" coils, to high gain triode-hexode frequency-changer; I.F. transformer coupling to H.F. pentode; I.F. transformer coupling to double-diode-triode which gives full automatic volume control and L.F. amplification; resistance-capacity coupling to high-slope compensated output pentode. Tone compensation. Full-wave valve rectifier, and compensated inverse feed-back—resonance-free reproduction.

General

At 12½ guineas the A.W.88 represents a wise investment for those requiring an efficient A.C. operated all-waver capable of giving good quality reproduction, and possessing the ease of control which can only be associated with spin-wheel tuning, the whole being housed in a cabinet which is both pleasing and well finished.

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Leaves from a Short-wave Log

Austrian Broadcasts on High Power

TO carry the Vienna radio programmes across the seas the *Ravag* proposes to build on a new site a 50-kilowatt transmitter at a cost of well over fifty thousand pounds. In due course this station will replace the 1½-kilowatt plant at present in use at Vienna-Rosenhuegel. It is hoped to open the transmitter towards in the near future.

Italy Tries Out Two New Channels

From Prato Smeraldo (Rome) the E.I.A.R. is carrying out experimental broadcasts daily with the new 12RO high-power short-wave station on 19.62 m. (15.29 mc/s) and 19.7 m. (15.23 mc/s). The transmitter is also entitled to use 19.78 m. (15.17 mc/s). High-fidelity transmissions are also being made from the new plant installed at Monte Mario, on 6 m. (43.5 mc/s), daily between G.M.T. 18.00-21.30.

Tristan da Cunha on the Air

Under the leadership of Dr. Erling Christopherson, a Norwegian expedition has left Cape Town (South Africa) for the lonely island of Tristan da Cunha. A special permit has been granted by the British Colonial Office for the installation of a radio station on the island; the call-sign allotted is ZD9AB.

The Cairo Conference

When the delegates to the World Telecommunications Conference meet in Cairo (Egypt) this month, one of the principal items on the agenda will relate to short-wave transmissions. Plans will be put forward to provide a rational allocation of short-wave channels for broadcasting and other services. So far only 91 official channels have been available for broadcasting, and already 245 stations are using these frequencies, thus causing considerable mutual interference.

Spanish Stations with Regular Schedule

The Spanish short-wave stations which are now daily broadcasting war news bulletins are the following: EAQ1, Madrid, 30.43 m. (9.86 mc/s), G.M.T. 18.00-19.45; EAQ2, Madrid, 31.65 m. (9.48 mc/s), G.M.T. 19.45-21.00; EALTN, Madrid, 45 m. (6.666 mc/s), G.M.T. 23.30; CNT, Barcelona, 44 m. (6.818 mc/s), and CSU, Barcelona, 42.88 m. (6.995 mc/s), G.M.T. 19.20; PFI, Barcelona, 41.63 m. (7.206 mc/s), G.M.T. 20.00; Radio Naçional, Salamanca, 44 m. (6.818 mc/s), G.M.T. 14.00-15.30; Valladolid, 42.5 m. (7.1 mc/s) and 42.83 m. (7.005 mc/s), G.M.T. 19.00, 23.45, and again at midnight; Radio IDD, on the Aragon Front, 44.10 m. (6.8 mc/s), G.M.T. 14.00-18.00; EAJ8, San Sebastian, 41.67 m. (7.2 mc/s), G.M.T. 12.00-19.30.

Another Call from Venezuela

Listeners report having picked up a broadcast from a Maracaibo station giving its call-sign as YV1RL, relaying YV1RK, with the additional slogan *Radio Populare*. The wavelength was 50.59 m. (5.93 mc/s) and time when heard between G.M.T. 01.45-02.00.

A Powerful Colombian Transmitter

HJ1ABE, Cartagena, now logged regularly on 31.58 m. (9.5 mc/s) is stated to have increased its power to 1½ kilowatts. The studio gives out its call in Spanish (phon: *At-cha hota ee ah bay aye*), *La Voz de los Laboratorios Fuentes en Cartagena* (phon: *Carta-hayna*), Colombia; and in English: *Ladies and Gentlemen, this is HJ1ABE, of Cartagena, calling you.* The broadcast opens with a bugle call, sometimes repeated during programme intervals, and closes down with an organ rendering of *Aloha*. At midnight G.M.T. (19.00 Colombian standard time) chimes similar to those of Big Ben are used as a time signal. Address: Apartado Postal, 31, Cartagena (Colombia), South America.

A Call from Peru

OAX4D, Lima, styling itself *Radio Dusa* or *La Voz del Peru*, may be heard under favourable conditions on 51.87 m. (5.78 mc/s). The broadcasts are preceded by a wailing siren, the interval signal consisting of two cuckoo calls similar to those adopted by the Lisbon short-wave transmitter. Announcements are made in both Spanish and English, and as a rule the station closes down with a morse signal—its call-letters—followed by the playing of *A Perfect Day*. Address: Estçiones OAX4D y OAX4C, Avenida 28 de Julio, 950, Lima (Peru), South America.

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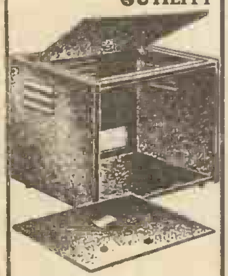

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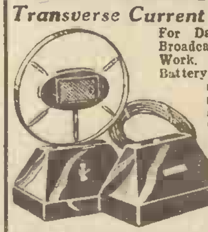

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Useful Constructional Hints

Notes on Coil-former Construction, and Adapting Plug-in Coils for Quick Insertion are Given in this Article - - By A. W. MANN

WHEN constructing a short-wave receiver of modern design, it is always advisable to incorporate the coils specified by the designer. This also applies to calibrated apparatus, as, for example, wavemeters and frequency monitors, modern plug-in coils of the four- and six-pin types, and also tapped coils.

It sometimes happens, however, that experiments are contemplated which will require the construction and winding of special large-diameter coils of a type which is not commercially available, unless made to special order. Some time ago the writer had a series of experiments in mind for which large-diameter coils would

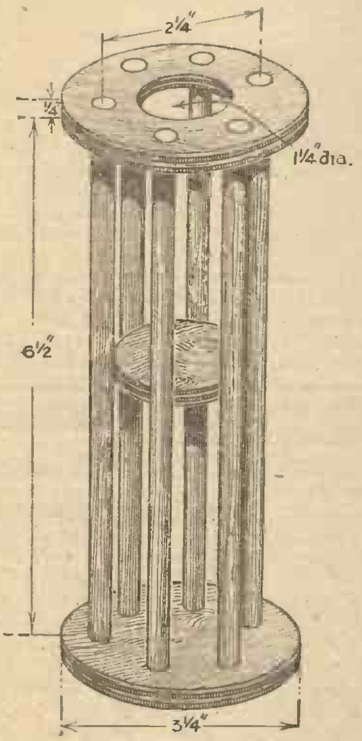


Fig. 1.—Method of making up a low-loss (squirrel-cage) coil-former.

be necessary. Ribbed ebonite formers of suitable diameter were obtainable, but taking into account the nature of the experiments, the expense did not appear to be justified.

Coil-former Construction

The requirements were as follow. Two low-loss formers 2½ins. diameter, 6½ins. long, to be wound with 30 turns of 14-gauge tinned copper wire, spaced 3/16in. between turns. The cheapest method of construction was to use ⅜in. wood dowelling, and plywood end discs and centre disc. Fig. 1 shows the form of construction and dimensions.

It will be noted that a wooden centre disc is fitted. This is advisable especially when winding with the heavier gauges of wire, such as 14 and 16 gauge, as the tensioned windings will otherwise spring the dowelling, and consequently reduce the actual diameter of the coil turns in the centre portion.

Good quality glue must be used for holding the dowels and discs together, and the centre disc must be glued in place before winding; also, in the interests of efficient insulation, three or four coats of shellac varnish should be given, and allowed to dry thoroughly.

The most difficult task, and one which is associated with all forms of short-wave and low-loss coil construction, is grooving. There are various methods which may be adopted. In the writer's case, it was desired to make and varnish the formers one day, and groove or slot and wind them as opportunity allowed. Whilst accurate grooving and spacing was desirable, a quick method of doing so was required.

Method of Grooving

In order to obtain the desired results, a sheet of graph paper with tenth, half and one inch squares, was cut to the width between flanges, and wound around each former, then cut to allow a half-inch overlap at the ends.

The graph paper was then removed, and marked out to give a spacing of 3/16in. The former ribs were then smeared lightly with glue, and graph paper rewound on them, and overlap glued under tension. Later, the same method of marking out was carried out, so that along each rib were 30 equidistant points.

To cut at one sitting suitable slots to take 14-gauge wire was obviously inadvisable; therefore, first cuts were made with a fret saw, second cuts with a hack saw, and the final cuts with two hack saws fastened together, sawing by forward movement in the first two instances, and to and fro for the final cuts. Whilst the final results were not up to machine cut standards of accuracy, they were very satisfactory.

It only remained to varnish inside the slots and wind the coils under tension by fastening one end of wire to a convenient hook, and keeping the wire taut as winding in the slots was carried out.

Adapting Coils for Quick Insertion

Receiver designs which make provision for the insertion of coils through the front panel are few, apart from certain American commercial products, the reason being, no doubt, that it is difficult to make the coil pins register with the coil base sockets. Fig. 2, shows a simple method of adapting commercial or home-made short-wave coils for quick insertion, provided that solid-type coil bases are used.

The open end of the coil former is fitted with a wooden disc to which a circular aluminium plate is fastened. In the centre of this plate a suitable wooden knob is fixed as shown.

The most satisfactory method of fastening, in order to assure a rigid assembly, is to pass a long brass bolt through the full length of former, wooden disc, metal disc and knob.

It will be noted that a short brass pin is fitted in the metal disc. This pin registers with a suitable hole in the metal panel of the receiver, and thus makes the coil pins self locating. Careful and accurate drilling is, however, essential.

Fig. 3 shows a more elaborate disc, fitted with an aluminium handle, riveted to the disc. Whilst this type will enhance the appearance of the front panel, it will be found much more difficult to make, unless the constructor is experienced in the working of sheet metal.

Tapping Coil Turns

One of the difficulties associated with the winding and use of short-wave coils wound on paxolin concerns tapping off turns by means of crocodile clips.

This, however, can be overcome by soldering short stubs of wire to the turns from which tappings are required. In doing so, however, it should be remembered that not only the number of turns tapped off are of importance, but also the actual point at which the tapping is taken. This

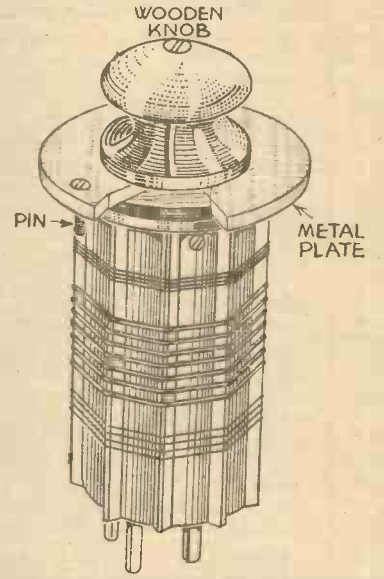


Fig. 2.—A simple plug-in device to ensure easy registration of pins and sockets.

applies especially in the case of aerial-tuning units when used in conjunction with regenerative non-H.F. receivers, and contributes towards stability.

Interest in ultra-short-wave reception is on the increase, especially with regard to the 10-metre band. Some doubt exists in the minds of experimenters, as to the type of plug-in coil required to tune down to 10 metres, using a .0001 mfd. tuning condenser in conjunction with a low-capacity bandspreading condenser. The following data will therefore be of use:—

Four-pin coil wound on standard machine-

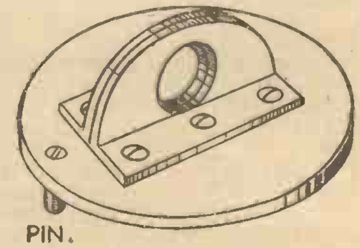


Fig. 3.—An alternative to the scheme shown in Fig. 2.

threaded former, such as Eddystone, B.T.S., etc.

Grid, 2⅓ turns—20-gauge tinned copper wire.

Reaction, 2⅓ turns of same gauge wire, spaced between turns as per standard grooving. Distance between windings, one-sixteenth inch.

Practical Television

January 15th, 1938. Vol. 3. No. 83.

Equal Definition

FOR the purpose of arriving at some quantitative figure which can be used in determining the modulation frequency of a given type of television picture conforming to a known line standard, picture ratio and frames per second, it is assumed generally that there is even picture definition both horizontally and vertically. The assumed pattern in determining the arithmetical figure is a draughtboard with alternate black and white squares, the side of the square being made equal to the total picture depth divided by the number of lines into which a complete picture is divided. From calculations of this nature very useful design data is obtained, for although the assumed initial conditions may appear artificial they do represent a limiting case which can conceivably arise in practice.

The Scanning Spot

Under normal operational circumstances, however, the shape assumed for the scanning spot does not materialise. In a cathode-ray tube, for example, every effort is directed towards making the spot a perfect circle, although in many cases its shape is a closer approximation to an ellipse with the longest side either horizontal or vertical. This brings about a lack of equality in the horizontal and vertical definition, and is a factor which has to be given due consideration when subjecting a given cathode-ray tube picture with its associated radio receiver to a careful qualitative and quantitative analysis. Again, the scanning lines may overlap or underlap according to spot size in a vertical direction, and thus the scanning field deviates from the assumed one of contiguity. A certain degree of latitude is, of course, inevitable, but as far as possible the ideal conditions are approached to within the narrowest practical limits by designers.

Increasing the Beam Current

The beam of electrons used in the standard form of cathode-ray tube is generated at the cathode by indirect heating, and drawn from the cathode surface by a high voltage electrode in close proximity so that the velocity of impingement on the front screen produces a glowing area of small dimensions at the point of impact. There are several important factors which govern the magnitude of this initial stream of electrons, and it is by varying the intensity or number of electrons in the stream that the light intensities of the final picture are brought about. A scheme has now been suggested for increasing the initial intensity of this stream before modulation. It is based on the well-known fundamental principles of secondary emission, and consists of the insertion of perforated discs in the primary electron stream path. These are coated with secondary emissive material, and as a result of the striking of these discs by the main stream, the electrons in the beam are added to by the released secondaries. To maintain beam direction and focus, a number of external solenoidal coils surround the tube neck; and by adjusting the current through these coils the amplified stream is directed towards the front screen as required.

Another Use for Projection Tubes

The employment of projection type cathode-ray tubes for big screen television pictures serves to recall that this same device has been employed quite successfully at the transmitting end for televising both films and studio subjects. The use of this method as a film scanner was shown very clearly by Cossors' at the Science Museum television exhibition. This was the first time that a scheme of this nature had been shown publicly over an extended period, and the results were not only good, but gave the public an opportunity of making a comparison with the B.B.C. method of televising talking films. In the equipment shown during the exhibition the scanning field of the tube was seen to be made up from a rather bright centre section having a top and bottom portion not quite so brilliant. This was due to the method used for covering the film frame with a properly interlaced scan. The film projector was of the normal intermittent type, and the start of the first frame scan began when the film was moving into the gate. Under this condition the scanning spot traced a proportion of its lines in a direction opposite to the film motion. As soon as the film remained steady in the gate, however, the scanning spot of the tube continued to trace a normal interlace. Before the second frame was completed the film began to move out of the gate, and the tracing spot was therefore made to lap over and move as a series of lines against the film motion. This overlapping at the beginning and end of the trace during the film exploration gives the effect of differing brilliance.

A New Situation

A new situation has arisen as a result of the big screen demonstrations, for it is now stated that Gaumont-British intend installing projection cathode-ray-tube equipment in a selected number of their cinemas within the service range of the B.B.C. signals. With this apparatus it is proposed to reproduce short excerpts from the television programmes now being radiated. So far the B.B.C. has a monopoly in television broadcasting, and owing to copyright, and other associated problems, official permission has never been given for public demonstrations, but as readers know from the exhibitions, etc., which are frequently organised, these shows have not been banned. In some quarters this interesting situation is looked upon as a challenge to the B.B.C.'s right to what may ultimately be an entertainment monopoly.

Big Screen Pictures

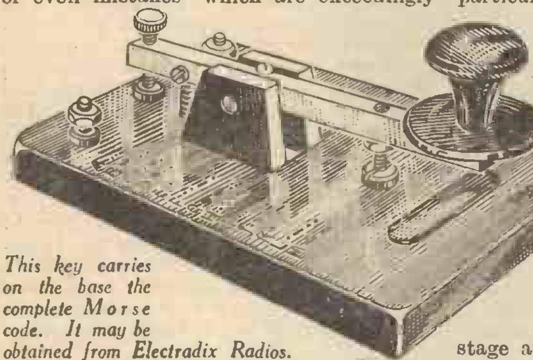
It recalls very vividly Thermion's trenchant remarks in this journal a few weeks ago when he said he would welcome the efforts of private enterprise, and looked upon this as the only way to meet the lethargic attitude of the B.B.C. towards the development of television. Already a question is to be asked in the House of Commons to see if the Postmaster-General gave permission for the television broadcast to be shown on a big screen, and if not, what the Government proposes to do in the matter. It is conceivable that an entirely separate transmitting station could be made available for the dissemination of picture signals to public theatres and cinemas, or even cable linkage would be possible. In any case, recent events show that this rather complex situation has now got to be faced, and the solution will be awaited with interest.

America's first mobile television station, delivered recently to the National Broadcasting Company at Radio City, New York. One van provides operating positions on the roof for the cameras, and the other a "trolley" aerial for relaying the pictures back to Radio City.

THE BRITISH LONG-DISTANCE LISTENERS' CLUB

Learning Morse

SEVERAL members are in difficulty regarding the acquisition of the necessary knowledge and speed of the Morse code. They ask for advice regarding the best way of setting about the work as they wish to take out a transmitting licence sooner or later. The big snag in amateurs getting together to learn Morse is, of course, that as they do not know it, the sending will be very bad, and it is extremely easy to get into wrong habits—either of spacing, or even mistakes—which are exceedingly difficult to overcome at a later stage. By using a key of standard type, such as that illustrated, upon which the Morse code is embossed, the correct code may be employed for each letter, but the utmost care is needed to get the spacing right and the correct length of dots and dashes. A simple oscillator may be used so that headphones have to be employed, and this will enable two or more listeners to take down messages which may afterwards be checked. This will assist in checking the sender. Of course, a much better plan is to build a good short-wave set and tune to amateur transmissions, endeavouring to pick out letters without regard to the context. If you can get into touch with an experienced amateur you could, of course, arrange for him to assist in the study.



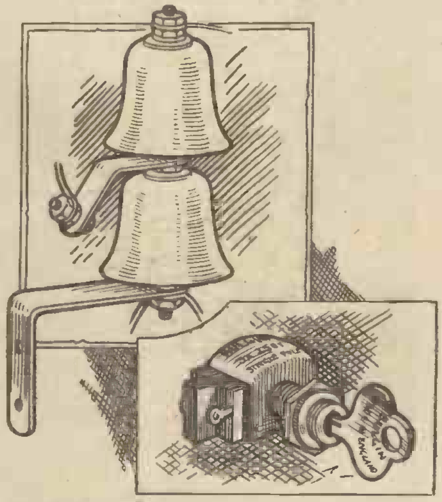
This key carries on the base the complete Morse code. It may be obtained from Electradix Radios.

Insulation Problems

Many members seem to find difficulty in erecting the all-important aerial, and many makeshift ideas are adopted, without thought as to the efficiency or weather-wearing properties of the system. For instance, the leading-in wire is generally brought down at an angle and led into a room through a window or window-frame. The result is that when it rains, the moisture runs down the lead-in and into the window, or, to prevent the latter, it is wrapped round with insulation tape or some other material. The result is not elegant and is not efficient. Special stand-off insulators may be obtained at quite a reasonable price, and will assist in making a water-tight joint as well as provide a secure anchorage for the leading-in wire, which, if it sways in a wind, will often introduce tuning difficulties, especially on the short waves. The insulator which is illustrated on this page may be screwed to the wooden window-frame or nailed to the wall and the lead-in may be drawn tightly down to the point shown. The lead to the set may then be taken at an *upward* angle to enter the window, and thus moisture will not enter the house. Furthermore, if the apparatus is situated in a hut or similar building, the device could be fitted on the roof and would greatly simplify the fitting of an efficient aerial system. The other component illustrated in the sketch is a lock switch such as was mentioned on page 483 of last week's issue.

A Question of Layout

A problem which often confronts the amateur is what layout to adopt for a particular receiver which it is desired to build—where no blueprint is available, or where a circuit to an individual design is to be adopted. Unfortunately, it is impossible to lay down any hard and fast rule for this. A straight receiver, for instance, could easily be built exactly as it is drawn in a theoretical diagram—that is, with the aerial input circuit at one end of the chassis or baseboard, and each successive stage arranged by its side, and so on to the output stage at the opposite end of the chassis. A superhet, however, would be very cumbersome if built this way, and, furthermore, it is unnecessary to do it owing to the fact that the I.F. stages are operating at a totally different frequency and thus the same risks of instability, feed-back, etc., are not met with. The simplest way of building a superhet is to start in front of the chassis, and run backwards and forwards, from front to rear and across the chassis, but in every case it should be the aim of the constructor to keep the aerial at one end and the speaker at the other end. The remaining stages must be arranged with due regard to stability and with regard to the amount of room available. One golden rule is not to cramp the stages, but at the same time undue lengths of wire from one stage to another must also be avoided, and thus a chassis form of construction, with many components below "deck," will always be found more efficient than a standard baseboard form of construction for receivers with three or more stages.



The Bulgin combined insulator and safety spark gap, and lock switch.

Correspondent Required

A member living near Sheffield would like to correspond with another member about his own age (24). He says he is quite a lone wolf in his district and is interested in short-wave work. Perhaps other readers who are interested would care to write to him. His name and address is C. Wright, The Cross, Coal Aston, Nr. Sheffield, Yorks.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

C. B. (Cambridge). We cannot supply a blueprint of the circuit referred to, but the pictorial diagram which is given should be of help to you.

T.F. (Killorglin). In addition to the books you already hold there are very few which we can recommend. The articles in these pages should be of most use to you, and you can obtain all of the parts for our sets from Messrs. Peto-Scott direct.

H. W. W. (Gloucester). The details given in the Short Wave Log in each issue are the most useful to you, and there is no other data in this connection published by us.

L. E. (Newcastle-on-Tyne). We cannot advise modifications to commercial receivers, and suggest you write to the makers if the set fails to give satisfaction from a quality point of view, as there may be some defect which will be easily put right.

R. F. K. (Erdington). We can only recommend our blueprints when the parts which we specify are employed. We have no details of your surplus and therefore cannot suggest a suitable circuit.

H. A. W. (Portsmouth). As stated in this issue the period of listening was August and not as given on the cutting you send. The Trophy is awarded for each period of 30 days.

H. T. J. (Christchurch). We cannot supply any other details than those published in the article in question. What other information do you require?

H. R. H. (Exeter). Full details for an H.F. stage for the Prefect receiver were published in our issue dated June 27th, 1936.

E. H. M. (Bournemouth.) It would appear that the frame is too large to enable you to tune down to the local station. The short circuit you introduce will not damage anything, but it may be preferable to have your local dealer strip off two or three turns from the medium-wave winding in order to tune the station and this will not affect the remaining stations.

W. B. (Goldthorpe). The Prefect S. W. Three is the nearest receiver, Blueprint P.W. 63. You could omit the last L.F. stage and use this as a two-valve set.

W. J. (Lancaster). You would be unable to obtain permission to build a transmitter of the type mentioned. A licence must first be obtained and you would have to pass a Morse test, sending and receiving at 12 words per minute. We would remind you that the licence is not issued merely to allow you to communicate with a friend, but only for experimental work, the lines of which have to be stated in your licence application, For further details write to the Engineer in Chief. Radio Section, G.P.O., Armour House, London, E.C.

R. R. (Thornton Heath). It is possible to dispense with the battery leads and use a single H.T. lead, but before the resistance values can be calculated you must know the current in each lead, and calculate the resistance needed to drop the voltage from the maximum to that required. The voltage to be dropped is divided by the current in milliamps and the answer multiplied by 1,000.

H. B. (Co. Kildare). We cannot give the data necessary for rewinding the commercial coil. We suggest that you apply to the makers for the necessary details. To join the Litz wire each strand must be cleaned and neatly soldered, but if you do not wish to preserve the maximum efficiency throughout, you could solder all the strands together at the two ends and then join them. The coils for the All-Wave Corona cost 9s. 0d. each, plus 1s. 0d. for the spindle and position registration plate.

EVERYMAN'S WIRELESS BOOK

By F. J. Camm

Wireless Principles and Fault Tracking simply explained.

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VALVE CHARACTERISTICS—2

THE worth or suitability of a valve is judged by its characteristics. The fundamental consideration of any problem of set design must revolve about the behaviour to be expected from the valves to be used.

Unfortunately, valves, like many other things in this country, lack standardisation, and, worse still, the characteristics of similar valves are measured under dissimilar conditions, which can give rise to great mental confusion if the whole subject is not fully understood. To take an example, if we look casually at the makers' catalogue we shall find that the Cossor 41 M.S.G. has an impedance of 400,000 ohms, while the M.S.G./H.A. has an impedance of 500,000 ohms. The amateur might well be excused for selecting the 41 M.S.G. in preference to the M.S.G./H.A. on account of the lower impedance quoted (assuming, of course, that a valve of low impedance is required).

If we give these characteristics more careful attention it will be found that these figures are arrived at under dissimilar conditions, inasmuch as the 41 M.S.G. is measured with zero bias, and the M.S.G./H.A. with -1.5 grid bias.

If the valve is to be used as an H.F. amplifier it will be required to work with a negative grid bias of 1.5 volts. As we are concerned with the impedance of the valve under working conditions, the significant figure will be the impedance of the 41 M.S.G. with negative 1.5 volts grid bias, which is about 1,500,000 ohms.

It will be observed that the impedance of the 41 M.S.G. is not 20 per cent. lower than the M.S.G./H.A., but 200 per cent. greater.

Abbreviations Used

The above example shows very clearly that characteristics require more than a surface knowledge; before considering characteristics in detail it will perhaps be advisable to outline the abbreviations in general use for indicating the conditions under which characteristics are measured.

The letter V always indicates that the number following it is voltage, whereas the letter following the V indicates the particular electrode to which the voltage is applied; therefore Va indicates anode voltage, Vg grid voltage, Vsg screening-grid voltage, and Vag auxiliary grid voltage. It is usual to use Vsg when referring to screen-grids and H.F. pentodes, and Vag when referring to output pentodes and tetrodes, but this is not a hard and fast rule, and often one or the other is used throughout.

In valves of elaborate structure where it is desired to express the voltage on several grids a small figure is placed after the letter, i.e., Vg_1, Vg_2.

Vg_1 is always the grid nearest the cathode, Vg_2, the grid immediately next to it, and so on. A few examples will make this form of notation quite clear; the characteristics of a screen-grid valve measured at Va 200, Vsg 80, Vg —1.5 would mean that the measurements were taken with 200 volts on the anode, 80 volts on the screen and 1.5 volts negative bias on the grid. A triode measured at Va 100, Vg 0, would have characteristics quoted with 100 volts on the anode and zero grid volts, i.e., the grid returned to cathode or negative filament.

Va 100, Vg 0, is the conventional way of rating a triode valve, a method that in the writer's opinion is most unsatisfactory because when bias is applied the slope is greatly reduced. Alternatively, could anything be more absurd than rating a valve at Va 100, Vg 0, when it is intended to work at, say, Va 400, Vg 43?

Impedance, Amplification Factor and Mutual Conductance are Explained in this Article

Impedance

This characteristic is usually described as differential internal resistance, but in plain English it may be described as the internal A.C. resistance of the valve, or more accurately as a measure of the ability of anode voltage to influence anode current. Impedance is measured by making a small change of anode voltage, for example, 90-110 in the case of triodes, and dividing by the change brought about in the anode current. For instance, suppose that at 90 volts a power valve passed 12 milliamps, and at 110 volts passed 17 milliamps, we see that a change of 20 volts has brought about a change of 5 milliamps, and if we divide the latter into the former we get the answer in 1,000's of ohms, i.e., 20÷5=4 (1,000's of ohms), that is to say 4,000 ohms impedance.

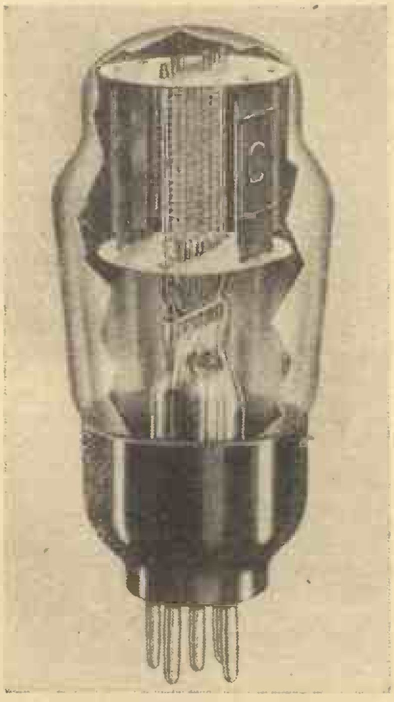

Fig. 1.—A modern high-slope output valve—the Cossor 42 OT. Note the close grid spacing which with the 2-watt heater gives the high slope of 7 mA/V.

It will always be found that the impedance of a valve is almost entirely dependent on anode current. An increase in anode current will bring about a decrease in impedance; in the case of an output triode it is desirable that the impedance should be as low as possible.

Unfortunately, it is impracticable to reduce anode impedance indefinitely owing to the corresponding increase of anode current. Therefore, in the interest of economy, and valve life, it is customary for the manufacturers to indicate the maximum anode voltage and optimum grid bias which are suggested as a suitable compromise between a decrease in impedance, and an increase in anode current.

It should be thoroughly understood that while grid bias is primarily applied to enable the valve to accept adequate grid swing, an increase of bias reduces anode current and increases impedance. Where high gain per stage is necessary, valves are employed with relatively high impedance. For intermediate L.F. stages impedance of 10,000-30,000 are usually chosen. For H.F. or I.F. amplification screen-grid or pentode valves are employed with impedances multiplied by 10 or more; bearing in mind the same order of mutual conductance is available in each case, the result is an increase of valve amplification by a similar multiplication factor. The reason why large changes of impedance bring about large changes of amplification factor, but do not materially vary the slope, is fully explained below. In the same way that a limitation is imposed on the desirable decrease of impedance of output valves, a limitation is imposed on the increase of impedance of screened valves, as such increase brings about a corresponding decrease in permissible grid acceptance, and anode voltage swing, which is undesirable if certain effects are to be avoided that are detrimental to selectivity and good quality.

Amplification Factor

The amplification factor, sometimes called magnification factor, may be described as the superiority of the grid over the anode to control the flow of electrons from filament to anode. In other words it is a measure of the ability of the valve to amplify. The method of measuring the amplification factor is very simple and shows very clearly the significance of this factor. To measure the amplification factor the procedure is as follows, taking as an example a simple triode valve. The anode current is measured at zero grid and 90 volts, under which condition it will pass, say, 12 milliamps. The anode current is then measured at zero grid and 110 volts, when it will pass, say, 16 milliamps; the grid is made progressively negative until the valve is passing the same anode current as it passed with 90 volts on the anode. We will assume that it was necessary to make the grid 2 volts negative. It will be seen from the above figures that a change of 2 volts on the grid brought about the same change in anode current as 20 volts on the anode. We now divide 2 into 20 and the answer is 10, which is the amplification factor of the valve.

The outstanding point in the preceding paragraph is that the control of grid over anode is the magnification factor. If a valve has an amplification factor of 20, 1 volt on the grid will change the anode

(Continued overleaf)

VALVE CHARACTERISTICS—2

(Continued from previous page.)

current the same amount as a variation of 20 volts on the anode, and so on.

It is customary to refer to the amplification factor by the Greek letter μ (pronounced mu), but it is as well to remember that the same Greek letter also means "one thousandth of" and also "permeability."

With the exception of a diode detector, the prime use of the valve is to amplify; it is obvious, therefore, that if no limiting factor crept into the argument the valve with the highest amplification factor would be the one to choose. Unfortunately, however, valves of high μ have high impedance, therefore it is only possible to use a high μ valve where the input is small, i.e., under conditions where high impedance is not undesirable.

Mutual Conductance

The reader will already have realised that the efficiency of a valve cannot be measured in terms of either impedance or amplification, since both factors must be considered simultaneously; for this reason the "goodness" of a valve is measured by a factor which is a combination of both, in other words mutual conductance. This factor is colloquially known as the slope, and is usually written "g." Here again the same symbol is also used as an abbreviation meaning grid.

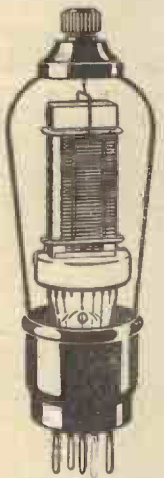

Fig. 2.—The electrode assembly of an early high-impedance valve of the type referred to in the text.

Mutual conductance is measured in a very simple manner. The valve is fed with whatever anode voltage it is to be measured with, and the anode current noted at zero grid voltage; taking a triode as an example, let us assume this figure to be 15 milliamps. A negative bias of 1 volt is then applied to the grid, and the decrease in anode current noted. If this decrease is, say, 3 milliamps, the valve has a slope of 3 milliamps per volt, written 3 mA/v. If the decrease is 4.3 milliamps, then the slope is 4.3 mA/v, and so on.

If the impedance and amplification factor are known, mutual conductance may be found by taking away three noughts from the impedance value and dividing what is left into the amplification factor. For example, if a valve has an impedance of 4,000 ohms and an amplification factor of 9, take away three noughts and we have the figure 4, divide this into 9 and we get 2.25, which is the slope.

Conversion Conductance

Mutual conductance serves to indicate the efficiency of any class of valve except (A) the diode, which has no grid, and therefore has no amplification factor and consequently, no slope, and (B), frequency changers.

The merit of a frequency changer is measured by conversion conductance, which is a rough counterpart of slope, except that instead of being a purely static measurement it is the ability of H.F. voltage applied to the signal grid to vary the I.F. current in the anode circuit.

(To be continued)

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

"The Overseas Market"

SIR,—I read with interest the two letters entitled "A Colonial Impression," and "The Overseas Market," published in PRACTICAL AND AMATEUR WIRELESS, dated November 13th and 27th, 1937. With regard to the first letter, I, as one of the regular readers of PRACTICAL AND AMATEUR WIRELESS, quite agree with the writer as regards the reproduction of American superhet instruments. The average person out here would not dream of purchasing an instrument unless it is a 6 to 8-valve commercial superhet, the only type of receiver which seems to give satisfactory results under our weather conditions. This means an all-wave instrument, which may be purchased from £20 to £28 on easy terms of £1 per month. The average American instrument gives good quality reproduction out here, and has all the necessary refinements.

I will not say that the British designers are *not* as competent as the American designers, but I have heard some British superhet instruments, and they certainly lack punch when compared with their American counterparts.

The trouble appears to lie in the circuit design. Judging from different components which I obtained some time back (prior to the American invasion of our market), I am convinced that these components have proved the test.

A few days ago I had the pleasure to hear and handle two British superhet all-wave instruments, and I must admit that the reception and quality were good, and compared favourably with a good American instrument, and better than some.

Take, for instance, the British valves. There are certainly various types, suitable for the different stages of receivers; but why not have them standardised the same as American valves?

American valves may be obtained throughout the whole of South Africa, Rhodesia, and beyond, without any difficulty. We don't have to worry about who the manufacturer is, as long as the valve operates under the same characteristics as the "79" or "58" type of valve we require. When we want to replace a certain make of valve of British manufacture, a great inconvenience is experienced.

The dealer sympathises with us for not being able to meet our requirements, and at the same time politely offers an American equivalent, unless you are prepared to wait a week or more for this particular type of British valve to arrive from somewhere, if obtainable.

I think it will pay British manufacturers to investigate the matter thoroughly, for I can safely say that the radio enthusiasts out here would prefer the British instruments and component parts.—M. POTGIETER (Port Elizabeth, S. Africa.).

Station CS2WD

SIR,—For the benefit of other readers, I wish to report the following details of station CS2WD, Lisbon. Frequency: 5,977 kc/s; power, 200 watts. Schedule: 20.30-22.30. QRA: Radio Renascenca, Rua Capelo, 5, Lisbon.

The announcer does not give the call, but frequent reference is made to "Radio Renascenca."

Wishing yourself and the staff of your excellent paper the compliments of the season. —THOMAS CROSSFIELD (Halton, Lancs).

A Beginner's Log

SIR,—I am only 14 years old, and have recently taken up S.W. listening. To begin with, I built your "Simplest Short-Waver," and although my aerial is only a length of 28 d.c.c. wire stretched diagonally across my den, you can see by my log that this little set works splendidly. I regularly receive the following stations: W1XAL, W2XAD, W2XAF, VK3ME, DJN, DJA, 2RO, JVM, EAQ, and HBJ.

I am sure that I would not have met with this success if it had not been for your excellent journal.—R. PROCTOR (Watford, Herts).

CUT THIS OUT EACH WEEK.

Do you know

—THAT ordinary iron (such as iron bolts and screws) is unsuitable for inclusion inside a coil for providing an effect similar to modern iron-core coils.

—THAT the movement of inter-connecting wires in a short-wave set may cause effects similar to fading owing to the shifting of tuning positions.

—THAT care should be taken when using headphones with a mains receiver, as there may be sufficient current flowing to burn out the 'phones.

—THAT in a D.C. or Universal receiver a dial light may be included in series with the heater filaments to provide also an indication that the heater circuit is intact.

—THAT a metallic "twanging" noise from the speaker when a mains receiver is switched on and off may indicate a failing heater in the rectifier or output valve.

—THAT accumulator and H.T. batteries should be kept well clear of the aerial lead in a short-wave receiver.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL AND AMATEUR WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE CARDIFF AND DISTRICT SHORT-WAVE CLUB

THE above Club has been very active all through the summer and winter, and meetings have been arranged for January 20th and 27th. at the Roath Park Hotel, City Road, Cardiff. All those interested in short-wave radio are invited to attend these meetings, which are devoted especially to this subject.

The club has been favoured with two demonstration models of the 1938 range of "W.B." speakers, and these have been on demonstration at recent meetings. Amongst the members are twelve active full-licensed transmitters, and the club has recently been favoured by a visit from the Australian amateur VK5AP. Discussions on all short-wave topics take place at all meetings, and a series of lectures is now being arranged to commence in the near future. The local "Hamfeast" of the society will be held early in February, and the date and venue will be announced later.

All interested in the activities of the society are asked to communicate with the Hon. Sec., H. H. Phillips, 2BQB, 132, Clare Road, Cardiff.

SHEPPEY AMATEUR RADIO CLUB

THE above radio club holds meetings every Wednesday at 7 p.m. at 161, Invicta Road, Sheppey. The club is mainly for the short-wave enthusiast interested in receiver design and operation, and amateur-band listening, etc.

We shall be delighted to co-operate in any experimental transmissions any transmitting reader of PRACTICAL AND AMATEUR WIRELESS cares to make, or to take part in any club's DX contest. Also the members would be willing to act as checking stations for amateur transmitters in any part of the country. Incidentally all members are regular readers of PRACTICAL AND AMATEUR WIRELESS and join with me in wishing it continued success.—F. G. Maynard (2CVM), hon. sec.

ROBERT BLAIR RADIO SOCIETY

THE wireless class which has been held for some years past at the L.C.C. Islington Institute, Blundell Street, London, N.7, under their technical adviser, Mr. E. W. A.-de-Kretser, have formed themselves into a club. The club is to be known as the Robert Blair Radio Society, and will continue to meet at the Institute as heretofore, Wednesday and Thursday evenings at 8 p.m., commencing in the New Year on Wednesday, January 12th. Anyone is welcome to any of our meetings. Just drop in and have a chat, or write to the secretary, Mr. A. R. Richardson, 24, Mercers Road, Holloway, London, N.19.

SLADE RADIO

ON December 2nd last the above society celebrated its tenth birthday with an annual supper, at which our founder and President, Dr. C. H. Harcourt, presented trophies and certificates for success in the year's Direction Finding tests to Messrs. H. E. Cuttler, N. B. Simmonds, and S. Bullock, and commented on the popularity of these tests over the last nine years, in which the skill of the members had developed to a very high stage. The evening concluded with a most enjoyable concert.

On December 16th the members were addressed by Mr. H. G. Ebans (G8MC) on "The ABC of Short-wave Listening." This was very thorough and instructive, and the lecturer explained clearly the peculiar conditions which governed operating on the higher frequencies. For the last event of the year, on the 30th ult., the members debated the question: "Is Television developing on the right lines?" The debate leaders were L. A. Griffiths (for) and N. B. Simmonds (against), and after each had outlined his case a general discussion ensued in which all the members took part.

The winter quarter programme of this society is given below:

January 13th.—Wavemeters and Oscillators. Their construction and use. By Mr. N. B. Simmonds.
January 27th.—Junk Sale.
February 8th (Tuesday).—Lecture by Mr. Quarrington, of Messrs. A. C. Cossor, Ltd., on Cathode Ray Tubes and their application, by arrangement with M.A.R.S. Meeting place (in the City) to be announced.
February 24th.—Modern amateur-band communication receivers. By Mr. G. Brown, G5BT.
March 10th.—Direction Finding night.
March 24th.—Principles of synchronous and asynchronous motors. By Mr. A. B. Cape.

Morse practice class at 8 p.m. sharp at each meeting, except February 8th (outside event).

The Slade Radio Society, founded in 1927, provides Midland amateurs, experts or novices, with the means to co-operate and promote mutual interests. Entrance fee 2s. 6d.; annual subscription 10s.; club badge, 1s. Hon. sec., G. C. Simmonds, 38, Rabone Lane, Smethwick.

(Continued on next page)

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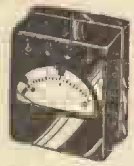

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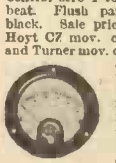

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Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	—	PW31
Selectone A.C. Radiogram Two (D, Pow)..	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen) ..	—	PW23
D.C. Ace (SG, D, Pen) ..	—	PW25
A.C. Three (SG, D, Pen) ..	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen) ..	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen) ..	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC)) ..	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) ..	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen) ..	5.12.36	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen) ..	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull) ..	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull) ..	9.2.35	PW47
A.C. All-Wave Corona Four ..	6.11.37	PW81
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve) ..	5.6.37	PW40
F. J. Camm's 2-valve Superhet ..	13.7.35	PW52
F. J. Camm's £4 Superhet ..	—	PW58
F. J. Camm's "Vitesse" All-Waver (5-valver) ..	27.2.37	PW75
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	1.12.34	PW42
Universal £5 Superhet (Three-valve) ..	—	PW44
F. J. Camm's A.C. £4 Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4 ..	—	PW60
"Qualitone" Universal Four ..	16.1.37	PW73
SHORT-WAVE SETS.		
Two-valve : Blueprint, 1s.		
Midget Short-wave Two (D, Pen)	—	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow) ..	—	PW30A
The Prefect 3 (D, 2LF (RC and Trans)) ..	7.8.37	PW63
The Bandspread S.W. Three (HF Pen, D (Pen), Pen) ..	29.8.36	PW68
F. J. Camm's Oracle All-wave Three (HF, Det, Pen)..	28.8.37	PW78
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) ..	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen) ..	19.6.37	PW77
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl.B) ..	15.5.37	PW12
MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE		
CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set ..	12.12.36	AW427
1934 Crystal Set ..	—	AW444
150-mile Crystal Set ..	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver ..	—	AW387
Twenty-station Loudspeaker One-valver (Class B) ..	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)..	—	AW388
Full-volume Two (SG det., Pen).	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans) ..	—	AW338A
Lucerne Minor (D, Pen) ..	—	AW426
A Modern Two-valver ..	—	WM409
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
New Britain's Favourite Three (D, Trans, Class B) ..	15.7.33	AW394
Home-built Coil Three (SG, D, Trans) ..	—	AW404
Fan and Family Three (D, Trans, Class B) ..	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans) ..	2.12.33	AW412
1934 Ether Searcher; Baseboard Model (SG, D, Pen) ..	—	AW417
1934 Ether Searcher; Chassis Model (SG, D, Pen) ..	—	AW419
Lucerne Ranger (SG, D, Trans)..	—	AW422
Cossor Melody Maker with Lucerne Coils ..	—	AW423
Mullard Master Three with Lucerne Coils ..	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans) ..	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans) ..	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen) ..	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen)..	June '33	WM327
Economy-Pentode Three (SG, D, Pen) ..	Oct. '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen) ..	—	WM351
£3 3s. Three (SG, D, Trans) ..	Mar. '34	WM354
Iron-core Band-pass Three (SG, D, QP21) ..	—	WM362
1935 £6 6s. Battery Three (SG, D, Pen) ..	—	WM371
PTP Three (Pen, D, Pen) ..	June '35	WM389
Certainty Three (SG, D, Pen) ..	—	WM393
Minitube Three (SG, D, Trans) ..	Oct. '35	WM400
All-wave Winning Three (SG, D, Pen) ..	Dec. '35	WM396
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans) ..	—	AW370
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402
2HF Four (2 SG, D, Pen) ..	—	AW421
Crusader's A.V.C.4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class B Outputs for above : Blueprints, 6d. each)..	25.8.34	AW445A
Self-contained Four (SG, D, LF, Class B) ..	Aug. '33	WM331
Lucerne Straight Four (SG, D, LF, Trans) ..	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	Feb. '35	WM381
The H.K. Four (SG, SG, D, Pen)	Mar. '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen) ..	Apr. '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans) ..	May '33	WM320
Class B Quadradyne (2 SG, D, LF, Class B) ..	Dec. '33	WM344
New Class-B Five (2 SG, D, LF, Class B) ..	Nov. '33	WM340
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
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Economy A.C. Two (D, Trans) A.C.	—	WM286
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Three-valve : Blueprints, 1s. each.		
Home-Lover's New All-electric Three (SG, D, Trans) A.C. ..	—	AW383
S.G. Three (SG, D, Pen) A.C. ..	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
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Mantovani A.C. Three (HF Pen, D, Pen) ..	—	WM374
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Harris Jubilee Radiogram (HF Pen, D, LF, P) ..	May '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior ..	—	WM375
Varsity Four ..	Oct. '35	WM395
The Request All-Waver ..	June '36	WM407
1935 Super Five Battery (Superhet) ..	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C. ..	—	AW425
Heptode Super Three A.C. ..	May '34	WM359
"W.M." Radiogram Super A.C...	—	WM366
1935 A.C. Stenode..	Apl. '35	WM385
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF, Class B) ..	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B) ..	1.7.33	AW393
Family Portable (HF, D, RC, Trans) ..	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21) ..	June '34	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS—Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (Price 6d.)	—	AW329
S.W. One-valve for America ..	23.1.37	AW429
Rome Short-Waver ..	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG det., Pen) ..	Feb. '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans) ..	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen) ..	30.6.34	AW438
Experimenter's Short-waver (SG, D, Pen) ..	Jan. 19, '35	AW463
The Carrier Short-waver (SG, D, P)	July '35	WM390

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Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices, *which are additional to the cost of the Blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

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Amateur Wireless	4d.	,, ,,
Practical Mechanics	7½d.	,, ,,
Wireless Magazine	1/3	,, ,,

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Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

RADIO CLUBS AND SOCIETIES

(Continued from previous page)

THE CROYDON RADIO SOCIETY

A BUSY programme has been arranged for the period up to April, the following being a selection of the meetings for the immediate future. Meetings are on Tuesdays, unless otherwise stated.

January 18th: Voigt loudspeaker demonstration by a member, Mr. V. Williams.

January 25th: "Hi-Q Short-Wave Components." A lecture to be given by Lissen, Ltd., followed by a practical illustration of their 6-valve A.C. 4-wave superheterodyne.

February 3rd: Joint meeting with the British Sound Recording Association, to be held in Central London. The subject is a talk and demonstration on: "Sound Recording on Direct Play-back Blanks." Special travel facilities and location of hall will be announced later. It is hoped that the society will be well supported for this event.

February 8th: Belling and Lee, Ltd., represented by Mr. H. J. Walters, will lecture on "Electrical Interference Suppression as applied to Broadcast Suppression."

Fixture cards with full programmes, and any other particulars of the society, are available for PRACTICAL AND AMATEUR WIRELESS readers, and a welcome is also extended to any meeting. Hon. pub. sec.: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

BRADFORD SHORT-WAVE CLUB

THE last meeting of the above club for 1937 was held on Friday, December 31st. Friday promises to be a suitable club night, and meetings will continue at the usual time and place. The next special evening will be January 21st, when Messrs. Belling and Lee, Ltd., will give a lecture and demonstration to club members. A cordial invitation is extended to everyone interested. S. Fischer, Edenbank, 10, Highfield Avenue, Idle, Bradford, Yorks.

QUERIES and ENQUIRIES

Making An All-wave Set

"I am just starting on short-wave work and I enclose a circuit for a three-valve all-wave set. I should like your criticism on the circuit before building. It is aperiodic on short waves in the H.F. section. I will wind my own short-wave coil, and should like you to suggest a suitable three-way switch."—E. A. C. (Sydenham).

THE design is theoretically sound, but there are a number of points which must receive attention as this is a straight all-wave set. In the superhet type of all-waver there is adequate amplification to make up for any losses introduced in the wiring, but in a straight simple receiver of the type you indicate you will have to take precautions to reduce all losses to a minimum. The wiring to the switches may easily introduce sufficient loss to render the short-wave band useless. You may find it necessary to carry out considerable experimental work in order to find a suitable lay-out which will give the desired high performance on the short waves. Suitable switches may be obtained from Messrs. B.T.S. or Bulgin.

Using a Mains Unit

"Can you tell me whether, by using only the socket marked 50/80 volts on my H.T. eliminator and not using the 120-volt socket, I have harmed the same in any way? I have been testing a three-valve set for someone and I tried the 120-volt socket first, but got a bad hum, so used the 50-80 volt. When I re-connected my set it did not seem so good."—N. W. (Chesterfield).

THEORETICALLY you should not have damaged the unit by using only the low-voltage output. A great deal depends, however, upon the components employed in the unit and the method adopted for obtaining the low-voltage tapping. The hum which was caused was no doubt due to the fact that the receiver was unsuitable in its present condition for use with a mains unit. It is often necessary to introduce decoupling components in a receiver in order to obtain satisfactory results with a mains unit, and it is also possible that the receiver you tested required a high current output and thus overloaded the mains unit.

Using a Push-pull Stage

"I have a set which is fitted with a push-pull output stage, and a speaker transformer of the universal type is fitted. I have tried my present speaker with unsuccessful results. Would it be possible to do away with one of the transformers in order to obtain better results?"—F. H. T. (Highbury).

WITH a push-pull stage, in which is a transformer giving high and low-impedance outputs, there are several alternative methods of connection available. You can use an ordinary speaker having its own transformer and connect this to the high-impedance terminals of the amplifier, or can disconnect the speaker transformer and join the low-impedance speech coil to appropriate terminals on the amplifier. This method will do away with one transformer, and obviously it is desirable to dispense with as much additional iron as possible in the interests of quality in this particular type of apparatus. You can, if the high-impedance output terminals do not provide suitable matching, connect your speaker transformer to the two anodes of the output stage through 2 mfd. condensers in order to provide choke-capacity feed for the speaker, and this will provide another ratio which may prove of use in obtaining correct matching.

Valve for Short-wave Set

"I am building a one-valve short-wave set and should like to know the best type of valve. The set is to use a triode with reaction on quite standard lines."—R. W. S. (S.W.7).

ANY good triode of the detector or general purpose class could be used in a circuit of the type mentioned. If you intend to use plug-in coils so that you can go down to really low wavelengths then you may prefer to use one of the special valves designed for short-wave sets such as the Hivac D210SW. Obviously, however, to take full advantage of this type of valve all other components in the set should be chosen with a view to high efficiency on the short waves.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Amateur Directory

"Could you tell me where I could get an up-to-date directory of amateur transmitters? I should also be glad if you could recommend a book of instruction on the morse code, explaining the various abbreviations used by amateurs."—J. A. S. (Stalybridge).

THE directory of amateurs may be obtained from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Essex, price 6s. It is known as the Radio Amateurs Call Book. In this will also be found the Q and R codes as well as other interesting signals used in amateur transmitting. We have also published the information in our latest book, "Coils, Chokes and Transformers," price 2s. 6d., or 2s. 10d. by post.

Local Station Interference

"I have built a one-valve set and converted it into a two. I get a number of stations on the medium waves and three on the long, but I get Washford all over the dial and should like to know whether you can recommend a remedy. I live about four miles from this station."—D. J. V. (Llanfairfechan).

WHEN living in the close proximity of a powerful station such as Penmon, you are bound to experience some difficulty with a simple type of receiver. You should endeavour to reduce your aerial and arrange it so that it is non-directional to that station, and may also find it essential to use a wave-trap in order to reduce the spread of the station. An ordinary medium-wave broadcast coil may be used for a wave-trap, tuned by a .0005 mfd. condenser. An iron-core coil will give sharper cut-off.

Increasing the Tuning Range

"I have a commercial set which only tunes up to 520 metres. This means that Athlone on 531 metres is out of range. I have been told that I can add a small loading coil and should like to know how to make them and what part of the circuit to fit them in."—W. H. (Newtown).

IF you add small coils in series with the existing coils, although this will give you the desired increase in wavelength it will also raise the minimum to which the set tunes and you may thus lose some stations at the lower end of the scale. It will therefore probably prove preferable to include small fixed or pre-set condensers in parallel with the main tuning condenser to obtain the desired result—quite a small capacity being required to give the necessary few extra metres. If desired, the additional condenser could be joined in series with an on-off switch so that it could be included only when required, and you may even be able to arrange that the switch could be automatically operated by the tuning condenser when it comes to the end of its travel.

Relay Interference

"I have made a tape machine which I work off a small short-wave receiver. The relay I am using works off the set, but I found that relay would not keep step with the morse. After some investigation, I realised that the receiver was continually picking up the spark which was made when the relay clicked, and this passed out through the receiver and relay and made another spark and thus I could not get good results. Can I cure this in any way?"—L. J. R. (Windsor).

THE relay will have to be screened. This may easily be done by putting it in a metal box, or a wooden box lined with metal foil connected to earth. You may find, however, that merely by altering the position or the angle of the relay you will be able to make some reduction in the degree of interference, but undoubtedly for the complete elimination of the trouble total screening would appear the most satisfactory solution. Have you connected a fixed condenser across the contacts?

A similar difficulty is sometimes experienced with electric bells, and a fixed condenser across the contacts where the spark occurs is successful in preventing the spark and thus eliminates the trouble.

The coupon on page iii of cover must be attached to every query.

RECEIVERS, COMPONENTS AND ACCESSORIES
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Packed with short-wave information and circuits of mains and battery receivers, including straight, superhet and 5-metre transmitters, modulators, etc. Information on transmitting licences, aerials, Class B amplifications, neutralizations, superhet alignment, etc. The most comprehensive manual published, written by practical engineers, price 6d., post free, 7½d. including catalogue.

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TELSEN A.C./D.C. Multimeters, 5-range (tests anything radio or electrical), 8/6; loudspeaker units, 2/6, Ace (P.O.) microphones, complete with transformer ready for use with any receiver, 4/6; headphones, 4,000 ohms, 3/- pair.

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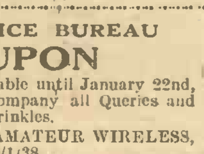

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Special Speaker for above, fitted Pentode Transformer, 600 Ohm Field, 7½in. Cone, 12s. 6d. each.

500 AERODYNE 5-valve Battery Superhets, a really magnificent job, listed 8½ gns. The Chassis is contained in a handsomely finished Walnut Cabinet of Upright Design. The Dial is really attractive and is station named. Tuning is indicated by means of a rotating light. The Valves used are as follows: FC2A, VP2, 2D2, PM2B, and 220 PA Cossor. Speaker, large type P.M. Rola. Our Price to clear, £4 4s.

We would emphasize that the above are in both instances Brand New as from the makers.

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3 Only, BUSH A.C.23 Band Pass Receivers. This is a handsome little A.C. Mains Receiver, fitted with Band Pass Tuning. Good Tone, Volume and Range are obtainable; **our price to clear £3 19s. 6d.**

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Price £6.17.6

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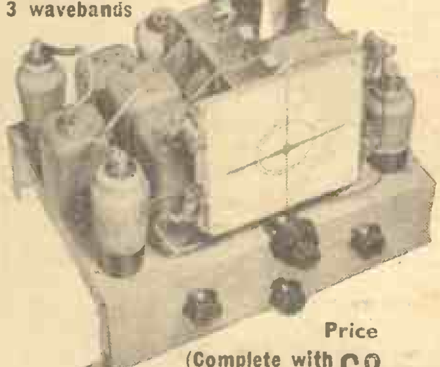
This moderately-priced 7-stage 5-valve all-wave receiver utilises a remarkably efficient superheterodyne circuit which provides exceptional sensitivity on all three wavebands—18-50, 200-550, 1,000-2,000 metres.

Circuit includes: Latest type triode-hexode frequency changer, vari-mu pentode I.F. amplifier, double diode-triode operating as diode detector and I.F. amplifier, and providing full A.V.C. High slope 3 watts output pentode. Wave-change and gram. switch. As illustrated, but with new type dial with principal station names.

6-valve all-wave Superhet with Radio Frequency Stage

8 Stages
8 tuned circuits
3 wavebands



Price (Complete with B.V.A. Valves) £8.17.6

Performance (made possible by use of multi-electrode valves) equal to that of many receivers employing 8 valves or more. Brief specification includes: Large "Airplane" dial, with different coloured lights, automatically switched on for each wave-range. Micro-vernier 2-speed drive, 4-point wave-change and gramophone switch. Volume control and variable tone control also operative on gramophone. Reinforced heavy-gauge steel chassis. Covers 19-2,000 metres.

Circuit comprises: Preselector circuit, radio frequency amplifier (operative on all 3 wavebands), triode-hexode frequency changer, double band-pass I.F.T. coupled I.F. amplifier, double diode-triode detector and L.F. amplifier. D.A.V.C. applied to 3 preceding valves. 3-watt pentode output.

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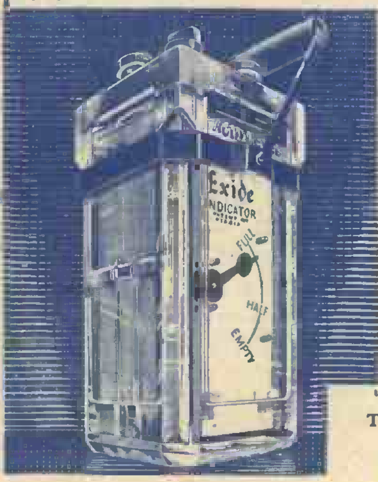

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A SIMPLE TRANSCEIVER—See Page 523.

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

a GEORGE NEWNES Publication

Vol. 11. - No. 279
January 22nd, 1938

AND PRACTICAL TELEVISION

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Pra.W. 22/1/38

Systematic Fault Finding—See Page 515

Practical and Amateur Wireless
Edited by F. J. CAMM
Technical Staff:
W. J. Delaney, H. J Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.
VOL. XI. No. 279. January 22nd, 1938.

ROUND *the* WORLD *of* WIRELESS

All-wave Sets

THE present tendency in radio receiver design is to provide short-wave reception in addition to the medium- and long-wave signals, and there are various ways of accomplishing this. The superhet receiver is obviously that most suited to all-wave reception, as many of the difficulties of satisfactory short-wave working are overcome by the method of changing the frequency of the incoming signal. But the straight set may also be adapted in various ways, although obviously the efficiency will not be so great. We have described several receivers of the straight type for all-wave reception, and as there are still many readers who require a set of this type and who, for some reason or another, are not building those so far described, we are giving in this issue full constructional details of yet another three-valve circuit covering the short and normal broadcast wavelengths. A somewhat different scheme is adopted in this receiver, however, and in place of the "all-wave" coils previously used we employ standard screened broadcast coils for the normal wavelengths and a special short-wave coil for the short waves, and to remove many of the difficulties which some readers find in building a set, we have arranged for these to be supplied ready mounted on the chassis with switches also in position. We are sure this step will be received with satisfaction by those who have so far hesitated to construct an all-wave receiver.

Long-distance Television

AS a result of experiments carried out by the Radio Gramophone Development Co., Ltd. (R.G.D.), at a point near Birmingham, it has been established that regular reception of the present B.B.C. television programmes may be carried out. The only essentials appear to be a really good set and an efficient aerial, and this firm state that they are now prepared to install a limited number of their televisors outside (as well as inside) the present recognised "service" area of Alexandra Park. It is claimed that an increase in the power of the television transmitter would result in still greater useful ranges.

New Scottish B.B.C. Station

IT is stated that the B.B.C. propose to install a new transmitter at Nigg, on the south side of the river Dee, to replace the existing transmitter used for the Aberdeen area. The new station should be ready by the beginning of next year and will have a power of 5 kW, compared with the existing 1 kW. New studios and offices will be taken in Aberdeen so that the area may be better served.

On Other Pages

Dummy Valves

SOME consternation is being felt in American radio circles by the disclosure that certain American radio firms are supplying receivers in which a large number of valves are used merely to give the set a powerful appearance, the valves being dummies not fulfilling any function. It is even stated that certain firms are fitting resistors and condensers inside "blown" valves so that their advertisements may claim that the valves are not dummies but are essential parts of the receiver.

Broadcast Talks

A PAMPHLET giving full details of the talks to be heard throughout the spring of 1938 is now available from the B.B.C. There are 20 pages containing details and tables of the various subjects, together with some sketches illustrating speakers and points covered in the talks.

First Full Opera Broadcast

THE first full opera production from St. George's Hall by the newly created Music Productions Unit of the B.B.C will be given in the National programme on January 21st and in the Regional on January 24th. Massenet's "Manon" is the work which has been chosen and it will run without interruption for two hours.

Pantomime Burlesqued

AT this time of the year there are many pantomimes running, and a number have been broadcast. On the 25th, in the Northern programme, "Phantomime," a burlesque of the panto., is to be given by R. J. Finnemore, Muriel Levy, Joyce Lustgarten and Henry Read, with David Porter producing.

Public Address Fields

THE field of utility covered by modern public address equipment widens daily, and the latest news is of a complete chapel mounted on wheels, with altar and other necessary equipment for open-air services. A microphone with speakers on the roof enables a vast crowd to be addressed. The use of gramophone records of bells with loudspeakers in belfries is also increasing and protests are stated to be proposed in certain districts due to the fact that bell-ringers are being put out of work.

You Have Been Warned!

READERS are again warned not to hand over their receivers to men who may call at the door professing to be either service engineers from a radio firm, from the Post Office or from the police authorities. The old confidence trick is again being worked, where someone calls and claims to be one of the above and requires to take the set away.

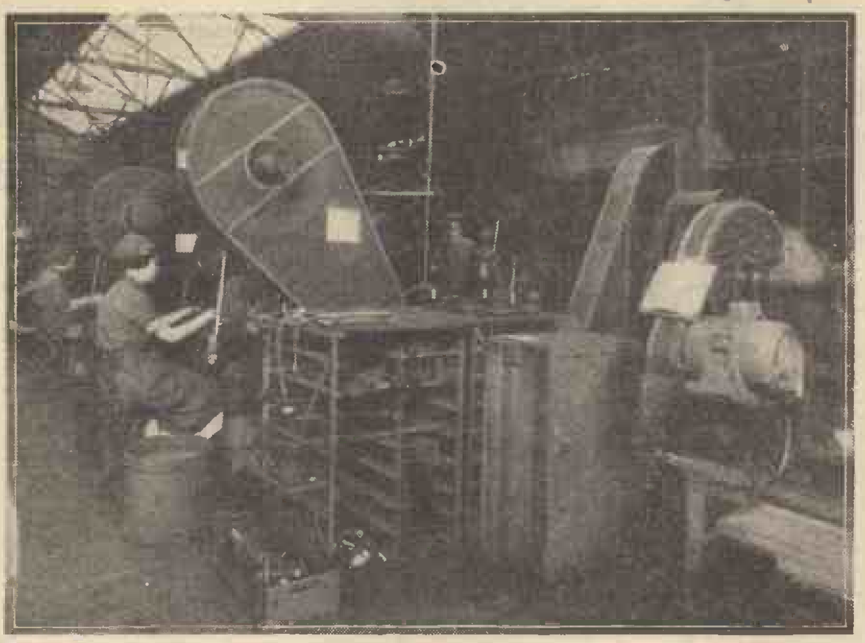
Missing pages: 515-518, 525-528.

ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL NEWS and NOTES

New Radio Beacon Guide for Aircraft

FOR the guidance of air liners approaching Croydon, a new automatic radio beacon, erected at Mitcham, about four miles north-west of the airport, is now in operation. It sends out one-minute signals on the same frequency as a beacon at Amsterdam, and the signals, which are continuous from 7 a.m. to 10 p.m. daily, will be made outside these hours on request from incoming pilots.



These presses in the Ekco factory stamp sheet-metal struts, brackets, laminations, and other chassis fittings. The chassis are produced on still larger machines.

Broadcasting a "Snail Derby"

NEWS of a novel racing event, in the form of a Snail Derby, comes from Australia, where, in Victoria, racing of various kinds outstrips all other forms of sport. The broadcast will be given from station 3DB, and we are informed that the heats for the event are being held nightly, the winner being "stabled" until the day when the final is to be run. Apparently the snails are to run under their own colours, painted on their shells, and while at the station they are carefully fed, and guarded. The "race" will take place over a marked course in the 3DB studio.

Satire on the Cinema

UNDER the title "Picture Gallery" a short revue on the cinema will be heard on January 26th, but its satirical purpose is perhaps better expressed by the sub-title, "Cinecisms." Rae Elrich, the author, says that his subject is "film stars, film fans, and other funny folk." He intends to let listeners hear about the foibles of the film-maker as well as of the film-goer. One of his sketches will deal faithfully with those for whom a weekly visit to the "pictures" has become a ritual in which the quality of the film to be seen is the last consideration.

Japanese Stations in China

ACCORDING to a recent report the temporary broadcasting stations erected by the Japanese at Peking and Tientsin after the North China outbreak in the summer of last year are to be replaced by permanent stations. At present these stations broadcast news supplied by the Japanese military authorities, in addition to lectures in Japanese, Chinese, and English.

New Bulgarian High-power Station

THE new station at Sofia, with a power of 100 kW., is now making regular test transmissions on the same wavelength (352.9 m.) as the old transmitter. The times of transmission (G.M.T.) are, Sundays—5 a.m. to 8.45 a.m., 10 a.m. to 1 p.m., 3 p.m. to 10 p.m. Weekdays—5 a.m. to 6.30 a.m., 10 a.m. to 1 p.m., 5 p.m. to 9 p.m.

Broadcasts from Holborn Empire

BY special arrangement with the General Theatres Corporation a series of six half-hour broadcasts of variety from the Holborn Empire will be included in programs fortnightly, beginning on Tuesday, February 1st. The broadcasts will always take place at the same hour—from 8 p.m. to 8.30 p.m.—but not necessarily on the same day of the week. Roy Speer, of the B.B.C. Variety Department, will compere each broadcast from the wings of the theatre.

Concert from Torquay

THE Torquay Municipal Orchestra, led by Harold F. Petts and conducted by Ernest W. Goss, will broadcast a concert from the Pavilion, Torquay, on January 23rd. The soloists will be Olive Goff (soprano) and Maurice Clare (pianoforte).

The Ghost Hunters

PART Two of the serial shocker entitled "The Ghost Hunters," written and told by P. Caton Baddeley, may be heard on January 27th in the Northern programme.

Saxophone Concerto

PART of the City of Birmingham Orchestra's Concert in Birmingham Town Hall on January 27th will be broadcast. The conductor is Leslie Heward. Sigurd Rascher and the Orchestra will play the Glazounov concerto. Tchaikovsky's "Francesca de Rimini" is the chief work in the programme.

Liverpool Pantomime Excerpt

HALF-AN-HOUR of pantomime, "Babes in the Wood" at the Empire Theatre, Liverpool, will be relayed to Northern listeners on January 26th. This is a Tom Arnold show and the company includes Jack Edge, Tom Gamble and Helen Breen.

Australia Day Broadcasts from Sydney

AN Empire broadcast of great historic importance will be heard in the National programme on January 26th when Lord Wakehurst, K.C.M.G., Governor of New South Wales, opens Australia's 150th anniversary celebration. He will be heard speaking from Sydney. Also during this broadcast a commentary will be given from the famous Harbour Bridge, in Sydney, describing a water pageant taking place below, commemorating the landing of Governor Phillip and his men from the brig *Supply* in 1788. The programme will come to England via a beam radio.

The B.B.C.'s "Big Bertha"

WHAT is probably the largest book in London is in regular use in Broadcasting House. It is officially known as the Studio Allocation Book, but is often referred to as Big Bertha. When open, the book occupies the whole of the top of a desk seven feet long, and to facilitate the assistant's movement when using the book, a special chair is provided which runs on rails laid on the floor.

SOLVE THIS!

PROBLEM No. 279.

Raglan built a three-valve receiver for the medium waves only, and when tested out experienced a very high-pitched whistle as a background to all stations. After one or two tests he found that this could be suppressed by placing his finger on the grid terminal of the output valveholder. What was the most likely cause of the trouble and the simplest cure? Three books will be awarded for the first three correct solutions opened. Envelopes should be marked Problem No. 279 in the top left-hand corner and must be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be posted to reach this office not later than the first post on Monday, January 24th, 1938.

Solution to Problem No. 278.

The trouble with Jackson's set was that the ganged condenser had an oscillator section designed for an intermediate frequency which was different from that of the I.F. transformers which he obtained, and consequently it was possible only to obtain the correct frequency at one or two settings and it would not hold through the tuning range.

No reader successfully solved Problem 277, and accordingly no books are awarded this week.

Systematic Fault Finding—3

The L.F. and Output Stages are Dealt With in this Third Article of the Series

It is quite a good plan when carrying out tests to cut out the A.V.C. circuit by shorting the decoupling condenser of the network to earth. If this results in improved performance it must not be assumed that the A.V.C. is not working correctly. It is more than likely to be too effective, and the degree of control may be reduced, and therefore the sensitivity of the receiver increased, by using a higher value of delay voltage.

Faults in a receiver incorporating A.V.C. —at least those faults due to faulty alignment of the various tuned circuits in the receiver—are often due to the fact that trimming is attempted with the A.V.C. in action. This is due to the fact that A.V.C. tends to mask the alignment process so that the meter used does not indicate a sharp peak at the point of resonance of the various circuits. The more efficient the A.V.C., the more difficult ganging is. The usual procedure is to work with a very small input so that the resultant circuit reaching the detector is too low to bring the A.V.C. into action, but A.V.C. may be cut out as recommended above and the circuits trimmed without its action.

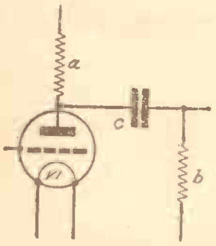


Fig. 9.—R.C. coupling.

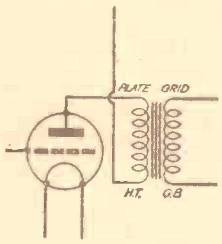


Fig. 10.—Transformer coupling.

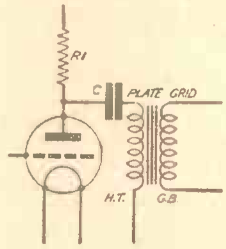


Fig. 11.—Parallel-fed transformer coupling.

Frequent results of faulty ganging, and they are all due to the masking effect of the A.V.C., are bad selectivity, distortion, and even instability, so that, when all other tests have failed, if not before, attention should be turned to that simple little valve, and more often than not forgotten, the diode detector.

We have now considered the H.F. and detector stages, and there now remain the L.F. stages and power pack. These will be dealt with next, and will be followed by detailed instructions for testing the various components which go to make up the modern receiver.

For those readers who are particularly interested in detector faults, attention is drawn to the following articles: The Importance of the Detector Stage (27/2/37), More About Automatic Volume Control (6/2/37), and Reaction Faults and Remedies (7/3/36).

L.F. and Output Stages

L.F. Stages.—Here we come to another part of the receiver which has several variations, chief of which are R.C. and transformer coupling, circuits of which are shown in Figs. 9 and 10.

R.C. coupling (Fig. 9).—Complete silence probably means a broken resistance (a), bad quality and crackles, faulty resistances (a) and (b), but most likely a leaky coupling condenser (c). If a leaky condenser is suspected, replace with a *mica* condenser. The voltage on the anode of V.1 should be tested as explained in the previous sections, and a milliammeter inserted in series with the anode of V.1 and condenser (c) to test for condenser leakage.

Transformer coupling (Fig. 10).—The faults likely to be found here, presuming, of course, that the valves have first been tested, are a broken-down transformer, especially the primary winding carrying the H.T. Corrosion of the wire of the primary winding or even mechanical breakage sometimes occurs, but the most usual cause of failure is a burnt-out primary, due to the surges in current which it has to carry when the set is first switched on. When signals are very faint and distorted, a broken-down transformer primary is more often than not the cause. Test for continuity as explained for coils in a previous section, or measure the primary resistance with an ohmmeter.

Parallel-fed transformers.—A cause of bad quality in a transformer coupled amplifier is often saturation of the coupling transformer. A remedy for this is to revert to the parallel-fed arrangement shown in

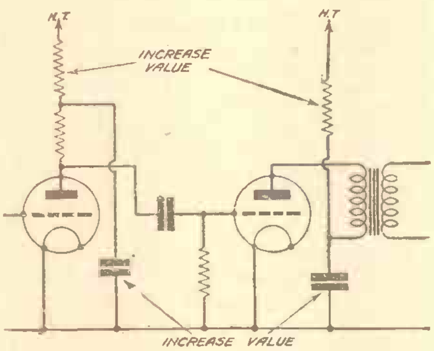


Fig. 12.—Showing how to increase decoupling efficiency.

Fig. 11. The value of the anode resistance R.1 depends upon the impedance of the valve; the higher the impedance of the valve, the higher must be the value of the resistance. 20,000 to 50,000 ohms are usual values and, generally speaking, a resistance having a value equal to twice the value impedance will be found satisfactory.

Low gain is probably due to the use of too high a value of coupling resistance, while thinness of quality usually indicates a leaky condenser C. Bass response may be increased by using a higher value of coupling condenser, the usual values of which vary from 0.5 to 2 mfd.

When using an auto-coupled transformer so as to give an increase in the step-up ratio, the primary leads are often reversed. In some instances this may completely alter the characteristics of the transformer in use, and if noticeable lack of bass or treble is observed, this is one of the points to suspect and the plain parallel-fed arrangement shown in Fig. 11 should be tried.

Motor-boating and instability.—Practically every cause of motor-boating or instability may be traced to inadequate decoupling, and additional decoupling resistances and condensers must be tried in every anode lead in turn.

A frequent cause of instability in a transformer-coupled receiver is the use of too good a transformer. The higher the degree of amplification and the better the response of an L.F. transformer, the greater will be the tendency to instability. By this we do not mean that the proper procedure in a case like this is to substitute the good transformer with a cheap one, although this would probably effect a cure. The thing to do, of course, is to see that every stage is efficiently decoupled. Increased decoupling should always be done without, if possible, reducing the anode voltage on the valves, that is by increasing the capacity of the by-pass condensers. (Fig. 12).

Connecting the loudspeaker by means of a parallel-fed arrangement is often a cure for motor-boating.

Where instability only occurs on gramophone, it is fairly safe to suspect the pick-up leads if they are not shielded, while bad quality may be caused through overloading. If it is not possible to shield the pick-up leads, a low ratio (1 : 1 or 1 : 2) L.F. transformer should be interposed between the pick-up and the receiver. The secondary winding of the transformer should be connected to the receiver with very short leads and the primary to the pick-up. The latter leads may now be quite long without any fear of their introducing instability.

The output stage.—The remarks given above regarding the various forms of coupling, motor-boating, instability, etc., apply equally as well to the output stage as to the L.F. amplifying stages of a radio receiver, and the tests mentioned should be carried out. Absence of H.T. on the anode of the output valve indicates a burnt-out winding on the speaker transformer. Where there are long leads between the receiver and the speaker, H.T. leakage is often introduced together with instability and L.F. oscillation. The remedy is to fit the speaker transformer in the receiver and keep the long leads on the speech coil

(Continued overleaf)

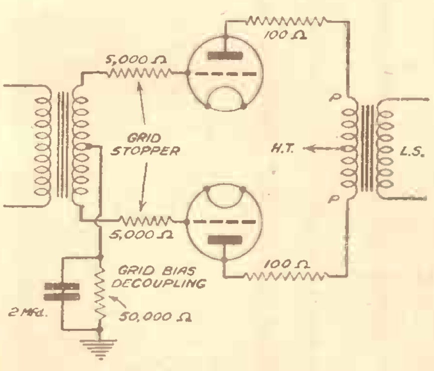


Fig. 13.—Circuit diagram of a push-pull output stage.

SYSTEMATIC FAULT FINDING

(Continued from previous page)

side. Incorrect output transformer ratio causes lack of volume and bad quality.

Carry out the usual tests on the valve, viz. H.T., L.T. and G.B. supplies, condenser and resistance tests, etc., as described in previous sections. A diagram showing the tests to be carried out on a pentode output valve appeared on page 476 of our issue of January 8th.

Push-pull Output Stage

Fig. 13 shows a typical output stage using two directly-heated mains output triodes.

The usual tests on anode current, etc., are first carried out. Note that separate bias is applied to each valve. It is not necessary for each valve to be accurately matched, but if quality is bad and distortion present, the anode current of each valve should be measured. A large difference in the values obtained would indicate the cause. This often occurs when valves have been in use for some time, one "wearing out" quicker than the other. Try reducing the bias applied to the worn-out valve in order to bring its anode consumption nearer to the other.

It is often thought that because the two valves work in opposite phase, distortion is automatically cancelled out and that such a system is not prone to instability. Instability often occurs with modern high-efficiency power valves, however, especially if they happen to be a little soft, and a stabilising resistance of about 5,000 ohms should be inserted in each grid lead and one of 100 ohms in each anode lead. It may also be found necessary to decouple the bias circuits, as shown in Fig. 13, as a common connection often acts as a means of unwanted coupling producing instability. Note that it is necessary to have a separate L.T. winding on the mains transformer for each directly-heated output valve. For the sake of simplicity this is not shown in Fig. 13.

Class B and Q.P.P. output.—Circuits for these and some suggested cures for instability and distortion are shown in

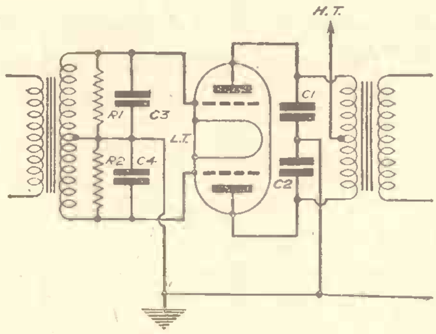


Fig. 14.—Class B output stage, showing the inclusion of condensers and resistances to counteract instability and oscillation.

Figs. 14 and 15. Note the use of condensers C.1 and C.2 and resistances R.1 and R.2 in Fig. 6 to prevent parasitic oscillation and give stability and correct tone. If the standing anode current of a Class B output valve is on the high side, try the use of top cutting condensers C.3 and C.4, as this prevents heterodyne voltages being applied to the grid and thus causing the valve to operate and increase the current. Distortion of such a stage may be caused by insufficient decoupling of the driver valve.

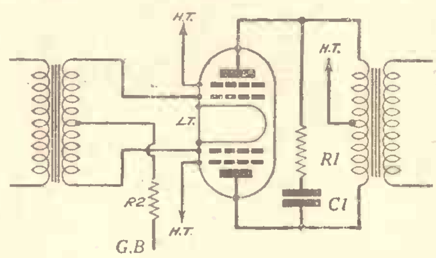


Fig. 15.—Circuit diagram of a Q.P.P. output stage. Note the stabilising resistance R2 and tone correcting circuit R1 and C1.

Q.P.P. Output

Compare Fig. 14 with Fig. 15, which shows a typical Q.P.P. output stage, and note the inclusion of grid-bias. This is a fruitful source of instability, and accordingly the grid-bias supply lead includes a fixed stabilising resistance of approximately 100,000 ohms. Note, too, that it is necessary to include a tone-correcting circuit R.1 and C.1 to minimise peak voltages and correct over-emphasis of high notes.

If the anode current of a Q.P.P. output valve is abnormally high, adjust the screen rather than the common bias voltage. There is a separate screen to each section of the valve and this must be adjusted in accordance with the instructions of the valve manufacturer. Note also that as the anode and screen voltages are adjusted, so the total impedance of the valve alters and wrong ratio of the output transformer is often a fruitful source of bad quality.

Like Class B, Q.P.P. is liable to generate parasitic oscillation and resistances and condensers as shown in Fig. 14 may also be connected in circuit with a Q.P.P. stage with good effect. The bias resistance R.2 and the tone-correcting circuit R.1 and C.1 must always be used. The absence of the latter especially gives rise to bad quality, due to a rise in valve impedance at high audio-frequencies with consequent harmonic distortion.

It is also essential with a Class B or Q.P.P. stage to use a suitable H.T. supply, and this is of great importance when choosing an H.T. mains unit.

(To be continued)

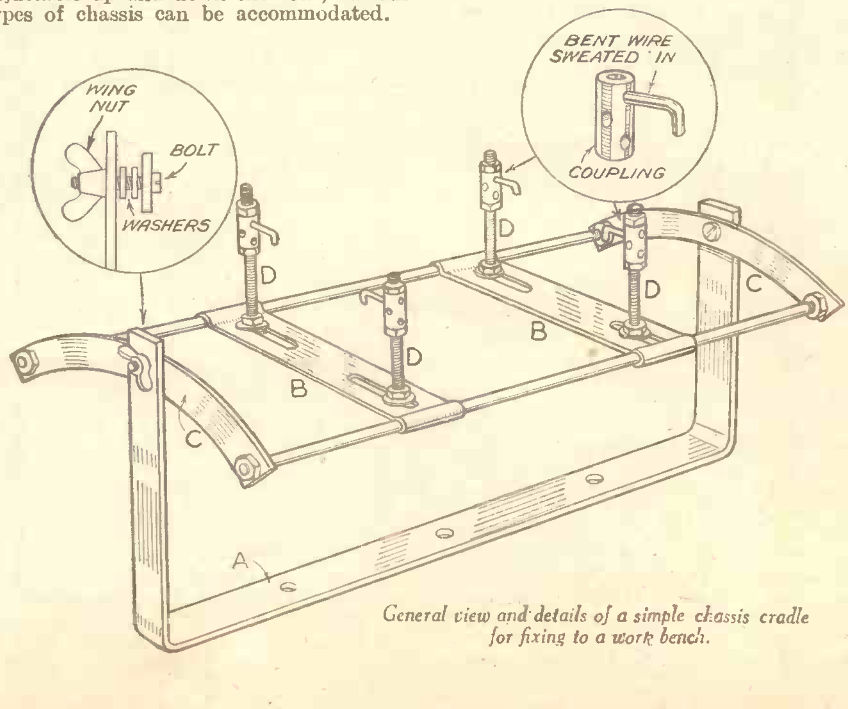
A SIMPLE CHASSIS CRADLE

FROM time to time articles have appeared in this journal of useful apparatus for testing and fault-finding—suitable for both outside servicing and workshop use. To locate a fault successfully the receiver must be removed from its cabinet, and to simplify handling it is clamped in a test "cradle." This piece of apparatus is a very useful device, and the accompanying sketch shows how a cradle for fixing to a bench can be built-up from parts you may have on hand. A frame A of flat strip iron about 1½ins. to 2ins. wide and 4ft. long, the cradle side C (of similar material) and rods are all bent in their required shapes. Your local iron smith or garage would do this part very cheaply.

When the frame and cradle is assembled, i.e., the frame bent to shape, rods sweated to the sides (fixed by nuts, as shown) and holes drilled in the correct places, it is then time to fit the swivel bolts and wing nuts. In the sketch spacing washers are shown, and these are used to give a smoother swivel action. It should be noted that frame A will have to be bent up one foot, as when a chassis is clamped in and inverted a full clearance for large dials, etc., must be allowed for to avoid fouling the bench. The chassis supports B can be made from thin sheet-iron and bent to slide along the rods, the perpendicular rods D being spaced to allow a chassis easy access between them. These rods are held in position by a collar and set-screw. The "beaks" at the end of the rods D are made from coupling pieces or sleeves, in the centre holes of which a small bent piece of brass rod is soldered. Two set-screws are provided with these sleeves, so ensuring perfect grip, and as they are adjustable up and down the rods, various types of chassis can be accommodated.

The rods D are fitted in slots cut in the supporting strips B to allow for varying widths of chassis.

The parallel rods should be fixed at a distance of about 1ft. apart, and the upright rods D can be 6ins. long.—JOHN W. LEECH (Llandudno).



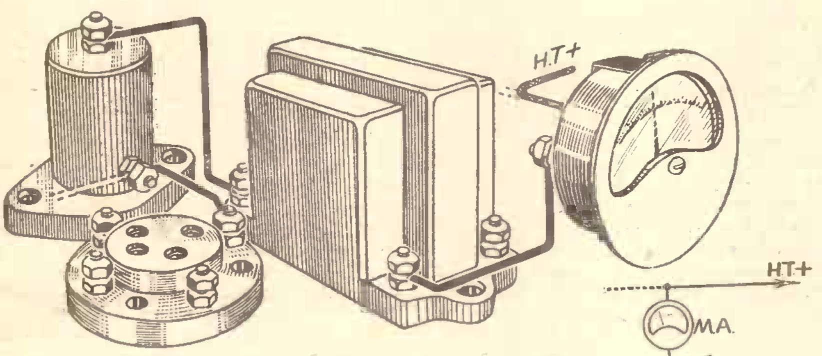
General view and details of a simple chassis cradle for fixing to a work bench.

WATTS AND DECIBELS

How to Measure the Output of a Receiver so that Comparative Tests May be Made Between Different Circuits and Components

By W. J. DELANEY

THE newcomer to radio is often mystified and sometimes confused by reading that such-and-such a receiver will give "5 watts," or that a certain engineer during tests found that a coupling which he tried "was 2db. down." These terms are somewhat loosely employed by present-day service people, and the ordinary listener is not generally concerned with either of them. The output power of a receiver is certainly a valuable figure to know, especially when choosing a set or loudspeaker. For instance, if a maker stated that a certain model of his loudspeakers will handle up to 5 watts, it would be foolish to purchase it for connection to a 10-watt amplifier, and it would also be useful to the listener to know when obtaining or building a new set that it delivered say 10 watts compared with his existing 5 watts. In other words, he could expect it to be twice as loud, but this does not necessarily follow—although the output stage would be capable of delivering twice the volume. The maximum output from a set is only obtainable when the output stage is fully loaded, and thus it would be possible in many circumstances to change a receiver and still not obtain a greater volume of sound simply because the nearest station was too far away to give sufficient load to the L.F. stages, or for some similar reason. The decibel problem is also similarly confusing, although the keen experimenter would find that his experiments would take on a new value if he were able to ascertain the decibel output.



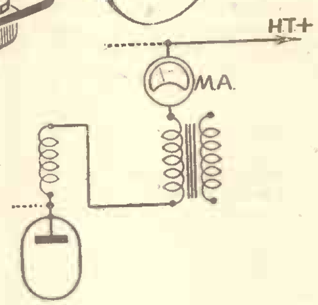


Fig. 1.—The simplest type of signal-strength indicator is a milliammeter connected in the anode circuit of the detector valve. It should be joined on the low-potential side of the anode load as shown here.

Simple Measurements

There is a somewhat similar figure which sometimes causes confusion and that is the "R" code which is so commonly used for denoting the signal strength of a station, but this code is purely arbitrary and ranges from very weak signals (R1) to good loudspeaker signals (R9), and, obviously, no two people will have the same conception of "good headphone signals," for instance. However, for the benefit of those readers who are interested in these measurements the following details will illustrate the various ways of making exact measurements which will give an indication of output watts, decibel changes, and at the same time we shall suggest a method for accurately giving the "R" code.

The loudspeaker is operated by the changing current in the anode circuit of the output stage, and thus power is obviously generated in that circuit. Power is, of course, the product of current and volts, and it is, therefore, a simple matter to utilise a meter to measure the wattage. Alternatively, it is possible to arrange to calculate the power or wattage by knowing the current—although it must be remembered that this factor is an A.C. measurement, and not a D.C. one. It is also possible to convert the wattage at given values into decibels, but as this is intended to be an article for the beginner, we will not go into the various formulæ which are required, but simply give easy ways of finding the output.

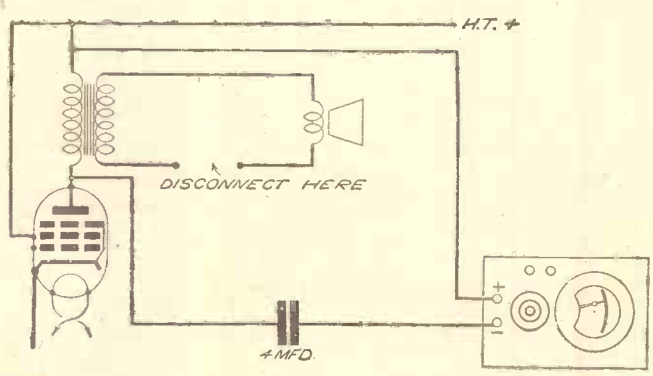


Fig. 2.—How an A.C. voltmeter may be connected in the output circuit to give a direct reading of watts and decibels. The readings obtained with a 1mA meter converted to read A.C. volts, and with different loads, are shown in the table on the next page.

Using an A.C. Meter

If an ordinary A.C. voltmeter is connected across the output anode circuit load (the primary of the transformer), and the speech coil is disconnected, the meter will give a voltage reading. By connecting a load across the meter corresponding to the valve load, the voltage reading will have a wattage relationship to the load value, and we may take as a standard for illustration purposes the more or less normal type of pentode in which the load is 10,000 ohms. A voltage reading of 100 will then be equivalent to a wattage output of 1, and this is obviously the standard formula for wattage, namely $\frac{V^2}{R}$. The scale of such a meter could be marked to give the wattage as a direct reading, or a small table may be drawn up to enable the different values to be ascertained without altering the scale. It is similarly possible to draw up a table of decibels, taking as a basis or level the reading which is equivalent to a standard output—say 1 watt. The only difficulty here is that the corresponding decibel figures are of a logarithmic character and thus a little calculation is necessary in order to make the conversion.

"R" Values

For giving the equivalent values of the "R" code, the same type of output meter may be used and calibrated on signals which are received, but a much better plan would be to use the ordinary type of anode-current meter in the I.F. stages of a superhet, or in the detector circuit of a straight receiver. If ordinary grid-leak rectification is employed the needle of a milliammeter connected in the anode circuit will be deflected when a signal is tuned in, and if a low-reading meter is utilised it will be possible to see quite clearly the difference in various signals. Again, these may be tuned in and the meter scale calibrated, or a scale of comparative values drawn up and kept in the receiver.

A Simple Indicator

A very much simpler scheme for measuring the output was suggested some time ago by a reader which did not involve the use of meters or other apparatus of an expensive nature. He proposed to suspend a small circular mirror in front of the loudspeaker, attaching it to a length of fine

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WATTS AND DECIBELS

(Continued from previous page.)

thread which was suspended between two rigid points at the top and bottom of the cabinet. The distance of the mirror from the speaker was found to be critical, but was found by experiment. A small flashlamp was then placed on a chair or other support so that the beam from it (reduced by placing a disc of paper inside the lens with a small hole in it) was directed on to the mirror, and this gave a reflection in the form of a spot of light on the wall or on a sheet of paper supported at a distance in a suitable direction. When the set was switched on and a signal tuned in, the sound waves from the speaker caused the mirror to oscillate and the reflected spot of light traversed the wall or sheet of paper and thus gave an indication of the power of the air waves coming from the speaker. This idea was tried out and found to be fairly accurate, although tricky to set up, and it was found of greater use in giving a visual indication of the hum-level of receivers and amplifiers, as the hum does not vary in the same manner as a signal, and changes in circuit design to eliminate the hum are much more easily seen by such an indicator. On a well-designed set or amplifier the spot of light should remain perfectly steady with no signal, but the slightest hum will result in a line of light on the wall or screen, the length depending upon the degree of hum.

Meter Readings in mA	Load Resistance Values								
	3,000	4,000	5,000	6,000	7,500	9,000	10,000	15,000	20,000
	WATTS OUTPUT								
0.2	0.14	0.1	0.08	0.07	0.053	0.05	0.04	0.026	0.02
0.4	0.54	0.4	0.32	0.27	0.213	0.18	0.16	0.107	0.08
0.6	1.2	0.9	0.72	0.6	0.48	0.4	0.36	0.24	0.18
0.8	2.14	1.6	1.28	1.07	0.85	0.71	0.64	0.43	0.32
1.0	3.4	2.5	2.0	1.7	1.33	1.13	1.0	0.66	0.5

This table shows how a watts scale may be calibrated for various loads and meter readings.

POINTS ABOUT A.C./D.C. SETS

In this Article a Comparison Between Universal and A.C. Receivers, Together With Operating Notes, is Given

A STUDY of radio manufacturers' catalogues will reveal that most A.C. mains receivers have a universal counterpart. Often the A.C. receiver and its A.C./D.C. counterpart are listed at the same price, while the latter sometimes costs a few shillings more.

This duplication appears strange to many; an A.C. receiver is, obviously, only suitable for use on A.C. mains, whereas the Universal model will work on both A.C. and D.C. mains. There is a reason why manufacturers catalogue what might appear to be a redundant type of set, and why they advise the purchase of an A.C. set except for those who are on D.C. or may move to a D.C. district at some later date.

It is difficult to see why a universal receiver costs more to make than an A.C. receiver, unless it is due to the relatively small number of the former, which would tend to raise manufacturing costs; whatever may be the cause of the slightly increased cost of universal receivers, it has the advantage of encouraging listeners to purchase the A.C. type whenever possible.

It is not suggested that the universal receiver is in any way unsatisfactory, but it is an indisputable fact that A.C. receivers have certain inherent advantages. This is due to certain peculiarities of universal receivers which are fully discussed below. For the purposes of these notes the expression "universal receiver" is intended to mean the type that works on either A.C. or D.C. mains without alteration or additional apparatus. Receivers that are designed for use on A.C. mains but are easily convertible for use on D.C. mains by the addition of a vibrator unit, or other device, are in a class by themselves, and these remarks do not apply to them.

Operating Voltages

Receivers are fitted with either various voltage tappings or a barretter for the purpose of suiting them to the mains voltage. In an A.C. type it does not matter whether the mains voltage is 200 or 250, the performance of the receiver is unaffected because the tapping on the mains transformer primary is so arranged that the voltage developed by the secondary is sensibly constant.

A very different state of affairs exists in a universal receiver, because there is no transformer; there is simply a mains resistance or barretter or both to ensure that the valve heaters pass just the right amount of current, but the H.T. voltage has, unavoidably, to be left alone. Since there is no transformer it is obvious that the H.T. voltage applied to the valves can never exceed the mains voltage; in fact, it must always be less than the mains voltage to the extent of the drop across the smoothing arrangements and the bias resistances. In an A.C. receiver the H.T. voltage is not only independent of the mains voltage, but is often stepped up to a voltage considerably in excess of it.

When a universal receiver is used on 250-volt mains the output valve may develop an undistorted output of, say, 2.5 watts. Since the undistorted output of a valve decreases in proportion to the power of 5/2 of the H.T. voltage, it follows that when the receiver is used on 200-volt mains the undistorted output will fall to about 1.4 watts, which is a very considerable loss of output. In actual practice the drop in output is not quite so serious, as the valve manufacturers so design the output valve that it develops its maximum output at something less than 250 volts. The loss is, however, quite appreciable.

Peculiarities of Universal Receivers

The next peculiarity of the A.C./D.C. receiver is the metallic connection between chassis and mains. There is no mains transformer to isolate the mains, consequently, when the receiver is used on D.C. mains the chassis is at full mains voltage in respect to earth when the mains are earthed on the positive side. Readers are doubtless aware that it is the practice of most electric light companies to run three wires down the street and earth the centre wire, with the result that half the houses in the road are fed with mains earthed on the positive side and half fed with mains earthed on the negative side.

When this type of receiver is used on A.C. mains, the chassis is either alive to earth or not, depending solely on which way round the receiver connection is plugged into the wall socket. This "liveliness" of chassis necessitates additional insulation and protection which is carried out most thoroughly by British manufacturers, but in addition it prevents direct connection between the receiver and its earth, and in substitution thereof connection is made through a condenser.

This indirect form of earthing is normally quite satisfactory, but in houses where there is a prolific source of background noise, the presence of the condenser in the earth lead is not helpful.

Readers will have noticed that gramophone pick-up sockets are seldom included in universal receivers, the reason being that if these were arranged in the normal way, one of them would be alive at the mains voltage, and so would the pick-up if it had any exposed metal not adequately insulated. Where pick-up terminals are fitted this difficulty is overcome by the use of a condenser in each lead, a resistance being provided on the receiver side of these condensers to complete the D.C. circuit between grid and cathode of the valve concerned.

Various individual versions of A.C./D.C. receivers have their own peculiarities, but there is one more characteristic which is common to all, particularly those of the superhet type.

Sensitivity

The variation of undistorted output caused by mains voltage has been fully outlined. To a lesser extent sensitivity is affected by a decrease of H.T. voltage; on a well-designed receiver this is scarcely apparent, although it is very noticeable where inter-component screening is indifferent as a change in H.T. voltage brings about a correspondingly large change in incidental reaction.

In order that a proper sense of proportion be maintained after reading the above notes, it is desirable to mention that the modern universal receiver is a perfectly satisfactory, efficient and reliable piece of apparatus, although on low mains voltages its performance must unavoidably fall short of an A.C. receiver of equivalent design. The fact that the chassis may be "live" is of no consequence whatever, as it is protected in just the same way that the mains leads are protected in an A.C. model. These notes are not intended to disparage the universal receiver, which fulfils a useful and obvious function, but are intended to show its peculiarities and the reason why A.C./D.C. receivers and A.C. receivers find a place, side by side, in up-to-date catalogues.

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On Your Wavelength

By Thermion

We Acknowledge the Honour

ONE of my friends on the Press wished to communicate with me the other day, but had forgotten my address, so he sent his letter to this journal. His letter was addressed to: Thermion, "*Classical* and Amateur Wireless." Glad to know that my Press friend thinks so highly of this journal. The Post Office had no difficulty in delivering the letter to the correct address.

Swing is in the Air

H. A. R., of Cardiff, writes:

"I have never been able to make up my mind as to whether there are or are not people who actually can tolerate jazz and find it pleasurable, particularly conductors and leaders who must necessarily have some conception of what music really is, or whether they are only like those millionaires who preach capitalism. It seems impossible that any person of intelligence who can define jazz—that is, a variety of instrumental cacophony in which each player contributes his own fool idea of extemporised notes to a common rhythm—will even listen to the filthy Yankee-cum-nigger muck.

"Glance at the glossary, and consider whether such a childish jargon could possibly have any connection with an art! It would be insulting applied even to a dog-track!"

The glossary to which this correspondent refers says that a real swing musician just plays and feels as he goes, and swings as he feels—just the joy of living expressed in spontaneous musical invention.

A swing musician is a hot musician, a ride man, or a sender. When inspiration carries him away a sender goes out of the world; that is to say, he ignores the written notes and goes to town on it. He plays round the melody and embellishes it with impromptu phrases. These are known as licks or getoffs or riffs. When the process gets really exciting it becomes gut-bucket, and finally evolves into a screw-ball. The rowdy stage is known as whacky. This is according to a well-known swing musician. Have you ever heard such tripe? My only wish is that swing musicians will.

Poem

K. T. H. sends me the following humorous poem:

A Licence-holder's Lament

BRITONS never shall be slaves,
Unless it's on the wireless waves,
Where Reith, and not King Neptune, rules
And his unwilling subjects fools.
The sponsored programmes have to go,
Because King Reith will have it so.
We find the cash: he calls the tune.
From criticism quite immune.
So, for our uplift, we must hark

This is a reader's idea of a hot set referred to on the following page.

To everlasting John S. Bach.
The spinet and the harpsichord
Have won King Reith's complete accord.
Swing music earns a royal frown,
And so, gadzooks, he turns it down.
So far as Sunday programmes go,
No more indulgence shall we know.
But "better things" shall be our "food,"
Selected by the "unco guid."
And so, against our wish and will,
King Reith will lift us higher still.
Alas, poor Neptune, whom the ocean laves,
He has no kingdom o'er the wireless waves.
Lay down thy trident, sword return to sheath,
And bow thy conquered neck, like us, to Great King Reith.
Says he: "The iron's hot, and now's the time to strike it;
Culture they *shall* have; in time they'll grow to like it.
I'll stop the naughty continong
From sending over sponsored song.
Sundays in England shall be spent in gloom,
And naught but culture fill the living-room.
No more shall crooners sing of love's young dream;
Professors shall expound the cosmic scheme;
Gershwin shall vanish when I've finished sifting,
For chamber music's so much more uplifting.
Its educational value I'll enhance.
I'll stop my subjects tuning-in to France.
Radio as I think best, or go without it.
I'll show them who is boss, in case they doubt it.
My inspiration came whilst in my marble bath.
'Keep British listeners to the narrow path.'
The radio trade, and Parliament, may squeal,
I've got 'em all right underneath my heel.
My autocratic sway they're all beneath;
To Jove himself I'm second-in-command—King Reith!
I'll reign supreme. There's none can shift or slay me,
Unless disgusted listeners cease to pay me.
Poor B.B.C., its biggest guns thus spiked,
We'd *have* to give the listener what *he* liked."

Sir John, I'm sure, will enjoy this joke.

A Wasp from Accrington (?)

A READER (alleged) who signs himself W. M., of Accrington, and is such a bold critic that he puts a false address on his letter, doesn't like my attacks on crooners. He says that, as he has been 20 years in the newsagency trade, he "knows what the public wants." I have been writing for the Press for rather more than that period and do not necessarily admit that because you sell good clothes you know what good clothes are. Because you are behind a counter and someone asks for a copy of a particular journal, you are not the connoisseur, but the purchaser. You are merely handing the public what the public has chosen as the best, so the point passes. As so many of our erstwhile contemporaries are no longer with us we may take it that there cannot be very much wrong with PRACTICAL AND AMATEUR WIRELESS, although we are always striving to improve it. I do know, however, what the public does not like, and that is anonymous letters and false addresses. W. M., who gave the address of Kirway, Accrington, is evidently not such a bold critic that he could give the correct address.

Humour

I HAVE been compelled to send the following reader a book in sheer self-defence. His letter was written on cardboard, for he wished to write me a stiff letter. He has accompanied it with the sketch which I reproduce on page 519. "You've been hollering for some radio guys who are cartoonists(it sounds silly, doesn't it?) to send you wit, 'cartoonisterized' (what a word!). Well, cop for this big chief, and I'm sending you a stiff letter with it (I've no writing-paper, 'cause the boss ain't got none), but I'm demanding one of them there books, and you'll send it to the above address per return (I hope). If you've no more books left, a threepenny Yank blood will do, but don't send one I've read.

"Being a radio service engineer to the trade you can guess my abilities by the dumb cartoon you're about to hoist into the waste-paper basket. I might inform you that I've got a lot more good ideas, and all original, too, but you're not getting them yet. I'd've sent you this one sooner, but I've been on one glorious binge during the festive season, and have had to wait until to-night to get my hand steady enough to grasp the pen and brush. Well, I dashed into the job all full of beer, and now you can see the result (perhaps).

"I hope you'll like my crack about crooners, and the drawing; you'll have to any old 'ow, but I'd like to shave about 15 of 'em anyway, they'd all go off the food for keeps.

"Well, here's wishing you all the best for the New Year, and you can buy Mr. Camm a pint of the very best (old and mild for me, gosh but I feel generous), and all the best to PRACTICAL AND AMATEUR WIRELESS, the only paper I've really taken seriously since I came over to here from Australia. Well, as we Aussies say: Your blood's worth bottling and hookoo."

Re-winding a Transformer

DURING experimental work it may be found that an existing mains transformer which has been discarded for some purpose, is required for a new job, and the windings on it are unsuitable. Some experimenters feel difficulty in ascertaining the data needed for a re-wind, amd it should be remembered that this may easily be calculated by stripping down one of the L.T. windings. These will, no doubt, be of the 4-volt type, and if the winding is in good condition and is needed, it will only be necessary to undo the winding up to the centre-tap. Count the number of turns as the winding is undone, and if you go only to the centre tap multiply the number of turns by two. This will give the total number of turns needed to obtain 4 volts, and, obviously, by dividing by 4 you will know the basis adopted for winding the complete transformer in turns per volt. A new winding may, therefore, easily be calculated.

Makeshift Meters

IT was recently necessary to test the voltage applied to a certain part of a receiver, but owing to an oversight the service engineer had left out of his case the all-important voltmeter. The only instrument he had was a milliammeter, and the difficulty was overcome by removing the components in the anode circuit of the valve in question, connecting them in series with a battery, and by means of the current reading calculating the exact values of the resistances. The components were then replaced, and the meter joined in series with them and the set switched on. By means of the current then indicated he was able to calculate the voltage drop and by proceeding in this way the exact voltage was ascertained. It is worth while remembering that this process can often be adopted not only in the manner outlined but for the opposite form of calculation, as, when two factors are known, it is only a simple application of Ohms law to find the third.

The Leakage Path

IN short-wave apparatus it is important to avoid leakage between certain points, and it is often possible to improve certain components by cutting away the solid material so that air will take the place of the former dielectric material. An instance is in the older pattern solid valveholders, where, by making saw cuts between the pin sockets the leakage path between grid and anode and other electrodes may be lengthened and thus the risk of losses will be reduced.

Beer and the B.B.C.

"THE LISTENER" recently made some comments concerning Drink and the B.B.C.

"Anyone who reads the newspapers must have noticed that a number of criticisms have lately been directed against the B.B.C. on the score of its broadcast references to drink. Were one to judge only from the more extravagant charges, the programmes would appear to be as liberally sprinkled with alcohol as the heavens are with stars.

"The majority of critics, however, are more moderate. They do not sense in the programmes that powerful alcoholic aroma which assails the nostrils of their extremist brethren; they merely confine themselves to saying that the B.B.C. in speech and song frequently advertises the use of alcoholic liquor. It is a grave charge, but happily one that is not water-tight—that is, if the word 'advertisement' is used in its ordinarily accepted sense. Neither drink nor any other commodity is given any intentional advertisement through the microphone."

I publish this because it just shows to what extent teetotal fanatics will go. They apparently are peeved because some comedian may refer to a glass of booze whilst the T.T. fans are not permitted to prate their nonsense and use the air for their extremist policy. I congratulate the B.B.C. on its wisdom in not permitting fanatics of any particular policies to use the air.

American Reception

DURING the past few weeks I have spent a fair amount of time listening to a few of the American short-wave broadcasting stations. One evening recently I found it very interesting, after having heard the News Bulletin from London Regional to hear another news broadcast from Schenectady, and a third (in English) from Rome and a fourth from U.S.S.R. It was purely by chance that I happened to "strike" these news items all within about ninety minutes, but the result fascinated me. In the end I wondered if there was any truth in this world. Of the American stations, I have found Schenectady on 31-point-something metres as reliable as any.

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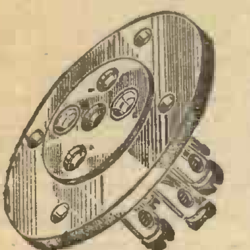

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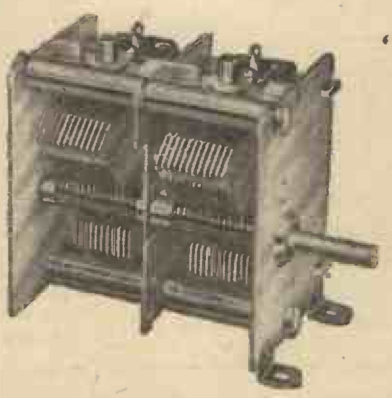

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THE BRITISH LONG-DISTANCE LISTENERS' CLUB

Plug-in Pick-up

IT is interesting to note how certain problems appear to come in cycles or, in other words, how certain details crop up from time to time in a similar manner. For instance, in the large post handled by the Queries department of this paper sometimes out of a hundred queries there will be no two alike, whilst on another occasion there may be more than a dozen all dealing with exactly the same point. During the past two or three weeks there have been instances of this, where dozens of inquiries have been received regarding the use of the gramophone pick-up. The reason may be that dozens of readers have received or obtained pick-ups for Christmas presents and are now faced with the problem as to the best way of using them. A common failing which the amateur meets with is that the introduction of the pick-up or the associated wiring introduces losses or causes instability—in spite of the fact that a switch may be included. The trouble should be cured by screening the leads or by keeping the grid leads short, but in some cases it is found that nothing seems to prevent trouble beyond taking out the pick-up entirely. This is, of course, a lazy way out, but on the other hand, there are many reasons why such an arrangement may be of great value. For instance, when making comparative tests of pick-ups some simple method of changing them quickly may be of great value in saving time, and therefore the idea of using a plug and jack arrangement should not be turned down entirely. By mounting a suitable jack close to the detector valve-holder wiring may be kept short, and the pick-up may be plugged in when desired, thus avoiding losses due to the pick-up leads or a troublesome switch. The accompanying illustrations show the type of jack and the method of connecting it to a battery and an indirectly-heated valve such as would be used in a mains receiver. In the latter case, note that the grid leak is returned to the cathode direct and thus a bias resistance may be kept in circuit and will only provide bias when the pick-up is connected.

Suitable jacks are still obtainable from a number of manufacturers and may, of course, be used for many other experimental purposes.

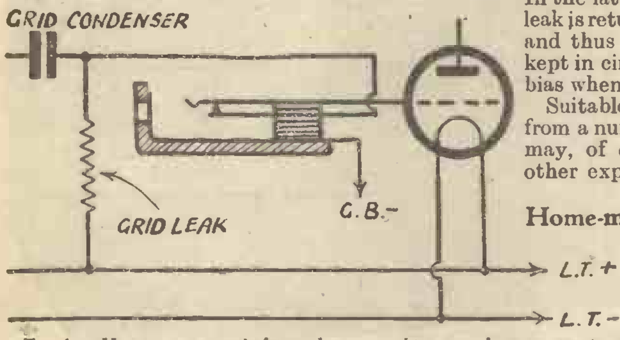


Fig. 1.—How to use a jack for pick-up switching in a battery circuit.

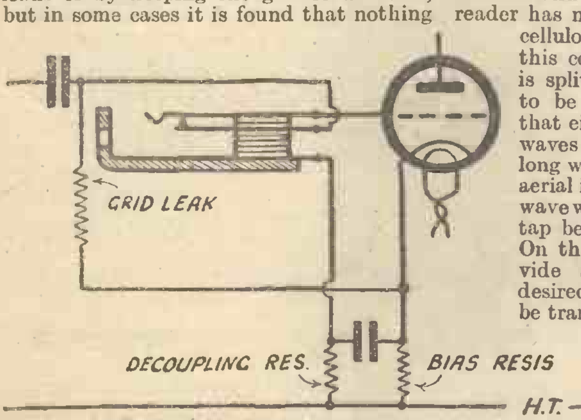


Fig. 2.—This diagram shows the same type of jack used for pick-up switching in a mains circuit.

Home-made Coils

Making coils is one of the sections of radio construction which appeals to the majority of amateurs. Our recently published book, "Coils, Chokes and Transformers" gives all the necessary data for building short-wave coils and standard broadcast components, both of the screened and the unscreened type, and every constructor should make a point of acquiring a copy of this book for reference purposes. A member in Norwich wishes to make a special coil for experimental purposes on the medium-wave band, and the details which we have given him of a coil may be of interest to other experimenters. The coil is to be wound on a 1-inch paxolin former, and the various details are indicated in the accompanying illustration. It will be noted that the long-wave winding is divided into three sections, these being wave-wound by a small machine which the reader has made, and held in position by cellulose dope. The main feature of this coil is that the reaction winding is split, and a wave-change switch is to be included in this winding, so that either 40 turns for the medium waves or a total of 100 turns for the long waves may be employed. The aerial is tapped down on the medium-wave winding—in this model a centre-tap being employed for the purpose. On the long waves this should provide adequate selectivity, but if desired the aerial connection could be transferred by means of a switch to the junction of the second and third sections of the long-wave winding.

For High Power

A member has been experimenting with a car radio receiver, and although of simple design and satisfactory in the majority of directions it fails to give sufficient volume to make listening enjoyable to the passengers in the car. He asks for a suitable modification. For such a case we could not do better than recommend the substitution of a modern tetrode for the simple output triode. A very suitable valve for this purpose is the new Tungsram type 6V6G, which costs 13s. 6d. This has a 6.3 volt heater consuming 0.45 amp. H.T. for anode and screen is rated at 250 volts, and the anode and screen currents are 45 and 4.5 mA respectively. The amplification factor is 218 and impedance 52,000 ohms, and with a single valve operated correctly an output of 4.25 watts may be obtained. If two of these valves are employed in a Class AB push-pull circuit it is possible to obtain 13 watts when they are fully loaded.

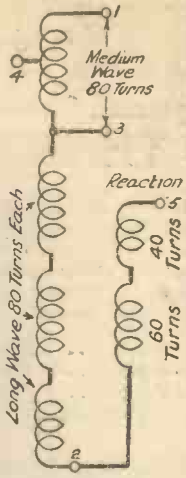


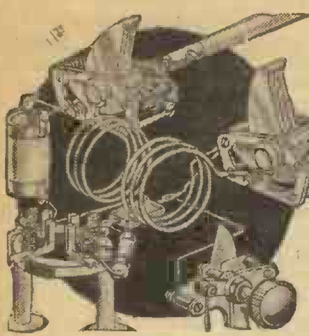
Fig. 3.—Wiring data for a broadcast coil with reaction and aerial tap.

Using a Piezo Pick-up

Several complaints have recently been received from members who have substituted an ordinary type of pick-up by one of the crystal type, and they have found that results are not so good as with the previous model. It must be remembered that when using a better-class input or output component it is often necessary to make circuit modifications in order that the improved performance may be made use of. For instance, a similar difficulty often arises where a good moving-coil speaker is used in place of an old-fashioned model—the resultant reproduction with the new speaker sounding screechy or whistles being experienced. The latter were undoubtedly present in the receiver originally, but the lack of high-note response with the old speaker masked the whistle and the new speaker makes it audible. Similarly, the improved response of the piezo type of pick-up may not be handled satisfactorily by the existing amplifier, and therefore should the trouble mentioned be experienced the amplifier design should be considered and modified if necessary. It is important to remember that the connections for this type of pick-up are slightly different and a resistor must be connected across it. With certain high-fidelity models a resistance in series with a condenser is required across the pick-up, the maker's recommendations in this particular case being 15,000 ohms with a 0.03 mfd. condenser.

Latest Developments

A visit to the recent exhibition of scientific instruments and apparatus at the Royal College of Science, South Kensington, revealed that cathode-ray tubes and photo-electric cells have reached a high stage of development and been applied to an increasing number of certain sections of scientific apparatus. Whereas a few years ago C.R. tubes were something of a rarity, very expensive to buy and needed expert handling to give oscillographic results, they are now included in numerous measuring and visual devices. Both small and large diameter were in evidence with linear working up to very high frequencies. Furthermore, certain exhibits enabled internal effects to be watched and studied in ingenious ways. For example, in one case it was possible to determine the optimum focusing condition for a magnetically operated tube with the minimum watts dissipation by means of an experimental coil having a continuously variable air gap. The importance of secondary emission from the fluorescent screens was also shown, while the effect of negative ions on the composition of fluorescent powder compounds could be investigated.



Short Wave Section

MAKING A SIMPLE TRANSCEIVER

The Experimenters Show the Similarity Between a Simple Transmitter and a Single-valve Regenerative Receiver, and Describe how the Two can be Combined to Make a Set for Both Transmission and Reception.

by The Experimenters

WE mentioned last week that a number of inquiries had been received from readers concerning a so-called transceiver, which is, as the name implies, a combined transmitter and receiver. It appears from correspondence that most of those who require the information are not in possession of a transmitting licence, and this makes it difficult to know just where to start. As all readers are no doubt aware, it is essential that a transmitting licence be obtained before any form of radiating device may be connected to the aerial. That matter has been explained in various previous articles on the subject of transmission, but we consider it advisable to repeat that warning. You will have seen in the papers on more than one occasion that people have been fined for operating transmitters without licence.

"Artificial" Licence

But there must be hundreds of readers who are sufficiently interested to go to the trouble of passing the morse test and complying with the other strict requirements of the Post Office in order to take out a licence. In the meantime, it is not difficult for bona fide experimenters who have a sound knowledge of radio principles to obtain a licence to use a "dummy" or artificial aerial; that is, one which will not permit the radiation of signals beyond the walls of the holder's premises. Such people will find a simple transceiver a very convenient initial form of equipment.

Apart from this, a transceiver is particularly useful when built in portable form. This is because a considerable amount of space can be saved by using the same general circuit for both transmitting and receiving. Apart from these two purposes—ignoring for the moment the point of view of general interest—a transceiver is not the best type of apparatus. It is clear that if the same valve and circuit must be used for two different purposes both receiver and transmitter must be in the nature of a compromise.

An Oscillating Receiver

It is a fact, however, that a simple transmitter is almost identical in main principles with a simple single-valve receiver. The chief difference is that the receiver, with reaction, is used in a state just short of oscillation, while the principal object of a transmitter is that of providing sustained oscillations. In the case of C.W. or morse transmissions the oscillation is interrupted by means of the tapping key, whilst when telephony is being transmitted, the sound or audio frequencies must be superimposed on the steady oscillation.

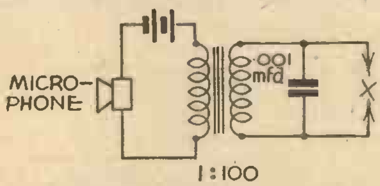


Fig. 2.—Connections for a microphone and microphone transformer to provide the audio frequencies.

Fig. 1 shows a typical circuit for a single-valve receiver with capacity-controlled reaction. Values given apply chiefly to a short-wave receiver for wavelengths between 16 and 100 metres, but connections would be the same if it were to be used for medium- and long-wave reception; in that case the tuning and reaction condensers would have higher values.

As you are well aware, this circuit could be caused to oscillate simply by increasing the capacity of the reaction condenser. In that state it would radiate, through the medium of the aerial, a steady oscillation. That oscillation would be the equivalent of the carrier wave of a normal transmitter. Consequently, in order to use the receiver for transmitting it would be necessary only to "inject" into the oscillatory circuit audio frequencies. That could be done by including the microphone and microphone transformer, along with a dry battery to energise the microphone, in one of various positions in the circuit. Three suitable positions are indicated by means of crosses; one is in the anode circuit, the other is in the earth circuit, and the third is in the grid-return circuit.

The Simplest Transmitter

Of these, the last mentioned is generally most satisfactory, and a modified circuit —this time of a transmitter with a form of grid modulation—is shown in Fig. 3. The similarity between the two arrangements is very clear. The only important difference is that the H.F. choke is connected directly to H.T. + instead of through the 'phones. In addition to this, it will be seen that the values of grid condenser and leak are different and that the lower end of the grid coil is not joined to the earth line.

For satisfactory working, the valve should be of the small power type and should be fed with not less than 120 volts H.T. If a sensitive microphone were employed it might also be necessary to increase the value of the reaction condenser to ensure continuous oscillation. The reason for this is that strong audio-frequency inputs would tend to stop the oscillation. Explained in terms of the received signal, this would mean that speech or music would be "bubbly" and seriously distorted. The coil might be of precisely the same type and size as used for the receiver in Fig. 1, and would generally be a six-pin plug-in coil of the usual pattern.

Combining Two Circuits

Fig. 4 shows how the two circuits already referred to could be combined in a fairly simple manner. It can be seen that two grid leaks are connected in series; one has a value of 3 megohms (as required for reception) and the other of 10,000 ohms as used for transmission. A simple on-off switch is used to short-circuit the 3-megohm resistance when the set is being used as a transmitter. A second on-off switch, marked S.2, is used to short-circuit the secondary of the microphone transformer during reception, while there is a third switch, S.3, which serves to short-circuit the 'phones when transmitting. In practice

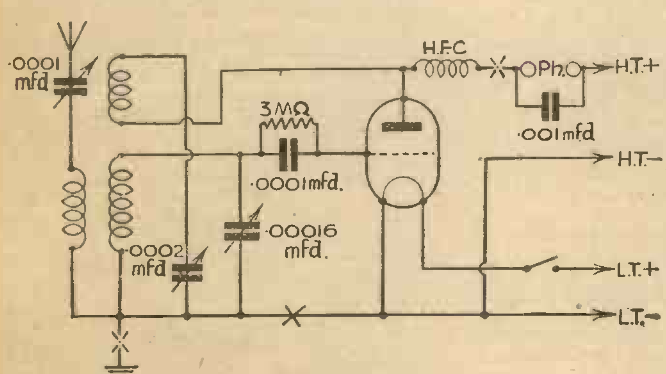


Fig. 1.—A normal type of single-valve S.W. receiver. Points at which audio frequencies can be injected are marked X.

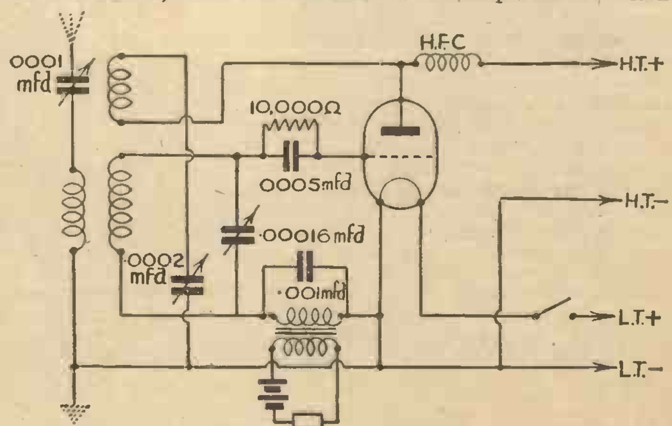


Fig. 3.—The similarity between this simple transmitting circuit and the receiving circuit shown in Fig. 1 is obvious. Aerial and earth are shown broken because these will be replaced by a "dummy" aerial when a full transmitting licence is not held.

(Continued overleaf.)

SHORT-WAVE SECTION

(Continued from previous page)

it would be desirable to combine these three switches for one-knob operation. The knob would give two positions—transmit and receive.

Of the three switches, S.1 and S.3 must be closed and S.2 open for transmission, and vice versa. This switching combination could be obtained in several ways, but it is obviously important that there should be a minimum of capacity between the three sections. In many respects, therefore, it is best to employ three baseboard-mounting toggle switches controlled by a common spindle. One of the switches, S.2, should be mounted in the opposite direction to the other two so that it is "on" when the others are "off." To avoid capacity and other losses the three switches should be placed as near as possible to the components they control and should not be mounted directly on a metal chassis. An alternative switching arrangement consists of employing a three-pole double-throw anti-capacity switch, such as the type made by Wearite. Connections for both of the systems mentioned are shown in Fig. 5.

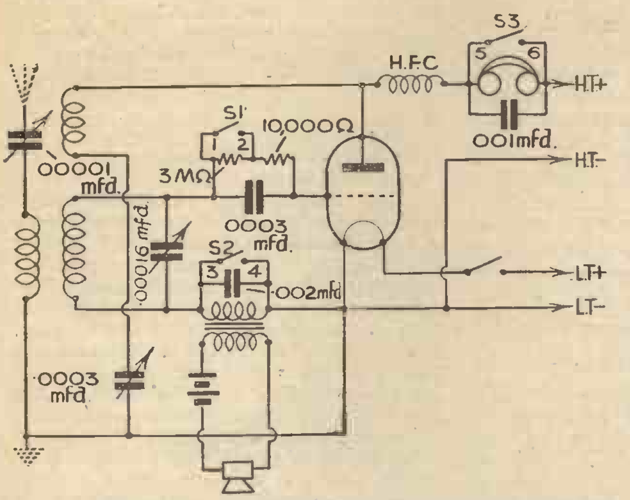


Fig. 4.—How receiver and transmitter circuits can be combined by using a simple switching system.

Tuning Difficulties

One of the great objections to any form of transceiver is that the tuning has to be changed almost every time the switch is turned from the transmit-to-receive and receive-to-transmit positions. Consequently, the tuning scale should be clearly marked at the correct position for the transmitting wavelength. An alternative method would be to have two condensers, one always set to the same wavelength, with a switch to bring either into circuit as required; the switch could be ganged with the other three.

It should be made clear that a simple transmitter of this nature would not be looked upon with favour by the Post Office, due to the fact that there is no system of accurate wavelength control, such as is provided when using a crystal. But as the set is not in any case intended for use with an "open" aerial, this is not a serious matter. If at any time the set were used by a licensed transmitter on an outside aerial it would be essential to have an accurately-calibrated wavemeter by means of which the frequency could frequently be checked and adjusted.

On the 5-metre Band

Transceivers are most frequently used on the 5-metre band (to use which for transmitting a special permit is required in connection with the transmitting licence) and on the ultra-short waves they are capable of very satisfactory results. When built in portable form and used in conjunction with a copper-tube aerial only a few feet long ranges of several miles can often be covered when using an ordinary H.T. battery to supply the power.

It has been found that a very convenient circuit arrangement for a transceiver of that nature is of the super-regenerative type employing two valves—for oscillator and quench. When used for transmitting the quench valve can be employed as what is known as a modulator valve. Thus, the microphone is connected in the grid circuit of the quench valve, used as modulator, and the audio output from this is applied to the oscillator.

One of the advantages of using a super-regenerative circuit is that the normal "receiver" valve, as opposed to the quenching valve, is maintained in a state of oscillation at all times; thus, the conditions under which it works are more nearly the same during both transmission and reception. We cannot very well give details of such an outfit in the space at our disposal this week, but we hope to do so at a later date. We have had a unit of this type in successful operation, and have satisfied ourselves that its construction need present few difficulties.

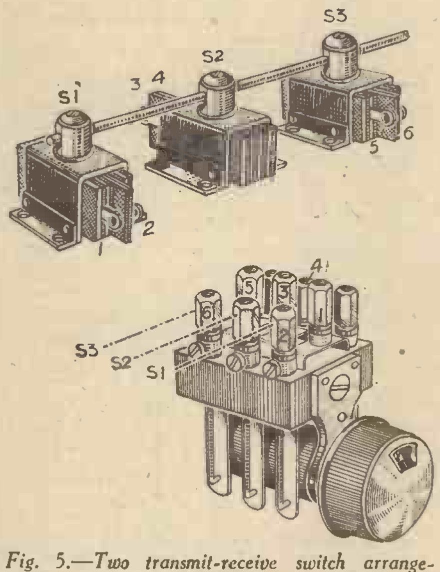


Fig. 5.—Two transmit-receive switch arrangements. The terminal numbers correspond with those in Fig. 4.

Your Circuits, Please

In the meantime, however, we hope that a large number of readers will comply with the request made last week that they should let us have details of any transceiver circuits which they have employed. You need not give comprehensive particulars, but we should like to have copies of the circuits, with values indicated. You have favoured us very often in the past with circuits of all kinds, so we know that you will not let us down on this occasion. You see, it is our opinion that the more circuits that can be passed on to other readers, the more interesting will these notes become. We have found that all readers are interested to know what their fellows are doing, and to learn of any hints that have been discovered as a result of practical experience. Despite the considerable amount of experimental work that we were able to do ourselves we do not claim to have tried every circuit. Cheerio.

Full Details of the Transmitting Licence and Application Forms may be obtained from
The Engineer in Chief,
Radio Section,
G.P.O.,
Armour House, E.C.

FALSE CURRENT READINGS

FAULT tracking with a milliammeter is a perfectly sound procedure, but sufficient care is not always taken to ensure that the connection of the meter does not upset the receiver to the extent of varying the anode current to be measured.

To take an example, suppose that a mains superhet is being investigated, and when the milliammeter is connected in circuit it is found that the I.F. valve is only passing .5 mA. Obviously this is too low—reference to data on the valve concerned will show that it should pass, say, 6 mA.

The incautious would, after testing all associated circuits, triumphantly remove the valve, convinced that the fault had been found. It is quite possible, however, that the valve was O.K. and that the explanation of this low reading was simply that the leads to the milliammeter had introduced coupling to the grid circuit and caused the valve to oscillate, with consequent reduction in anode current.

Measuring Anode Current

It is a good rule when using a milliammeter to measure the anode current, to take the reading in the usual way, and then retake it after connecting a 2-mfd. condenser from chassis to the grid of the valve under test. Unless the valve under test is a frequency changer or separate oscillator, the readings should be identical; any appreciable difference will show that the meter or leads is causing the valve to oscillate.

The use of a condenser to "kill" the grid circuit is preferred to a dead short, as it cannot affect the D.C. characteristics of the circuit.

To avoid self oscillation when taking current readings for some receivers using screen grid circuits—notably battery portables—it is necessary to remove the valve on either side of the valve under test When automatic bias is used care must be taken to avoid upsetting the bias to the valve under test, or to make allowance for the consequent variation of anode current.

A PAGE OF PRACTICAL HINTS

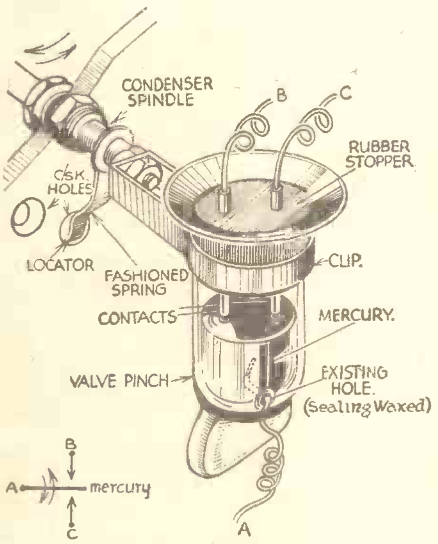
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

A Two-way Tip-switch

THIS switch is very simple to make and serves a number of useful purposes; for example, extension speakers may be controlled and cut out of use when not required; disconnecting pre-gramophone



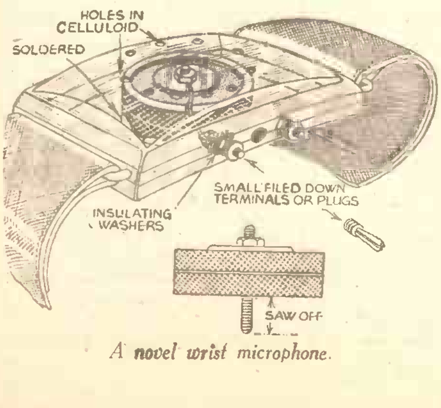
A simple two-way mercury-operated tip-switch.

amplifier valve heaters, miscellaneous dial lighting, etc. I used a glass "pinch" from an old valve for the mercury container, since this is very much stronger than a test tube, and permits a thick rubber bottle stopper to be used, thus obtaining rigidity for the heavy gauge wire contacts B and C shown in the attached drawing.

The amount of mercury required for this fitment is optional, being governed by the size of the glass "pinch," and it will be seen that only a small amount is necessary. Another factor to be considered is the amount of tilt to be allowed, and these points must be left to the constructor. —B. R. SWAIN (London, S.W.11).

A Wrist Microphone

A MORE convenient form of the "Lapel" microphone may be made quite simply by means of a disused wrist-watch



A novel wrist microphone.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL AND AMATEUR WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL AND AMATEUR WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original.* Mark envelopes "Radio Wrinkles." DO NOT enclose Queries with your wrinkles.

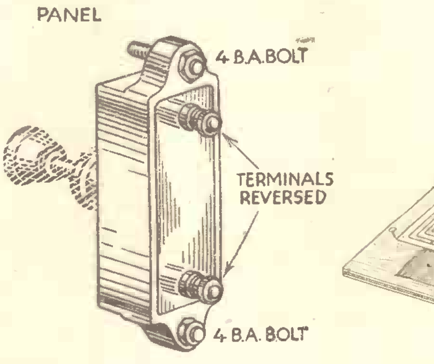
SPECIAL NOTICE

All wrinkles in future must be accompanied by the coupon cut from page iii of cover

case and a microphone button. Any shape of case may be used, but an oblong one will probably be found the most suitable, especially as this kind is often made with a celluloid top. The fixing bolt of the button is sawn off, and symmetrical holes are drilled in the watch-case top. Two small filed-down bolts serve as plugs for the exterior connections. Other details are clearly shown in the sketches.—C. W. OLIVER (Sidcup).

Aerial Condenser Hint

I HAVE an old set and found that selectivity was not quite good enough. I found an old pre-set condenser in my junk



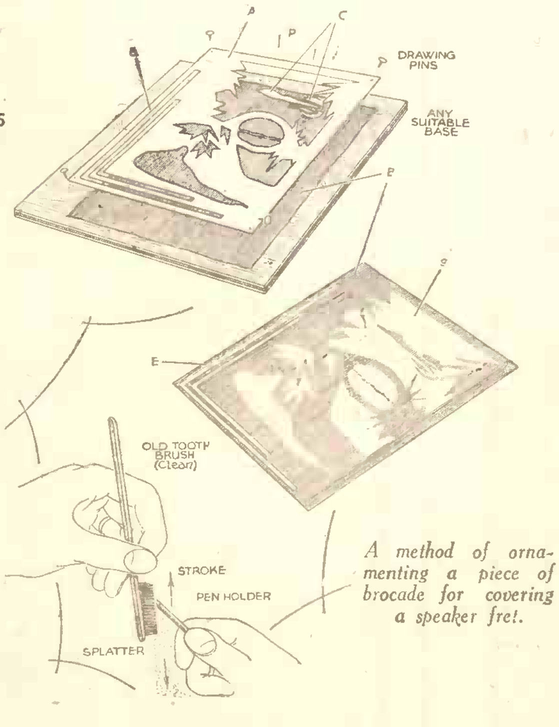
An aerial condenser conversion.

box and after trying this found it gave very good results, but on some stations an adjustment was required. In other words, no single adjustment gave best results throughout the tuning scale. It was inconvenient to reach round to the aerial terminal to make the necessary adjustments and I decided that the component should be panel mounted. I therefore took it to pieces, reversed the terminals, and then drilled a hole in the panel through which the control knob projected. The attached sketch shows the conversion, and the condenser was held in place by two 4 B.A. bolts. Although this is another panel control I find the adjustments it gives are very valuable in DX work.—D. J. PICKEN (Golders Green).

Improving a Speaker Brocade

HAVING a rather dull piece of brocade adorning the front of my speaker cabinet, I decided to improve mattters by splattering a design on in gold and silver paint, and the following is the manner in which this was done. Firstly I removed the brocade, taking care to leave sufficient margin as shown by "E" in the accompanying drawings; then I purchased a piece of cartridge paper (1½d.) and sketched my design on this in pencil; next carefully cutting along the pencil lines with a razor-blade, thus obtaining a stencil in accordance with the illustration. Laying the brocade on a suitable flat base, and pinning down with drawing-pins and ordinary tailors' pins "P" with the stencil "A" on top, and also carefully arranging the "floating" pieces of cartridge "C," the brocade "B" was ready for spattering. This was simply done with the aid of an old, but clean, toothbrush, as shown.

Those readers contemplating a similar project, and having little or no experience in "splattering," should experiment on a piece of paper, and it will be found possible to adjust the intensity of the shading by using a pen-nib as splatterer, or a stick or pen holder, and the resultant toning "S" should be very attractive. —W. F. WILLIAMS (Tynemouth).



A method of ornamenting a piece of brocade for covering a speaker fret.

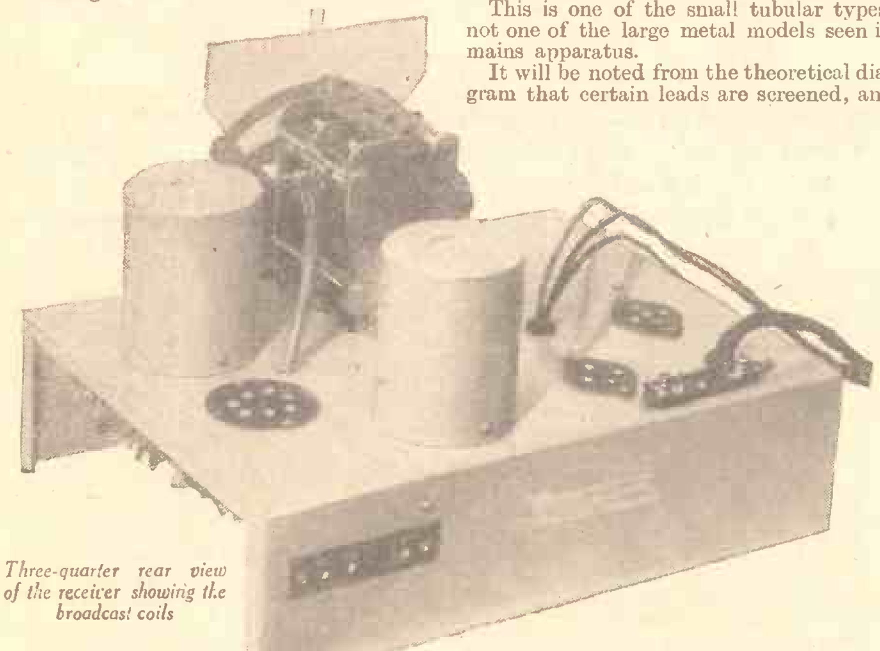
BUILDING THE T

A Simple Three-valve, Battery Using Separate Coils for the Br

THE present tendency for all-wave reception has resulted in a demand for simple receivers which will provide the alternative of short-wave reception when conditions permit. As every listener knows, however, conditions are often so bad that it is impossible, even with the most powerful receiver, to obtain clear signals from long distances, but there are dozens of short-wave stations near at home where good signals may be obtained at all times. There is little doubt that the addition of short-wave tuning to a broadcast receiver tremendously increases the value of such a receiver and will enable good entertainment to be obtained at all times. We have described several of these all-wave sets from time to time, but so far the majority have included special all-wave coils which have incorporated a self-contained wave-change switch. There are, however, certain advantages to be gained by removing tuning in the aerial circuit on the short waves, and this enables a really efficient H.F. stage to be employed. A short-wave choke or fixed resistor must be included in the aerial circuit and this sometimes introduces switching difficulties. In response to many requests for a simple S.G. Three (by which the average listener recognises the S.G., Detector, and Output circuit), we have produced this Triband three-valver, adopting the chassis form of construction with additional simplification for the beginner to avoid difficulty in wiring the switch unit and coils.

The Circuit

Dealing with the receiver from the technical point of view, therefore, we have an H.F. pentode in the first stage, a triode valve as leaky-grid detector, and a pentode in the output stage. Incidentally, the suppressor grid is not shown in the theoretical circuit, Fig. 1, but this is internally connected and will not affect the wiring or design. Alternative aerial sockets are provided so that a fixed condenser of low capacity may be included when desired, and the aerial lead is taken to one section of the multi-switch. This selects the long and medium-wave coils or the short-wave choke for short-wave reception. The grid of the first valve is also joined to the switch to complete the wave-change operation. Coupling between the H.F. and detector stages is by means of the tuned-anode system, and the third section of the switch is included here. The screen of the H.F. pentode is connected to a potentiometer so that an accurate adjustment of the screen potential may be made, but the bias on the valve is fixed, and is obtained by the lead marked G.B.—1.



Three-quarter rear view of the receiver showing the broadcast coils

The L.F. Circuit

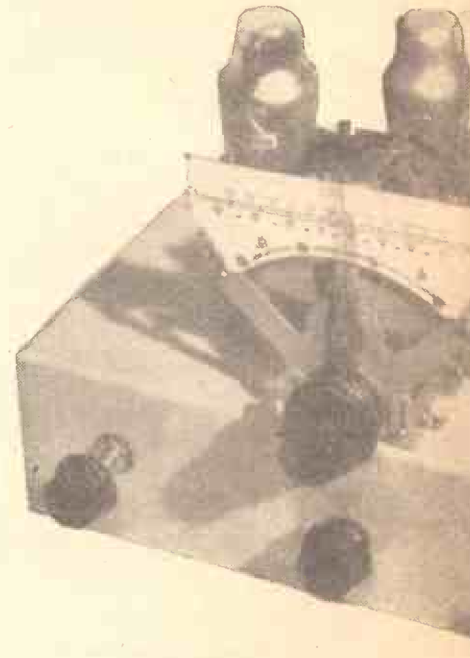
An L.F. transformer is employed for the L.F. coupling and this is parallel-fed, with a resistance connected across the secondary to act in the dual function of tone-correcter and stabiliser. A further device serving the two functions is joined between the anode of the output valve and the earth line. A refinement not often found in a battery-operated receiver is an 8-mfd. electrolytic condenser connected across the H.T. supply, and this will be found to offer adequate smoothing on the short waves to prevent various forms of instability.

This is one of the small tubular types, not one of the large metal models seen in mains apparatus.

It will be noted from the theoretical diagram that certain leads are screened, and these are provided in the chassis as supplied.

Constructional Work

The chassis is of the steel type, cadmium-plated, and as already mentioned we have arranged for the manufacturers to supply this with the switch unit, the broadcast and the short-wave coils ready mounted and wired, and this will simplify construction. The first part of the constructional work consists of mounting the various chassis parts, the aerial-earth socket strip, reaction condenser, H.F. potentiometer and ganged condenser. Before mounting the latter component, remove the trimmers from the top of it. The remaining components which are attached to the chassis are fixed by means of bolts and nuts, but before mounting the L.F. transformer we suggest that leads are attached to the terminals, together with the fixed resistor across the secondary terminals. If this is not done, some difficulty will be experienced in obtaining access to the terminals.



The finished receiver ready fo

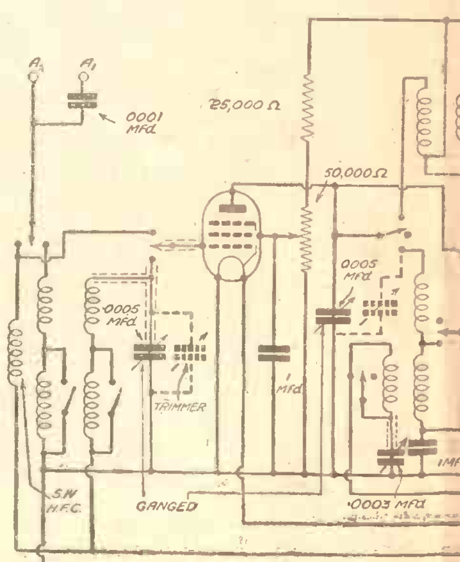
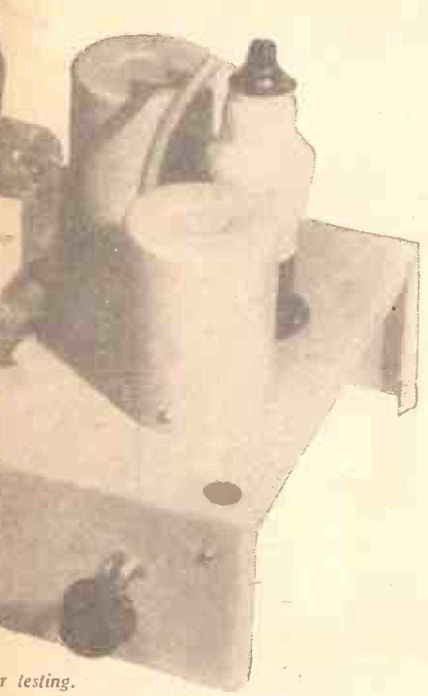


Fig. 1.—Theoretical circuit of th

TRIBAND THREE

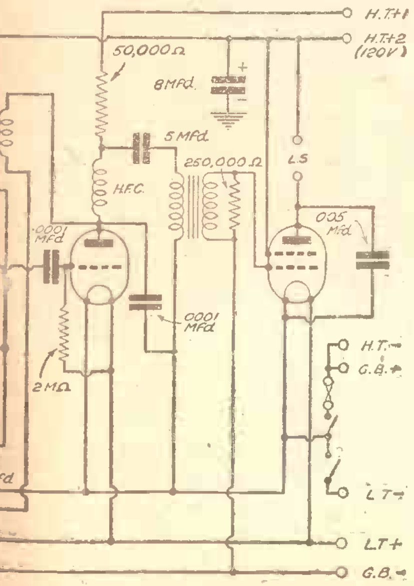
-operated, All-wave Receiver
oadcast and the Short Waves

At two points on the underside of the chassis there will be seen soldering lugs marked "M.C." and these are earthing points which must be in good contact with the chassis. Consequently, before placing the lugs into position on the chassis the plated surface should be cleaned and scraped



r testing.

so that a really good connection will be obtained after the nuts have been locked up tight. The final connection from chassis to the earth terminal is obtained from the



e Triband receiver

bolt holding the small trimmer in position close to the earth terminal.

Wiring

It will thus be seen that the constructional work is of quite a simple nature, and all that remains is to complete the wiring. For the earth connections mentioned a bare wire should be run as shown in the wiring diagram and then the various points and components may easily be soldered to this wire at the respective points—avoiding thereby long leads and awkward connections. As the receiver is to be used for short-wave reception all connections should be soldered, if possible, as this will avoid background noises which might arise should a connection become slightly loose. The vibration from the speaker, or even from traffic passing the house, may easily cause serious background noises, which might be mistaken for atmospherics, if a connection is in the slightest degree loose. For connection to the batteries, lengths of flex, or one of the proprietary battery-cords should be used. They should be provided with the wander plugs and spade ends mentioned in the list of parts, and to simplify identification of the various leads they may be made from different coloured flex. These leads are brought through a hole near the L.F. transformer and, if desired, a rubber grommet may be fitted in this hole, or the leads may be wrapped with a piece of insulation tape in order to prevent the edge of the chassis cutting through the flex and thus introducing a short-circuit.

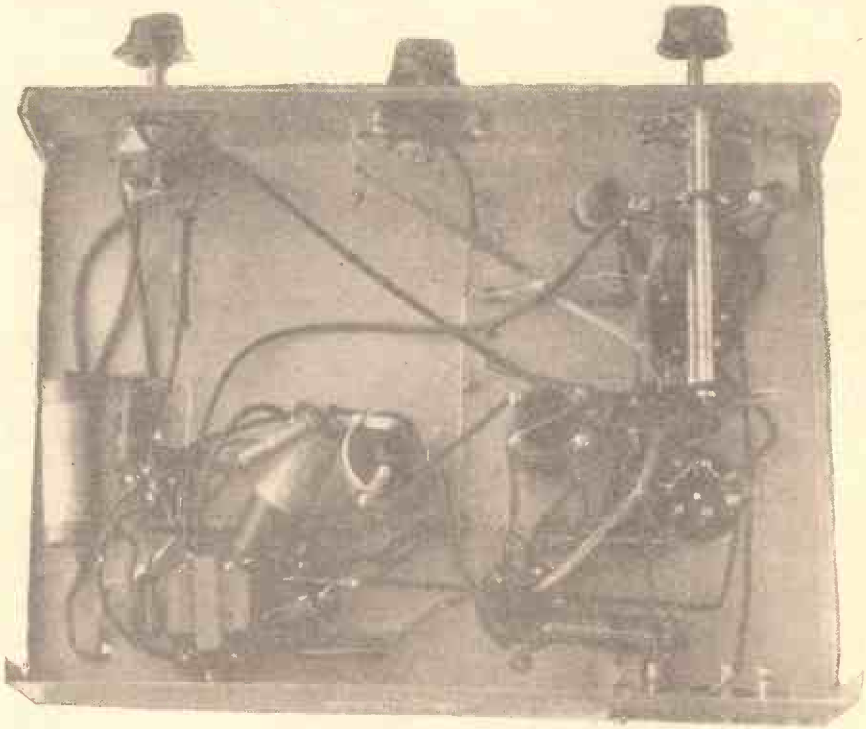
The condensers and resistances which are specified have wire ends, and these, with one exception, must be cut down so that they just reach from one point to another, the requisite length being measured by placing the component in position and cutting off the ends to suit. The exception is the 25,000-ohm resistor joined from one side of the potentiometer to the H.T. lead, which has its anchoring point on the centre terminal of the third valveholder. In this case a short length of wire will have to be connected to one end of the resistor and to prevent this from coming into contact with any earthed point a length of insulated sleeving should be slipped over it or it should be wrapped with insulating tape.

Testing

Preliminary testing notes will now be given, although more detailed notes will be given in our next issue. The aerial should be inserted into socket A2 for first tests, and the wave-change switch should be turned to the centre position. The receiver will then be adjusted for use on the medium-wave-band and the lower centre control should be turned as far as possible in an anti-clockwise direction. The left-hand control should now be turned clockwise and the first part of its movement will bring the on-off switch into action and the set will be switched on. Turning the control further will vary the voltage on the H.F. valve and this must be adjusted to provide the best results on the particular waveband in use. Turn the tuning control to the local station, which should easily be found, and then adjust the small trimmers which will be found on the right of the chassis and at the rear edge. When maximum results have been obtained on the local station turn the wave-change switch to long waves (maximum movement in a clockwise direction), and the long waves should be tuned successfully throughout the range.

On the short waves (with the switch in its maximum position anti-clockwise) tun-

(Continued overleaf)

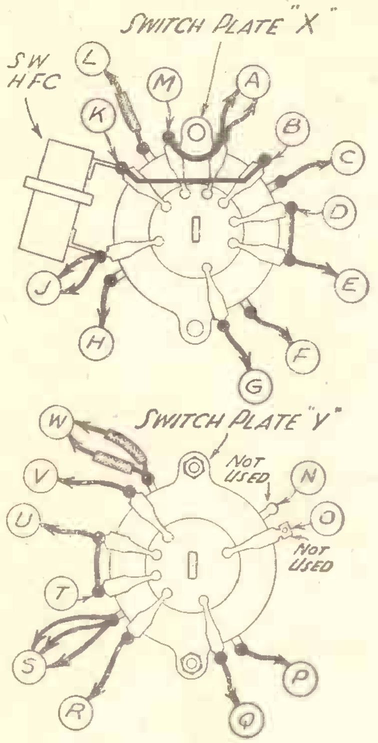


This underside view of the receiver shows the switch assembly and other wiring details.

BUILDING THE TRIBAND

(Continued from previous page)

ing must be carried out very slowly, and full use will have to be made of the small concentric trimming knob on the tuning control.



This diagram shows the wiring points on the two switch units, viewed from the rear of the chassis.

It will be noted in the wiring diagrams which are given on this page that the connections to the various points on the switch units are not completed, but instead, reference letters are given to a number of wires. These letters refer to the diagram of the two switch plate units which is also given on this page, and although a number of these will be found ready made when the chassis is purchased, it would be as well to make certain that they are all correctly in position in case of damage in transit or some other reason. In this connection it should be noted carefully that the switch connections are given for the plates separately and are as seen from the rear of the chassis. One other point may cause confusion to beginners and concerns the on/off switch which is mounted on the combined volume control and switch. A three-point shorting switch is intended to be used in this receiver, and in some components it may be found that there are four contacts on the switch. As shown in the wiring plan, however, two of these should be bridged to act as a single point, the remaining two points going to the L.T. negative battery lead and the combined H.T. negative and G.B. positive leads, via the fuse.

Further details will be given next week.

LIST OF COMPONENTS

One metal chassis, drilled and fitted with coils, switch and two trimmers (Peto-Scott).
One 2-gang Bar type .0005 variable condenser (C1 and C2) (Polar).
One S.M. drive, horizontal, type S.L.11 (with degree dial) (J.B.).
One microfuse and holder, 100 mA (Microfuse).
One socket strip, E, A1, A2 (Clix).
One potentiometer with switch (3-point), 50,000 ohm, VM 36 (R2) (Bulgin).
One L.F. transformer, "Senator" (Bulgin).
One all-wave H.F. choke, H.F. 15 (Bulgin).
One reaction condenser "Dilecon," .0003 (C3) (J.B.).

FIXED CONDENSERS

One T.C.C. 8 mfd. "F.W." 150-vol. (C11) (T.C.C.).
One .005 mfd., type 300 (C10) (T.C.C.).
Two .0001 mfd., type 300 (C7 and C9) (T.C.C.).
Two .1 mfd., type 250 (C5 and C6) (T.C.C.).
One 0.5 mfd., type 250 (C8) (T.C.C.).

RESISTANCES

One 2 meg. ½-watt (R3) (Erie).
One 25,000 1-watt (R1) (Erie).
One 250,000 ½-watt (R5) (Erie).
One 50,000 1-watt (R4) (Erie).

VALVEHOLDERS

One 4-pin chassis-mounting valveholder
One 5-pin chassis-mounting valveholder
One 7-pin chassis-mounting valveholder
} standard (Clix) type

VALVES

One 220 H.P.T. (V1) (Cossor).
One 210 Det. metallised (V2) (Cossor).
One 210 V.P.T. (V3) (Cossor).

PLUGS

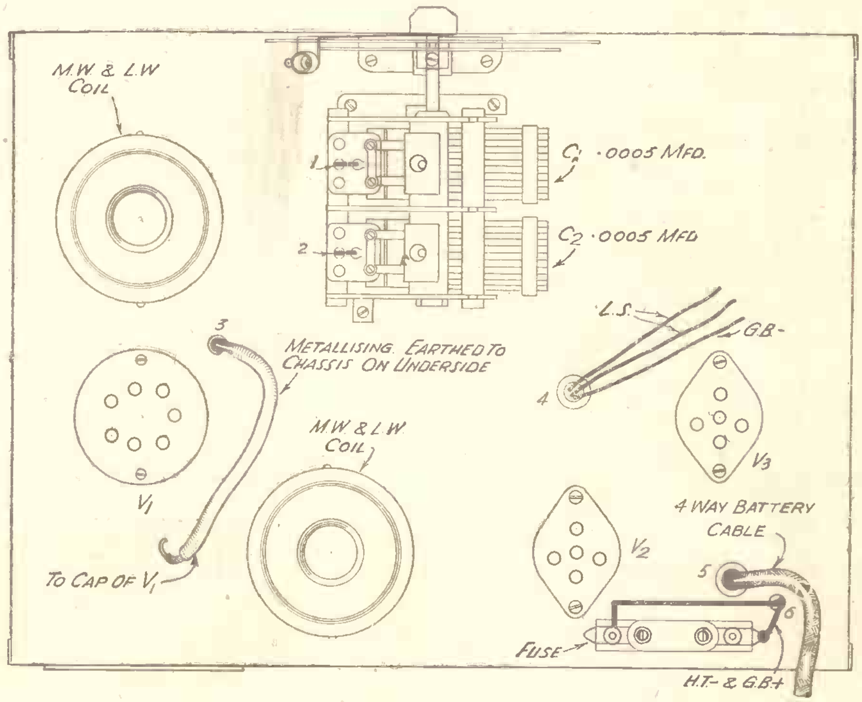
H.T.—, H.T. +1, H.T.+2
G.B.+, G.B.—1
} (Belling-Lee.)

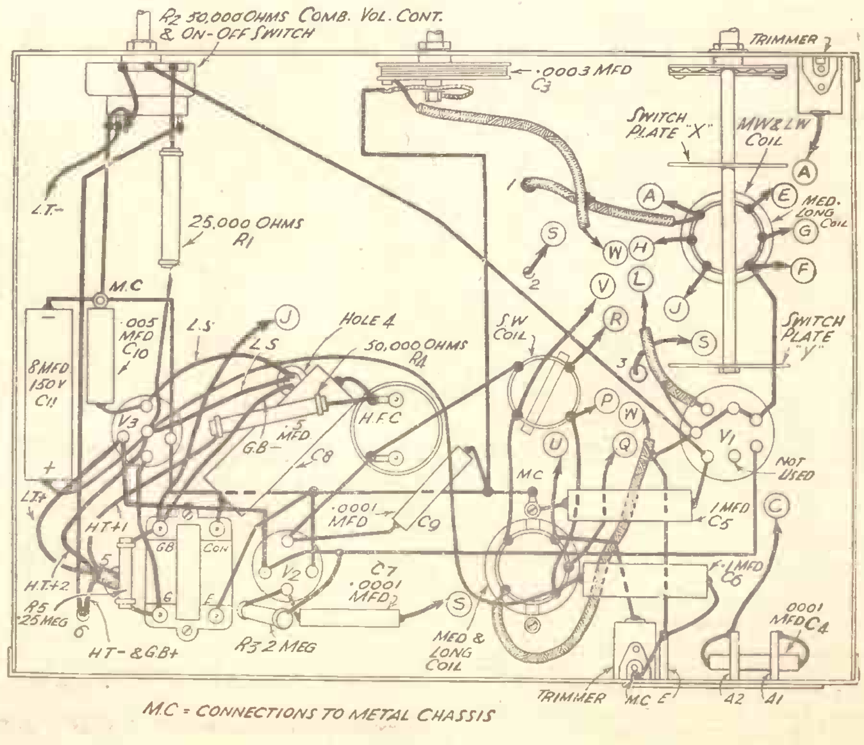
SPADES

L.T.+, L.T.—

One speaker (Stentorian Junior) (W.B.).
One H.T. battery, 120-volt (Exide).
One bias battery, 9-volt (Exide).
One accumulator, 2-volt (Exide).

WIRING DIAGRAMS OF THE 1938 TRIBAND THREE





M.C = CONNECTIONS TO METAL CHASSIS

TELEVIEWS

"Growing Concern"

THE attitude of some M.P.s towards television's recent activities is reflected in a motion which has been put down for discussion at an early date. It is to the effect that "this House views with growing concern the development of television displayed on the screen in places of public amusement in the London area, on the grounds of the monopoly control secured by the British Broadcasting Corporation and the additional expenses involved. Since this situation was not contemplated at the time the charter of the B.B.C. was renewed, the House urges on the Government the necessity of a charter revision for the B.B.C. to enable them to deal with this development." This new tabled motion no doubt had some reference to the rapidly-growing practice of showing pictures on television receivers in cinema and theatre lounges, public houses and restaurants, and may also in part be due to the P.M.G.'s remark that he had not so far been consulted in connection with proposals to equip theatres for big-screen television. Even if questions of copyright do arise, a reasonably proportioned fee, or an addition to an existing one, should be capable of meeting this particular side of the situation. In any case, it is certain that when the plans for running the B.B.C. were laid down some years ago, the possibility of television's rapid development could not have been foreseen, and for the B.B.C. to control public pleasure in places of entertainment is not likely to be tolerated without opposition.

Improvements

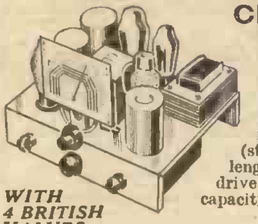
EACH month brings its crop of new ideas with a view to improving both the transmitting and receiving equipment essential for the maintenance of an efficient television service. Many of these schemes have already found their place in the new apparatus, a fact testified to by the material improvements seen in recent pictures. A great deal of attention has been directed towards the screen of the cathode-ray tube, for this can make or mar the reproduced results. Research into the chemical compositions of the powders, coupled with a suitable binding agent, has ensured a screen of uniform thickess and colour in the better quality products, with immunity from flaking and odd colour patches. Whereas green was the predominating initial colour, this has now been superseded by black and white, or, in some cases, a bluey-white somewhat similar in colour characteristics to the modern-type daylight lamp. The storage principle in electron cameras has been the subject of considerable laboratory work, for by its successful adaptation the initial signal derived from the optical image focused on the plate surface is high above the "mush" level. The elimination of the stray electrons released from the camera's photo-electric surface is also another item of research, and auxiliary collectors are now charged with the function of collecting these in order to leave the primaries capable of carrying out their main purpose. These one or two items are sufficient to show that research and applied practice are working well together in a determined effort to provide results worthy of the newest of sciences.

PETO-SCOTT EVERYTHING RADIO—CASH C.O.D. or EASY TERMS

IMMEDIATE DELIVERY—Peto-Scott's All-Wave Chassis Bargains are unsurpassed for RELIABILITY, QUALITY and VALUE. An all-round supremacy in the direct-to-public radio market that is the natural outcome of 20 years' service—backed by Peto-Scott's personal guarantee of satisfaction.

ASTOUNDING CHASSIS BARGAINS

4-VALVE A.C. ALL-WAVE CHASSIS



3 WAVEBANDS 18-52, 200-550, 900-2,100 metres

Band-pass tuning; Full-vision illuminated dial (stations and wavelengths); Slow-motion drive; Rotary low capacity switch.

WITH 4 BRITISH VALVES

LIST VALUE £7:15:0 OUR PRICE £4:19:6

BRIEF SPECIFICATION: 4 British valves, variable-mu H.F. Pentode, Screened Grid Detector, High Efficiency Output Pentode and Rectifying valves, Steel Chassis, Sensitivity and Volume Control, 3 Watts undistorted output. Gramophone Pick-up Sockets. For A.C. Mains only, 200-250 volts, 40/100 cycles. CASH OR C.O.D. CARRIAGE PAID, £4/19/6, or 7/6 down and 12 monthly payments of 8/6.
Or with High Fidelity 2,500 ohms Energised Moving-Coil Speaker, £5/19/6 or 7/6 down and 12 monthly payments of 10/4.

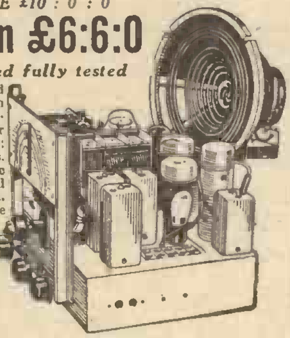
5-valve ALL-WAVE A.C. SUPERHET RADIO/GRAM CHASSIS

with 5 British Valves and Moving Coil Speaker

LIST VALUE £10 : 0 : 0

Bargain £6:6:0

Guaranteed fully tested



Tour the World on this modern 6-stage All-Wave Receiver 18-50; 200-550; 900-2,000 metres. Automatic Volume and Tone Controls. Wavechange and Gramo. Switch. Illuminated station-named Dial. Output 3 Watts Size: 10" high x 11½" wide x 8¼" deep. For A.C. Mains 200-250 volts; 40-80 cycles. Complete with specially matched energised speaker.

6 Gns. Cash or C.O.D., or 7/6 secures, balance in 17 monthly payments of 8/9

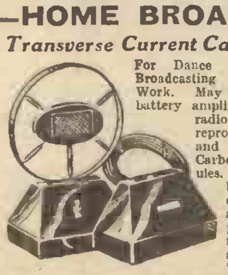
PETO-SCOTT MAINS UNITS

MODEL A.C. 12. Cash or C.O.D. 25/-
Or 2/6 down and 10 monthly payments of 3/-. This efficient model is suitable for sets operating on output of up to 12 m/a. For A.C. Mains 200/250-v. 40 to 100 cycles. Output 120-v. at 12 m/a. 4 tappings: 60-v., 75-v., 90-v., and 120-v.

MODEL M.A.10/30. Cash or C.O.D. 39/6
Or 2/6 down and 11 monthly payments of 4/9. A super model that is justly famed as one of the best on the market, this outstanding unit incorporates a Trickle Charger, which re-charges a 2-volt L.T. accumulator at 0.5 amp. For A.C. Mains 200/250-v. 50/100 cycles. Westinghouse Metal Rectifier. Four H.T. tappings: Screen, Detector, Medium Power, High Power. Output 20 m/a. at 120 volts.

HOME BROADCASTER

Transverse Current Carbon Microphone



For Dance Bands, Crooners, Home Broadcasting and Public Address Work. May be used with A.C. or battery amplifier, or attached to your radio receiver. High-fidelity reproduction at all speech and musical frequencies. Carbon electrodes and granules. Diaphragm protected by metal grille. Supported on 4 sensitive springs attached to a chromium plated ring, on black moulded base. On-off switch. 30-1 microphone Transformer with bias battery in separate bakelite moulding for greater efficiency. Overall height 10¼ins.

List Value £2 : 2 : 0 OUR PRICE £1 : 1 : 0

Cash or C.O.D. Carr. Paid. or 2/6 down and 11 monthly payments of 2/-. 25ft. of heavy braided flex extra.
With Telescopic Chromium-Plated Stand, height 3ft. 6ins. closed, 6ft. extended, £2/2/0, or 2/6 down and 11 monthly payments of 4/-.

2/6 DOWN

TRIBAND 3

Described in this issue.

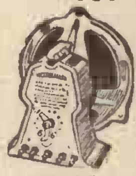
KIT "A" Cash or C.O.D. Carriage Paid £4:4:0
or 7/6 Deposit and 11 monthly payments of 7/9
Comprising Author's Kit of first specified parts including Peto-Scott fitted chassis, but less valves, batteries, cabinet and speaker.

KIT "B." As for Kit "A," but including set of 3 specified valves only. Cash or C.O.D. £5/10/4 or 10/- Deposit and 11 monthly payments of 10/3.

KIT-BITS Any item supplied separately, Cash or C.O.D. Orders sent Post Charges paid.

	£	s.	d.
1 Peto-Scott Metal Chassis, drilled, with all coils, switch, choke and trimmers fitted and wired	1	7	6
1 Polar 2-gang Condenser .0005 mfd.		12	0
1 J.B. S.M. Drive with dial, type No. S.L.11		6	6
1 Set 3 Specified Cossor Valves	1	6	9

1938 W.B. SPEAKERS



Model 37J

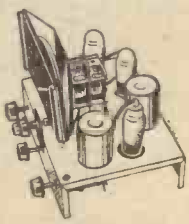
MODEL 378. Amazing reproduction provided by new magnet and exponential moulded cone. Microlode matching device Cash or C.O.D. Carr. Paid, £2/2/0. Or 2/6 down and 11 monthly payments of 4/-.
MODEL 37J. Matches any receiver as principal or extra speaker. Cash or C.O.D. Carriage Paid. £1/12/6. Or 2/6 down and 11 monthly payments of 3/-.

2/6 DOWN

SUPER ALL-WAVE BATTERY S.G.3 CHASSIS

LIST VALUE £6 : 0 : 0 BARGAIN £3:19:6

Complete with 3 British Valves



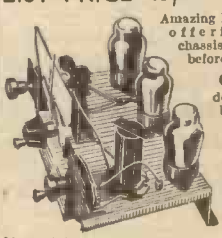
3 Wavebands: 18-52; 200-550; 900-2,100 metres. Double Ratio Slow-motion Drive 9-1 and 100-1. Plate-glass station named dial. Rotary low-capacity switches.

For world reception of a high order all day and every day. 3 British valves, variable-mu H.F. Pentode, High Efficiency Detector and Harries High Efficiency Output Pentode. Variable Selectivity. Pressed steel chassis, Size 11½" x 9" x 10½" high. Screened Air-cored Coils. Dual Electrostatically screened short-wave coils. H.T consumption approx. 10 m/a. Complete with valves and fully tested on all wavebands before dispatch.
Cash or C.O.D. Carriage Paid £3 : 19 : 6 or 5/- Deposit and 15 monthly payments of 6/9.

5/- DOWN

STRAIGHT 3 CHASSIS

LIST PRICE 45/- BARGAIN 29/6



Amazing Peto-Scott offer! Each chassis tested before dispatch.

CIRCUIT COMPRISES detector reaction, followed by R.C.C. and triode super-power output stage. Metal chassis. Slow motion tuning. Dial calibrated degrees. 200-2,000 metres. Low H.T. consumption. Complete with 3 British valves, all knobs and escutcheon. Cash price 29/6 or 2/6 down and 11 monthly payments of 2/9.

COMPLETE RECEIVER Above chassis in horizontal consolette cabinet, complete with valves and moving-coil speaker, less batteries. List Price £4/19/6. Bargain. £2/2/0 Cash or C.O.D. or 2/6 down and 11 monthly payments of 4/3.

2/6 DOWN

PETO-SCOTT CO. LTD.
77 (Pr. W. 21), City Road, London, E.C.1 Clissold 9875
62 (Pr. W. 21), High Holborn, London, W.C.1 Holborn 3248
Est. 1919

VALVE CHARACTERISTICS—3

UNDISTORTED output is assumed by many to be the maximum wattage that a valve can deliver without introducing distortion from the valve itself. This is incorrect, but the term itself is such a misnomer that wrong interpretation is inevitable.

If the output of various valves were quoted for conditions of absolutely no distortion, the figures would be so small that quite large power valves would appeal unsuitable for use with loudspeakers. In fact, the efficiency of an output valve interpreted as the ratio of power consumed against power delivered would only be a few per cent.

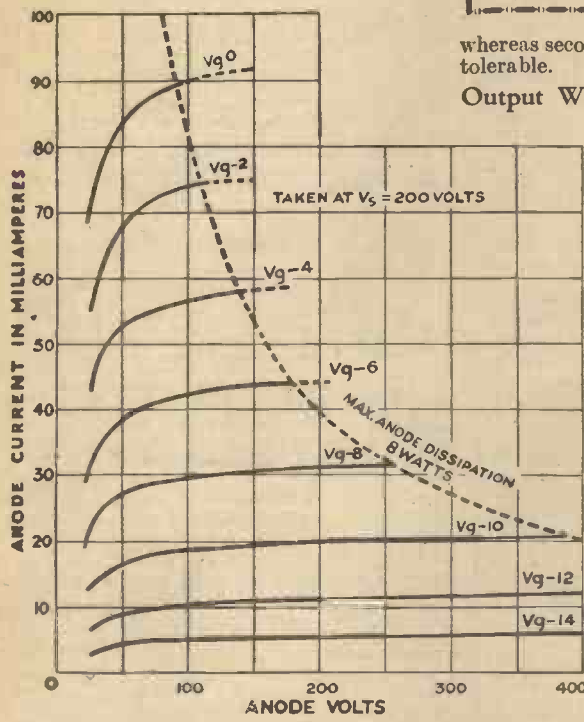


Fig. 1.—A typical example of an anode-volts/anode-current curve from which the undistorted output is calculated.

It is evident that some distortion must be permitted, but for the purpose of comparison some limit must be fixed. This limit is conventionally 5 per cent. and this needs a little explanation.

Second and Third Harmonics

The function of a power valve is to reproduce in the anode circuit exactly the wave form fed into its grid circuit. This would actually happen if the characteristic curve of a valve were dead straight. The characteristic of a triode valve is a straight portion with a curve at one end; this results in the valve making an addition to the true wave form of a certain amount of artificially produced second harmonic, in other words, if the broadcast being received were a single note on the flute, of say middle C, the valve would add on its own account a little of the C one octave higher, this addition not exceeding 5 per cent. of the true note.

The permissible distortion for a pentode (or tetrode) is given a 5 per cent. third harmonic. In a pentode valve, therefore, if the broadcast being received were a single note on the flute of say middle C, the pentode would add on its own account a little of the note G approximately one and a half octaves higher.

It is generally admitted that third harmonic distortion is decidedly unpleasant, whereas second harmonic distortion is more tolerable.

In This Third Article of the Series, the Subject of Undistorted Output is Dealt With

Output Wattage

After this attempt to explain the meaning of the word distortion as applied to the valve, we must revert to the original trend of thought, namely, the true meaning of the term undistorted output. Broadly speaking this may be interpreted to mean the wattage which an output valve is capable of delivering to the loud speaker without introducing more than 5 per cent. harmonic distortion, i.e., 5 per cent. second harmonic distortion if it is a triode valve and 5 per cent. third harmonic distortion if it is a pentode or tetrode.

In the interests of accuracy it is necessary to state that there are one or two output valves which are something of an exception, because the undistorted output quoted by their manufacturers is achieved at about 4 per cent. distortion. This inconsistency is brought about by the fact that the valve is slightly under-run because its maximum *permissible* anode current is lower than the anode current necessary for maximum output.

Readers will doubtless be aware that second harmonic distortion may be cancelled out by using output valves in push-pull, and third harmonic distortion may be cancelled out by using negative feedback. Both these subjects have been fully discussed in various issues of this journal.

When the undistorted output is quoted for a particular valve it is implied that this maximum will only be achieved if the valve is working under the most favourable conditions, that is to say, maximum permissible anode voltage, maximum permissible screen voltage if a tetrode or pentode, correct grid bias and correct optimum load. The significance of these terms is obvious with the exception of optimum load, about which a good deal may be said.

Optimum Load

Before actually defining optimum load, it is desirable to show why the load is more or less critical in the interests of power output, quite apart from considerations of quality. A useful analogy may be taken from the ordinary steam engine. If a locomotive ran from London to Manchester attached to a number of carriages so excessive that the train could only maintain a maximum speed of two miles an hour, it is evident that the power developed by the engine would be wasted because the engine could pull half the load in very much less than half the time.

To take the other extreme, if the engine ravelled with the minimum load—a single passenger sitting on a buffer—it is obvious hat all the power is being used in the locomotive and a minimum of power is being devoted to the work in hand.

Almost exactly the same thing happens in a valve. If the load in its anode circuit is excessive, the valve is so hampered that it cannot function efficiently. If, on the other hand, the anode load is too low, the bulk of the power available is expended in the valve instead of being used to drive the loudspeaker.

It is apparent from the above explanation that the anode load of an output valve must bear reasonable relationship to the impedance of the valve purely from the point of view of using the available power to the best advantage. But in the interests of good quality, reasonable relationship is not enough. If distortion is to be kept down to a minimum it is necessary that the load shall closely approximate to a definite impedance which is termed the optimum load.

The optimum load, unfortunately, bears no direct relationship to the impedance of the valve, although in the average triode the optimum load is about double the impedance. The optimum load is found by a somewhat elaborate graphical calculation on the anode—volts/anode—current curve (Fig. 1). Fortunately, the optimum load for various operating conditions is always quoted in manufacturers' catalogues, and in the instruction leaflet enclosed with the valve when purchased; consequently the user has no need to bother with this tedious calculation.

Variation of Output

Fig. 2 shows an interesting curve giving at a glance the second harmonic distortion, third harmonic distortion and power output for various values of optimum load. It will be observed that the output wattage rises steadily as the anode load increases until round about 6,500 ohms when the line begins to flatten out. It will also be observed that the total variation of output is from 2.2 to 2.9 watts, whereas the change in harmonic distortion is far greater. It is apparent, therefore, that the question of output may be ignored within reasonable

(Continued on opposite page)

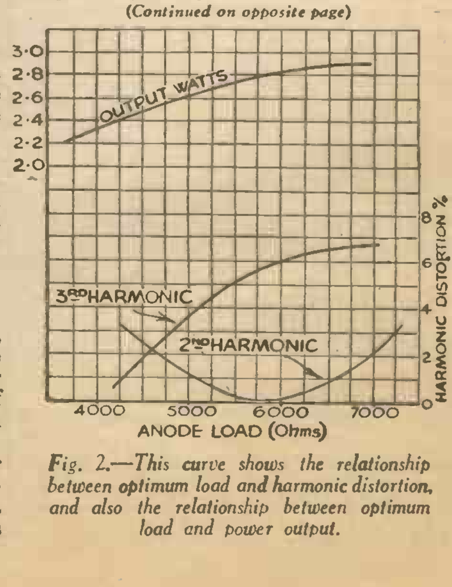


Fig. 2.—This curve shows the relationship between optimum load and harmonic distortion, and also the relationship between optimum load and power output.

VALVE CHARACTERISTICS

(Continued from facing page)

limits and the value of optimum load may be selected solely to avoid distortion.

A glance at Fig. 2 will show that a load of just under 6,000 ohms will give negligible second harmonic distortion but, unfortunately, a high value—6 per cent.—of third harmonic distortion; obviously a lower load must be chosen to reduce third harmonic distortion even at the expense of increasing second harmonic distortion.

The conventional selection would be 5,500 ohms, which will give the greatest power output without exceeding 5 per cent. third harmonic. The writer, however, would choose the value of 5,000 ohms which will reduce third harmonic distortion to 3.7 per cent. for the trifling sacrifice of .1 watt output. It is true that this lower load will increase second harmonic distortion from .3 to 1.2 per cent. It is purely a matter of personal taste, but the writer considers that a reduction in third harmonic distortion at the expense of a similar increase of second harmonic distortion is an excellent bargain.

Choice of Load Value

The selection of an optimum load for a triode is extremely simple as there is no alternative form of distortion to introduce complications. It is merely a matter of choosing a value which will give the lowest second harmonic content while maintaining an economic figure of output. As the triode is tolerant towards an incorrect load, the value is not critical.

The pentode, and to a lesser degree the tetrode, is intolerant towards an unsuitable anode load, therefore the recommendation of the valve manufacturer should be adhered to very closely.

NEW BROADCAST TIMES

Holland's New Short-wave Schedule

A revised timetable is now in force for the programmes broadcast through the PCJ, Huizen (Holland), transmitter, working on 19.71 m. (15.22 mc/s) and 31.28 m. (9.59 mc/s). On the former wavelength a programme destined to Australia and New Zealand may be heard every Tuesday morning between G.M.T. 08.30-10.00, and on Wednesday another radio entertainment for India and China is given between G.M.T. 14.00-17.00. On the longer channel four transmissions are now made weekly, namely, on Tuesday, from G.M.T. 10.30-13.00 (Australia and New Zealand) and again between G.M.T. 19.00-20.00 for Africa. On Thursday, from G.M.T. 01.00-02.00, the transmission is destined to Central America; on Friday, from midnight to 01.30, to South America, and from 02.00-03.30, to the U.S.A. and Central America. Announcements, according to programmes, are given out in Dutch, English, German, French, Spanish and Malay.

The Relays of Radio Nacional, Salamanca

The National broadcasting station at Salamanca (Spain) now controls a network of short-wave relays which simultaneously broadcast the "Franco" war news bulletins. They are as under: EDR4, Tenerife (Las Palmas), 28.92 m. (10.373 mc/s); Valladolid (FET1), 42.82 m. (7.006 mc/s); Bilbao, 41.4 m. (7.246 mc/s); EAJ8, San Sebastian, 41.65 m. (7.203 mc/s); Victoria (FET), 42.69 m. (7.027 mc/s); Gijon, 41.43 m. (7.24 mc/s); Jaca, 21.38 m. (14.032 mc/s); and Alcazarquivir, 42.12 m. (7.121 mc/s).

New Times Sales Co.

RADIO AT THE RIGHT PRICE

IMMEDIATE DELIVERY

SAVE £1 on your TRIBAND THREE

KIT "1" Cash or C.O.D. 64/- or 5/- down

Balance in 12 monthly payments of 5/6.

Complete Kit comprising all parts for Receiver, including specified Peto-Scott drilled metal chassis with all coils and switch fitted, J.B. Dial and T.C.C. fixed condenser, B.T.S. Choke, wire, flex, screws, etc. *3 Specified valves* £1 : 6 : 9 *cash or add 2/4 to deposit and each monthly payment.*
or Set of 3 matched valves, guaranteed efficiency, 17/6 *Cash or add* 1/6 *to deposit and each monthly payment.*

SHORT WAVE BARGAINS

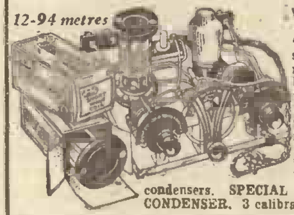
NEW SPECIAL OFFERS

"3-in-1" SHORT-WAVE KIT

RECEIVER — ADAPTOR — CONVERTER

List Value 41/3 BARGAIN 25/-

12-94 metres



VALVE FREE

ADAPTS or converts your battery set for short-wave reception, or may be used as one-valve Short-wave Receiver. Slow-motion bandspread tuning SIMPLIFIES WORLD RECEPTION! Air-spaced bandspread and tank condensers. SPECIAL ANTI-BLIND SPOT CONDENSER. 3 calibrated scales.

KIT comprises every part for assembly, including 3 4-pin coils, wiring and assembly instructions. Cash or C.O.D. Carr. Pd. 25/-, or 2/6 down and 10 monthly payments 2/6. VALVE FREE.

2/6 DOWN

3-VALVE BANDSPREAD S/W KIT: 12-94 metres. Complete Kit, including three coils. *List value* £3/17/6. BARGAIN, 37/6 cash, or 2/6 down and 11 monthly payments of 3/6: 3 matched valves FREE.

4-VALVE BANDSPREAD S/W KIT: 12-94 metres. Pentode Output, will bring a lifetime of fascinating short-wave entertainment. Complete Kit, including 3 6-pin coils. *List value*, £4/16/6. BARGAIN, 42/- cash, or 2/6 down and 11 monthly payments of 4/-: Four matched Valves FREE.

1-VALVE SHORT-WAVE KIT: SPECIAL OFFER. Complete Kit, including 3 coils; 12-94 metres, matched valve and pair of super-sensitive headphones: 27/6 cash, or 2/6 down and 9 monthly payments of 2/6.

PLEASE NOTE: If headphones required with 3-in-1; 3 or 4 valve Kits add 4/- to Cash Price or 1/- to Deposit.

AMPLIFIERS

HOME BROADCASTERS

4-watt BATTERY AMPLIFIER Q.P.P. output providing quality reproduction on gramo. and microphone. Dimensions: 7in. long, 5in. deep, 7¼in. high. For use with ordinary H.T. battery 135-150 volts. With 3 valves, fully tested. List Value £4/4/0. BARGAIN. Cash or C.O.D., £2/15/0, or 4/6 down and 12 monthly payments of 4/9.

Recommended Speaker. Goodman's P.M. Special Type, 19/6, or 2/6 down and 8 monthly payments of 2/6.

7-WATT A.C. AMPLIFIER only. 4-valve push-pull circuit. Undistorted output 7 watts. For microphone or pick-up. Circuit, triode, resistance transformer coupled to 2 power amplifier valves in push-pull, valve rectifier, consumption 60 watts. Steel chassis. Size: 7¼in. high, 4in. wide, 10in. long. For A.C. Mains 200/250 volts 40/80 cycles. Complete with 4 valves, ready for immediate use. List Value £4/19/6. BARGAIN, Cash or C.O.D. £3 : 10 : 0, or 5/- down and 12 monthly payments of 6/-.

5/- DOWN

Energised Speaker of required handling capacity, 37/6, or 2/6 down and 12 monthly payments of 3/3.

MICROPHONES. Transverse current type for use with above amplifiers, OR FOR USE WITH YOUR PRESENT RADIO. Faithful reproduction at all musical and speech frequencies. Complete with transformer and ready for instant attachment.

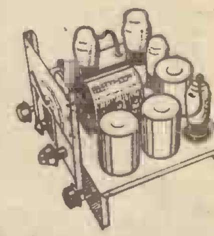
Table Model, 21/-, or 2/6 down and 8 monthly payments of 2/9. Telescopic Floor Model, 2 Gns., or 2/6 down and 11 monthly payments of 4/-.

REPLACE YOUR OLD CHASSIS

1938 4-Valve ALL-WAVE BATTERY CLASS "B" CHASSIS

LIST VALUE £7 : 0 : 0 Bargain £3 : 19 : 6

Wave range: 18 to 2,100 metres



Amazing Super Band-pass All-wave circuit with Class "B" output giving range and volume equal to a powerful mains set. Waveranges: 18-52; 200-550; 900-2,100 metres. Station-name and Wavelength illuminated dial as illustrated above. Low H.T. Consumption. Chassis Size: 10in. high, 11¼in. wide, 9in. deep. Complete with four matched valves, knobs and escutcheon. Guaranteed fully tested. *£3 19 6 cash,*

5/- *secures, balance in 13 monthly payments of 7/6.*

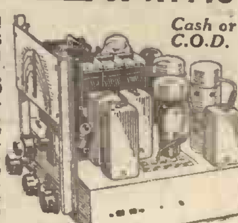
Or with matched Speaker £4 19 6 cash, or 5/- down and 15 monthly payments of 7/11.

1938 ALL-WAVE 5-valve A.C. SUPERHET CHASSIS

Amazing Offer! Immediate Delivery!

List Value 8 *Gns.* BARGAIN £4:17:6

Cash or C.O.D.



COMPLETE WITH 5 VALVES, KNOBS & ESCUTCHEON

● 3 wavebands: 18-50, 200-550, 900-2,000 metres. ● A.V.C. band-pass on all bands. ● Input to triode hexode detector oscillator, V.M. H.F. pentode, double-diode-triode 2nd detector triode resistance capacity stage coupled to high-slope output pentode. ● Output 3 watts. ● Combined on-off switch and volume control. ● Separate tone control. ● 4-position wave-change and gramo-switch. ● Illuminated rectangular full-vision slow-motion dial, 80-1 and 9-1 reductions, scale engraved station names and wavelengths. ● Overall dimensions: 10in. high, 11¼in. wide, 8¼in. deep. For A.C. mains 200/250 volts, 40/80 cycles.

7/6 *down secures; balance 15 monthly payments of 7/11.*

ORDER NOW TO AVOID DISAPPOINTMENT.

If required with matched moving-coil speaker add 27/6 to Cash Price, or 7/6 down and 17 monthly payments of 8/9.

SHORT-WAVE COILS

These highly efficient coils are wound on a former of low loss material and supplied with 4- or 6-pin bases having 2 and 3 windings respectively.

4 PIN TYPE.

9-14, 12-26, 22-47, 41-94 metres. *List* 2/9. Bargain 1/9 each. 76-170 metres: *List* 3/-. Bargain 2/- each. 150-325 metres: *List* 3/3. Bargain 2/3. 260-510 metres: *List* 3/6. Bargain 2/6. 490-1,000 metres: *List* 3/9. Bargain 2/9. 1,000-2,000 metres: *List* 4/-. Bargain 3/-.

6-PIN TYPE.

9-14, 12-26 metres: List 3/3. Bargain 2/- each. 22-47, 41-94 metres: List 3/6. Bargain 2/- each. 76-170 metres: List 3/9. Bargain 2/9. 150-325, 260-510 metres: List 4/-. Bargain 3/- each. 490-1,000 metres: List 4/6. Bargain 3/6. 1,000-2,000 metres: List 5/-. Bargain 3/9. Postage extra.

FROM 1/9 EACH

New Times Sales Co

56 (Pr. W. 50), LUDGATE HILL, LONDON, E.C.4.

Please send me CASH /C.O.D./H.P.:

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together with your Free Short-wave Booklet and 1938 Receiver and Component Bargain Lists.

NAME ....

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Please cross P.O.'s and register currency.

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Britain's finest

VALVES

Behind every Cossor Valve is the crystallized experience of research and manufacture of radio valves since their inception. These long years of specialised endeavour have provided a range second-to-none—a range that represents the most advanced practice in this sphere of radio technique. With a type for every circuit Cossor Valves are acknowledged as first for efficiency, uniformity and dependability.

AT YOUR SERVICE

If you should experience any difficulty or doubt in selecting the correct Cossor Valves for your set — write to A. C. Cossor Ltd., Technical Service Dept., Highbury Grove, London, N.5.

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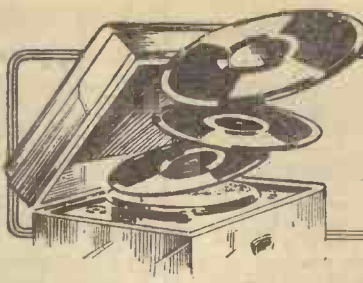

Impressions on the Wax

STRAUSS'S music is always popular, and this month we have the Viennese Waltz Orchestra playing J. Strauss's waltz "The Music of the Spheres" on *H.M.V. C* 2977. Other light instrumental recordings are supplied by the New Mayfair Orchestra, who serve up a tuneful medley of famous melodies by Padilla, including, of course, "El Relicario" and "Valencia" on *H.M.V. B* 8678, and also an attractive selection from the new film "Damsel in Distress"—*H.M.V. BD* 486.

Reginald Foort, at the B.B.C. organ, plays Moussorgsky's "Serenade" and, with Alfredo Campoli (violin), King's "Song of Paradise" on *H.M.V. BD* 484. Selections from "Double or Nothing" and "The Command Performance" are played by Al Bollington on the organ of the Paramount Theatre, London, on *H.M.V. BD* 477.

Vocal

JUSSI BJORLING, the young Norwegian tenor, follows up his recent successes with "Cielo e mar" (Heaven and Ocean!) from "La Gioconda," and "O Paradise" from "L'Africana," on *H.M.V. DB* 3302.

Nelson Eddy, now said to be America's most popular film and concert singer, has recorded two ballads in "The Rosary" and "Perfect Day" on *H.M.V. DA* 1589. Richard Crooks uses his powerful tenor voice in two songs, "Come, Here my Love Lies Dreaming" and "Ah! May the Red Rose Live Always"—*H.M.V. DA* 1598. In the first of these he is assisted by The Balladeers.

Songs from the Films

SONGS from the films are naturally well represented on records.

Frances Day sings "Because You Are You" and "Midnight and Music," from the film "Who's Your Lady Friend"—*H.M.V. B* 8679. Patricia Ellis, star of "Paradise for Two," sings the theme song and "Kiss me Goodnight" on *H.M.V. BD* 481. Bobby Breen, boy soprano, makes his first entry into the H.M.V. lists with "Make a Wish," from the film of that name, and "My Campfire Dreams," this last having a chorus of choristers—*H.M.V. BD* 480. Ramona, the clever American singer who accompanies herself on the piano, is in excellent form with "That Old Feeling," from "Walter Wanger's Vogues of 1938," and "Moonlight on the Waterfall"—*H.M.V. BD* 478. Monte Rey sings "Sailing Home" and "Water Lilies in the Moonlight" on *H.M.V. BD* 483, and Dan Donovan will please many with his Irish medleys, introducing such favourites as "A Little Bit of Heaven" and "The Mountains of Mourne" on *H.M.V. BD* 479. Max Miller, the "Cheeky Chappie," has two good laughter makers in "Ain't Love Grand" and "The Farmer's Daughter" on *H.M.V. BD* 482.

Dancing Time

THERE are some really good tunes in this section, including "Remember Me" and "That Old Feeling"—*H.M.V. BD* 5299 and "Roses in December" and "Things are Looking Up"—*H.M.V. BD* 5309, all played by Roy Fox and his Orchestra. Jack Harris has recorded two titles from the film "Damsel in Distress." They are "Foggy Day in London" and "Nice Work If You Can Get It" on *H.M.V. BD* 5304. With Elsie Carlisle and Sam Browne as vocalists, Jack Harris has also recorded "How Many Rhymes Can You Get," coupled with "Say Si, Si"—*H.M.V. BD* 5305.

That very popular number, "Little Old Lady," has been recorded by Ray Noble, the reverse side containing "Now"—*H.M.V. BD* 5287. Henry Jacques has added another strict dance tempo record to his list—"It's the Natural Thing to Do," together with "The Moon Got in My Eyes"—*H.M.V. BD* 5283. For those who like swing music, Bunny Berigan has recorded "Roses in December," coupled with "First Time I Saw You" on *H.M.V. B* 8680, and Tommy Dorsey's two titles are "Smoke Gets in Your Eyes" and "Night and Day," on *H.M.V. B* 8681.

Decca

ON record *Decca K* 872, Szekely presents an arrangement for violin and piano of four of the Rumanian Dances by Bela Bartok. Interesting music superbly played by Szekely in association with Geza Frid.

On *Decca X* 196 is a splendid performance of Josef Holbrooke's "Children of Don" overture, directed by Arthur Hammond. The seven Spanish folk-songs by de Falla are presented by Nancy Evans on *Decca X* 197-8.

The "Street Singer," whose records are always popular, has recorded for his latest disc "Can I Forget You" and "Mine Alone," on *Decca F* 6564. Jessie Matthews, the popular film star, has recorded "Jessie Matthews Memories" on *Decca K* 871, and Charlie Kunz adds Piano Medley No. 10 to his excellent series of pianoforte solos.

"Presenting All Stars"

I SHOULD like to draw your attention to a record which, I think, will prove extremely popular. It is called "Presenting All Stars," Parts 1 and 2, and is recorded on *Decca K* 870. The artists featured are Ambrose, The Street Singer, Jessie Matthews, Lew Stone, Geraldo, Greta Keller, Charlie Kunz and Josephine Bradley. These artists between them present a medley of popular tunes, introducing "Home Town," "Gangway," "September in the Rain," "Cherry Blossom Lane," "Moon at Sea," "You're Here, You're There," "Sailboat in the Moonlight," and "Can I Forget You." I am quite certain you will enjoy this.

George Formby, the popular radio star, has made a new recording on *Decca F* 5569, of "Fanlight Fanny" and "Share and Share Alike."

TELEVISION AND SHORT-WAVE HANDBOOK
By F. J. CAMM
3/6, or 4/- by post from
George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Practical Television

January 22nd, 1938. Vol. 3. No. 84.

What Does "Provision" Mean

WHEN reading the details of proposed or completed cinemas, it is now quite common to come across the phrase "provision has been made for television." Now what exactly is meant by that expression? Large-screen television as demonstrated recently is a comparatively new development of the art of high-definition television, and at the moment two separate and distinct systems hold the field. One is optical/mechanical in its conception and the other optical/electrical. Complete specifications of the equipment involved, space required, whether suitable for back or front screen projection or a combination of both, are as yet not available. It is, therefore, difficult to see how cinema architects or builders can make proper provision for something which is relatively unknown to them. Where the equipment is to be housed, and how it will fit in with ordinary talking-film projection is unknown to the cinema designer at present, so one can only assume that what is inferred is the fact that the cinemas concerned are watching developments closely and will adapt the theatres to meet requirements as soon as details are known.

Not Yet

IN an effort to secure a definite decision on a matter which crops up at repeated intervals, namely, the establishment of provincial television stations, a member asked in Parliament the other day if the P.M.G. would give particulars of the reason for the delay in completing the arrangements for the proposed television station at Birmingham. Information was also sought on when it was contemplated that this or other similar television stations would be opened in the provinces. The Assistant Postmaster-General replied that the matter had been very carefully considered by the Television Advisory Committee, who had decided that further research was necessary on certain aspects of the problem. It was stated that the committee charged with the work was carrying out an intensive research, but until this has been completed no recommendations concerning the establishment of additional television stations could be made. As it is now some months since the committee made any public statement it is regrettable that some information at least has not been released. It seems certain, however, that recent Parliamentary questions on this and kindred television subjects will bring about some decision in the near future.

Television and the Stage

EARLY in the New Year a dramatic play is to be produced in a London theatre which proposes to deal with the vastness and possibilities of future wars. The action is supposed to cover a wide field, and in order to keep abreast with modern invention it is proposed to introduce television. This will endeavour to show how the directors of military, naval and flying activities will watch distant operations through the medium of televised pictures, but so far no details have been released to indicate how the idea will be put into effect.

This is an instance of the stage realising what television really means and taking advantage of the topicality. As against this there is a certain section of the variety profession now talking of the "menace of the machine." They appear to regard television as a development likely to intrude on their ground. It is difficult to see how this is the case, for the public will never be persuaded to stay away from the theatre or music hall where they can enjoy the atmosphere of mass entertainment. The whole situation would seem to merit a round-table conference of all interested parties, especially now that big-screen television is looming so much in the background. A happy spirit of co-operation between the various parties involved is certain to be productive of a workable scheme which will in no way exploit one section to the ruination of another. An appreciation of every side's point of view will clear the air, for at no time can the retardation of scientific progress be tolerated.

An interesting departure from the usual run of variety turns in the B.B.C.'s television programmes was the transmission recently of a "Shove Halfpenny" feature. The game was between Patrick O'Neill, a 51-year-old Covent Garden porter, who has played the game for thirty years, and Tom Blackaby who was only fifteen when he played his first game in Seven Dials, back in the early 'nineties. The programme was compiled by Frank Benton, who gave a running commentary on the match.

German Plans

THE Germans are certainly taking a very long view of the possible future developments of television, for it is now stated that a 10-year plan has been drawn up by the Post Office, and the scheme has been approved by the Government. It is felt in that country that ultimately no one will require a set for sound broadcasting alone but will desire a combined vision-and-sound instrument to be used according to individual dictates. The whole country is to be split up into television broadcast areas, and no doubt in addition to local transmissions, each station will be interlinked with the co-axial cable runs which are now being extended in Germany. The cable itself is capable of handling the German picture standard of 441 lines, 25 pictures, 50 frames per second (interlaced scanning), and for this purpose self-operated repeater stations are being included at approximately 11-mile intervals. Each local relay station when complete will replace the sound broadcast station, and bearing in mind the German keenness for propaganda, it is certain that political groups will use the combined vision-and-sound service to provide the public with national information. With genuine Government support this plan will forge ahead, and this country will have to watch carefully to ensure that it is not robbed of its present pre-eminence in the field of television services. In Germany, plans are also afoot to market receivers at a price within the reach of the majority, and so follow the "People's Set" campaign fostered by the Nazi régime. These and other schemes are of sufficient importance to merit close consideration by the authorities at home. The radio trade are convinced that 1938 is destined to be a "Television year," and Government co-operation is urgently needed to ensure the maximum success.

(Continued overleaf.)

PRACTICAL TELEVISION

(Continued from previous page)

Another Museum Exhibition

PROMPTED no doubt by the very praiseworthy effort of the Science Museum in its recent organised television exhibition, a German television museum exhibition has now been arranged in Munich. This is really an addition to the picture telegraphy section, and quite naturally it gives great prominence to the early pioneers of that nation. Bearing in mind the class co-operation between the German Post Office and the Baird Company in 1929 and 1930, it is difficult to understand why the name of the English pioneer does not appear at all, but no doubt this will be remedied at a later date. Starting from the crude suggestions of Paul Nipkow on scanning and light modulation, the visitor is able to see the developments made by the leading television firms of Fernseh, Telefunken, Loewe, etc. The Karolus lamp screen and Kerr cell, as well as Mihaly's "Telehor," are all displayed, while modern technique is represented by electron cameras and intermediate film equipment. It is amazing to see the progress which has been made during the last few years, and if development is maintained at the same rapid rate the organisers will be hard pressed to find accommodation for "antiques." Direct pick-up with an electron camera is shown very clearly, a miniature ultra-short-wave wireless link transmitting the signals to neighbouring television receivers to show every section of the chain from camera to cathode-ray tube. All the working exhibits use a definition of 180 lines, and no doubt this will be altered during the course of the year to the present accepted standard of 441.

Television Advertising

The principles of television are being applied in many directions, and the latest scheme is in connection with advertising as represented by moving lamp signs. These signs give the appearance of motion by lighting up a series of lamps in a predetermined rotation or manner so that figures appear to move, although rather jerkily. The method suggested for replacing this is of a far more ambitious nature. A number of receiving screens would be connected to a central source or studio, each of these screens being made up from a large number of electric lamp bulbs arranged something like a honeycomb of separate cells. At the transmitting end is a similar bank, but instead of lamps each small section is taken up with a photo-electric cell; cells and lamps being connected together (through an amplifier) so that they have the same relative positions in a geometrical sense. On to the transmitting screen is projected a normal cinematograph film from a standard projector. Each cell would then produce a voltage in accordance with the degree of light intensity of the film picture to which it was exposed. This is conveyed to the receiving screen so that the electric lamp is made to glow with a degree of brightness corresponding to the cell's generated signal. Since this is done instantaneously by each cell and lamp at the same moment, the receiving screen will portray the film picture in terms of lamp brilliance. The idea has many advantages over the older type of moving advertisement signs, as the pictures portrayed are not a constant repetition of the same small movement but can show pictures of real live interest. Picture brilliance is outstanding, and the sponsors of the scheme have gone so far as to suggest that the idea could be applied to the showing of talking films in daylight as distinct from straightforward advertising.

SECRETS OF THE GRAMOPHONE STUDIOS

Few members of the public ever have access to gramophone studios, but viewers will be privileged spectators when the Mobile Television Unit visits the H.M.V. studios at St John's Wood on January 28th. In the afternoon transmission, television cameras will show scenes both in the studios and the control rooms during a recording session, and it will be shown how the flawless balance of voice and orchestra in a gramophone record is obtained only by careful placing of artists and instruments, which may entail any number of "play-backs" until musical director and engineers are satisfied with the result. The cameras will show in close-up such fascinating details as the stylus cutting into the wax as the record is made.

In the evening it is hoped that well-known artists will appear before the recording microphone.

Correcting Distortion

It is well known that when a mechanical form of scanner such as an apertured disc or mirror drum is used to explore a picture, a certain measure of distortion is introduced, making the original rectangular shape of the picture assume a trapezoidal or wedge-shaped formation. This can be compensated for in a variety of ways, but one of the most ingenious is to make the scanning aperture itself undergo either an apparent or real displacement while it is carrying out its exploring movement. One method for carrying this to a successful conclusion is to have a combination of slots in a disc intersecting with a fixed slot in a mask. The area of intersection then becomes the scanning aperture, and by a predetermined relative inclination between fixed and moving slots it is possible to produce the degree of correction necessary to restore the trapezium shape to one of rectangular outline identical with that at the transmitting end of the system.

Important Broadcasts of the Week

NATIONAL (261.1 *m. and* 1,500 *m.*)

Wednesday, January 19th.—London Pie, a revue.

Thursday, January 20th.—Edward Grieg: a programme of Norwegian music.

Friday, Jan. 21st.—Manon, an opera by J. Massenet.

Saturday, January 22nd.—National League: Wembley Lions v. Harringay Racers, a commentary on the last period of the game, from the Empire Pool and Sports Arena, Wembley.

REGIONAL (342.1 *m.*)

Wednesday, January 19th.—The Case of Lady Talond, a new radio play by Norman Edwards.

Thursday, January 20th.—An excerpt from Goody Two Shoes, from the Prince of Wales Theatre, Birmingham.

Friday, January 21st.—Meet the Family, a farce with music by The Melluish Brothers.

Saturday, January 22nd.—Richard Savage, a radio play based on scenes from the novel of the same name by Gwyn Jones.

MIDLAND (296.2 *m.*)

Wednesday, January 19.—The Bull Ring, feature programme.

Thursday, January 20th.—An excerpt from Goody Two Shoes, from the Prince of Wales Theatre, Birmingham.

Friday, January 21st.—Meet the Family, a farce with music by The Melluish Brothers.

Saturday, January 22nd.—Shakespeare Songs: choral programme.

NORTHERN (449.1 *m.*)

Wednesday, January 19th.—The Whistle Blows, a radio play by T. Thompson.

Thursday, January 20th.—Hallé Society's Concert, from the Free Trade Hall, Manchester.

Friday. January 21st.—Dance and Duet: Orchestral concert.

Saturday. January 22nd.—Leeds v. Halifax: a running commentary on the second half of the Rugby League Football Match, from Headingley Football Ground, Leeds.

WELSH (373.1 *m.*)

Wednesday, January 19th.—Changing Face of South Wales, a talk by Brinley Thomas.

Thursday, January 20th.—Concert from the Powis Hall, University College of North Wales, Bangor.

Friday, January 21st.—By Firelight—mainly Love Songs.

Saturday, January 22nd.—Richard Savage, a radio play based on scenes from the novel of the same name by Gwyn Jones.

WEST OF ENGLAND (285.7 *m.*)

Wednesday, January 19th.—They Made the West, a chronicle of English History—1, The Triumph of Christianity: Alfred and Cuthrum, by David Ayerst.

Thursday, January 20th.—Personal Choice, a programme of gramophone records.

Friday, January 21st.—For Western Gardeners: Why Flower Shows? a discussion.

Saturday, January 22nd.—An excerpt from Aladdin. from the Palace Theatre, Plymouth.

SCOTTISH (391.1 *m.*)

Wednesday, January 19th.—Gaelic Concert.

Thursday, January 20th.—Choral programme.

Friday, January 21st.—Crony o' Mine, a Scots comedy by Andrew P. Wilson.

Saturday, January 22nd.—Orchestral concert, from the St. Andrew's Hall, Glasgow.

NORTHERN IRELAND (307.1 *m.*)

Wednesday, January 19th.—Dance Music from the Plaza Palais de Danse, Belfast.

Thursday, January 20th.—Organ recital from the Cathedral Church of St. Columb, Londonderry.

Friday, January 21st.—Meet the Family, a farce with music by The Melluish Brothers, from Midland.

Saturday, January 22nd.—Choral programme.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

J. G. H. (South Harrow). We cannot give instructions for converting old receivers, and in any case do not think it would be a practical proposition to try to convert the set in question to an all-wave model.

F. R. (Erith). You do not state why you cannot test the set. Can you supply further details? We do not advise stripping the set so as to use the coils as the set may be quite in order.

A. J. V. (Shorncliffe). We have several blueprints of the type you require. and details will be found in the Blueprint list at the back of this issue.

F. D. (Abertillery). We regret that we cannot supply a blueprint for a transmitter-receiver of the type you require. We are also unaware of any source from which you could obtain one.

BM/GBG4. There are perfectly sound solutions to the points you raise, but we cannot deal with queries without a name and address. If you will let us have these we will answer your points.

E. M. (Rotherham). The valve you have is a 6-volt type, with a .1 amp. filament. The impedance is 3,550 ohms and amplification factor 8. It is rated as a power valve. We could not advise regarding the conversion of the loudspeaker for microphone purposes, and do not think you need to rewind the coil for this purpose.

R. G. (Redruth). We regret that, at the moment, we have no official details of the station in question, but if they come to hand they will be included in the Short-Wave Log.

D. W. H. (Romford). We could not supply a diagram of a set of the type you mention. There would be great difficulty in overcoming hum when using 'phones in the type of set mentioned, and we suggest you consider a battery all-wave three-valver which would give you the desired results.

A. E. (W.1). We cannot supply a blueprint of a portable transmitter.

A. H. (W.9). A list of the type you refer to will be found in our Encyclopædia.

J. B. (Southsea). Full details for your requirements will be supplied upon receipt of a stamped, addressed envelope.

E. R. C. (Acton). Either the output valve or the L.F. transformer is faulty according to the indication given in your letter. Have both tested.

L. S. (Bath). The trouble you indicate can be due to several causes, and further details would be necessary to give an exact diagnosis.

W. H. W. (Bristol). The Harris Radiogram, blueprint WM 390, would be suitable for your purpose if you need battery apparatus. We can also supply a 5-watt A.C. blueprint, WM 392.

J. M. (Glasgow, C4). The amplifier should meet your requirements and is battery operated. What other details do you require concerning this model?

A. E. G. (Hanwell). The Prefect S.W. Three is a suitable receiver, or if you require a simpler tuning arrangement, we recommend the Bandspread S.W. Three. Blueprints for both are available at 1s. each.

F. R. B. (Aylesbury). We cannot understand your reference to a speaker primarily intended for short-wave work, and some further details would be necessary, together with details of the set in order to ascertain the difficulty you are experiencing in obtaining results.

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The owner-driver's journal which tells you how to repair, overhaul and obtain the best performance from your car.

3d.—Every Friday

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The only English journal of its type. It deals with every branch of Science, Mechanics, Invention, Model-making, Chemistry, Astronomy, Photography, Television.

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The leading weekly for every Cyclist, Clubman, Utility Cyclist or Tourist. Join "The Cyclist" Road Club and also take advantage of the FREE Insurance.

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Read what students say:—"I was engaged on the spot as Engineer-in-Charge of their Service Department." ● "I have much pleasure in announcing an increase in salary and promotion." ● "He engaged me at a big increase in salary. I couldn't have got the situation without your help." ● "My engagement was due entirely to the knowledge I gained from your training." ● "I have been delighted with the whole Course, and am already earning more money." ● "I could not have obtained this job without your Course." ● "I have obtained a position at double the pay."

These extracts from hundreds of letters prove that my students get good jobs. What they have done, you can do. Without interfering with your ordinary occupation you can learn in your own home how to become a Qualified Radio Engineer and we will help you to get employment or teach you how to earn money in your spare time.

Take the first step to success and better pay by posting coupon now.

My students get good jobs because we **specialise** in Radio and Television and all our energies are concentrated on helping them to become successful Radio Engineers. Every student is under my personal supervision and receives individual tuition. The Courses are prepared by practical experts and are praised by leading radio employers and the Technical Press. All training is conducted by post; you study in your own home at your own pace.

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Post coupon now for Free copy of "Radio as a Career" and FREE SPECIMEN LESSON.

Post in unsealed envelope; ½d. stamp.

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Please send me Free Specimen Lesson and Free copy of "Radio as a Career," in plain envelope. No Canvassers.

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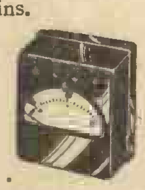
P.R.703 ....

ELECTRADIX BARGAINS

***NOW READY*—Our NEW Enlarged and Illustrated Sale List for 1938.** Send stamped and addressed envelope for this wonderful collection of amazing bargains.



THE DIX-MIPANTA. This is a wonderfully versatile, high-grade moving-iron multi-range meter for service on A.C. or D.C. jobs. No projecting terminals. THREE ranges of volts, 0-7.5, 0-150, 0-300. Used for MILLIAMPS, reads 12½ m.a. and 75 m.a. In black bakelite case. Only 2¼in. by 2¼in., 19/6.

METAL CABINETS. 42in. x 24in. x 16in., with front hinged door, 57/6. Smaller size, 18in. x 18in. x 11in., with side door, 30/-.

BELLS. Desk with movement in gong, 2/6. Wall Bells, 3/-. Large, 7/6. Big All Brass 12 volt single-stroke, 15/-. Mains outdoor Fire Alarm, 10in., D.C., 37/6.

HOME RECORDERS. Feigh, 37/6. Bradford, 45/-. Blanks, 4/- doz. Gramo. Motors with turntable, 25/-, 37/6, 45/- and £3/10/-.

MIRRORS. 5¼in. dia., Hello or Television, 1/6. Parabolic Concave, 10in., 20/-; 20in., 25/-; 24in., 30/-. Carr. fwd. Neon Lamps, 2/6 and 3/- each, with holder. Miniature Neons, 2/6.

LIGHT RAY CELLS. LESDIX CELLS are light sensitive, with gold grids, moisture proof, 5/-. Mounted in Bakelite Case, 7/6. Super-model in oxy-brass body, with window, 10/-. Complete Burglar Alarm Sets, £3 10s.

TELESCOPES. Navy Telescopes, hand spotters, 25/-; Gun type 17/6.

STICK PERISCOPES, 3¼" x 1¼", mirror with cover and swivel holder, 9d.

IMMERSION HEATERS. 110 volts, 2/6; 220 volts, 3/6; Hot-plate, 110 volts, 500 watts, 3/6; 660 watts, 5/-; 3-heats, 220 volts hand Motor Blowers, 17/6; Wax Heaters, 100-250 volts, 15/-; Bowl Fires, 220 volts, bronze finish, 9/6; ½ kw. Bar Fire, 7/6; 1 kw. 220 volts, 17/6; Elec. Curling Tongs, 220 volts, 5/-; Elec. Heating Pads, cloth 9" x 7", with flex and adaptor, 12/6.

MICROPHONES. Hand Mike, bakelite case. No. 11, 5/6. Table Model PM, with transf. and switch, 15/-. Transverse Mikes 30/- and 55/-. Table Stands, adjustable, 5/-, 7/6 and 10/-. Floor Stands, 15/-, 17/6 and 22/6.

For other Radio and Electrical Bargains see previous adverts. or write for New Bargain List.

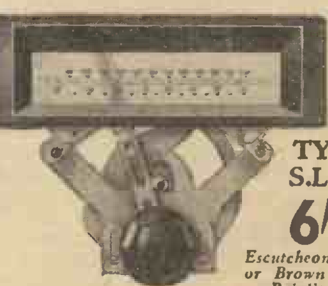
PORTABLE ENSIGN CINE PROJECTOR 35 m/m steel enclosed for L.C.C. Cost £70; as new, bargain. 12-ft. picture, £12; Camera £3. Soundheads £4 to £15.

PARCELS of experimental odd coils, magnets, wire, chokes, condensers, switches, terminals, etc., post free, 10 lbs., 7/-; 7 lbs., 5/-. 1,000 other Bargains in large Illustrated Sale List "N."

ELECTRADIX RADIOS
218 Upper Thames Street, London, E.C.4.
Telephone: Central 4611

Specified for the "TRIBAND THREE"

This J.B. horizontal type friction drive is absolutely accurate in operation. The design precludes back-lash and slip. The pilot lamp moves along with the hairline indicator thus making the scale easily read in all positions. Dual ratios 8-1 and 100-1. Rigid in construction and pleasing in appearance.



TYPE S.L. 11
6/6

Escutcheon in Black or Brown metal or Bakelite finish.

J. B. "DILECON" Condenser *also specified.* **·0003, 2/6**

Our 1938 Catalogue "N" Free.

JACKSON BROS. (LONDON) LTD.,
72, St. Thomas Street, London, S.E.1.

LETTERS FROM READERS

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Logged at Hull: Correspondent Wanted

SIRS,—I have not seen a report of reception from Hull, so I submit mine. I use the simple 0-v-1 receiver, with 60 volts H.T., which I find gives ample headphone strength.

During the last six weeks I have logged on 'phone and C.W. 400 amateurs. To give you a complete list of stations received would take up too much of your valuable space so I include a list of countries: S. Africa, U.S.A., Italy, Hungary, Sweden, Czechoslovakia, Austria, Belgium, Switzerland, Paraguay, Poland, France, Germany, Denmark, French Indo-China, Norway, Russia, Finland, French Morocco, Brazil, Virgin Isles, Belgian Congo, Porto Rico, Haiti, South America, Australia, Newfoundland, Holland, Spain, French West Africa, Canada, New Zealand, Alaska, Estonia, Greece and Cuba, a total of thirty-six countries.

The best catches are ZP1AT, CN8AJ, CN8AM, OQ5AE, PY2KT, PY2AL, PY2KX, YV5AA, VO1P, VK7AB, S8KI, YV7MT, VE3AH, ZL1MR, VE4SM, ZL1KH, VE2KX, VE1VR, SU1NK, SV1CA, LU1DA and ZL3FK.

I should like to correspond with any other reader interested in S.W. reception or transmission. And now, a last word to thank you for your very fine Christmas number.—F. WELCH (31, Chestnut Avenue, Queens Road, Hull).

A Tested Two-valver

SIR,—I wish to thank you for a very fine paper; it is most helpful, particularly on short-wave matters.

My receiver is an 0-v-1 with bandspread, and has been rebuilt about 30 times in one year, but it always goes back to the same circuit, similar to the one you described in the issue for August 7th, 1937. H.F. stages, extra L.F. stages, resistance-controlled reaction have all been tried and discarded. The antenna is 40ft. long and 20ft. high.

About 150 G stations and 100 W's have been heard and identified on 40, 20 and 10 metres, also CX2AK, YV7KP, HH2B, and VP3THE in South America, F4AA, VQ4CRE, and Egyptians and North Africans. In Europe, LY1J, LY1BB, ES5D, HB9B, HB9T, SP1DC, SP1MR, and numerous French, Belgian and Greek stations, also LX1TW of Luxembourg. Altogether about 380 stations in one year.

Has anyone heard W2XBJ, just at the low-frequency end of the 20-metre band? I heard it on 8-11-37 from 21.00-22.00, R4-8.

Could we have an article, please, on receiving antennas for amateur-band use; not necessarily noise-reducing, as we are not all cursed with that bugbear.—P. S. WOODHAM (South Harrow, Middx.).

Station EA9AH

SIR,—I should be interested to know if any other reader has received a QSL card from EA9AH, Tetuan, Spanish Morocco. I sent a detailed report about two months ago, which covered a fortnight's listening, to that station, whose address I read in PRACTICAL AND AMATEUR WIRELESS. I also enclosed an International Reply coupon.—H. L. KERSHAW (Oldbury, B'ham).

Correspondents Wanted

SIR,—Having been a regular reader of your paper for a number of years past, I would be glad to know if there are any readers residing in my district who would care to co-operate in morse instruction, and (if sufficient replies are forthcoming) in forming a short-wave club in Stalybridge and districts. If such readers would communicate with me by letter I shall be pleased to make arrangements to meet them personally. I may add that I hold the A.A. licence.—F. HULME (7, Moorland's Crescent, Micklehurst, Mossley, Lancs).

Back Number of A. W. Wanted

SIR,—May I ask, through the medium of your columns, whether any of your readers could send me a copy of *Amateur Wireless* giving particulars of the "150-mile Crystal Set" (blueprint AW 450), which I will pay for. This particular issue is out of print, hence this request.—EDWARD SAMUEL (6, Gregory Place, Wellawatta, Ceylon).

Amateur Transmitting: Correspondent Wanted

SIR,—In addition to being very interested in S.W. listening I am also interested in amateur transmitting and have an A.A. licence for transmitting under the call-sign of 2CYI. I should be very pleased, therefore, to get in touch with an amateur transmitting member (not necessarily in this locality) who is chiefly interested in battery-operated transmitters. I am too busy to be able to attend the local short-wave club, and should very much like to exchange ideas and tips on experimenting by post, and later via the ether, with someone who has had some experience.—ARTHUR A. JONES (2CYI), ("Lyndhurst," Warren Lane, Chapeltown, nr. Sheffield).

CUT THIS OUT EACH WEEK.

Do you know

—THAT modern dual-range coils are wound to standard inductance values, agreed upon by the competent manufacturers.

—THAT special I.F. filters for inclusion in the aerial circuit of a superhet to remove interference on the "I.F. wavelength" may now be obtained.

—THAT when making test instruments it is possible to obtain specially calibrated resistors from the makers to ensure high accuracy.

—THAT in some cases of noisy short-wave reception it is possible to reverse the aerial and earth leads and thereby obtain noise-free reception without loss of signal strength.

—THAT H.F. currents leaking into the L.F. stages can cause a variety of troubles and therefore every precaution should be taken to avoid this.

—THAT a new type of octal valve is shortly to be placed on the English market and is claimed to possess advantages over the existing type.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL AND AMATEUR WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

PROPOSED CLUB FOR ACCRINGTON

A FEW S.W. enthusiasts in Accrington are desirous of forming a club in this district, and any interested readers residing in the locality are invited to get in touch with Mr. R. Booth (2BAZ), 8, Rose Place, Bullough Park, Accrington.

CROYDON RADIO SOCIETY

THE fixture card for the above society's meeting to the end of March is as follows:—

February 15th.—Mr. P. K. Turner, of Hartley Turner Radio, Ltd., once again visits us, this time with a new "B" type negative feed back amplifier.

February 22nd.—Latest valve topics are discussed by the Mullard Wireless Service Co., Ltd., including valve application in television receivers.

March 1st.—Mr. G. A. Hoskins, vice-Chairman, gives another popular musical programme on records.

March 8th.—To be arranged.

March 15th.—Demonstration and Talk by Mr. R. P. Jonas, Hon. Librarian.

March 22nd.—"Progress in Commercial Set Design." Latest models are exhibited and performances compared. This special feature has been arranged by Mr. Marks, of C. A. Mackenzie, South Croydon.

Hon. Publicity Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

EDGWARE SHORT-WAVE SOCIETY

THE annual General Meeting of the above society was held at All Saints Church Hall on Thursday, January 6th, at 8 p.m., for the election of officers. Mr. Thursgood was elected chairman, Mr. Yale hon. secretary, Mr. Joyce treasurer, Mr. Harris (2AHF) and Mr. Mayhead (2AZA) on the committee. Mr. Jouthed promised the society testing equipment. Our transmitter is now working on 40-metre 'phone, the society's call-sign being 2DDK. Why not join us? Write to the Hon. Sec., Mr. Yale, 40, Raeburn Road, Edgware.

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Leaves from a Short-wave Log

Proposed Brazilian High-power Station

UNDER the ægis of the Brazilian National Department for Propaganda, the Association of Coffee Planters proposes to install a high-power medium- and short-wave station in the neighbourhood of Rio de Janeiro, with a view to the diffusion of special radio programmes in relation to coffee, and specially destined to listeners in Europe and the United States of America.

To Prevent Studio Interference

In order to expunge from the broadcasts the noises caused by the rustle of programmes by an audience of 1,400 guests at the Saturday evening Arturo Toscanini symphony concerts at New York, which are being relayed through the U.S.A. short-wave stations, the programmes will be printed on soft thick material of the nature of blotting-paper. By this simple means, the N.B.C. engineers consider that they can reduce greatly studio static in Radio City.

English News Bulletins from Bangkok

Daily at G.M.T. 13.45, HS8PJ, Bangkok (Siam), broadcasts a short news bulletin in English. The station works from G.M.T. 13.00-15.00, and in the course of the broadcasts announcements are made in Siamese, English, French, Spanish and Dutch for the benefit of the mixed population. The interval signal consists of three chimes (ascending scale), soh-doh-me-doh-me-soh-doh, the call being: *This is the experimental station, HS8PJ, Bangkok (Siam), on* 31.58 *metres,* 9.5 *megacycles.*

London *versus* Rome

In order to counteract the Italian propaganda broadcasts to the Near East, the B.B.C., as previously announced, started to carry out on January 3rd last special transmissions in the Arabic language through Daventry Empire GSC, on 31.32 m. (9.58 mc/s). These are now being made daily from G.M.T. 18.00-18.15. For this special service the B.B.C. has engaged the Chief Announcer of the Cairo station as well as other former officials of the Egyptian State Broadcasting Service. Similar broadcasts are being carried out through the Jerusalem transmitter.

In connection with the above it is interesting to note the times at which the Rome short-wave station carries out broadcasts in the English language. The *American Hour*, a daily feature, starts at G.M.T. 22.00. Transmissions are also given at G.M.T. 17.00 and 22.10, on 25.4 m. (11.81 mc/s), and at 01.40 and 06.35 on 31.13 m. (9.637 mc/s).

Italian Transmissions

The transmissions from the Italian transmitter 2RO are carried out on 25.4 metres (11,810 kc/s) until 5.20 p.m., and on 31.13 metres (9,635 kc/s) from 5.30 p.m. onwards. The special broadcasts for Italians abroad, as well as all programmes and news bulletins between 6.10 p.m. and midnight, are also broadcast by Rome II, the medium-wave station working on 245 metres (1,222 kc/s). The address of the Rome transmitter, from which copies of their programmes may be obtained, is 5, Via Montello, Rome, Italy.

A Memorial to Famous Amateur Transmitter

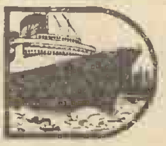
Under the auspices of the American Radio Relay League, five short-wave transmitters are being erected at Newington (Connecticut) as a mark of respect to Hiram Percy Maxim, who, as founder and first President of the A.R.R.L., worked from 1914 to his death in 1936 to establish and champion the rights of radio experimental amateurs in the United States of America. The stations will be of one kilowatt in power, and it is hoped to bring them on the air within the next three months.

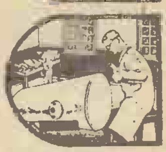
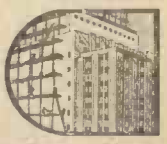
Does XEWW, Mexico, Work on Two Channels?

Listeners report having heard a broadcast from Mexico City on 31.58 m. (9.5 mc/s). So far, XEWW has been fairly frequently received on 19.79 m. (15.16 mc/s), but there is a strong possibility that for the winter months the higher channel has been adopted. It relays the medium-wave studio XEW (aykis-ee-dooble-vay), and gives out as its slogan: *La Voz del America Latina.* Interval signal: one single note on a gong, occasionally followed by four chimes (descending scale). Many references in the course of the broadcasts are made to the "RCA Victor."

New Mexican Short-waver

XFTW appears to be the call of a transmitter situated at Tampico (Mexico), announcing its wavelength as 49.63 m. (6.045 mc/s).

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"W.B. Loudspeakers embody so many unique features that they should become the automatic choice of all radio constructors and listeners."—Mr. Kenneth Jowers, Editor of "Television and Short-Wave World."

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Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

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QUERIES and ENQUIRIES

Switch Connections

"I had an old set made by —— and I decided to re-make it with some up-to-date components. I removed the metal panel which was scratched and fitted a paxolin one to match the cabinet and left the coils. A new ganged condenser and L.F. transformer, with valves, were the only replacements, but the set will not work now. I send a sketch and should be glad if you could help me. The set will not switch on and the wave-change does not make any difference."—C. S. (Gravesend).

FROM your sketch it is obvious what has happened in your conversion scheme. The original metal panel was employed as a connecting point, and the existing two-point switches for wave-changing and on/off switching are used as three-point switches, the plunger rod which is in contact with the mounting bush being used as the third point, and the filament connection being taken to the metal panel. Thus, in omitting the panel you will have to solder a third lead to the metal plunger of the two switches and join these up according to the original wiring. You will no doubt remember a lead connected to a bolt or soldered to the panel and this will be the lead which must be used. There will be a possibility that two separate connections may now have to be made, and this will depend upon the circuit.

Removing Hum

"I had a commercial superhet which was assembled on two chassis, and as I have obtained a new, smaller cabinet, I split the two sections and have the mains pack now in the bottom of the cabinet and the set in the top. There was a 7-way connecting cable between the two chassis, and I have replaced this with a longer cable, but otherwise have made no alterations. There is a very bad hum now on the set, and I should be glad if you could suggest how this has arisen and how it may be corrected."—G. E. (Hove).

ASSUMING that nothing has become damaged during your modification, there is only one probability which can answer for the hum trouble. The heater supply for A.C. valves is centre-tapped, and the centre-tap is joined to earth. An alternative to this scheme is to use a centre-tapped potentiometer or two pilot lights across the heater wiring, and we imagine that in your set the potentiometer device was employed. The lengths of the heater leads were such that the adjustment of the potentiometer removed the hum, but now that longer leads are employed the heater winding has become unbalanced, and the potentiometers need adjusting. Alternatively, it may be desirable to remove them from the mains pack and place them near the valves, then adjusting the centre tap to balance out the hum. We assume that you have so placed the loudspeaker that there is no possibility of interaction between the speaker transformer and the mains transformer or smoothing choke.

A.V.C. Distortion

"My set has developed a fault which is puzzling me. On the long-distance stations there is now perfectly good quality, much better than it has ever been since I bought the set. The volume is up on those stations, too. On the locals, however, there is bad distortion, even when I turn the volume right down. I have tried a new output valve but cannot cure the trouble, and two or three of my friends have suggested different things which have been unsuccessful. I should be glad if you could help."—S. S. M. (Belfast).

THE most likely cause of a trouble of this nature is a defect in the A.V.C. system. This is borne out by the fact that you state that distant signals are now louder, which indicates that the bias applied by the A.V.C. system is lower than previously. A powerful signal no doubt applies too much bias, and this gives the distortion as no doubt the frequency-changer and I.F. stages are controlled together from the A.V.C. line. We advise you to obtain a good meter and measure the values of the various resistors in the A.V.C. circuit, and check all condensers which are joined to it, when no doubt you will locate the faulty component which has introduced this trouble.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Accumulator Drain

"I had a Fury Four which I built when it first came out, and I modernised this according to your recent instructions. At the same time I made a change of my own, fitting new condensers and dials, and the only circuit alteration which I made at this time was to fit indicating lights for medium and long waves, as in a recent reader's wrinkle. I am finding, however, that the accumulator now does not last nearly as long, and I wonder if the lights are responsible. If this is so, how can I overcome it without buying a larger accumulator?"—D. B. R. (Bristol 1).

IF you have used the correct type of lamp for your dials there should not be any undue increase in the L.T. consumption, but if you have used the ordinary type of flash-lamp bulb there would be an increase. If you are still using two separate condensers and have fitted lamps to both, it would be desirable to fit an ordinary on/off switch in the leads to the lamps so that they may be switched off after you have tuned to a station and thus avoid the additional current drain. Special low-consumption bulbs are, however, readily obtainable and will avoid the difficulty of additional consumption.

Switch Troubles

"I am experiencing a peculiar fault with my set which, rightly or wrongly, I attribute to the switch. This is of the wafer type with seven sections, and when turned to the medium waves I sometimes cannot obtain a signal. By turning the switch backwards and forwards once or twice there is a plop in the speaker and signals can be obtained. Do you agree with my suggestion and, if so, what would be the best way of curing the trouble?"—J. N. (Gateshead).

IF your switch is of the type having a bent-over finger which runs across small contact points there is a possibility that owing to excessive solder or a connecting wire which has become bent, the moving arm has caught and been twisted. Thus, in one position the drag would cause this to fold back, and although in the remaining sections correct contact would be made, on that particular section the arm may rest between two adjacent contacts. These may be short-circuited or no contact may be obtained, depending upon the make of the switch and we advise you to look carefully at the various sections, and if you cannot locate the faulty one, perhaps it would be advisable to have the set examined by the makers or their local service agent.

H.F. Instability

"I had an S.G. Four set, and this had given good results for a long time. I bought two new valves, which I am assured are of identical characteristics to the original S.G. and detector valves, but there is marked instability, especially on the lower part of the medium waveband. I find that this may be stopped by holding the valve with the hand (detector), and wonder if this will indicate the trouble to you. It is fairly good on the rest of the band and can be used satisfactorily, although I cannot turn up the volume too much."—F. D. (Abertillery).

IF the valves are indentical and no changes in wiring or circuit have taken place the most useful suggestion we can make is that the metallising on the valve is not earthed properly. This can occur due to the small seal which is affixed on the metal surface becoming loose, or the wire connected to it from the filament pin may have become broken. Examine the point carefully, and if there is a paper label marked "E" stuck over it, remove this and see if the metal is sprayed over the wire and seal correctly. If not, a bare wire should be twisted round the metal surface and joined to the appropriate filament pin and we think this will cure your trouble.

The coupon on page iii of cover must be attached to every query.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical and Amateur Wireless," Tower House, Southampton Street, Strand, London. W.C.2.

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TELSEN A.C./D.C. Multimeters, 5-range (tests anything radio or electrical), 8/6; loudspeaker units, 2/6, Ace (P.O.) microphones, complete with transformer ready for use with any receiver, 4/6; headphones, 4,000 ohms, 3/- pair.

VALVES.—Full range for American receivers, 6/- each.

MORSE Tappers, complete radio-telegraph set (flasher, buzzer and tapper), with batteries, bulb. code, 3/-.

BARGAIN Parcels of Assorted Components, including coils, resistances, condensers, chokes, wire, circuits, etc., value 21/-; 5/- per parcel.

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SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Euston 3775.

CONVERSION UNITS for operating D.C. Receivers from A.C. Mains, improved type, 120 watt output at £2/10/0. Send for our comprehensive list of speakers, resistances and other components. **WARD**, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

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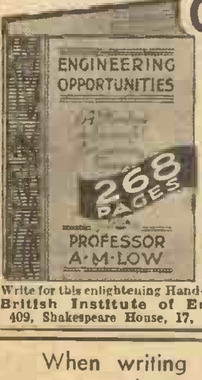

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Price **£6.17.6**

(Complete with B.V.A. Valves)

This moderately-priced 7-stage 5-valve all-wave receiver utilises a remarkably efficient superheterodyne circuit which provides exceptional sensitivity on all three wavebands—18-50, 200-550, 1,000-2,000 metres.

Circuit includes: Latest type triode-hexode frequency changers vari-mu pentode I.F. amplifier, double diode-triode operating a diode detector and I.F. amplifier, and providing full A.V.C. High slope 3 watts output pentode. Wave-change and gram. switch. As illustrated, but with new type dial with principal station names.

6-valve all-wave Superhet with Radio Frequency Stage

8 Stages
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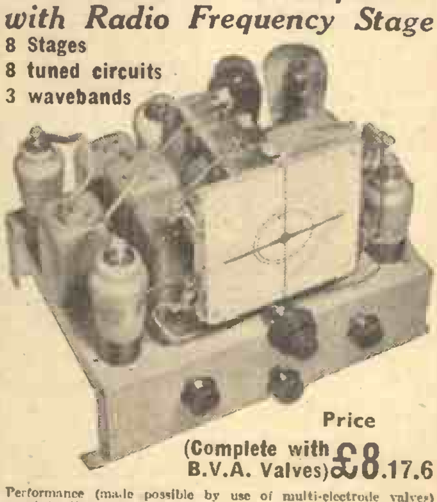
3 wavebands



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Optimum Load Resistance	2,200 ohms	6,000 ohms	3,000 ohms
Power Output	7.25 watts	32 watts	50 to 60 w.

CHARACTERISTICS OF OSRAM KT66

Heater Voltage 6.3
Heater Current .... 1.27 amp.
Anode Voltage .... 400 max.
Screen Voltage .... 300 max.
Mutual Conductance .... 6.3 mA/v.

(At Ea=250, Es=250, Eg=—15)

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Practical and Amateur Wireless, January 29th, 1938.

USING THAT ELIMINATOR—See page 545.

Practical and Amateur Wireless

3D. EVERY WEDNESDAY

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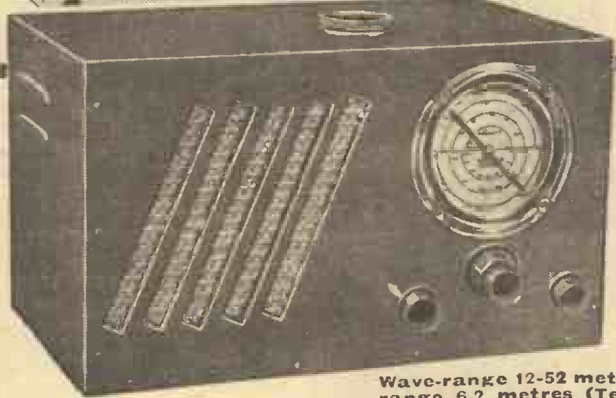

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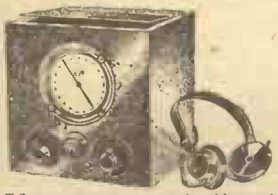

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Reaching Out on the Short Waves—See page 555

Practical and Amateur Wireless

Edited by F. J. CAMM

Technical Staff:
W. J. Delaney, H. J Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.

VOL. XI. No. 280. January 29th, 1938.

ROUND *the* WORLD *of* WIRELESS

Mains Unit Problems

ALTHOUGH the mains unit—generally referred to as an eliminator—is such a simple piece of apparatus, and of such great value to the battery set user who eventually has the mains brought to his house, it seems that it can cause no end of trouble. We are continually receiving queries from readers who have obtained one of these units, and when it is tried with their receiver it either hums, gives poor results, or the receiver fails to act in the original manner. In most cases, however, a simple modification to the wiring of the receiver will enable the unit to give just as good results as were obtained from the H.T. battery, and in many cases it will give even better results, as it may be found that the unit will deliver 150 volts compared with the 120 or less given by the battery. Furthermore, the output from the mains unit should always be the same, whereas an H.T. battery delivers a gradually falling voltage, and in many cases it will be found that the battery is kept in use for a considerable time when it is delivering only 80 or 90 volts. On page 545 this week we give details of the usual difficulties which are met with, and the manner in which they may be overcome, and it will be found in the majority of such cases that the details given will enable satisfactory results to be obtained. There may, of course, be certain individual cases which are exceptional, and upon receipt of details we will, in the usual way, deal with the problems individually and, if possible, instruct the user how to obtain satisfactory results. A stamped and addressed envelope must be enclosed (together with a coupon cut from a current issue) if a postal reply is desired.

New B.B.C. Transmitters

THE introduction of foreign-language broadcasts from the B.B.C. Empire transmitter is likely to lead to increases in the number of short-wave transmissions, and some new apparatus has been ordered from the Marconi Company. Extensive alterations are being made at Daventry and an increase in the power used is stated to be under consideration. Can we visualise the introduction of a revolving aerial system to provide alternative programmes to different countries, as is being used elsewhere?

New Belfast Studios

NORTHERN IRELAND is to have better facilities in the near future coinciding with extensions of the buildings and studios in Belfast. A magnificent building is to be erected on the site at the junction of Linenhall Street West, Ormeau Avenue, and Dublin Road at a cost of more than £70,000.

ON OTHER PAGES

Sunday Television

IT is announced that steps are being taken to increase the hours of television broadcasts from the B.B.C. television station, and at some future date (probably early in April) a Sunday session may be included.

British Interference Standard

THE British Standards Institution have drawn up some limits of magnitude, duration and frequency of occurrence of interference producing voltages and/or electric fields as measured at any frequency from 1,500 to 200 metres and a mark is being protected under Section 62 of the Trade Marks Act for use with apparatus which complies with the specification issued by the Institution. It is to be hoped that increasing use will be made of this device, and that it will hasten the passing of a law prohibiting the use of any apparatus which causes interference with radio receivers.

Canadian Broadcasting

A RECENT conference at Havana resulted in an agreement giving Canada sufficient channels for all present and projected high-power stations using 5 kW. or more. The agreement is between Newfoundland, Canada, United States, Mexico, Cuba, Santo Domingo and Haiti, and is approved by an inter-American radio convention between the countries of North, Central and South America. It covers a period of five years, and dates from one year after the Governments of Canada, United States, Mexico and Cuba have ratified it.

Dance Music from Paris

AS a further addition to the outside broadcasts of dance music which are now being featured by the B.B.C. it is announced that on January 29th, in the Regional programme, Eddie South and his band will be relayed from Paris. Eddie is a well-known coloured violinist, and his band is a great feature in the French capital. A few years ago he was playing at the Café Anglais in London after the band had secured fame at the Club Alabam' in New York.

Holborn Empire Broadcasts

THE first of the new series of variety broadcasts from the stage of the Holborn Empire in London will be given on Tuesday, February 1st. These broadcasts will always take place (fortnightly) at the same time—namely, from 8 to 8.30 p.m., but not necessarily on the same day of the week.

Sound-film Broadcasts

THE B.B.C. announce that, by arrangement with a number of prominent British and American film companies, a series of radio versions of well-known sound films is to be broadcast. The first will be "Top-Hat," and will be heard on the National wavelength on February 8th and on the Regional on February 10th. Diana Ward is to play Ginger Rogers' original part and tests are being made with a view to finding an actor to take the part of Fred Astaire. The second broadcast will be "Congress Dances," on February 22nd.

ROUND the WORLD of WIRELESS (Continued)

INTERESTING and TOPICAL NEWS and NOTES

Radio Equipped Motor Coaches

ACCORDING to a recent report a fleet of new Green Line coaches, supplied to the order of London Transport, are to be fitted with wireless sets. The new coaches, which are built on luxury lines, are six-wheelers.

Eskimo Radio Enthusiasts

AN interesting story comes from far-away Labrador, where a teacher in the Mission School reports that several Eskimos ride through forty miles of ice and snow in open dog-sleds to hear the broadcasts of Edward MacHugh, the Gospel Singer, who broadcasts daily over the American network. What a lesson for armchair listeners in this country, who are always grousing about the B.B.C. programmes!

Pitcairn Island Station

LISTENERS who are also cinema goers, and who remember that fine film the *Mutiny of the Bounty*, will be interested to know that through the generosity of a number of United States radio manufacturers a new wireless station will shortly be installed at Pitcairn Island, whose inhabitants are descendants of the mutineers of the *Bounty*.

At present the islanders possess an old set operated by an old 12-volt storage battery, which has to be sent thousands of miles to New Zealand to be recharged when it runs out. The station, with the call-letters PITC, uses its equipment to contact ships.

The new outfit will enable the islanders to communicate by short waves with the outside world. Two 300 ampere hour batteries will supply the power, and will be recharged by a 12-volt wind-charger. A receiver, covering all bands between 9.5 and 3,750 metres, will complete the equipment.

Midland Variety

A VARIETY interlude will be provided by the Three J's, a new harmony trio broadcasting for the first time, and Schofield Earl, a Warwickshire piano-accordionist, on January 31st. The members of the Three J's have all had a good deal of experience as solo radio artists.

New B.B.C. Announcers

THE latest announcers to be appointed by the B.B.C. are Mr. P. Fettes, and Mr. E. H. H. Ward, who have now taken up duty at Broadcasting House. After leaving Cambridge, Mr. Fettes studied singing and elocution at the Royal College of Music. Mr. Ward was with Messrs. Reuters, Ltd., in London and China from 1931 to 1936.

Melodies from the Comedies

LISTENERS to the Midland programme on February 1st will hear tunes from stage and screen played by the Revue Orchestra, conducted by Reginald Burston. The programme will be compèred by Martyn C. Webster, and the pianist will be Michael Cole.

Dance Cabaret

IN a popular programme of Dance Cabaret from the Pavilion Ballroom, Bournemouth, on February 5th, the artists will include: Vine, More and Nevard, "In Original Songs at the Piano"; Bennett and Williams, "The Jovial Jesters with their Phonofiddles"; and dancing to Sim Grossman and his Dance Band, with Edward Slade.

Lionel Falkman, whose popular Apache Band is well known to listeners.

Caught by Radio

ANOTHER smart piece of work by the mobile police was recently reported. A dramatic chase of a car alleged to have been stolen and the crashing of the suspect car took just twenty minutes, according to the wireless log at Scotland Yard. Here is the log:—

8.50.—Car reported stolen and police wireless description broadcast.

9.3.—Patrolling police car, having received radio message, sights suspect car coming from Barnes direction; gives chase.

9.10.—Suspect car crashes.

In connection with the affair two men were brought up at the West London Police Court.

Austrian Listeners Terminate Subscriptions

OWING to the fact that the wireless subscription in Austria has been raised to £1 annually, it is not surprising that about 37,000 listeners, as against 9,000 at the end of 1936, have given notice to terminate their subscriptions to Ravag. It is anticipated, however, that a great many listeners will find that they cannot do without their sets, and will rèjoin.

Pantomime Broadcast

LISTENERS who like a little light entertainment will enjoy the broadcast from the Midland Regional on February 4th, when excerpts from the Birmingham Theatre Royal pantomime, *Mother Goose*, will be heard. This pantomime is presented and produced by Tom Arnold (for Julian Wylie Productions Ltd.), The book is by J. Hickory Wood and Dan Leno, Jnr., and the music is by Jas. W. Tate and W. W. Eyre. George Lacy, the well-known dame, plays "Mother Goose," Billy Danvers and Helen Barnes are her children, Jack and Jill; and Nita Croft is a dashing principal boy as Jill's lover, Robbie. There is a strong supporting cast, and Mickey Mouse's Christmas Party is one of the most popular features.

Radio "Rehearsal"

ON the morning of February 3rd, Regional listeners will get an aural glimpse of preparations for the broadcast that evening from the Argyle Theatre, Birkenhead. Most people have no experience of, nor opportunity for, seeing or overhearing the preparation of the shows whose finished performance delights them. On February 3rd they can do some radio-eaves-dropping, and, consequently, will find the show relayed later in the day the more interesting.

SOLVE THIS!

PROBLEM No. 280.

Hoskins was using a straight three (S.G., Detector and Pentode) receiver and decided to convert the HF. stage to the variable-mu type.. He therefore bought a 4-pin variable-mu H.F. pentode to replace the S.G. valve and a 5,000-ohm potentiometer which he joined across the G.B. battery, with the arm of this control joined to the lower end of the grid winding of the first stage. This winding was first disconnected from earth and a fixed condenser used in the ordinary way to complete the coil circuit. He found, however, that although results were quite good for the first two or three days they speedily deteriorated, and on the fifth day no signals could be received, due to excessive oscillation. What was the trouble? Three books will be awarded for the first three correct solutions opened. Envelopes should be addressed to The Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 280 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, January 31st, 1938.

Solution to Problem No. 279.

The trouble in Raglan's set was L.F. instability, which could be cured either by reversing the connections to the secondary of the L.F. transformer, or by placing a high resistance in series with the grid terminal. In some cases of instability of this nature it might be necessary to carry out both of these suggestions.

The following three readers successfully solved Problem No. 278 and books have accordingly been forwarded to them: G. Reid, 62, Kingsland Crescent, Barry Dock, Glam.; E. Bryant, Shamrock Cottage, School Hill, Peasmarsh, Sussex; W. H. Wardley, 51, Southview Drive, Westcliff-on-Sea.

The Experimenters Discuss Class A, B and C

These Three Terms, Along With the Associated One of Class A-B, are Frequently Misunderstood, and this General Explanation will Help to Clear Away Many of the Doubts that have been Expressed by Readers

by The Experimenters

WE have often been asked by readers to explain in really simple terms the meaning of the expressions Class A, B and C. For once we can please both battery and mains users at the same time, for these expressions can be applied to circuits involving the use of these two-valve types. In the first place, however, let us point out that a good deal of confusion often exists concerning the expressions with which we are dealing. Frankly—and here we shall meet with opposition—we should prefer to dispense with the terms, describing the circuits more laboriously but with less likelihood of misunderstanding.

However, we do not consider ourselves fully qualified to dictate to radio technicians throughout the world, so we must for the present accept the terms and attempt to assist readers in understanding them. One reason for our suggestion that they should be banned is that they are not always used in quite the same sense. Another, although not an important one to-day, is that classes A, B and C have sometimes been used with reference to rectifying valves, instead of to amplifier circuits. It was not unusual a few years ago to speak of a 250-volt, 60 mA rectifier as class A, one having an approximate output of 350 volts, 120 mA as class B, and one rated at 500 volts, 120 mA as class C. If the terms are to be used, let us apply them to one aspect, and one aspect only.

Class A: Push-pull

Briefly a class A amplifier circuit is a standard push-pull arrangement similar in general form to that shown in Fig. 1. The two valves may be either triodes or pentodes, mains or battery operated. Requirement number one is that the valves should be used, with regard to their bias resistance, anode and grid loads, in precisely the same manner as if either valve were used on its own in a simple resistance or transformer-coupled circuit.

In other words, if the valves were rated to operate with a maximum anode voltage of 200 when the grid-bias voltage was —7.5, the same potentials would be applied whether the valves were used singly or in pairs in a push-pull system. Additionally, if the optimum load of one valve were 10,000 ohms, the optimum load of the two in push-pull (when the valves are in series as far as the filament-anode circuits are concerned) would be 20,000 ohms. Yet another way of explaining the point is that if the speaker had a centre-tapped transformer, each half of which provided an average impedance of 10,000 ohms, one half of that winding would be used with a single output valve, and both halves in a push-pull circuit. Figs. 1 and 2 will help to make this clear.

That general explanation of push-pull, or class A, applies whether the valves are directly or indirectly heated. If of the latter type, the correct bias resistance to feed both valves—included in the common cathode lead—would be half of the value required when using a single valve. That is because the anode current would be doubled, so that the voltage dropped by the resistor would be the same in both instances.

Class B, Including Q.P.P.

The appearance of the theoretical circuit for a class B amplifier is almost the same as that for class A, but the operating conditions are changed. There are, however, two main types of class B circuit: in one the grid-bias voltage is either zero or a very low figure; in the other the grids are biased to about twice the voltage that would be used if either of the valves were used separately. The two circuit arrangements mentioned are more commonly referred to as class B and Q.P.P. respectively, but both come under the general classification of B.

Figs. 3 and 4 show typical class B and so-called Q.P.P., or quiescent push-pull, circuits respectively. In the former case a double triode or class B battery valve is shown, and in the latter there are two pentodes. The class B valve is specially

(Continued overleaf.)

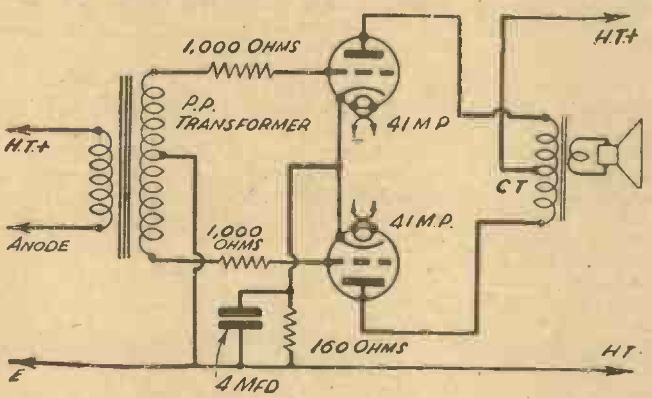

Fig. 1.—Skeleton circuit of a push-pull amplifier using two Cossor 41 M.P. indirectly-heated power valves.

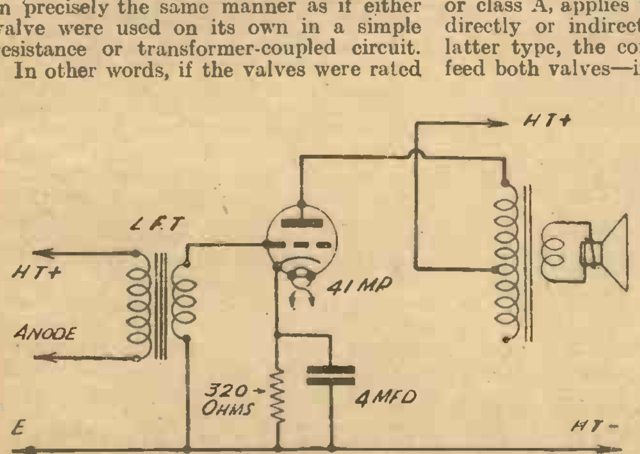

Fig. 2.—A simple L.F. amplifier circuit of conventional type, using a single 41 M.P. valve. Note that the bias resistor has twice the value of that used in Fig. 1.

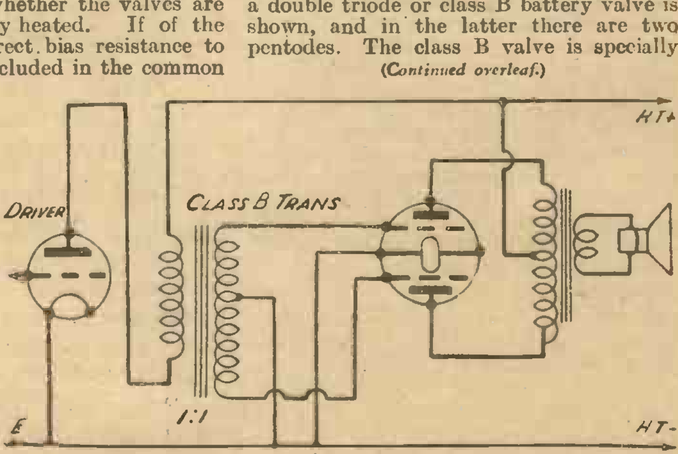

Fig. 3.—Skeleton circuit for a Class B output valve with driver

THE EXPERIMENTERS DISCUSS CLASS A, B and C.

(Continued from previous page.)

designed for use in a circuit such as that illustrated, and is shown as having a zero grid voltage. This is not universal, however, for certain class B valves are designed to operate with a G.B. voltage of 1½ to 3 volts negative.

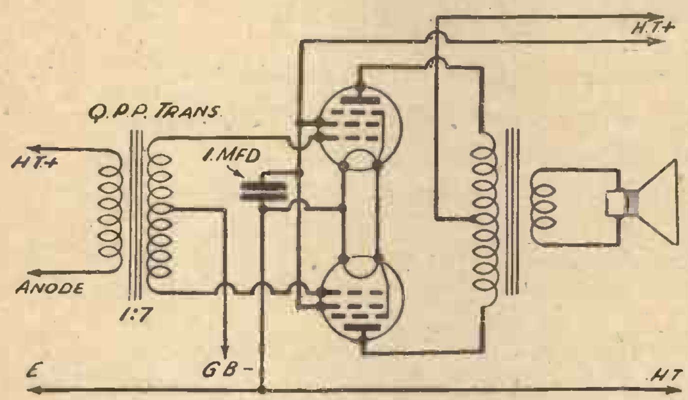

Fig. 4.—This diagrammatic circuit is for two pentodes in Q.P.P.

The principal requirement is that there should be a flow of grid current through the secondary winding of the centre-tapped intervalve transformer, called the driver transformer. For this reason the secondary winding must have a very low resistance, a usually-required value being 300 ohms. This is so that there is very little opposition to the passage of a variable-grid current through it. Another requirement is that power, as distinct from mere signal voltage, should be applied to the class B valve. For this reason the driver transformer has a ratio of not more than 1 : 2, but generally about 1 : 1. Also, to ensure a supply of power, a so-called driver valve is required between the detector valve and the class B stage. This takes the form of a small-power valve operated under normal conditions.

Increased G.B.

In the other form of class B, known as Q.P.P., a high-ratio push-pull transformer is employed, no driver being required. The grid-bias voltage, as mentioned above, should be roughly twice that used when one valve is employed in the normal type of L.F. circuit. The effect of this is to keep the anode current at a very low value when signals are not being applied to the output circuit. This also applies to the class B system, since the double valve is designed to pass a very low anode current when the grid is at zero volts.

In both cases, anode current increases with the signal voltage applied to the grids: in the case of class B, the signal voltage gives the grids a positive potential, and with Q.P.P. it acts in opposition to the high "standing" bias, so reducing the effective negative grid potential. Thus the anode current varies in proportion to the applied signal voltage. On loud passages the current increases, and on soft passages the current falls.

Economical Current Consumption

From this it will be clear that both systems—or shall we say class B systems—give many of the well-known advantages of push-pull in conjunction with the more important advantage, in a battery set, of low average anode-current consumption. We must stress the word "average" in the last sentence, because the peak or maximum current might, for very short intervals of time, reach 50 mA. or so. That explains why special H.T. batteries and eliminators are desirable for class B and Q.P.P. amplifiers.

In Figs. 3 and 4 we have assumed that a double triode valve is used for class B and two separate pentodes for Q.P.P. This has been done purely for convenience, for it is possible to obtain double pentodes for Q.P.P., and there is no reason why a pair of suitable triodes should not be used for ordinary class B.

The Third Class

Class C—What is it? The term is used differently by different people and in different parts of the world. It is often applied to circuits of the Q.P.P. type in which large mains pentodes are fitted. But that is not standard, and many technicians in this country will tell you that the expression has no application to receiver amplifiers, but should be confined to certain transmitting arrangements. We are inclined to agree with the latter view, but if you hear the term applied to amplifiers the brief explanation given will no doubt enable you to understand the reference.

A-B, Or Low-loading

But that is not the end of this class A, B and C business. Class A-B is a term frequently used for rather special high-power amplifiers using super-power valves, and a circuit of the type suggested by the Osram people using a pair of PX25A valves is given in Fig. 5. A low-frequency amplifying valve is used as a driver, and the circuit is capable of providing approximately 32 watts output with only 5 per cent. third-harmonic distortion (if that means very much to you). In any case you will see a good deal of significance in the fact that one of these valves used alone has a rated approximate maximum output of only about eight-and-a-half watts.

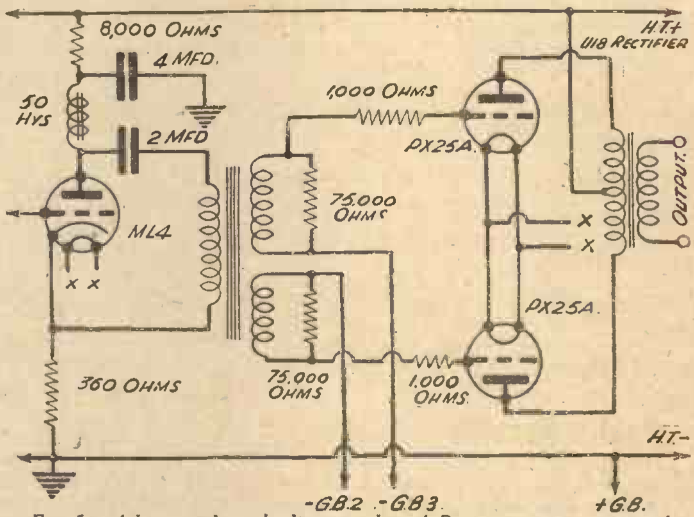

Fig. 5.—A low-impedance-loading, or class A-B circuit, using a pair of Osram PX25A valves.

Experience Necessary

We could not possibly deal fully with class A-B amplifiers in the space at our disposal, and we must ask readers please not to write for circuits and full constructional details. There are several rather "tricky" points to be observed, and an amplifier of this type is suitable for construction only by those with fairly extensive experience of amplifier design and who are in possession of a few accurate testing instruments. Important details are obtainable from a few valve manufacturers, and we shall be pleased to tell experienced constructors where they can obtain these.

Class A-B amplification is often referred to as "low-loading" or "low-impedance loading," due to the value of the anode impedance of the valves required in a circuit such as that reproduced. A modified arrangement for use with pentodes is sponsored by Tungsram, who refer to the system as class AB1. With valves such as the Tungsram APP4E a somewhat simpler circuit can be used, but in all cases it is desirable—and generally essential—to employ a specially made push-pull transformer designed for use with a pair of valves of any particular type.

More Confusion

Just one more point. The abbreviation of the term low-impedance loading to low-loading has sometimes led to a further source of confusion. We have occasionally heard the name of low-loading applied to a resistance-coupled amplifier in which the load resistance for the penultimate valve is included in the cathode lead, instead of the more customary position between the anode and H.T. positive. The load is "low" in the circuit, but this arrangement is merely a modification of the normal resistance-coupled amplifier and is certainly not a class A-B nor a low-impedance loading circuit.

Well, we hope that this very general description of the three alphabetical terms will have cleared away some misapprehensions, even if we have not been exactly "practical" or "experimental" in our discussion this week.

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USING THAT ELIMINATOR

Points About A.C. and D.C. Battery Units which Often Cause Difficulties Which May Be Overcome in Many Cases by Simple Means - - - - - By W. J. DELANEY

MANY listeners seem to encounter difficulty when they endeavour to operate a battery set from a mains unit—either of the A.C. or the D.C. type. In many cases the trouble is due to the fact that the mains unit is unsuitable, and may not be used with the receiver, whilst in other cases a simple alteration to the receiver circuit may enable the unit to be used. The first point is covered by the fact that the mains unit will not deliver sufficient current for the receiver with which it is used, whilst the second point is covered by the fact that the user attempts to use the marked outputs on the unit, and the circuit is unsuitable for the internal arrangement of the unit. In the case of the listener who uses H.T. batteries it will have been noted that certain types of H.T. battery do not last nearly so long as other types, and this is due to the fact that the current which the batteries will deliver is governed by the size of the cells, and if the current taken by the set is very large and a small type of battery is used, the battery runs out very quickly. Similarly, when using a mains unit the type of rectifier which is fitted, in the case of an A.C. model, will govern the output, but instead of a small unit running out quickly, what happens is that the voltage which is delivered will be very much below the rating of the unit.

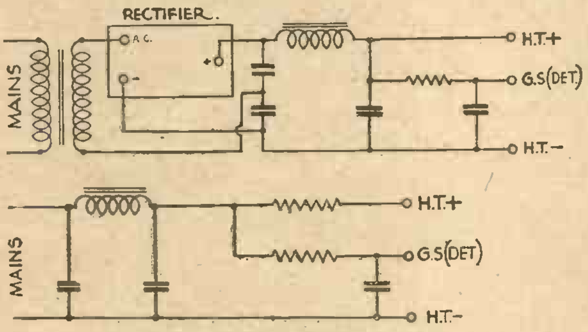


Fig. 1.—Standard circuits for an A.C. and a D.C. mains unit.

Output Ratings

The majority of A.C. units are rated to deliver so many volts at so many milliamps, and, therefore, if you are buying a unit, or building a set to use with a unit which you already have, you should ascertain the total current of the receiver and thus avoid the difficulty of over-running. Add together the current of all the valves, plus that which may flow due to a potentiometer across the H.T. circuit (for instance, supplying the screen of an H.F. stage). Provided that the mains unit will deliver adequate current no difficulty should be experienced in obtaining satisfactory working with any set. In Fig. 1 the usual standard arrangement is shown for an A.C. and a D.C. mains unit, and it will be noted that there is a smoothing choke in the H.T. positive lead. This has a certain inductance value, and is rated to pass a maximum current of so many milliamps. When this is exceeded, the choke will become saturated and this will cause hum troubles to be experienced, whilst in some cases a resistance will be included in series with this choke and the output voltage is calculated by allowing for a certain voltage drop through that resistance. Thus, if the current used in the calculation is exceeded there will be a larger drop through the resistance, and this will result in a lower output value than is marked for the unit.

The above are the two main difficulties which are experienced by the average listener, but, unfortunately, there are a number of additional troubles which will now be explained.

S.G. and Det.

Many units have sockets marked S.G. or DET., in some cases a single socket having both markings, and in other cases there are two sockets, each bearing these marks. The general indication given by these marks is that a voltage of between 60 and 100 is available at those points with a current of three or four milliamps. In some units this low voltage is obtained by means of a large resistance connected to the H.T. positive line as shown in Fig. 2.

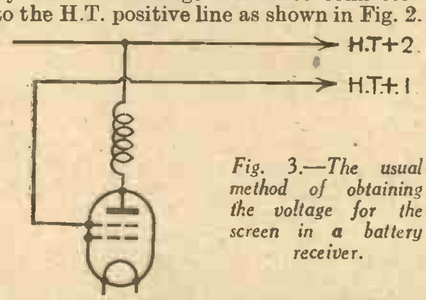


Fig. 3.—The usual method of obtaining the voltage for the screen in a battery receiver.

The units of this type should work quite satisfactorily if the receiver is provided with a single lead feeding only the screen or the detector. In some circuits, however, it may be found that the screen of the H.F. valve is joined to the lead feeding the anode of the detector valve, and although the set will work satisfactorily when such a lead

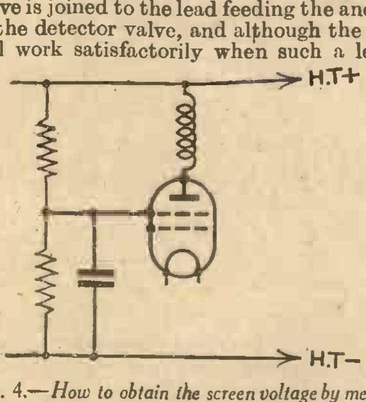


Fig. 4.—How to obtain the screen voltage by means of a potentiometer.

is joined to the 80-volt tapping on an H.T. battery it will probably be found that by joining it to the S.G. socket on some mains units, instability (motor-boating) will result. In such a case the two points in the receiver should be separated, and the screen voltage obtained by means of a potentiometer across the H.T. supply, and the detector anode voltage only supplied by the tapping. Figs. 3 and 4 show the old and the new arrangement, and the potentiometer will have to be chosen to provide the correct voltage for the screen, which varies with different types and makes of H.F. valve from 60 to 100 volts.

Decoupling

With some receivers it may even be found impossible to use the S.G. or detector outputs of a mains unit, due to the particular design of the circuit, and in cases where experiments with different output leads do not enable a satisfactory arrangement to be found the best plan is to re-arrange the circuit so that only one H.T. positive lead is needed, the remaining voltages in the set being obtained by means of series resistances which act as decoupling units, the arrangement being completed by a fixed condenser joined between earth and the component in the anode circuit to which the resistance is joined. This is shown in Fig. 5, where the original leads are shown by the broken lines, and the new wiring is indicated by the heavy lines. Provided that the unit will deliver sufficient current and voltage this alteration should enable any type of mains unit to be used with a battery receiver, although in the case of a set designed for use on the short waves it will probably be found necessary to introduce much more effective smoothing as hum is very troublesome on the short waves with such a combination. One way of removing the trouble is to use a second smoothing choke, connecting this in the lead to the detector valve in place of the decoupling resistance R, shown in Fig. 5.

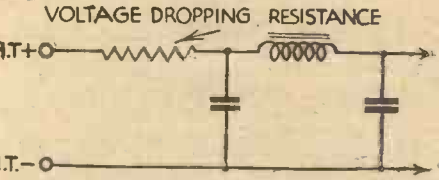


Fig. 2.—A voltage dropping resistance is sometimes included in the H.T. positive lead as shown here.

Making the Calculations

If a receiver is built and tried with a mains unit, with unsatisfactory results, the first step is to obtain a good H.T. battery and try the set with that. If the results are still unsatisfactory, you will immediately know that the circuit or the receiver wiring is at fault, and steps should accordingly be taken to remedy the trouble. If the set works with a dry battery but fails to function with a mains unit, the current should be checked, and the mains unit tested with a good meter (remember that a high-resistance meter should be used for reliable tests). If the unit is in order the

(Continued on next page)

USING THAT ELIMINATOR

(Continued from previous page)

next step is to modify the receiver wiring to conform with the remarks in the previous paragraph. The most satisfactory way of doing this is to reconnect to the dry battery and experiment with the voltages at each anode until maximum results are obtained. Next include a good milliammeter in each anode circuit in turn, and note the exact current which is shown. From the output given by the mains unit you can then calculate the values of the resistances which have to be joined in each circuit to the total given by the eliminator, and the answer divided by the number of milliamps shown by the meter. The answer is the number of thousands of ohms required. An example will make this quite clear, I hope. For instance, if the detector stage is found to pass 5 milliamps when working with 80 volts on the anode, and the mains unit delivers 150 volts, the resistance required is 80 from 150 divided by 5 $\left(\frac{80-150}{5}\right)$, or 14,000 ohms. This could be made up by using two or more resistances

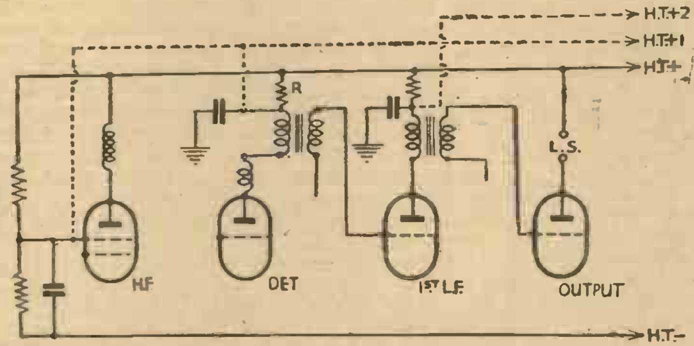
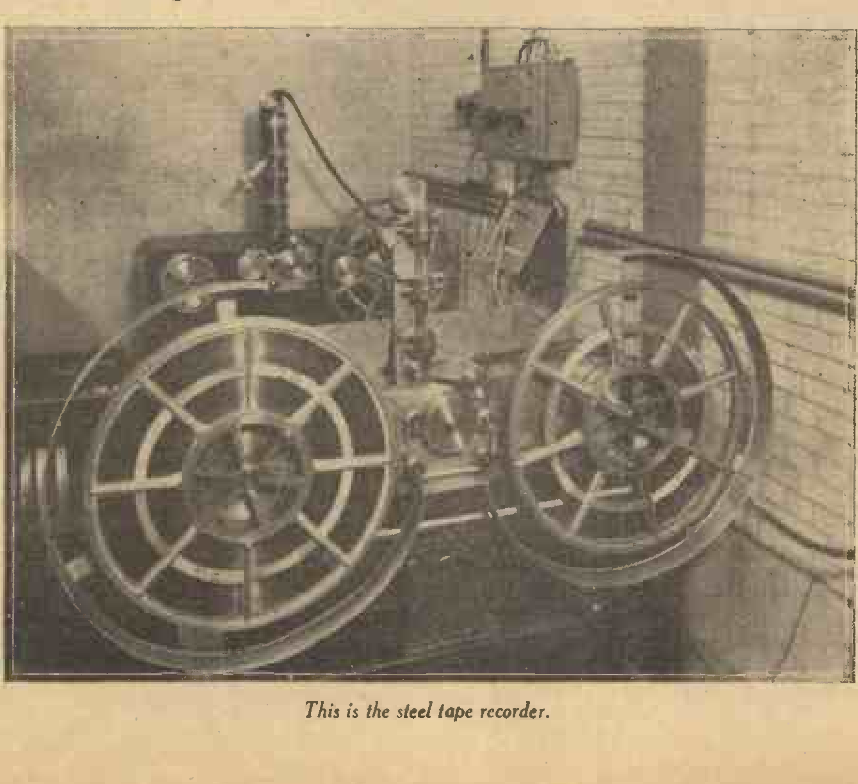


Fig. 5.—Skeleton diagram of a battery receiver showing the modification necessary for using a single H.T. feed. The usual separate battery leads are shown by the broken lines.

leave the voltage which is required as indicated by the battery tests. For the benefit of those who are not familiar with the method of working out such resistance values it may be mentioned that the simple formula of Ohms Law is used, the voltage required at the anode being deducted from in series, or by using a 15,000 ohm resistance, the slight difference not being of great importance, but where an exact value is not available it may be worth while to carry out one or two experiments to find whether the nearest value below or above is most effective.

THE BLATTNERPHONE

THE accompanying illustration shows the apparatus which is familiarly referred to as the Blattnerphone, which is used for recording the broadcast programmes on a steel tape. A modification of this apparatus is used by the B.B.C., and is known as the Marconi-Stille apparatus, and it has the advantage of enabling high-quality recordings to be made, which may be removed by simple means, and which enables reproduction without background noises to be obtained. The tape passes through a magnetic system and the recording is made by means of a varying magnetic field. In the illustration, which shows the apparatus to be used at the new Brussels station, the tape passes vertically down through the gaps and it is possible to play the "record" back immediately, using one gap for recording, one for play-back and one for wiping out the record.



This is the steel tape recorder.

Important Broadcasts of the Week

***NATIONAL* (261.1 *m. and* 1,500 *m.*)**
Wednesday, January 26th.—Symphony Concert from the Queen's Hall, London.
Thursday, January 27th.—Hill Billy programme.
Friday, January 28th.—Kentucky Minstrels programme.
Saturday, January 29th.—Music Hall programme.

***REGIONAL* (342.1 *m.*)**
Wednesday, January 26th.—Band programme.
Thursday, January 27th.—Table Tennis: a commentary from the Albert Hall.
Friday, January 28th.—I Remember: Orchestral and choral programme.
Saturday, January 29th.—Chamber Music.

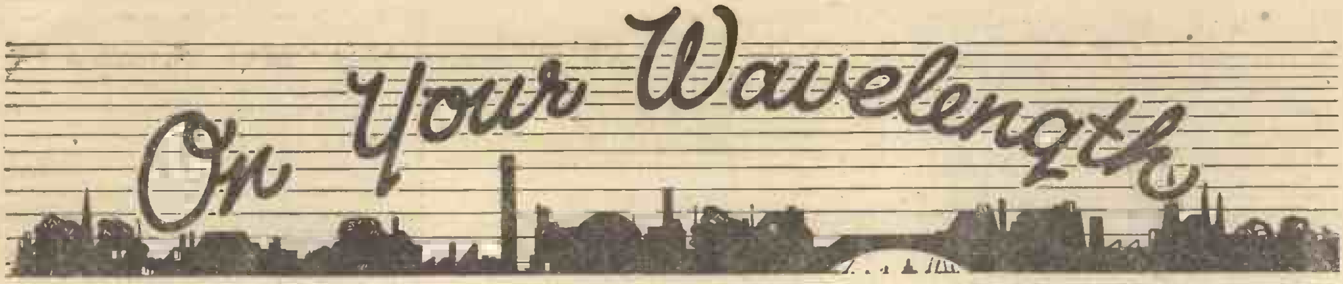
***MIDLAND* (296.2 *m.*)**
Wednesday, January 26th.—Choral programme.
Thursday, January 27th.—Orchestral concert from the Town Hall, Birmingham.
Friday, January 28th.—I Remember; Orchestral and choral programme.
Saturday, January 29th.—The Furnace, a Black Country play by Francis Brett Young and William Armstrong.

***NORTHERN* (449.1 *m.*)**
Wednesday, January 26th.—An excerpt from Babes in the Wood, from the Empire Theatre, Liverpool.
Thursday, January 27th.—Ghost Hunters—2, a serial shocker.
Friday, January 28th.—Variety from the Theatre Royal, Stockport.
Saturday, January 29th.—A running commentary on the second half of the International Rugby League Match, England v. France, from Odsal Stadium, Bradford.

***WEST OF ENGLAND* (285.7 *m.*)**
Wednesday, January 26th.—They Made the West: A chronicle of English History—2, The King's Men, a talk.
Thursday, January 27th.—Band concert.
Friday, January 28th.—Great British Organ Music—8, The Victorians: Organ recital from St. Andrew's, Plymouth.
Saturday, January 29th.—Squash: Commentary on part of the finals in the Inter-County Competition, South West Area, from the Torbay County Club, Torquay.

***WELSH* (373.1 *m.*)**
Wednesday, January 26th.—The Changing Face of South Wales: A Stampede from the Area, talk for Discussion Groups.
Thursday, January 27th.—Organ recital from Windsor Place Presbyterian Church, Cardiff.
Friday, January 28th.—Programme of Welsh Music.
Saturday, January 29th.—Welsh Song recital.

***SCOTTISH* (391.1 *m.*)**
Wednesday, January 26th.—Picture Gallery, or Cinecisms: a satirical side-line on films and film artists.
Thursday, January 27th.—Reid Orchestral Concert, from the Usher Hall, Edinburgh.
Friday, January 28th.—Orchestral programme.
Saturday, January 29th.—Sandy McCrowe, a comedy by Arthur Black and C. B. Forbes.



By Thermion

Gladly Will I Change

"IF any man can convince me that I do not think aright, gladly will I change, for I search after truth by which man never yet was harmed." Those are the words of Marcus Aurelius, and gladly will I change my views when I am convinced that they are wrong. No one has yet so convinced me that my views on the average service man are wrong. I continue to receive numbers of letters concerning poor service. If you know of dealers in your district who sympathetically treat home constructors, and carry a reasonable stock of components, and are reasonably capable people, I shall be glad if you will let me know their names and addresses so that I can compile a white list for the benefit of other readers who write to me.

Story

ONE of my readers, who is employed in that famous trade which dates back at least to the building of Solomon's Temple (he is a bricklayer), tells me the following:

"We get some rather nasty cold jobs, and to-day was no exception to the rule, for we have had a hard, wet day laying a drain. I wish to avoid being too technical, but perhaps it is enough to say that the cutting was forty feet in length, two feet wide and 'had a fall' from four feet to nine feet six, and most of it was through cold, wet, clinging clay. On top of the physical strain of slipping about in a narrow trench for eight hours, there is the mental worry wondering whether the drain would pass the very exacting tests imposed by an even more exacting City Engineer; so I returned home feeling tired and dispirited.

"I turned on the wireless quite haphazard and relaxed, when, judge to my amused horror, I heard a 'female' voice say, 'And now we come to the drainage; all we require is a trench from the house to a cesspool, laid to a suitable fall, and some earthenware pipes which must be fastened with strong mortar. Probably you will not believe me when I tell you that it is quite a simple job.'

"Sadly I reached for the switch; to think that I had spent eight hours on a job that was simplicity itself, and which could be dismissed in as many minutes by a female."

Why So Few Club Journals?

I WONDER why it is that there are so few club journals in the hobby of wireless. If you take the pastime of cycling and similar hobbies you will find that there are hundreds of well-produced club journals which help to keep interest together. In the wireless club movement I do not know of one printed journal, although I know of several duplicated efforts. Now a club journal can be a most important part of a club, particularly if it is run on bright lines with a certain amount of leg pulling. I suppose the trouble is to find the editor, but the local reporter or someone on a local newspaper can usually be persuaded to help both on the printing and editorial side, and local dealers may be helpful in providing one or two advertisements to help pay for the production. With a hundred copies or so the cost is not great. Which will be the first club to produce a really live club journal? I am referring to local club journals.

Sunday Television in April?

JUST a small whisp appears on the horizon. It may be the small puffs of smoke issuing from the small television factories which are pioneering television. It modestly approaches, like the violet, but may vanish upon the silent summer heaven, scared of the interests which are waiting to throttle it. However, we are promised that we may have an hour of television on Sundays from 9 p.m. to 10 p.m. as from April. We have been promised so many things with television without the goods being delivered that I shall believe it when it is a fact, and not before. Whilst the Post Office can find £200,000 for a relay experiment over the telephone system at Southampton nothing can be afforded for television. We see the licence figures gradually flattening out. The increase for 1937 was 523,000 as compared with 574,000 for 1936 and 634,000 for 1935. We must in a very few years approach the peak, and we shall require the novelty of television to reawaken interest, and to help create sales. It is not that television is without entertainment value, for there are many excellent receivers on the market. No one is going to buy them under the inducement of present programme material. Once the programmes are developed sets will sell. Apparently the B.B.C. wants the public to buy the sets before it will put out the programme, which is, of course, absurd.

"Lines on the Map"

I UNDERSTAND that a new series of programmes is to be introduced to listeners on January 27th with a broadcast entitled "Communication by Land." Bearing the title "Lines on the Map," the series is intended to increase the knowledge of Imperial enterprise.

At present it is proposed to broadcast four programmes dealing with various aspects of communications, showing how speeding up, modernisation and specialisation tend to alter the whole bases of Empire travel. Owing to time limitation (the programme will last thirty minutes) the broadcast cannot possibly be comprehensive. It is proposed to take special aspects and make them both vivid and amusing. For instance, the bicyclist, so often overlooked in broadcasting, and upon whose existence so much industrial organisation depends, is being represented in a series of two-minute talks, "I bicycle to work." One of these will be recorded in India, another in Canada and one in England.

John Pudney and Leslie Stokes will be responsible for this production.

G.E.C. Television Research

IT is interesting to note that the regular broadcast of the British Broadcasting Corporation's television station at Alexandra Palace, London, began in November, 1936, so that we are now commencing the second year of high-definition television. The decision to use only the 405-line system was made early last year, and simplified the problems of receiver design. The television section of the Research Laboratories, in co-operation with the G.E.C. Telephone Works, developed three new television receivers which were demonstrated at the Olympia Radio Exhibition in August.

Two of these receivers, with picture sizes 10in. by 8in. and 13½in. by 11in. respectively, have cathode-ray tubes mounted vertically, the picture being viewed in a mirror on the underside of the open lid of a table height cabinet. This arrangement permits of the incorporation of all-wave broadcast facilities without undue bulk. In these receivers sparkling pictures have been presented, which are many times as bright as those produced by earlier efforts ; moreover, a higher standard of quality has been attained. The third model makes a notable advance towards the ideal of popular television, being a " vision only " receiver ; it is arranged, however, to operate as a frequency transformer on the sound channel. A pair of leads from the television receiver can be plugged straight into the aerial and earth terminals of any normal medium-wave broadcast receiver, so that this will reproduce the sound accompaniment to the picture. With a picture size of 7in. by 5¾in., excellent entertainment value is provided.

In addition to the immediate development work outlined above, continual investigation has been made into problems of far wider scope. Of great importance has been the successful completion of the 405-line interlaced transmitter, which is of the disc type for the televising of films. During the past year three new cathode-ray tubes have also been developed for television receivers. The popular 12in. tube has been retained but is entirely re-designed to give a picture of higher brightness and more pleasing colour. The picture brightness now has an intensity of three to four times that of the old design.

Car-radio Interference

I FIND from my postbag that the use of car-radio is on the increase. Many readers have built receivers, and quite a lot of them are using ordinary portable sets with a car aerial. Several of them apparently find that they are unable to eliminate entirely the interference set up by the car electrical circuit, and ask my advice.

There is no set " rule-of-thumb " method. Sparking-plug and distributor suppression resistors are necessary, whilst condensers should be connected across the dynamo and

Short-wave Coils

IN certain experimental short-wave apparatus, especially transmitters, a self-supporting coil is needed to keep down to a minimum various losses which might be encountered if a solid former were used to support the coil. There are several ways of making such a coil, and one of the most reliable, and simple, is to wind the necessary turns round a glass bottle of suitable diameter. All turns should be placed tightly side by side using a heavy gauge of wire, and when completed the turns will spring open and automatically space themselves. To keep the turns in position to avoid changes in the inductance value a thin strip of celluloid may be cemented along the turns at intervals, using ordinary amyl acetate for the adhesive, or a collodion cement. As a makeshift for test purposes, the thin adhesive strips of paper now used for parcel packing may be used.

Assembling L.F. Chokes

WHEN making certain types of L.F. choke a constant inductance effect may be obtained by leaving an air-gap in the core. Standard laminations are available of such a size that when assembled the necessary gap will be obtained, but it is sometimes found that in the process of assembling these laminations the gap becomes short-circuited owing to one lamination not laying quite straight. A good hint to ensure that the gap is preserved is to place a thin piece of mica, celluloid or similar material in the gap of the first lamination and keep it in position as the remaining pieces are assembled. When completed it may be cut or knocked out.

A Level Indicator

USERS of large amplifiers or public address equipment often need some form of level indicator, especially where the user is unable to hear the output clearly. The " Magic Eye " tuning device may be used for such a purpose, fed through a rectifier from the output terminals of the equipment. The grid of the indicator should be connected to the arm of a volume control joined as a load across the rectifier and thus adjustments may be made, and as the deflection of the average type of indicator follows approximately a logarithmic law it will give a very true indication which may be used to judge the output. The control and value should be adjusted so that the shadow area on the target becomes zero at a convenient level, and this may be the point of overload or full modulation. When this level is exceeded there will be a bright line of light on the target.

contact breaker. When using a very sensitive receiver, however, it is sometimes found that corroded and dirty connections, or even rubbing between two parts of the metal body cause a form of static. It is necessary to check each possible source of trouble in turn, and a good deal of patience is required in many instances.

S O S Broadcasts

IT is interesting to note that through the willing co-operation of listeners in all parts of the country more than half the total of 1,213 S O S and Police Messages broadcast from all B.B.C. transmitters during 1937 were successful ; the percentage was actually 50.79.

The biggest of the four general sections into which these broadcasts are divided was again that for relatives of persons dangerously ill, and of the 823 broadcasts of this kind, 472 (or 57.36 per cent.) are known to have been successful ; the result of 66 of these S O S's it has not been possible to ascertain.

The significance of so large a proportion of successes is emphasised by the fact that these broadcasts are made only when all other means of communication have failed. Of the 318 appeals for witnesses of accidents 121 (38.05 per cent.) were answered. Six of the 26 broadcast messages designed to assist the police in the investigation of crime are known to have been successful, a percentage of 23.08. Of the 46 " special " Police Messages, 17 (36.96 per cent.) met with success. Analysis of the results in the Crime and " Special " sections may appear to show an unduly high percentage of failure, but it must be remembered that in helping to trace either criminals or missing drugs, the co-operation of the B.B.C. with the police authorities is only part of the general investigation.

The Leipzig Fair

I HAVE received some advance information concerning the Leipzig Spring Fair, 1938, which is to be held from March 6th to 14th, inclusive. The Fair's present-day size and importance is a direct result of the development of trade generally since the days of the nineteenth century, the growth in the manufacture of finished products, and the consequent international trading therein. The Leipzig Fair has always been able to derive profit from this development, because it could do what other forms of trading were not in a position to do, namely, to make personal contact between the buyer and the seller in the form of an array of goods or samples.

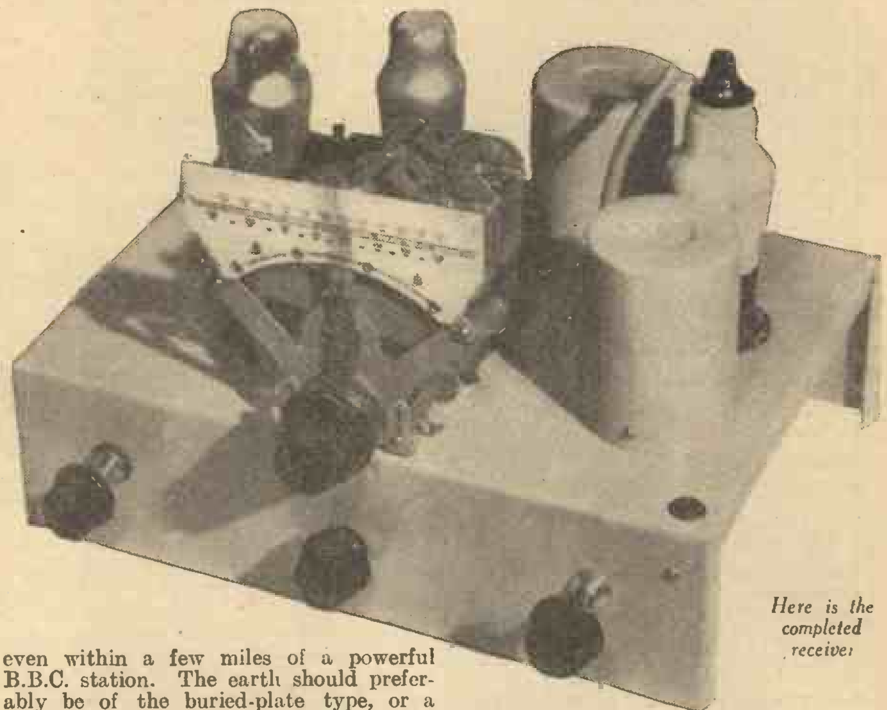
OPERATING THE TRIBAND THREE

How to Trim and Adjust this New Battery All-wave Receiver, and Suggestions for Tuning on All the Wavebands Covered

IN the main constructional details given last week we advised readers to remove the trimmers on the gang condenser, and we find that there is apparently a little confusion as to what is meant by removing these trimmers. On top of the condenser will be found a slotted tubular nut over a flexible plate on top of each section of the condenser. The nut should be removed and the flexible plate bent upwards to its fullest extent so that there is no risk of the plate shorting on to the threaded bolt which is left projecting. If the mica is removed it is still more important to guard against short-circuiting, and thus care should be taken to bend the top plate to such a position that there is no trimming capacity and no risk of short-circuiting. A further constructional point which might be emphasised is that the screening sleeves which are used over certain wires must be effectively earthed if they are to fulfil their function of screening. Therefore, a piece of bare connecting wire should be wrapped two or three times round the sleeving, and the soldering iron, carrying a good drop of solder, should be allowed to run over it so that a really sound joint is made. If the iron is not hot enough it will have to be left in position for some time, and this might result in the internal insulation being burnt away. Therefore, use a really hot iron, well tinned, and make certain that the sleeving and binding wire are thoroughly cleaned.

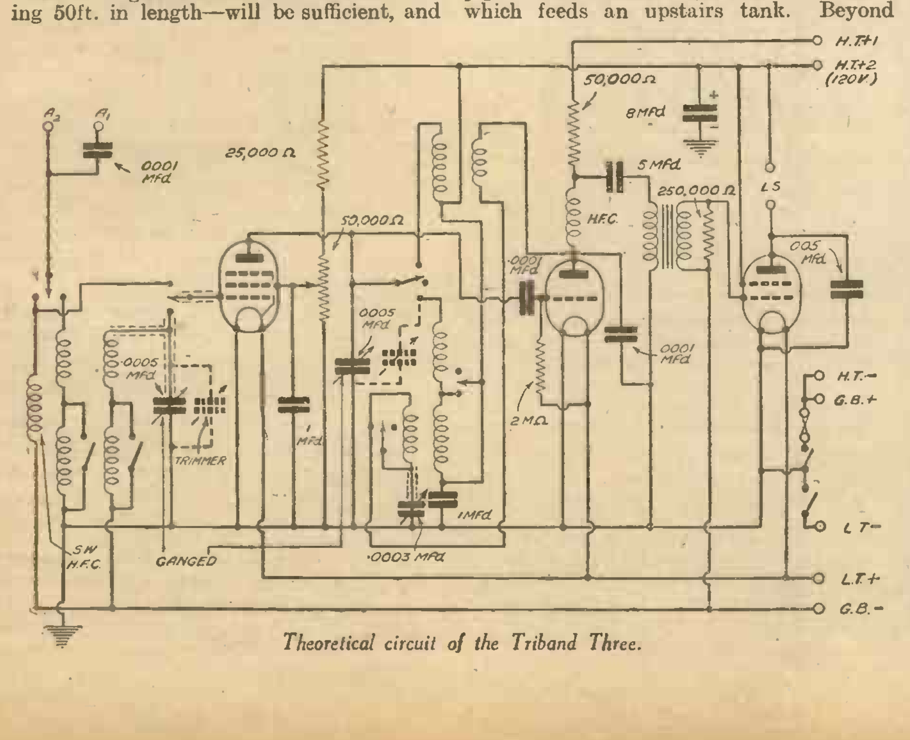
Testing the Set

A good aerial and earth are necessary, and as the receiver is used for short-wave reception the aerial should not be too large and the earth should be really efficient. In most cases it will be found that a medium length of aerial wire—not exceeding 50ft. in length—will be sufficient, and for best results a short vertical wire is often preferable. A total length of 10 or 15ft. will in most cases give adequate range and will avoid the trouble of directional reception, whilst it will also ensure that no selectivity difficulties will arise even within a few miles of a powerful B.B.C. station. The earth should preferably be of the buried-plate type, or a chemical earth which may be relied upon to give a low-resistance path. If a water-pipe has to be used, try to connect to the pipe which enters the ground, not the one which feeds an upstairs tank. Beyond these points the receiver may be connected up, using the following H.T. and G.B. voltages. The H.T.— plug should be inserted into the negative socket on the H.T. battery and the H.T.+2 plug in the 120-volt socket. The H.T.+1 plug should then be inserted for preliminary tests in the 80-volt socket, but it may be found later that a different voltage will give better results.



Here is the completed receiver

The G.B.+ plug should be inserted into the positive socket on the G.B. battery, and the negative plug into the 4.5-volt socket. An increase in signal strength will be obtained if this voltage is reduced, as it will result in an increase in the efficiency of the H.F. stage. On the other hand, however, it will increase the anode current of the output valve, which it also feeds, and this will result in the H.T. battery becoming discharged quicker. Consequently, when the receiver has been adjusted and results obtained, the G.B. negative plug should be moved to the highest socket consistent with clear signals and good sensitivity. Connect the L.T. spades to the positive and negative terminals on the accumulator, and the set is ready for test.



Theoretical circuit of the Triband Three.

Trimming Adjustments

On the right of the chassis will be found a small trimmer, with a similar one at the rear, and these will trim the coils for the medium and long waves only. Turn the reaction control (centre lower knob) as far as it will go in an anti-clockwise direction and turn the set on by turning the left-hand control clockwise. The first part of the movement will switch the set on

(Continued overleaf.)

OPERATING THE TRIBAND THREE

(Continued from previous page)

and the volume control, which is operated by the same knob, will then be at minimum. Further rotation will result in a build-up in the strength of the signal, and if oscillation takes place (with the centre knob still at zero) the bias voltage should be adjusted to a higher value. If you cannot cure it by this adjustment it will indicate that the wiring is incorrect or that interaction is taking place, but if carried out exactly in accordance with the wiring diagram the set should be perfectly stable throughout all the wavebands covered, with the volume control at maximum.

LIST OF COMPONENTS

One metal chassis, drilled and fitted with coils, switch and two trimmers (Peto-Scott).
One 2-gang Bar type .0005 variable condenser (C1 and C2) (Polar).
One S.M. drive, horizontal, type S.L.11 (with degree dial) (J.B.).
One microfuse and holder, 100 mA (Microfuse).
One socket strip, E, A1, A2 (Clix).
One potentiometer with switch (3-point), 50,000 ohm. VM 36 (R2) (Bulgin).
One L.F. transformer, "Senator" (Bulgin).
One all-wave H.F. choke, H.F. 15 (Bulgin).
One reaction condenser "Dilecon," .0003 (C3) (J.B.).

FIXED CONDENSERS

One T.C.C. 8 mfd. "F.W." 150-vol (C11) (T.C.C.).
One .005 mfd., type 300 (C10) (T.C.C.).
Three .0001 mfd., type 300 (C4, C7 and C9) (T.C.C.).
Two .1 mfd., type 250 (C5 and C6) (T.C.C.).
One 0.5 mfd., type 250 (C8) (T.C.C.).

RESISTANCES

One 2 meg. ½-watt (R3) (Erie).
One 25,000 1-watt (R1) (Erie).
One 250,000 ½-watt (R5) (Erie).
One 50,000 1-watt (R4) (Erie).

VALVEHOLDERS

One 4-pin chassis-mounting valveholder
One 5-pin chassis-mounting valveholder
One 7-pin chassis-mounting valveholder
} standard (Clix) type

VALVES

One 220 H.P.T. (V1) (Cossor).
One 210 Det. metallised (V2) (Cossor).
One 210 V.P.T. (V3) (Cossor).

PLUGS

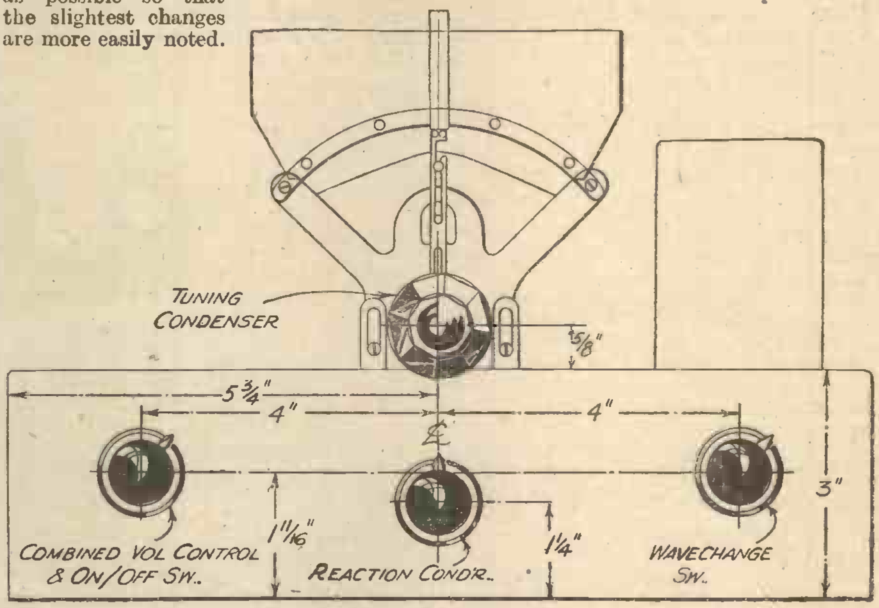
H.T.—, H.T. +1, H.T.+2
G.B.+, G.B.—1

SPADES

L.T.+, L.T.—
} (Belling-Lee.)

One speaker (Stentorian Junior) (W.B.).
One H.T. battery, 120-volt (Exide).
One bias battery, 9-volt (Exide).
One accumulator, 2-volt (Exide).

Turn the tuning knob until the local station is heard, and this should be possible even with the trimmers well out of adjustment. As soon as it has been located, turn up the volume a little more and then commence to adjust the two trimmers. Use a long pointed implement for this purpose to remove any hand-capacity effects, and it will be found that there is quite a critical setting which gives sharp tuning, and it should hold at all parts of the scale. Swing the tuning control backwards and forwards whilst making this adjustment, and keep the volume as weak as possible so that the slightest changes are more easily noted.



Dimensions for drilling a panel or cabinet for the Triband Three.

The Short Waves

On the short waves the trimmers are out of circuit and, therefore, once they have been adjusted for the medium and long waves they should not be touched again. To receive distant stations the reaction control may be used, and it should be found on this set that there is a gradual build-up in volume as this control is rotated clockwise, and the set should not burst into oscillation until the control is nearly at maximum. It should then be a smooth falling into oscillation which should cease immediately the control movement is reversed. If there is an overlap—that is, the oscillation does not cease until the knob has been turned a long way back, the voltage applied to H.T.1 should be adjusted. A position should be found where the action of this control is just as smooth as the volume control, and by this means long-distance stations may be brought up to comfortable volume and short-wave stations will be tuned in quite easily.

Final Notes

The three ranges covered by the set are from 18 to 52 metres, 200 to 550 metres, and 900 to 2,100 metres. The total H.T. consumption is approximately 10 milliamps, although, as already mentioned, this will depend upon the voltage applied to the G.B. negative lead. It should be noted, incidentally, that the positions of the wave ranges are the reverse of those given last week—that is, the short waves will be found when the wave-change switch is turned as far as possible in a clockwise direction, and the long waves when the switch is turned anti-clockwise.

NEWS FROM THE TRADE

Beethoven Amalgamates

BEETHOVEN RADIO, LIMITED announce that they have amalgamated with Messrs. Wilkes, Berger Engineering Co., Ltd., as a result of which the name has been changed to Beethoven Electric Equipment, Ltd. They intend to manufacture and market, in addition to the radio receivers, an extensive range of domestic electrical appliances. The policy and management remain unaltered.

Radiomart Manual

WE have received a copy of the new Manual from G5NI, the well-known Birmingham dealer. In addition to valuable technical data and circuit details given in this manual there is a complete table of American valve data and other information of the greatest value to the transmitter and ordinary listener. The cost of the manual is 7½d. by post.

Cellulose Cement

MESSRS. HOLIDAY AND HEMMERDINGER announce that they have now introduced a double-size bottle of the cellulose cement which was recently reviewed in these pages. The new size contains twice the quantity of the original bottle and costs 2s. net. The price of the original small bottle has been reduced to 1s. 3d. net, carriage 6d. extra for each size. This material is particularly useful for repairing speaker cones, coils, etc.

New Bulgin Lines

MESSRS. BULGIN announce that they will shortly be able to supply Octal cable plugs, bakelite shrouds for E.S. barretter lampholders, new type D.41 panel lights, acorn valveholders with a new type of contact, and a new type of valve top connector. Details will be given as soon as they are received.

18-Valve Chassis

C. F. WARD, of Farringdon Street, announces a new 18-valve superhet chassis which is shortly to be placed on the market. This will comprise a coil unit for superhet. work, all the necessary valves and a Rola G12 loudspeaker. The price will be 30 guineas. At a later date the coil unit may be available separately.

Philips Radio

MESSRS. PHILIPS announce that no new models will be introduced until the early summer, and the present range will be continued without decontrol of list prices.

Osram Valve Price Reduction

THE price of the DA100 Osram valve has been reduced from ten guineas to eight guineas. This power amplifying triode, with its indirectly heated filament, has established itself as one of the most reliable and stable types yet introduced for large power output. It is capable, under suitable circuit arrangements, of an anode dissipation of 100 watts.

VALVE CHARACTERISTICS—4

Electrode Assembly and Efficiency Factors are Dealt With in this Fourth Article of the Series

SO great is the diversity of shapes and sizes, spirals and hairpins, that a cursory glance at the electrode assemblies of modern valves suggests that they have come into being more by accident than design.

There are upwards of nine hundred valves on the British market to-day, but one and all have been evolved after much thought, care, and experiment. Readers of PRACTICAL AND AMATEUR WIRELESS will be aware that valves must vary greatly to suit their application, but no little speculation must be caused by the radically different appearance of types designed to fill precisely the same function, although interpreted differently by manufacturers.

Valve design is a most absorbing subject, and reveals great ingenuity in bringing about desirable characteristics and avoiding those that militate against efficiency. There are several ways in which the fundamental principles of valve design could be approached, but the most logical is perhaps the individual consideration of each electrode, starting from the middle and working outwards.

The Filament

The filament, or in the case of a mains valve the cathode, must fulfil three requirements: long life, high emission, and freedom from occluded gas. Cathodes are usually made of nickel, and of oval cross section which permits the easy entry of the doubled hairpin-shaped heater, and does not easily become mechanically distorted under the influence of heat. Filaments are usually made of nickel or tungsten, drawn with great accuracy through diamond dies and carefully annealed to avoid brittleness, and in the case of tungsten, treated in a special manner to avoid the metal adopting a small crystalline structure, which would result in premature breakage.

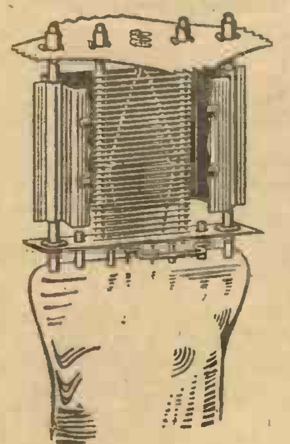


Fig. 2.—A typical triode; note the close spacing of the electrodes. The filament is held at each side by insulated hooks to keep it taut.

Metal, in the generally accepted sense of the word, will not emit electrons unless heated to a high temperature, so filaments and cathodes are coated with a substance that will allow the prolific emission of electrons at a relatively low temperature. Whatever the method of coating, the substance usually has a base of earth oxides called barium and strontium, although the exact formulas are carefully guarded secrets. Unless the valve is a diode, the filament or cathode will have a grid completely surrounding it (speaking electrically) and as close to it as possible, because the slope of the valve will increase with the proximity of the grid. Broadly speaking, the slope of the valve is proportional to the wattage of filament or cathode, and inversely proportional to the distance between the emissive coating and the grid.

It is impracticable to reduce this distance beyond certain limits, owing to the danger of short-circuit and the grid becoming heated to a dangerous point. Sooner or later a fractional amount of the emissive coating is bound to become lodged on the grid, which causes it to emit electrons at a comparatively low temperature. Such emission is known as grid emission, a fault which has been discussed in a previous article.

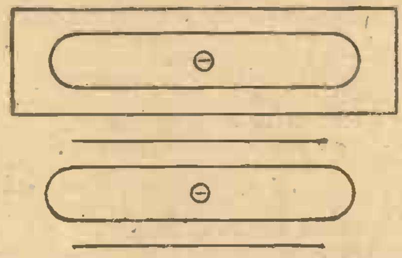


Fig. 1.—Sectional view of two triodes. Although mechanically different they are electrically similar.

Spacing of Electrodes

In order to decrease the safe spacing of these electrodes the grid supports are very often made of copper, a metal that conducts heat very readily and thus carries away heat from the grid as a whole, preventing the temperature from accumulating. The actual grid turns are usually made of nickel, nichrome, or molybdenum, the former having the advantage of easy manipulation while the latter is identified by its strength, high melting point, and the ease with which it may be freed from occluded gas.

The nature of the next electrode varies according to the type of valve; a triode will be used as the first example, which will mean that the only remaining electrode will be the anode. An anode may take any shape, square, oblong, circular, oval, or two separate flat plates with the grids between them; the factors that matter are free radiation of heat from the grid, freedom from secondary emission, and spacing.

Impedance

The impedance of the valve is largely controlled by the average distance between anode and grid; in low-impedance valves, therefore, the anode is arranged close to the other electrodes, but unless precautions are taken three troubles are likely to arise. Firstly, the great velocity with which the electrons hit the anode will result in electrons being driven off it and getting in the way of the main electron stream and generally being a nuisance. Secondly, in the case of a mains valve, the proximity of the anode to the cathode will cause the former to heat up and emit protons, a feat made possible by the high positive charge of the anode; this danger is avoided by coating the anode with carbon, which will not emit at any temperature likely to be met with, and also permits even distribution of surface temperature.

The third danger is secondary emission from the glass bulb which may form a considerable addition to the anode current. This may have serious results as the electrons from this source are not controlled by the grid; therefore, this contribution would be entirely of a random nature resulting in distortion and reduction of slope.

Before leaving the triode, one or two facts can be usefully summarised. It has been explained that the cathode or filament may take any reasonable shape provided that the coated surface is of adequate area. The grid must electrically surround the cathode, but need not necessarily be of the same section; an oval cathode surrounded by an oblong grid is a common arrangement, and providing the anode is in turn oblong, the whole assembly may be regarded as a cathode surrounded by the grid and placed between two flat anodes, because the narrow end of the oblong is so remote from the cathode that the electrons flowing in this direction will be negligible.

The previous paragraph shows that a triode assembly may have a box grid and a box anode, and yet have sensibly the same characteristics as an assembly with two separate flat grids and anodes. This example will show clearly that two designs which are apparently very dissimilar are, in fact, identical from an electrical standpoint (See Fig. 1). It requires little imagination to see that the purely mechanical difference will enable the valve to be manufactured in a different manner, and the choice of design will be governed by the convenience of the manufacturer, all other factors being equal.

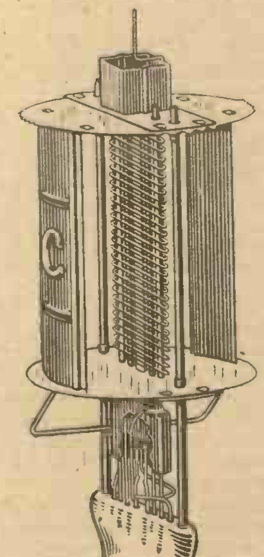


Fig. 3.—A well-designed output tetrode, the Cossor 42 OTDD; note the close spacing of cathode, control grid and screening grid, and the remote position of the anode.

Output Tetrode

The structure of an output tetrode will differ radically inasmuch as an additional electrode is inserted between the grid and anode. This addition, usually termed auxiliary grid or screen, is placed close to the inner grid, and since it is held at a high positive potential it will greatly accelerate the speed of the electrons, so that the anode may be placed in a position remote from cathode and inner

(Continued overleaf)

VALVE CHARACTERISTICS

(Continued from previous page)

grid. Such a structure is inherently very efficient, as the speech output available will be about twice that delivered by a triode (the total H.T. current being the same in both cases).

If such a structure were made without due thought, two troubles would most certainly arise: the screening grid would draw off too many of the electrons and, due to the acceleration caused by the screening grid, they would bombard the anode so violently that secondary emission would produce a cloud of electrons floating about within the anode, or travelling to the screen and producing that queer dipping characteristic associated with a screen-grid valve used with an unsuitable anode voltage.

As a matter of interest it may be mentioned that if the anode were placed in the same position relative to the filament as that obtaining in a normal triode, the electrons would soon raise the anode to incandescence and bring about a total collapse.

Electrode Assembly

In practice a tetrode is designed in the manner shown at Fig. 3. It will be seen that both control grid and screening grid are placed as close to the cathode as possible, and the anode at a safe distance. The latter is provided with two projections to pick up stray electrons and to prevent the formation of an electron cloud; it is also probable that these projections tend to obviate a serious escape of electrons past the edge of the anode.

An alternative design for the tetrode valve is a plain anode, but having the screening grid and control grid so wound and mounted that one exactly covers the other. Whatever the design of a tetrode, there is more similarity between various makes than in any other type because the very nature of the valve demands that the electrodes shall be spaced and designed in accordance with definite principles.

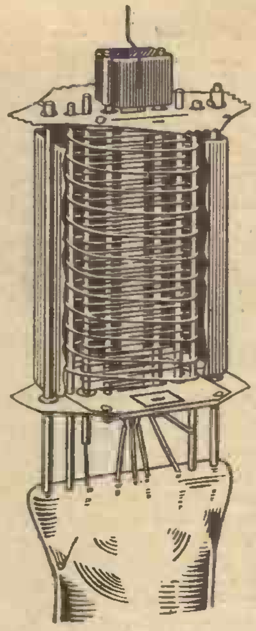


Fig. 4.—An indirectly heated pentode, the Cossor 402 Pen; the relatively close spacing of all three grids can be clearly seen. Observe the open nature of the suppressor grid and also the box cooling fin at the end of the grid supports to assist in cooling them.

"Electron Brake"

The output pentode can be most readily visualised as a tetrode with an "electron brake interposed between screening grid and anode. As already described above, the anode of a tetrode must be placed far enough away from the other electrodes to ensure that the electrons do not impinge upon it at excessive speed. In the pentode, the anode is placed sufficiently close to the other electrodes to avoid nonlinearity of characteristics arising from the screening grid partially assuming control when the signal swings the anode to a low voltage.

Such close spacing would result in tremendous anode bombardment and a big flow of secondary electrons from anode to screening grid, if it were not for the presence of the suppressor grid interposed between them. This grid is connected to the cathode or some other point near to cathode potential, and is, therefore, negative in respect to the screening grid, and although comprising only a few turns, it slows down the electrons so that they arrive at the anode in the normal manner; but this is not all, this grid being negative tends to bar the progress of electrons which approach it at such velocity, however, that they successfully gate-crash. Secondary electrons leave the anode at a comparatively slow speed, and are therefore unable to pass through the suppressor grid, in this way their passage from anode to screening grid is effectively prevented, i.e., suppressed; hence the name of the electrode.

Efficiency Factors

The close anode spacing and the prevention of trouble caused by secondary emission result in the pentode having great linearity of characteristic. This, and other factors too obscure to be gone into here, results in the valve being highly efficient and capable of delivering speech output equal to about half the anode wattage consumed.

The tetrode, which has a similar efficiency factor, is not quite so linear, but if properly designed has a lower impedance which tends to reduce loudspeaker boom, while the remoteness of the anode reduces the capacity between this electrode and everything else which gives improved top-note response.

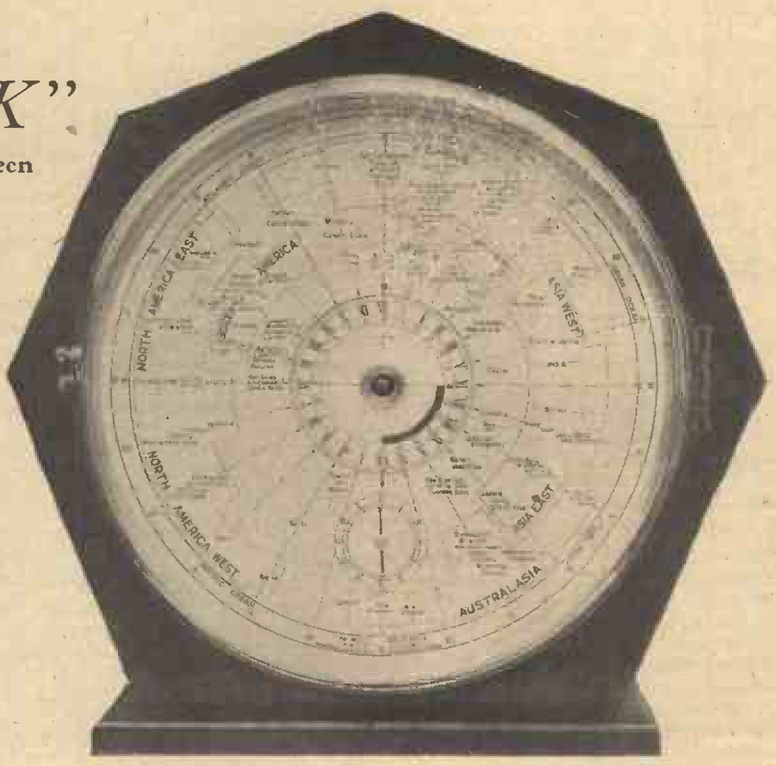
The next instalment of this series will deal with H.F. tetrodes and pentodes, the frequency changers, and the rectifier. The writer hopes that by unmasking some of the secrets of valve design in simple language, readers will more readily understand the manner of their working and will find greater interest when using and selecting valves.

THE WILLIS "WORLD CLOCK"

Details of an Interesting Timepiece for the Keen DX Listener

WHEN listening to long-distance stations, and compiling a log or reception record, some confusion is sometimes found to exist in view of the differences in time in different countries of the world. The accompanying illustration shows a novel form of clock, in which it is possible to see at a glance the equivalent time in all parts of the world, and the dial also takes into account the correction necessary for Summer Time. As will be seen a large fixed dial is employed and this is divided into the various continents, with the majority of the principal towns, islands and states marked thereon. In the centre is a rotating disc, divided into 24 hours and clearly marked for morning and night. At the bottom is a smaller dial divided into 12, round which travels a normal minute hand. Great Britain occupies a position at the top of the dial equivalent to 12 o'clock, and a red arrow indicates the hour on the smaller dial below this, and one hour to the right is a second arrow which is used for Summer Time. The hour dial rotates anti-clockwise, and if the clock is set for this country it is possible to see by merely following along the line corresponding to any country or town the exact time by Greenwich at that point. Where local corrections are necessary the number of minutes to add or subtract will be found printed by the name of the place.

The movement is a high-quality British unit, fully jewelled and reliable.



The complete clock, reviewed here, showing the dial divisions and markings. The dial is 9½ ins. in diameter.

A PAGE OF PRACTICAL HINTS

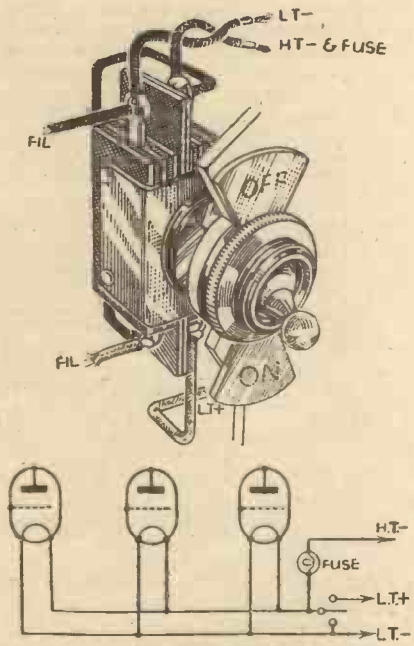
SUBMIT YOUR IDEA

READERS WRINKLES

THE HALF-GUINEA PAGE

Improved Filament Switch

A VERY simple arrangement which I employ to safeguard valves is to replace the ordinary on/off filament switch with a change-over switch, so that, when the set is off, the filaments of the valves are all short-circuited, and no current can therefore pass through them. Thus the



A useful change-over switch for safeguarding filaments.

valves cannot be damaged if the fuse in the H.T. lead blows, and even if there is no fuse included in the set no damage can be done to the valves. The idea only works *when the set is off,* and therefore should be used *in conjunction with,* and not be *substituted for,* a fuse.

I find this device extremely useful in my short-wave set. The fuse rating is correct for all the valves (100 m/A) but, as I am continually making adjustments, removing valves, etc., damage might result if only one valve happened to be in circuit when H.T. was inadvertently short-circuited.—T. R. NISBET (Dunfermline).

An Adjustable Coil-winding Stand

I HAVE found that whilst winding coils, and particularly with fine gauge wire, the insulation, and sometimes the wire itself is apt to get damaged by binding on the edge of the spool head when the spool is vertically mounted, and the wire is travelling upwards to the operator. To remedy the trouble I made an adjustable mounting for a number of coils, as shown in the illustration.

The whole assembly is constructed of wood, whilst the only other fitments required are three hinges, and two brass or steel binding pieces. I fashioned these

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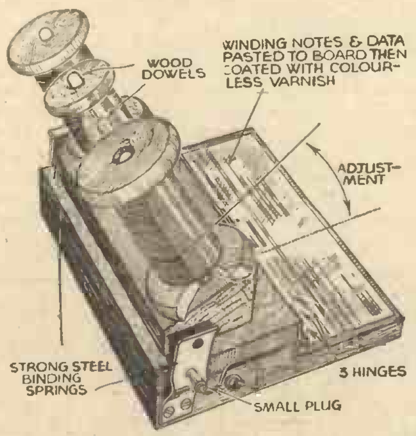
binding pieces out of soft steel strip, and they hold the coil mount in position without the peg or plug in place; however, it is advisable to include this wooden plug on one side at least, and in my case 3/16in. holes in the binding pieces with one corresponding hole in the wooden coil block prove very serviceable.

Wood dowels, ¼in. diam. glued into the mounting block will be found to suit the majority of requirements, and if these are not to hand, ordinary pencils will answer



General view of an adjustable coil-winding stand.

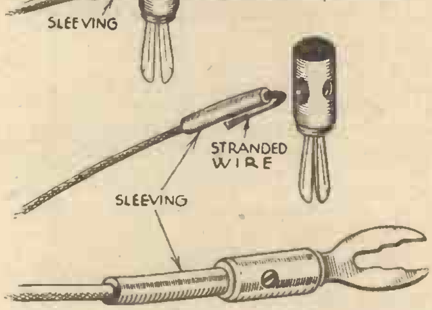
the purpose. I made the base of oak, and allowed sufficient width to affix a sheet on which coil data and miscellaneous notes were compiled. Four small pieces of rubber glued to the under side of the base prevent the whole assembly moving when in use.—D. W. ERWELLS (Blackheath).

Gauntlets for Wander-plugs

TO give a neat appearance to leads having the usual woven covering, which is inclined to fray badly at the ends where connected to plugs and spades, short lengths of insulating sleeving are slipped on, and secured as shown in the accompanying sketches.

The stranded wire is bent back so that the tightening up of the screw, while

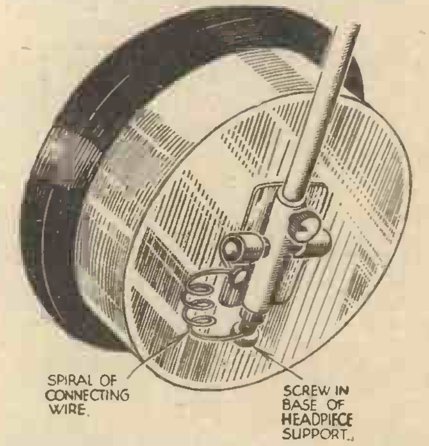
A handy dodge for preventing leads from fraying.



making good contact, holds the sleeving in place.—J. H. MARR (Bathgate, West Lothian).

A Headphone Tip

FOR a long time I was troubled by a crackling in the headphones of my short-wave set, which occurred most whenever the 'phones were moved. Eventually, I traced the trouble to a bad electrical connection between the wire supports and the ear-pieces, which were constructed so that the ear-pieces could swivel about easily in their sockets, but without consideration of the interruption and continual variation of "head-capacity," thus causing bad crackles, and often varying reaction and tuning settings. The remedy was very simple. I merely ran a small spiral of connecting wire (to maintain the swivel action) from each end of the support which goes round the head to the relative ear-piece. This may be modified to suit individual headphones, the only important point being that the faulty swivel-connec-



A method of preventing crackling in headphones.

tion must be short-circuited. In my case there was a small screw at the end of the support, and the other end of the wire was anchored to a bolt in the metal casing of the ear-piece. Alternatively the connection may be soldered, or taken to any convenient screw.—T. N. NISBET (Dunfermline).

Systematic Fault Finding—4

Power Packs, and a Summary of Tests for a Complete Receiver are Given in this Final Article of the Series

TESTS of power packs consist of testing the voltages on the secondary windings of the transformer, on the anodes of the rectifier and across the speaker field and chokes, as shown in Fig. 16. If metal rectification is used, test in the same manner with the exception that in this case there is only one A.C. input to the rectifier. Entire loss of D.C. volts or lower voltage than would be expected indicates, in the former case, either a broken down speaker field, choke or smoothing condenser, and, in the latter case, a leaky condenser. If at the point "A", in Fig. 16, there is a voltage of 350 volts, while on the other side of the speaker field at the point "B" the voltage has dropped to, say. only 100 volts, a good test is to disconnect the smoothing condenser C1, as it is the most probable cause of trouble due to the high voltage surges which it has to withstand. If an electrolytic condenser is used for C2, make sure that it will withstand the A.C. ripple imposed upon it.

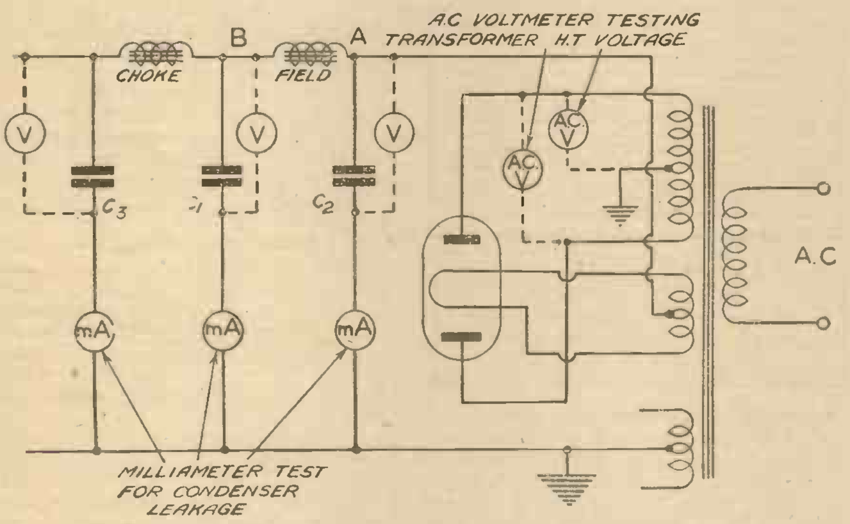


Fig. 16.—Testing a valve rectifier and its smoothing circuit.

Hum may be due to insufficient smoothing caused by a saturated choke or insufficient bypass condensers. Try increasing the inductance of the smoothing chokes and the bypass capacity. Tighten up the core of the mains transformer, and try shielding it in an earthed metal box.

Minimising Hum

If any hum still persists it must be picked up in the earlier stages of the receiver caused by relatively strong fields near grid wires, or interaction between the L.F. and mains transformers. This is easily detected by "earthing" the various grids in turn through a condenser until one is found where the test stops the hum. The faulty lead should be shielded, or, if it is a transformer, the latter should be moved to the position of minimum hum.

A good earth is always essential to keep down hum, while a mains H.F. filter in the mains leads to the receiver is often of advantage. Hum which is only apparent when a strong station is tuned in is due to a bad earth or a difference in potential between the receiver earth and the earthed side of the mains. A mains filter or a .01 mfd. condenser across each half of the mains transformer H.T. secondary winding usually effects a cure. A whole section could easily be written on hum and its prevention and cure, but the short summary given here will, in most cases, suffice to locate its source. Readers are directed to the many articles on this subject which have appeared in these pages.

The Complete Receiver

We have now shown how to test each stage of a receiver, presuming in each case that the fault has been localised. In Fig. 17 is shown the circuit diagram of a simple A.C. mains superhet. Whatever the fault, be it lack of volume, complete failure, intermittent fading, instability, distortion, or hum, it is always a good plan to read the voltages and current of every valve.

First commence in section 1, read the A.C. volts across the transformer H.T. secondary, D.C. volts at the positive terminal of the metal rectifier, through points 1, 2 and 3, with a voltmeter. Presuming all is O.K., proceed to section 2 and apply a voltmeter to the points 4, 5, 6, and 7, and so on right up to the first valve in the order 8-17. Now proceed to read the total current consumption of the receiver by inserting a milliammeter at the point "A," and then read the current consumption (both anode and screen) of each valve in turn. The next step is to measure the bias voltages as shown at 18, 19, 20, and 21, in that order.

You should now be in a position to

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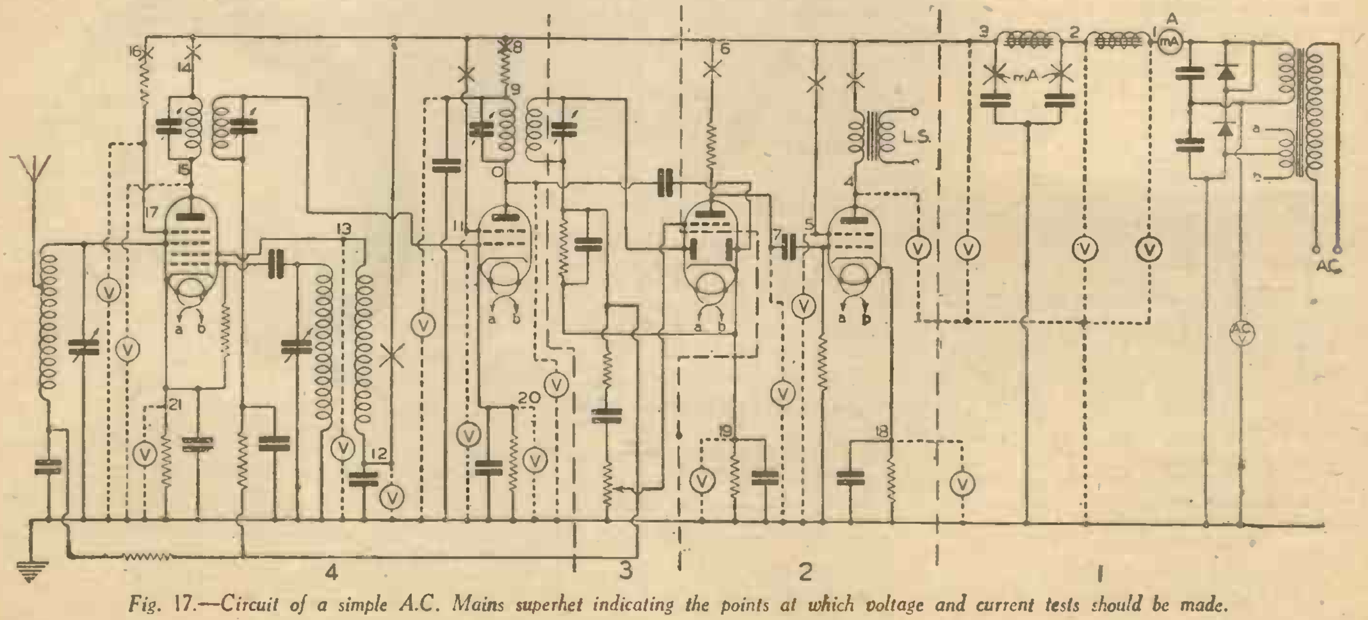
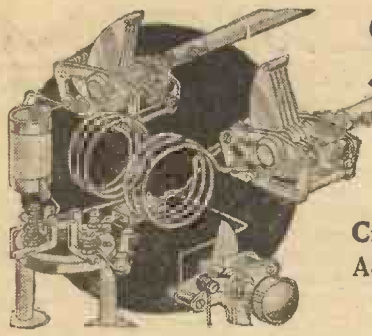


Fig. 17.—Circuit of a simple A.C. Mains superhet indicating the points at which voltage and current tests should be made.



Short Wave Section

Circuit Details for a Sensitive and Easily Adjusted Superhet with Triode-Hexode Frequency Changer and A.V.C.

THE simple detector-L.F. circuit has become almost obsolescent for broadcast reception in spite of its long run of popularity. It proved to be insufficiently selective and not sensitive enough for modern conditions. On short waves this type of circuit is still fairly widely used, but even in this direction its days seem to be numbered. Those amateurs who became so competent in using it for reception over incredible distances are now turning—perhaps with some misgivings—to more sensitive multi-valve superhet circuits. There is apparently a repetition of what happened on the longer wave-bands a few years ago. More and more people are listening to short waves, which has, it seems, something of a "sponge" effect. This in turn means that a more sensitive receiver is needed to keep up with real DX work.

Difficult Alignment

Amateur transmitters, whose success depends just as much on their receiver as on their transmitter, are using an increasing number of valves for reception purposes. Many of them, it appears, are "importing" ready-made communication receivers from America. Why they should not build their own is difficult to understand, but the fact remains that many of them are buying sets. And many of them are having not a little trouble with the sets bought. It is not that these commercial receivers are other than good, but that their accurate calibration and matching is frequently upset during shipment. The purchaser is then left with the difficult task of re-aligning the tuning circuits. Those readers who have ever attempted to make any kind of adjustment to a commercial receiver will understand the difficulties involved.

In many cases the buyers of these "super" sets would have been better off if they had made their own, especially if a good deal of laboratory equipment is not available for re-aligning. It is only in the matter of accurate trimming that the ready-made short-wave receiver can possibly score over a good, home-constructed one. But this does not mean that the constructor must be limited to a third-rate set—far from it.

The Ideal?

It is not a difficult matter to build a highly efficient instrument that does not call for a tremendous amount of skill and a variety of test gear. The question is to know what type of circuit is most likely to give best results. An expensive multi-valve communication receiver with pre-frequency-changer amplifier, followed by a triode-hexode and then by three I.F. stages, second detector and two L.F. stages, with crystal control thrown in and incorporating a beat-frequency oscillator is certainly a "handful," and not the kind of outfit that the average constructor would care to tackle. But a less pretentious circuit arrangement can be used with pronounced success.

A type of circuit that will meet the requirements of most enthusiastic short-wave listeners is shown on this page. It is not necessarily complete, but it will give experienced constructors some ideas for a long-range short-wave set that they might care to build. We do not undertake to supply a blueprint or full constructional details, for this is a case where the reader who is not able to adapt the circuit and translate it in the form of a complete receiver is not recommended to build it. Nevertheless, those who cannot actually make use of the circuit will find it of interest.

With the object of simplifying preliminary adjustments there are only two tuning circuits, although the I.F. transformers make up four more fixed-tune circuits and ensure adequate selectivity. The first stage is that of an aperiodic high-frequency amplifier; the aerial circuit could be tuned, but that would make accurate ganging rather more difficult. In addition to this, however, stability would not be obtained as easily.

Triode-Hexode

The frequency-changer consists of a triode-hexode in a standard circuit, and is followed by a single I.F. stage, which should be used with transformers tuned to 465 kc/s. A second I.F. stage would improve reception, but would introduce other difficulties, particularly in connection with stability. For second detection there is a double diode-triode, one diode anode of which is used to apply A.V.C. to the frequency-changer. When there is only a single I.F. stage it is not considered wise to apply A.V.C. to the valve, because there would be a danger of cutting down sensitivity.

An output valve is not shown, but any standard power amplifier can be used by connecting the upper terminal marked "phones or L.F." to the grid of the first valve. When phones are employed they should be connected to the two terminals marked; they will then be resistance-fed and will not have to carry the current to the anode of the double diode-triode. Moreover, they will be isolated from the H.T. supply by the .01-mfd. coupling condenser.

A delay voltage for the A.V.C. circuit is obtained across the 25,000-ohm variable resistance shown in the cathode lead of the last valve. By this means the delay voltage can be varied over wide limits. L.F. volume control is obtained by the .5-megohm potentiometer included in the circuit of the second-detector diode.

Component Values

The resistance and condenser values indicated are suitable when the H.T. voltage lies between 200 and 250, and therefore apply when the receiver is fed from a normal 250-volt rectifier. If this has a total output of 60 mA, a large power valve can be used in the output stage, since the total H.T. current consumption of the circuit as shown is approximately 22 mA at 250 volts. That leaves an ample margin of current for a large indirectly-heated power-valve or just about enough for one such as the Cossor 4XP.

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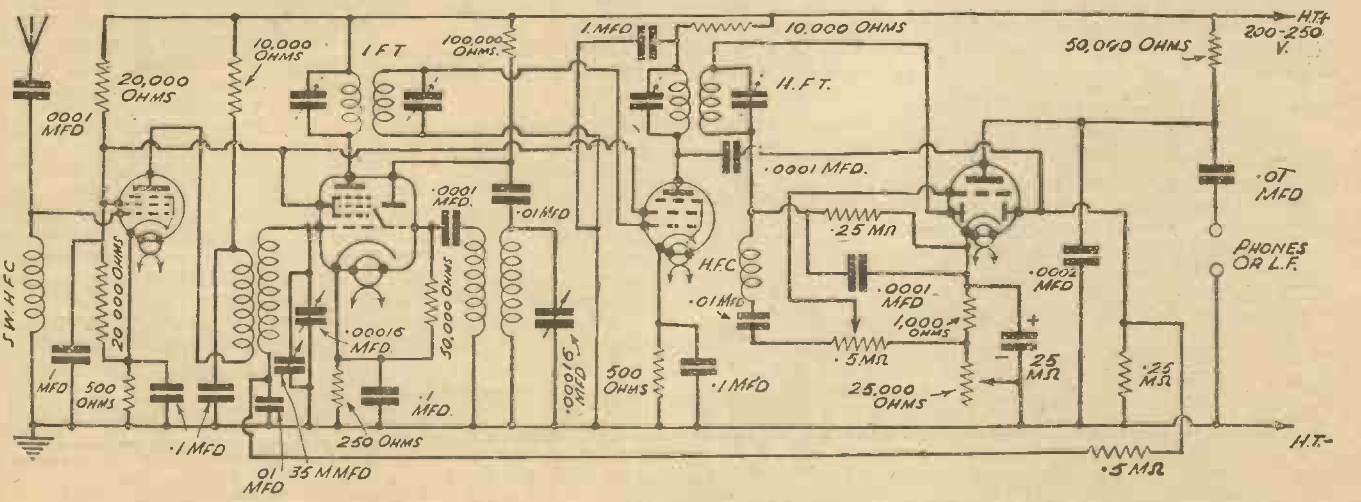


This is the superhet circuit referred to above. It is not necessarily complete in every detail, but gives sufficient data for experienced constructors.

SHORT-WAVE SECTION

(Continued from previous page)

With regard to the principal components, the two four-pin coils can be of the standard plug-in type, whilst a double-gang .00016-mfd. condenser can be used for tuning. There is a 35 mmfd. trimmer in parallel with the first section for final tuning. The H.F. choke in the aerial circuit is a standard short-wave component, and that in the diode circuit can be an ordinary "reaction" choke. Suitable valves in the Osram range are: first and third, VMS4B; second, X41; fourth, MHD4. Similar types in other makes can be used, but it must be remembered that the total current consumption will depend upon the exact types used. Thus, if an output stage is to be added, care must be taken that there is sufficient H.T. current available to operate it.

Leaves from a Short-wave Log

Test Broadcasts from Brazil

FROM PSH, Marapicu (Rio de Janeiro), Brazil, experimental broadcasts are being made nightly between G.M.T. 00.00 and 02.00. The following announcement is regularly broadcast: *This is short-wave station PSH transmitting a special test programme originating in the studios of station PRF4, Rio de Janeiro. We ask our listeners in the United States of America, and all over the World to report to us on receiving conditions. Further programmes of a similar nature will be given from this station if reception conditions are what we expect. All reports will be acknowledged by special QSL card. Address them to: P.O. Box 709, Rio de Janeiro, Brazil. Why not spend your vacation in Rio, the most beautiful city in the World*, and so on. PSH is a 12 kilowatt transmitter working on 29.35 m. (10.22 mc/s). In the course of the broadcast announcements are made in Portuguese, Spanish, English, German and French.

Portuguese Mystery Station

On about 45 metres, on odd days, a transmission has been picked up emanating from a Portuguese station of which the call-letters could not be distinctly heard. An announcement captured indicated that the broadcast was made by the Physical Laboratory of the University of Coimbra (Portugal). Has any reader logged this newcomer?

German Broadcasts to Brazil

Every Wednesday evening between G.M.T. 19.00-20.00 Berlin transmits a special radio programme destined to the Radio Club of Brazil, station PRA8, at Pernambuco. The transmissions are carried out through the Zeesen (Germany) transmitters: DZC, 20.15 m. (14.888 mc/s); DZE, 24.73 m. (12.13 mc/s); DZG, 19.53 m. (15.36 mc/s), and DZH, 20.75 m. (14.46 mc/s).

From the Polar Regions

OX2QY, the station operated by the McGregor Expedition, and situated at Reindeer Point (Greenland) some 750 miles from the North Pole, may now be heard working between G.M.T. 01.00-04.00 on about 20.86 m. (14.38 mc/s).

A.C.-D.C. HEATER CONNECTIONS

WHEN a battery or A.C. receiver is designed, it is conventional to join up heater or filament terminals in a manner that is most convenient from the point of view of neat and easy wiring, but in a universal receiver such haphazard measures may very often give rise to a certain amount of trouble. In the former case the circuit is held at sensibly earth potential, and in any case the resistance between the two wires is only an ohm or so, but in a universal receiver the filaments are, of course, in series, and in a four-valve set they will total a figure in the neighbourhood of 500 ohms; furthermore, while the ends may be held at sensibly earth potential, the "middle" valve will be "up in the air."

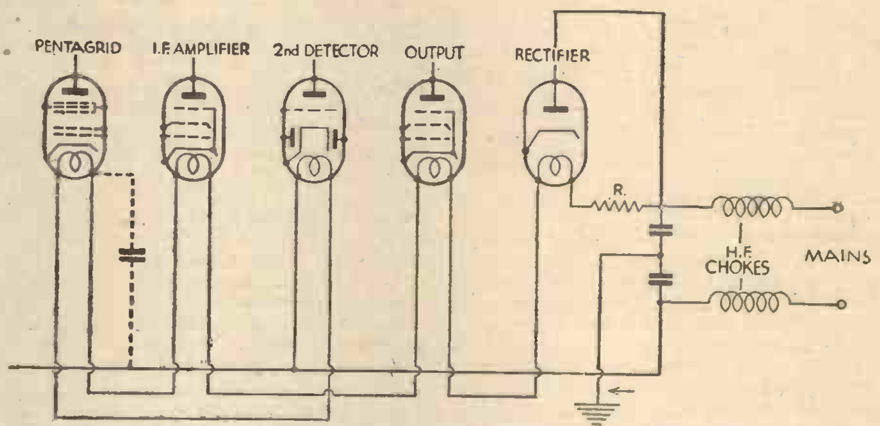
This comparative isolation of one or more heaters can give rise to instability and modulation hum, as the heater may be several volts above its own cathode from an H.F. point of view, while in the detector stage the H.F. voltage may become inseparably mixed with mains ripple, producing a particularly bad species of modulation hum. Since one end of the heater chain will be separated from the usual filter arrangement by the heater dropping resistance ("R" in diagram), it is usual to refer to that end of the *chain that is connected directly to the mains* as the "earth end."

Quite irrespective of the physical position of the valves, the earth end should go straight to the detector valve, and in the case of a three-valve set it should then go to the H.F. valve, the output valve, and lastly to the rectifying valve.

Heater Arrangements

The heater arrangement for a universal superhet is not quite so straightforward, as there are, or may be, two detectors—the second detector and the frequency changer. In the modern type of frequency changer, using a pentagrid or triode-hexode, there is no deliberate rectification, but rectification does exist and it must be considered, therefore, as claiming a place immediately following the second detector. Another reason why this stage should receive careful consideration is that owing to its position, any hum introduced will be amplified by every valve of the set, and any instability may set up a range of whistles that will interfere with the correspondingly large number of stations.

The suggested arrangement so far is negative mains direct to the second detector and thence to the frequency changer, after which may be placed the I.F. amplifying valve, or vice versa, the best arrangement being found by trial, as it will vary greatly with the actual layout of the components and disposition of the wiring. The suggested arrangement outlined above for the sequences of the heater connections of a four-valve plus rectifier superhet is shown in the diagram, from which it will be seen that a condenser is shown (dotted) between the earth end of the chain, and that side of the frequency changer which is remote from the earth. This component is made up of the order of .05 mfd. and it will be found useful when instability is arising due to inter-valve coupling brought about by the common resistance of the heater chain. While the condenser is shown connected to a particular point, it may be tried on other heater terminals, while in particularly obstinate cases two such condensers connected between the earth end, and other points on the chain, may be found an advantage.



Circuit diagram showing the sequence of heater connections that is generally the most satisfactory for a universal superhet.

Curing Instability

The writer recently came up against pronounced instability in an all-wave universal superhet, which could only be satisfactorily cured by connecting two condensers in series across the frequency changer, and earthing the centre point. This connection had to be taken not to the earth end of the chain, but actually to the common earth lead indicated by an arrow in the diagram. The necessity of such precaution is admittedly rare, but is well worth bearing in mind as indicating the way in which the heater chain may be cleaned up when instability is encountered.

Finally, the actual heater wiring should be twisted together as closely as possible, and more care should be exercised to keep it away from grid components, than would be necessary in any other type of receiver. This is due to the fact that the relatively high resistance of some of the heater wires causes quite a considerable H.F. voltage to build up across the heater terminals.

NEWNES' TELEVISION AND SHORT-WAVE HANDBOOK
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GEORGE NEWNES, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

SYSTEMATIC FAULT FINDING

(Continued from page 554)

localise the fault, especially if it is one of complete breakdown. The foregoing tests will have enabled you to check that voltages are being applied to every valve, and that they are taking their correct current. Should no voltage, for example, be applied to the anode of the I.F. valve V2, then it is reasonable to suspect the primary of the I.F. transformer or the anode decoupling resistance, which should be tested for continuity.

Current Consumption

Should you find that the current consumption of the output valve V4 is abnormally high, then it is as well to check for a broken bias resistance or condenser, or a leaky coupling condenser. A low value of current consumption for any valve would most probably indicate that its emission had been impaired, but it is wise to check to ensure that its bias is in accordance with the maker's instructions, and that sufficient anode voltage is being applied.

Instability in any one valve would be shown up by a wrong or fluttering value of anode current consumption. If the I.F. valve V2, for instance, is unstable, the fact that it is oscillating will result in a high anode consumption.

A high value of current in any particular lead may be the result of a leaky decoupling condenser, and the effect of disconnecting the latter should be noted while the milliammeter is still in circuit.

Reference should be made to the more detailed tests given in the various sections once the fault has been localised, but we give you below six golden rules when proceeding to service a receiver.

(1) See that the aerial and earth are connected.
(2) Test the output of the mains unit or battery.
(3) Test the voltage applied to each valve in turn, commencing with the output stage.
(5) Test the bias applied to each valve in turn.
(6) Proceed with caution—don't jump to hasty conclusions. Reason out why, for instance, the voltage is low or the current high, and then proceed to test the various components forming the suspected circuit.

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A.C. MODEL 200/250 v. 40/100 cycles. **£6 : 6 : 0** *or 10/- deposit and 12 monthly payments of 10/9.*

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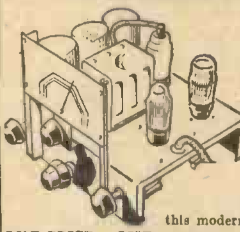
BARGAIN KITS

ALL-WAVE BATTERY S.G.3 KIT



Waveranges 14-31, 28-62, 200-550, 900-2100 metres. Illustrated on the left is the assembled Peto-Scott All-Wave S.G.3 Kit. Efficiency, economy and simplicity of construction and operation are the keynotes of this modern to-the-minute circuit.

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SUPER ALL-WAVE BATTERY S.G.3 CHASSIS

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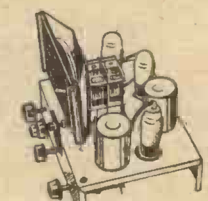
Complete with 3 British Valves



3 Wavebands: 18-52; 200-550; 900-2,100 metres. ● *Double Ratio Slow-motion Drive 9-1 and 100-1.* ● *Plate-glass station named dial.* ● *Rotary low-capacity switches.*

For world reception of a high order all day and every day. 3 British valves, variable-mu H.F. Pentode, High Efficiency Detector and Harries High Efficiency Output Pentode. Variable Selectivity. Pressed steel chassis, *Size* 11½" x 9" x 10½" *high*. Screened Air-cored Coils. Dual Electrostatically screened short-wave coils. H.T consumption approx. 10 m/a. Complete with valves and fully tested on all wavebands before dispatch.

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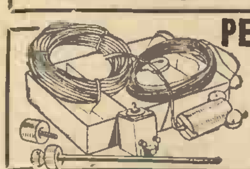

Increases signal strength on all bands. Improves selectivity. Waterproof and Weatherproof. Two transformers. Outfit comprises Duplex lacquered aerials, insulators, waterproof "lead-in" wire, aerial and set transformers, with instructions for erection. Cash or C.O.D. 21/-, or 2/6 down and 7 monthly payments of 3/-. **2/6 DOWN**

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KIT "A" *Cash or C.O.D. Carriage Paid* **55/6**
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Type 9/M.W. (178 to 580 metres)	per pair	5/6
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Includes panel, platform, screen, all necessary components, with 10 coils, 1 valve and FREE S.T.900 Dial Card. *Cash or C.O.D. £2/9/3, or 4/- down and 11 monthly payments of 4/9.* **4/- DOWN**

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Practical Television

January 29th, 1938 Vol. 3. No. 85.

Protection

WHEN using cathode-ray tubes for television picture reception or oscillograph purposes in the laboratory, high voltages are employed for applying to the anodes. The power unit designed for this purpose must incorporate suitable safety devices to avoid any risk of shock, and this is always done in the case of commercial receivers. Many different schemes have been devised for this purpose, and one of the latest, and incidentally one of the simplest, employs a vacuum switch. Inside a small diameter evacuated glass tube are two contacts, one of which is free to slide, and a cap at each end enables connection to be made. A small coil surrounding the outside of the tube actuates a soft iron core or plunger attached to the sliding contact. When the H.T. power unit is switched off the contacts are short-circuited, but when the tube is brought into use current furnished to the coil, *via* a mains transformer winding, separates the contacts. When switched off, the contacts close once more, and in this way discharge immediately any H.T. condensers through a fixed resistance, and so give adequate protection in a very simple manner. Rated at a maximum operating contact voltage of 6,000, the device should prove extremely useful.

Finding a Reason

MANY theories have been advanced to account for the occasional reception of the ultra-short-wave signals over enormous distances, by which is meant picture and sound signals being detected in South Africa, India and America, as distinct from the operation of sets a hundred miles or so from Alexandra Palace. While the latter feat is outstanding, the former, at first sight, would appear to border on the miraculous if cognisance is taken of the present-day theory of ultra-short-wave propagation technique. The discovery of new ionised layers in the upper atmosphere by Watson Watt has given a clue to the long distance working, for it has been proved that carrier waves of ultra high-frequencies can be reflected by these layers. In addition, engineers studying the whole question express the belief that the freak reception is a direct result of sun-spot activity which has been at the peak of an eleven-year cycle. Five years from now, that is, at the other end of the cycle, it is quite possible that conditions will be just the reverse. It is felt that these sun spots have not only altered the heights of the upper layers, but also their angle with reference to the earth, so that they have been in just the right position for reflection direct to these distant territories. Only continued research into this very important side of the subject will confirm whether this is the most acceptable explanation, and in the meantime the collation of data is being undertaken so that the whole thing can be considered from every possible angle.

A Fine Effort

THE praiseworthy effort made by the B.B.C. television staff in televising the Bertram Mills Circus from Olympia has been the subject of commendation from nearly every section. The sensitive cameras "occupied" front ringside seats, and although the lighting was far from ideal the pictures observed on home receivers were of first class entertainment value. A high-directional aerial on Olympia's roof beamed the picture signals on Alexandra Palace where they were re-radiated at high power, and the pictures seen proved conclusively that a circus is ideal material for television programmes. The only drawback of the transmission was the presence of interference which took the form of a fine mesh pattern over the whole picture. The interfering signal beat with the carrier to give what appeared to be approximately a megacycle pattern. This is one of the biggest problems to be solved in connection with television O.B's., for it is universally agreed that these outside broadcasts do more to popularise television than any studio material.

The elaborate gramophone record reproducing studio to be used at the new Brussels broadcasting station to be open shortly.

An American Coaxial Cable

ABOUT two years ago a good deal of controversy took place in the United States over a special type of coaxial cable developed by the Bell Telephone Co., and which they installed between New York and Philadelphia. This cable, suitable either for the handling of multi-telephone calls or a single television signal, was claimed to be capable of revolutionising existing cable distribution networks, and it is said that competitive interests feared the monopoly that might be conferred on the Bell Co., if it was put into service. The Federal Communications Commission took a hand in the matter with the result that for the past year the Bell engineers have been using the cable only under a strictly limited licence. They have not been permitted to place it into commercial service, and if any television company with proper transmitting and receiving equipment had made the request the Bell Company would have been forced to place it at their disposal. Actually, no company took these steps so development work has been proceeding steadily, and the cable manufacturers are now said to be ready to present a case to prove that the cable has a definite function as standard equipment in the telephone market. During the course of a recent demonstration in Philadelphia, television pictures with a 240-line standard of definition were sent along the cable at 24 pictures per second, and the results were claimed to be perfectly satisfactory. Furthermore, it is stated that the suggested R.M.A. standard of 441 lines can be handled by the cable, which has repeater stations at ten-mile intervals. As in this country, a cable of this nature is capable of solving the intricate problems associated with the distribution of television programmes, when several high-definition television stations are erected for the purpose of providing a nation-wide service. The production of individual station programmes may prove to be uneconomical, but if each station is linked by this high-frequency cable then relays can be made, and a marked saving in programme costs will materialise. One important engineering problem seems to have been solved in connection with coaxial cables, and that concerns the different speeds with which a wide range of frequencies will travel along a long length of cable. Without some form of compensation some parts of the picture would arrive at the terminal point before the others, and peculiar distortion would be apparent. Phase correctors and equalisers may be used to remedy this matter.

TELEVIEWS

An Important Factor

MANY factors contribute towards the building up of a television picture in a cathode-ray tube receiver, but one of the most important to which considerable research has been directed is in connection with the intimate relationship between light spot shape and size, and the degree of line definition employed. Uneven light distribution over the spot's visible area on the tube's screen will reduce the efficiency of an otherwise satisfactory picture, while any peculiar distorted shape will have the most deleterious effects. Quite recently an ingenious piece of equipment was developed, and demonstrated, for showing the actual electron distribution in two mutual perpendicular directions. This was done by passing the cathode-ray beam spot across an elemental slit area, and so determining a curve of current with reference to spot displacement across the slit. The various factors associated with the spot size such as focusing potentials or currents, anode volts, modulator volts, etc., could then be altered in a predetermined manner to provide a quantitative analysis, the resulting data being employed by the engineers responsible for cathode-ray tube design.

Picture Characteristics

THE question of the most acceptable picture characteristics to suit the tastes of individual viewers is a very intricate one, for it is based entirely on personal requirements. Just as there are such widely differing results when listeners are asked to judge loud-speaker reproduction, so the same thing happens with television. The two most important items in this connection are contrast (degree of signal strength applied to the C.R. tube's modulator electrode) and brightness (degree of bias applied for a fixed anode accelerating potential). To show these results very clearly, in so far as the degree of contrast is concerned, the G.E.C. demonstrated a very ingenious piece of equipment. Two projectors were arranged to throw on to a screen superimposed images of the same picture, one picture having a low contrast value and the other a high one. Through the medium of what are termed neutral density wedges placed in the front of each projector, the balance of contrast as well as the brightness could be adjusted to suit individual requirements. This was effected by a Bowden wire control from the front, and not only did the equipment show the range of variation in a most efficient manner but it was possible to record the individual's accepted picture characteristics. These varied over very wide limits for different persons, thus showing how difficult is the problem of the television-set designer in producing a product capable of satisfying all potential purchasers. It seems certain that contrast and brightness controls will have to be provided on the outside of the set for some time to come if the maximum of satisfaction is to be secured by each purchaser.

TELEVISION PROGRAMMES

"R.U.R."

KAREL CAPEK'S masterpiece, "R.U.R.," is to be televised in a forty-minute version which will give an impressionistic rendering of scenes in Rossum's Universal Robot factory. Jan Bussell, who is producing the play for television, will build up the atmosphere of vast mechanism and inhuman machinery by means of quick close-ups and changing camera angles, instead of attempting big scale scenery which might strain the television medium. This method will, it is hoped, prove specially effective in depicting the robot rebellion, in which all the human population is killed with the exception of Alquist, an old man upon whom devolves the task of proving to the Robots that they, too, have souls and can begin life again.

Cherry Cottrell will play the part of Helena Glory, and Stephen Jack that of the Managing Director of the factory, while Wilfred Walter will play Alquist.

"R.U.R." will be seen in the afternoon and evening programmes on February 8th and 11th respectively.

"Up the Gunners!"

REGINALD SMITH, who has produced many light shows for television, is a great believer in the inspirational value of a good title. "Up the Gunners!" is the title of a revue which he will present early in February, which will be built around Charles Heslop, one of the star comedians of television. Michael North, one of the famous "Co-Optimists" and a member of the "Television Follies," is now working on the music, and the story is being written by Moore Raymond. "Up the Gunners!" will be seen on February 3rd and 5th in the evening and afternoon programmes respectively.

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OVER 75,000 N.T.S. D.X. RECEIVERS IN USE THROUGHOUT THE WORLD

NEW SPECIAL OFFERS

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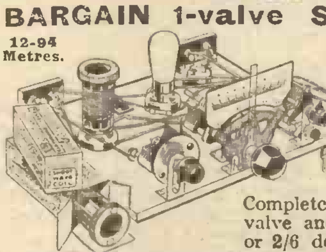
12-94 Metres.



Comprises Metaplex baseboard, variable and fixed condensers, switch, valve-and-coil-holders. H.F. choke, terminals, slow-motion drive, 3 short-wave coils, connecting wire, and FULL WIRING DIAGRAM. Less valve. Cash or C.O.D. Carriage Paid 19/6, or 2/6 down and 8 monthly payments of 2/6.

SPECIAL OFFER.

Complete Kit, including 3 coils; 12-94 metres, matched valve and pair of super-sensitive headphones: 27/6 cash or 2/6 down and 11 monthly payments of 2/6. **2/6 DOWN**

3-IN-1 SHORT WAVE KIT.

ADAPTS or converts your battery set for short-wave reception, or may be used as one-valve Short-wave Receiver. Slow-motion bandspread tuning SIMPLIFIES WORLD RECEPTION! Air-spaced bandspread and tank condensers. SPECIAL ANTI-BLIND SPOT CONDENSER. 3 scales calibrated. Complete Kit with 3 coils, 12-94 metres and all instructions, List value 41/3. BARGAIN 25/-, or 2/6 down and 11 monthly payments of 2/9. Matched valve FREE.

2-VALVE BANDSPREAD SHORT-WAVE KIT:

12-94 metres. Amazing performance. Amazing value. Complete Kit. List 59/6. BARGAIN 32/6, or 2/6 down and 12 monthly payments of 3/1. Two matched valves FREE.

3-VALVE BANDSPREAD S/W KIT:

12-94 metres. Complete Kit, including three coils. List value £3/17/6. BARGAIN, 37/6 cash, or 2/6 down and 11 monthly payments of 4/1; Three matched valves FREE.

4-VALVE BANDSPREAD S/W KIT:

12-94 metres. Pentode Output, will bring a lifetime of fascinating short-wave entertainment. Complete Kit, including 3-6-pin coils. List value £4/16/6. BARGAIN, 42/- cash or 2/6 down and 12 monthly payments of 4/-; Four matched valves FREE.

4-VALVE A.C. BANDSPREAD KIT:

12-94 metres. Entirely new design. Guaranteed world wide reception. Kit Complete with all coils. List value £7 15/6. BARGAIN, £3/15/0, or 5/- down and 12 monthly payments of 7/-. Four matched valves FREE.

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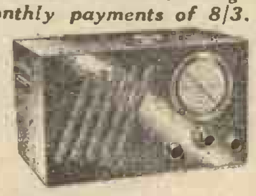
B.T.S. TROPHY SHORT-WAVERS

on EASIEST of EASY TERMS

Assembled and Tested, READY for IMMEDIATE USE

TROPHY 2. The amazing 2-valve headphone receiver as used by F. Lanaway, world's champion listener, 247 stations were received on this wonderful set between 12-52 metres. Circuit uses S.G.H.F. in detector stage, Aperiodic coupling and high-slope output pentode. Steel cabinet, complete with valves, 'phones and coils covering 12-52 metres. *Cash or C.O.D. Carriage Paid, £4 : 15 : 0, or 7/6 Deposit, Balance in 12 monthly payments of 8/3.*



TROPHY 3. A wonderful Short-wave instrument for record, headphone or loudspeaker results. Amazing reception provided on 12-52 metres and additional inductors available for 6.2 metres (Television) and 52-500 metres. Wavelength calibrated scale. Moving-coil speaker incorporated. Housed in beautiful black crackle-finished steel cabinet. Complete with valves and comprehensive operating instructions.

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(Less batteries)

Cash or C.O.D. **£5 : 15 : 0**

or 9/6 down and 12 monthly payments of 9/11.

A.C. MODEL

200/250 volts: 40/100 cycles.

Cash or C.O.D. **£6 : 6 : 0**

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N.T.S. New type lightweight headphones, 7/6.

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O.P.P. output providing quality reproduction on gramo. and microphone. Dimensions: 7in. long, 5in. deep, 7½in. high. For use with ordinary H.T. battery. 135-150 volts. With 3 valves, fully tested. List Value £4/4/0. BARGAIN. Cash or C.O.D., £2/15/0, or 4/6 down and 12 monthly payments of 4/9.

Recommended Speaker, Goodman's P.M. Special Type, 19/6, or 2/6 down and 8 monthly payments of 2/6.

MICROPHONE. Telescopic Floor Model, 2 Gns., or 2/6 down and 11 monthly payments of 4/-.

VALVES.—Give your set a tonic and fit new valves. Huge purchases enable us to supply at greatly reduced prices. Long and efficient service guaranteed. Battery, Det., L.F., and H.F., 2/9; S.G., V.M., Class "B," H.F., and L.F. Pentodes, 6/-. Mains Types, A.C., H.L., 5/-. All A.C., S.G., V.S., Pentodes and H.F. Pentodes, 7/-. Octodes and Hexodes, 9/-. Directly heated F.W. rectifiers, 350-0-350, 120 m.a., 5/-, postage extra.

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Technical Fundamentals—I

THE technicalities of radio—where shall we begin?

A good starting-point is represented by a close consideration of the character of the "signal" voltage developed in the receiving aerial by a broadcast transmission. Such consideration is well worth while, for by it can be gained considerable insight into the requirements of broadcast reception, and also some indication of the major problems which arise.

The Broadcast "Signal" Unmodulated

First, we will consider what happens during a pause in the broadcast programme, i.e., while the microphones are idle. The transmitter is still actively radiating, and the voltage produced in the receiving aerial has the comparatively simple character shown graphically in Fig. 1. The oscillations are of "unmodulated continuous wave" type and have a frequency which represents the "carrier frequency" of the transmitter. Note the constant amplitude of the oscillations.

The fact that different transmitters are allocated different carrier frequencies shows

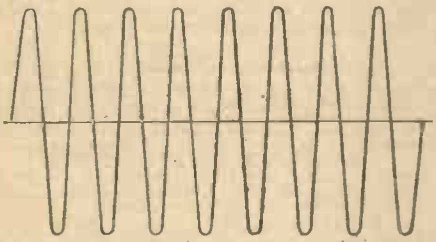


Fig. 1.—The simple wave-form of an unmodulated carrier.

at once the necessity for variable receiver "tuning," and also indicates where lies the possibility of avoiding interference between different transmissions. The selectivity problem is not a simple one, however, as we shall see.

Kilocycles, Megacyles—and Metres

The allocation of carrier frequencies is a supremely important matter from the listeners' point of view, and is a nightmare of a problem for those who have to decide upon such allocation.

If a list of medium-wave European broadcast stations, arranged in order of carrier frequencies, is examined it will be noticed that 9 kilocycles per second occur frequently as the difference between the frequencies of stations adjacent in the list. The allocation of frequencies has, as a matter of fact, been planned to give 9 kc/sec. separation as far as possible.

To make 9 kc/sec. separation constant throughout has been impossible, for the simple reason that there are too many stations to be packed into the band of available frequencies. The situation is eased a little by the fact that low power transmitters widely separated geographically can work close to each other's carrier frequencies with small risk of either interfering with reception in the service area of the other; also, synchronisation of stations radiating the same programmes has proved helpful. The problem of frequency allocation remains a serious one, however, and, cutting across the whole issue is the fact that 9 kc/sec. is, in any case, insufficient

The First Article of a New Series for the Beginner

from the point of view of the requirements of high quality reception.

What about wavelengths? It is unfortunate that so many of us have got into the habit of thinking about, and referring to, broadcast transmissions in terms of wavelengths; and a pity, too, that receiver manufacturers consider it necessary to pander to us by preserving wavelength calibrations on tuning scales.

Corresponding to every carrier frequency there is a particular wavelength, easily calculated from the following:—

$$\text{Wavelength} = \frac{300{,}000}{\text{Frequency}} \text{ metres}$$

the frequency being expressed in kilocycles per second.

Any information dependent upon carrier frequency values can, of course, be derived from the corresponding wavelengths, but to take wavelengths at their face values (without converting to frequencies) can sometimes be misleading. As an example, round about a carrier frequency of 565 kc/sec. a frequency difference of 9 kc/sec. is represented by a wavelength difference of 8½ metres approximately, whereas near a carrier frequency of 1122 kc/sec. a frequency difference of 9 kc/sec. is represented by a wavelength difference of 2 metres approximately.

Since consideration of frequencies is so important in respect of station allocation, and also with regard to the work of the receiver designer, it behoves the earnest amateur to make himself accustomed to thinking of broadcast transmissions in terms of their carrier frequencies. A table will be given in the next article. The frequencies of the short waves are of such very high values that they are more conveniently expressed in megacycles per second than in kilocycles per second. (N.B. — Kilo = 1,000, mega = 1,000,000.)

If the carrier frequency corresponding to any particular wavelength not shown in the table is required it can be calculated as follows:—

$$\text{Frequency} = \frac{300{,}000}{\text{Wavelength}} \text{ kilocycles per second}$$

the wavelength being expressed in metres.

The Broadcast "Signal" Modulated

As soon as the transmitter starts transmitting programme material the oscillations at the receiver take on a very complicated character. The oscillations now carry the characteristics of the broadcast sounds and they are in the form of an amplitude variation. This amplitude variation is, normally, continually changing and is, at any instant, of complex form.

Fig. 2 shows, graphically, a case of modulated H.F. oscillations which is comparatively simple, but is useful for illustrative purposes. It will be seen that the amplitude variation follows a simple sine wave curve, and this would be the kind of modulation produced if the sound controlling the transmitting microphone was a (single frequency) "pure tone."

The Modulation "Envelope"

The dotted curves of Fig. 2 constitute what is known as the "modulation envelope." Simple modulation of this kind can be fully described, first, in terms of the frequency of the modulation and, secondly, of the "depth of modulation." If, in Fig. 2, A represents the amplitude of the carrier oscillations when unmodulated, then the depth of modulation is given by the ratio B/A or, as is more usual, by the percentage

$$B/A \times 100$$

If the unmodulated voltage amplitude in one of the receiver circuits were 1 volt then, with 50 per cent. modulation, the amplitude would rise and fall at modulation frequency between the extremes of 1.5 volts and 0.5 volt, while at 100 per cent. modulation the extremes would be 2 volts and zero. Obviously, 100 per cent. represents a limit but, as we shall see later, there are reasons why the modulation shall not be allowed to reach such a limit.

Sideband Frequencies

Referring to Fig. 2 again, suppose the carrier frequency is F cycles per second and the modulation frequency M cycles per second. A process of analysis applied to modulated oscillations of this kind reveals that they must not be regarded as the resultant of the two components, F cycles per second unmodulated, and M cycles per

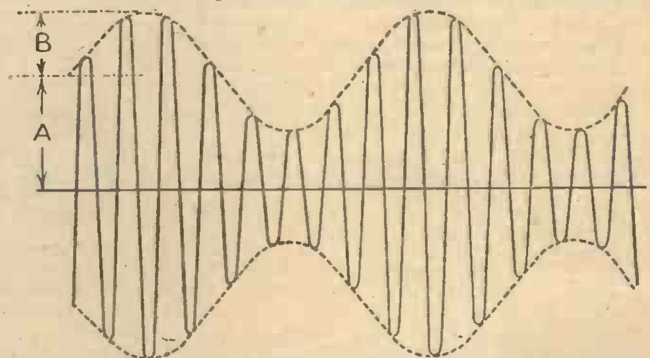


Fig. 2.—The effect of a modulated carrier showing the "modulation envelope."

second, unmodulated, which is what one might at first suppose. The analysis shows that three unmodulated components together make up a resultant of the character shown in Fig. 2. These three components are all of high frequency and the frequency values are, respectively,

F
F + M
F—M cycles per second

Whether we refer to the oscillations in terms of the graphical interpretation of Fig. 2, or whether we substitute the idea of the three unmodulated component oscillations, we are actually dealing with the same thing, but the analysis above makes it easier to understand many important practical facts.

THE BRITISH LONG-DISTANCE LISTENERS' CLUB

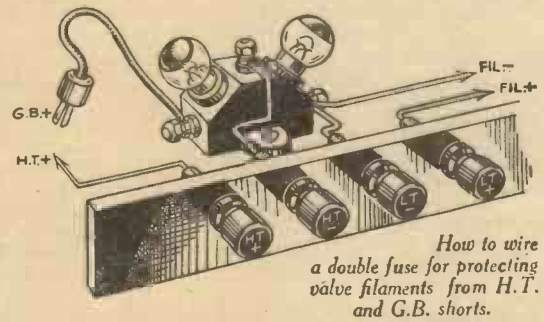
Dual Speakers

A READER raised an interesting point the other day concerning the use of an extension speaker. He had a commercial set and wanted to obtain an extension speaker. He wondered if he could obtain the latter in such a form that it could be added to the speaker in the set to give improved balance of reproduction, on the lines of the dual speakers which are fitted to certain quality receivers. On the face of it the idea seems quite good, but it must be remembered that the commercial receiver will have been fitted with a speaker which might be termed an "all-round" model—that is, one which gives a fair balance of high and low notes. Consequently, to obtain an improvement from a speaker of this type any additional speaker would have to be of the type giving improved high-note response, and would be more or less in the form of a tweeter. Such a speaker would be of little use on its own and could not, therefore, be used as an extension speaker. In the usual balanced pair of speakers one unit is chosen to give good low-note response and the other for the high notes, and thus a balanced reproduction covering a very wide range is obtained (provided that the receiver circuit will deal with the range of frequencies which the speakers will cover).

With a little care, however, it may be possible to find a new speaker in cases such as the above, where the two together will give added life to the reproduction from the receiver, and yet at the same time the extra speaker will work satisfactorily at a distant listening point. Remember that the best method of connecting such an additional speaker is by joining the speech coil only in parallel with the speech coil of the built-in speaker.

Chemical Action

There are many troubles which arise in receivers due to the action of some chemical whose presence is either forgotten or unknown. One of the most usual of these is to be found in battery receivers where the L.T. accumulator is placed too close to the set and the fumes from the electrolyte act upon thin brass or copper parts and eventually cause a breakdown. Before this stage is reached, however, the effects of the corrosion are made audible by cracklings and background noises due to the wires breaking up, and in some cases the performance of the receiver may fall off badly due to the increased H.F. resistance at the point where corrosion is taking place. Most listeners know of this trouble, however, and it is rarely met with nowadays. A point which is overlooked, however, is in the construction of tuning coils and other similar items where a paxolin or similar former is wound with very fine covered wire. In certain types of former it has been found that a chemical action takes place between the copper wire and the covering of it, and noises may arise due to the corrosion. If you, therefore, find that your set is becoming noisy and are unable to trace the cause, examine coils and other items of the above type and you may find that where the wire enters a small hole in the former for anchoring purposes, a small heap of blue or white powder has formed over the wire, indicating that the chemical action is taking place. It may be prevented in most cases by slipping a short piece of fine diameter insulated sleeving over the wire where it passes through the hole in the former.



How to wire a double fuse for protecting valve filaments from H.T. and G.B. shorts.

A Safety Hint

We recently mentioned the importance of fuses in battery receivers and pointed out that the high value of grid bias sometimes employed can be the source of danger. A member has written to ask the best way to fit fuses so that the valves are protected both from the H.T. and the G.B. supplies, and he requires a neat and easily replaceable fuse unit for the purpose. Fortunately, there is already available in the Bulgin range a fuse holder which is ideal for the purpose and it is illustrated on this page. The connections are shown on this sketch and it will be seen that the G.B. positive lead is attached to one side of the holder and the filament negative leads and H.T. negative leads to the other side. H.T. negative then goes to the top terminal on the holder and thus the fuse bulbs are included in the necessary leads and give the required measure of safety. We might be forgiven for mentioning again here, that when obtaining fuse bulbs the greatest care should be taken to obtain proper bulbs and not the ordinary cheap type of flashlamp bulb which in many cases will offer no safeguard to ordinary 2-volt filaments. Fuse bulbs are obtainable from any good radio dealer, and the current which they will pass is clearly indicated on the box.

Contacts Wanted

A member living at Woolwich would like to get into touch with another member in or near that district with a view to exchanging ideas. Will any member in that locality who would care to assist this reader write direct to H. Brant, 18, Fennell Street, Woolwich, S.W.18.

THE BEST WEEKLY FOR CYCLISTS
THE CYCLIST
2d. Every Wednesday.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

T. W. A. S. (Exeter).—The tuning condenser is joined across the points 1 and 2. The aerial (or the anode if the coil is used as an H.F. transformer) is joined to either 1 or 6, the latter giving better selectivity. The coil connected between 4 and 3 may be used for reaction or aerial coupling, 4 being the high potential end of the coil.

N. K. (Leigh-on-Sea).—We are afraid there is no more modern book than the one mentioned by you.

J. McE. (Glasgow).—The trouble may be H.F. instability and it is naturally only experienced when the circuits are correctly ganged. To test the condenser you must first disconnect the coils, as the reading you obtain is due to the coil winding, not a condenser short.

M. C. (Ramsgate).—We cannot recommend a circuit without details of the coils, such as type numbers.

J. R. (Perth).—You would need an ultra-short-wave set for the lower band mentioned and an ordinary set for the high wavebands. It would be rather difficult to make a set to be efficient over the entire range due to the different technique required in ultra-short-wave apparatus.

W. N. (Rotherham).—The valves you mentioned should work satisfactorily in the set but we cannot guarantee it as we have not tried them. P.E. would be the same as H.T., P.S. the same as P. or A., S.S the same as G., and S.E. the same as G.B.

N. S. (Southend-on-Sea).—We cannot recommend a book for your purpose, but the Encyclopædia and Newnes' Wireless Book should be of use to you.

G. W. (S.E.17).—Without type numbers it is impossible to give you connection details of the coils in question. We suggest you write direct to the makers, giving them all details to enable them to identify the type.

T. D. (Birmingham).—We do not advise the arrangement you outline. A frame would be of very little use with a one-valver and high quality could not be expected. One L.F. stage should be added, when the arrangement should be quite useful.

D. L. R. (Fulham).—Is the set operated from a D.C. eliminator? If so, a fixed condenser should be inserted in the earth lead, and separate leads should be employed for the motor, the set, and any screening which is fitted.

K. H. (Cranwell).—We do not advise the circuit you give, as it is for short-wave work. You will undoubtedly find great difficulty in overcoming hum, although the receiving side of the circuit is in order Considerable experiment may be necessary to reduce hum and special choke filters may be necessary in the heater and other leads.

W J. N. (Ilford).—An electric lamp or some other apparatus should be joined in one lead from a mains socket to your accumulator, the other accumulator terminal being joined to the remaining mains socket. To avoid overrunning the accumulator an ammeter should be included in series to ascertain that the correct current is flowing. The numbers cannot be identified on the transformer, but a simple test with phones and battery in series will enable the separate windings to be found, and experiment will show the relationship between the ends of these windings.

W. E. B. (S.W.18).—There is some fault which has developed in the receiver and we advise you to have it examined by the makers or their nearest local service agent. There are many things which can give rise to the trouble you are experiencing.

R. H. V. (Diss).—We cannot recommend one of our circuits into which the parts from your commercial set could be incorporated.

R. D. (Beighton).—We have given the complete details of the valves on more than one occasion. They will, of course, be given again when changes are made.

S. N. (Ipswich).—A service sheet is not necessary to re-trim the set. A good dealer should be able to line up the set, but in the event of any difficulty write direct to the makers at Power Road North, London, W.4.

S. G. (W.12).—We regret that we cannot supply a blueprint for a receiver with the valve in question in it.

G. F. C. (Henlow).—We cannot supply details of a set to meet your requirements. You would need at least one H.F. stage and this would necessitate at least a two-gang condenser. For quality of the type indicated a push-pull output stage would be required, and the cost of maintenance from batteries would be high.

H. G. C. (Gillingham).—The blue glow is often seen in modern power output valves and if not too bright you need not worry. If, however, the valve is being overrun (too much H.T. or too little G.B.) a similar effect is noticed, but is usually brighter than the glow just mentioned. A volume control with a higher value may be desirable with the valve you are using.

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The D.C. AvoMinor enables you to make tests with the ease and precision of the expert radio engineer. It gives 13 different ranges of readings with scientific accuracy . . . in milliamps, volts and ohms. Thirteen precision meters are combined in one self-contained instrument.

In handsome case, with testing prods, clips and instruction booklet.

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Deferred Terms if desired.

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0-6 m/amps
0-30 „
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VOLTAGE
0-6 volts
0-12 „
0-120 „
0-240 „
0-300 „
0-600 „

RESISTANCE ohms
0-10,000
0-60,000
0-1,200,000
0-3 megohms.

£5: 10s. *Deferred Terms if desired.*

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So that's why my set is a squeaker.
I'll get some FLUXITE
And this very same night
Re-create it into a LOUD speaker!"

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is always ready to put Fluxite on the soldering job instantly. A little pressure places the right quantity on the right spot and one charging lasts for ages. Price 1/6

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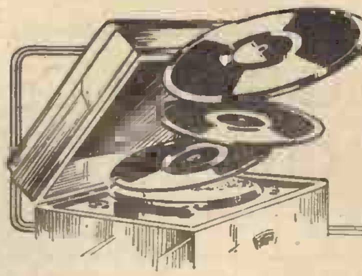

Impressions on the Wax

Rex

IN association with Fred Hartley and his Orchestra, Gracie Fields has recorded two tunes from the new film " Firefly " on *Rex* 9195. They are " Sympathy " and " Giannina Mia." Two old favourites, " Because " and " Moonlight Madonna " have been revived by Morton Downey, tenor, on *Rex* 9170. Of interest this month are two records by " The Four Aces," who make their appearance in the Rex list for the first time. They have recorded hits from their film " Let's Make a Night of it," " My Irish Song," and " Angel I've Got Something in my Eye " on *Rex* 9196, and " You've Gotta Take Your Pick and Swing " and " Calling All Cars " on *Rex* 9197. The latter coupling is a vocal impression of a gangster raid which is no doubt familiar to readers, as this quartet featured it in their recent broadcast. These boys, whose only instrument is a guitar, are extremely good.

Humorous Records

BOBBIE COMBER, the popular radio comedian, has recorded two humorous songs, " Ain't Love Grand " and " I'm a Little Prairie Flower " on *Rex* 9202, and Sandy Powell and Company have made another humorous sketch, " Sandy's Happy Home," on *Rex* 9156.

Primo Scala's Accordion Band version of " Little Old Lady," the biggest hit tune for a very long time, appears on *Rex* 9203. and Brian Lawrance, whose records are always popular, sings " In the Mission by the Sea " and " Mine Alone " on *Rex* 9190. He is accompanied by Fred Hartley and his quintet.

Reginald Dixon, the Blackpool organist, has made " Dixon Hit Medley No. 17 " on *Rex* 9194, introducing " You Can't Stop Me from Dreaming," " Little Old Lady," " Whispers in the Dark," " Horsey, Horsey," " Afraid to Dream," and " Good Night to You All."

Brunswick

GRACE MOORE features two songs from her film, " For You Alone " for her latest recording. " Our Song " and " The Whistling Song " are the titles on *Brunswick* O2400. Bing Crosby sings " In the Mission by the Sea," accompanied by Eric Dunsdreder at the organ on *Brunswick* O2525. The coupling is " I Still Love to Kiss You Good Night," from the film " 52nd Street."

Eddie Brandt accompanies himself on the piano with (a) " Too Late, My Love," (b) " Typical Tramp of the Tropics " and " Jack and Jill " on *Brunswick* O2522.

Vocalion

I THINK you will like " Skip It " and " Pardon Me, Pretty Baby," by Benny Carter and his Orchestra on *Vocalion S* 126. A unique feature of the latter tune is the chorus by Coleman Hawkins on a tenor sax and Carter on the trumpet, in which each of them take four bars alternately.

Records by Red Norvo and his Orchestra appear regularly in the Vocalion lists, and his latest, " Clap Hands (Here Comes Charlie) " coupled with " Russian Lullaby " on *Vocalion S* 121 features excellent solos by the leader, and also by tenor saxophone, clarinet, and piano. Artie Shaw's recordings are always amongst the most tuneful of swing presentations, and his latest, " The Blues," parts 1 and 2, on *Vocalion S* 124, offers something particularly novel in the shape of the first double-sided version of the traditional twelve-bar blues theme.

Panachord

OF the many dance tunes recorded by Panachord outstanding are " Sympathy," by Ted Rito and his Orchestra, coupled with " Moon at Sea," by Harry Sosnik and his Orchestra on *Panachord* 25924.

Will Osborne and his Orchestra feature two tunes from the film, " Mr. Dodd Takes the Air," on *Panachord* 25953. They are " Remember Me " and " Am I in Love ? "

Tex Ritter sings two hill-billy numbers—" Out on the Lone Prairie " and " My Sweet Chiquita," on *Panachord* 25954. as also do The Ranch Boys with " The Last Round-up " and " Where the Mountains Kiss the Sky," on *Panachord* 25955.

Decca

IF you like dancing, Josephine Bradley and her Ballroom Orchestra have recorded a tango and rumba on *Decca F* 6557, and Lew Stone and his Band play " I Still Love to Kiss You Good Night," from the film " 52nd Street," coupled with " My Swiss Hill-Billy " from the film " Lovely to Look At," on *Decca F* 6565. This band has also recorded " Remember Me " and " Sailing Home," on *Decca F* 6566.

Vera Lynn, accompanied by Fred Hartley and his Orchestra, sings " Good Night to You All " and " That Old Feeling " on *Decca F* 6551, and Charlie Kunz has recorded " Piano Medley No. D 10 " on *Decca F* 6559. He introduces " Whispers in the Dark," " Afraid to Dream," " Good Night to You All," " The First Time I Saw You," " I Know How," and " I've Got My Love to Keep Me Warm."

Jack Jackson and his Orchestra, who are stationed at the Dorchester Hotel, play two comedy foxtrots, " Horsey, Horsey " and " Little Prairie Flower " on *Decca F* 6552.

Geraldo and his Orchestra play two fine selections from the films. The first is " The Firefly " Selection on both sides of *Decca K* 868, and the other " On the Avenue " Selection on both sides of *Decca K* 864. " Deep Henderson " is a hot number of which Ambrose and his Orchestra give a good account on *Decca F* 6556. On the reverse the same band play " Message from Mars."

TELEVISION AND SHORT-WAVE HANDBOOK
By F. J. CAMM
3/6, or 4/- by post from
George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

The Croydon Radio Society

THE Croydon Radio Society's New Year activities opened on a novel note on Tuesday, January 11th, in St. Peter's Hall, S. Croydon. The reason for all this was the topic discussed, namely "Diathermy," by Mr. Harris, of the Radio Development Co. He recalled the views of Austrian and German scientists on the beneficial effect of high frequencies on the human body, and made it clear that an H.F. current would burn if strong enough, and if the frequencies were controlled they could be used to cut flesh. Where this method, moreover, was so successful was its power to prevent bleeding by coagulating the blood and, in the treatment of cancer, dispersement of the growth to other parts of the body was prevented.

Mr. Harris dealt with the effects of different wavelengths and discussed low intensity diathermy in much detail. This was based on the theory that all matter had a resonance factor. To demonstrate the cutting ability of high frequencies, portions of members' bodies were not used. Instead a piece of steak was subjected to the attention of the high frequency "knife." There were, of course, many applications for diathermy, as, for instance, in cases of rheumatism, and indeed with the method heat could be applied to any part of the body requiring it. Finally Mr. Harris was thanked for giving so fascinating an account and demonstration of this important development of wireless. There is no meeting on Tuesday, February 1st, but on Thursday, February 3rd, the Society meets at the headquarters of the British Sound Recording Association for a talk and demonstration on: "Sound Recording on Direct Play-back Blanks."—Hon. Pub. Secretary: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

Wellingborough and District Radio and Television Society

THE fortnightly meeting of the above was held on Wednesday at the Exchange Hotel, Wellingborough, when a lecture was given to the members by Mr. Glanfield, of Romford. The lecture was of special interest to battery users in that Mr. Glanfield gave a very interesting report of the experiments that were being conducted by Mr. Milnes with the development which enabled the battery user to utilise an ordinary gas supply for the provision of power for his battery receiver.

Mr. Glanfield went on to say that much of the development of the Thermo-Charger, as it was called, was due to the personal experiment and research of Mr. Milnes himself, and it had taken him four years to produce the unit that was such an attraction at the last Radio Show at Olympia when the Thermo-Charger was displayed to the public. Experiments were still being continued, and it was hoped that it would soon be possible to place the unit upon the market at a price suitable for the pocket of the battery user.

Mr. Glanfield then went on to describe the construction of the nickel cadmium battery known as the Milnes unit in which the action was that current was supplied from a six-volt accumulator to the unit for charging purposes, and then by means of an ingenious switching arrangement of the cells in the battery, a high voltage could be obtained to work the user's battery receiver. These units, said Mr. Glanfield, were practically indestructible, and some of the original models that had been sold were still giving excellent service after seven or eight years of continuous use. The construction of the cells and the component parts were described in detail by Mr. Glanfield, and questions by the members were answered at the completion of the lecture.

Hon. Sec., Mr. L. F. Parker (G5LP), 22, Second Avenue, Wellingborough, Northants.

Radio, Physical and Television Society

THE first meeting of the second half of the 1937-38 session will be held at the society's headquarters at 72a, North End Road, W.14, on Friday, January 28th, at 8.15 p.m.

It has been decided to hold weekly meetings for the remainder of the session, and any new members will be very welcome. Recent lectures have included "Microphones," by Dr. C. G. Lemon; "Some Interesting Chemical Phenomena," by Mr. M. F. Hamlett; and a lantern lecture by Mr. W. G. T. Nixon, of the Osram Valve Technical Department.

Although the society caters mainly for the wireless amateur, matters of general scientific interest are often dealt with at our lectures, there having been from time to time lectures on such subjects as X-rays, Microscopes, Transformer Design, Bacteriology and Biology.

Readers interested in the society are invited to write for further particulars to the hon. secretary, C. W. Edmans, 17, Prince George's Avenue, Raynes Park, West Wimbledon, S.W.20.

(Continued on page 565)

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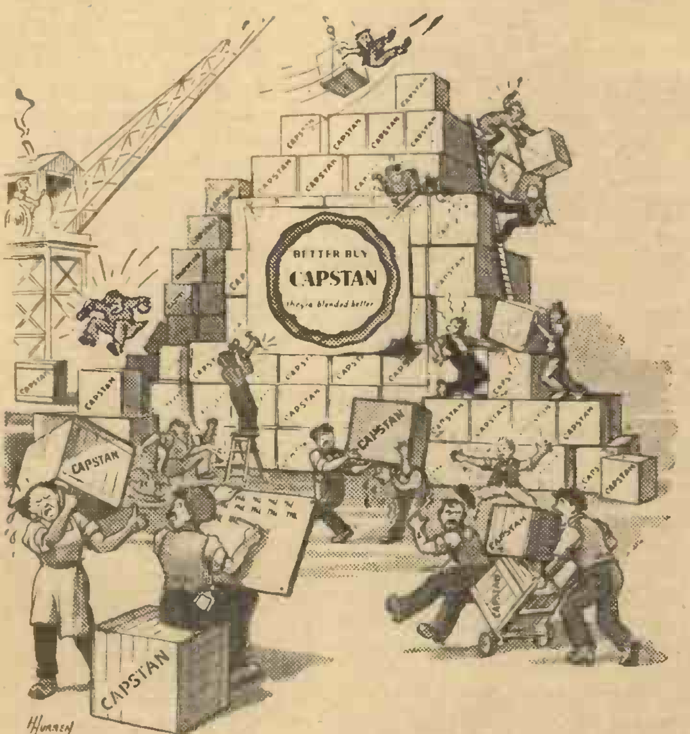

"They don't 'arf keep us busy, they don't" . . .
"'Oo do?" . . . . "They don't!"

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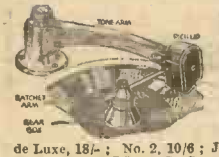

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GRAMO-MOTORS.—A.C. Gramo motors and turntable, Victor, H.M.V., 230 volts, motor, 30/-.

TELEPHONES.—For all purposes. Table or wall, house or office phones, from 10/-. Portable Emergency Telephones and Cable Headphones. Pocket type W.D., leather Headbands, 2/6 pr. Sullivan Radio Aluminium Headbands, 2/9 pr. 4,000 ohm S/W lightweight Headphones, 4/6 pr.

CRYSTAL SETS.—Buy one, they cost nothing to run. No battery or valves wanted. Quiet and efficient reception. Shop-soiled sets cheap. Mahogany Case, 5/6 and 7/6 each.

MOTORS.—A.C. Start on full load, 1/60 h.p., with pulley, Type 50, 1,500 revs., 18/6. 1/25 h.p., Type 36.G, 3,500 revs., 27/6. 1/4 h.p., 2,000 revs., 45/-. Squirrel Cage 1/10 h.p. Motors, 2,500 revs., 35/-.

D.C. MOTORS.—1/40 h.p., 110 or 220 volts, series, Type K.B., 1,750 revs., 15/-. Type G, 1/35 h.p., 2,000 revs., 16/-. 1/12 h.p. Type C, 110 or 220 v. shunt, 1,700 revs., 30/-. Tiny Motors, 6v., 12/6. 50 v., 14/-. 100 v., 15/-. 12 volt 1/4 h.p. compound, 40/-. Electric Water Pumps, 67/6. Compressor Paint Spray Sets, 37/6. Electric Fans, 12/6. MOTOR GENS.—220 v. A.C. to 100 v. 1 amp. D.C., 60/-. Big stock all types.

MICROPHONES.—Lesdix Microphones reproduce your voice amplified from your radio set to loud speaker. SOLO BUTTON MICROPHONES, 1/-. A new Practical Solo Microphone for broadcasting at home. It is a general purpose, robust mike, with solid bakelite body, back terminals, front metal grills. No. 11. New design finely finished, 5/6. No. 11A. Special, in solid brass body, unequalled at the price on speech and music, 7/6.

No. "NW" 11 Table Mike.—This is a splendid microphone for speech and music. The bakelite case, containing a 2in. mike and transformer, is on a bronze pedestal. Switch and plug-sockets are fitted on the case. It stands unrivalled for quality and price. 15/-.

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SMALL CHARGERS.—From A.C. mains. Midget for 2 volts, ½ amp., 12/6. 6 volts, 1½ amps., 30/-. Philips A.C. Mains Charger, giving 14 volts, 3 amps., D.C., £4. Trickle Charger for A.C., giving H.T. and L.T., 35/-. As we have a wide range of other sizes, kindly specify wants.

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By JOHN EDWIN HOGG

Some men appear to be always tempting Fate and "getting away with it." Mr. Hogg is one of them, as the story of his dramatic experiences as a test pilot in the February WIDE WORLD MAGAZINE will prove.

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LETTERS FROM READERS

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Canadian Correspondent Wanted

SIR,—It is just one year since I began to read PRACTICAL AND AMATEUR WIRELESS, and it is this fine weekly which made me take an interest in short-wave listening. On Christmas Eve I built a one-valve short-waver and was amazed at the results obtained. Good as this set is, it does not altogether please me, so I hope soon to build a 1-v-1 set with reaction on both detector and H.F. stages for extra efficiency. I should like to correspond with a reader in Canada who is interested in DX work. My age is fifteen.—WILLIAM FORSYTH (Bank House, Avoch, Ross-shire).

Quality from Battery Sets

SIR,—I was interested in the letter of Mr. F. B. Horsfall in your issue of January 8th. I can fully endorse what he says, having built up a 3-valve set using the same L.F. coupling, which has given excellent quality and is doing so at this moment.—G. B. MANLY (Birmingham).

A Good Log from Hitchin

SIR,—A fortnight ago I made the simple one-valver described in your paper, the circuit of which I am sure has been the start of many budding S.W. listeners. I made this set into a 5-valve all mains receiver, which has since proved to be a great set on the S.W. amateur bands.

The following stations I have logged, which are a mixture of 40 and 20 phone: KA1AN, KA1AK, KA1NE, VS6AF, VS6AS, VK3KZ, VK6AJ, VK2UD, VK2BQ, VK3NX, VK5WJ, PK4AU, PK6HA, PK1MX, J3EM, J4CD, J7CB, J8CJ, XU3FP, XU8MT and W6JYH. I also heard ZCK, ZBW, I2RO, K2RM; KA2, PI7A, PLP, SSF, SSB, SSC, and 300 S stations.

On 10 metres: W12ZE W1JLE, W1EWD, W2ECO, W2TP, and 75 other W's. My listening hours are 7 p.m. to 7 a.m.—A. PARKER (Hitchin).

Some Suggestions

SIR,—Many thanks for the book you sent me as a prize in your problem contest. I did not write you before as I was away. I know you always like to hear from your readers and I wish to offer a few suggestions.

Firstly, I am sure many readers would like a simple dual-wave or all-wave superhet that could be built up according to the constructor's means. I am seventeen, and have followed your fine paper for about two years. Some time ago you published some superhet circuits, and one had only two valves. Now my idea is that you describe in the paper how this set could be built up into a five or six valve set, something like your SW articles lately. Coils for tuning and oscillation can be obtained quite cheaply, and the range of a small set would be very good for a beginner; later he could add more IF's or a preselector, etc.

Also a mains A.C.-D.C. circuit could be shown using American valves, which although much cheaper, are apparently quite good. I bought some a few months ago and they are still perfect.

A superhet portable set would be very interesting with frame winding for tuning, or preselector and an oscillator coil; this would have a fine range, and would be much better than the H.F., Det., L.F. type, although costing little more.

I am looking forward to your new articles on transmitting. I followed your last articles with great interest, as one day I hope to have a transmitting licence.—D. SEFTON (East Sheen).

Logged on an 0-v-2 Receiver

SIR,—I note in a recent issue of PRACTICAL AND AMATEUR WIRELESS a request from A. Rozier (Stow-on-the-Wold), that you publish other 10-metre logs from any part of the country. I enclose mine, which may be of interest to other readers. All are telephony stations, received during the past few weeks on an 0-v-2, home constructed receiver, using a 33 ft. top antenna, 30 ft. high, pointing north and south. TF5C, YL2CD, SV1RX, K4EMG, K4EJG, K6NYY, LU7AZ, XE1P, CO6OM, TI2FG, TI3AC, VK2GU, HI7G, VO1J, VU2CQ, CO2OG, FA3JY, ZE1JA, ZE1JR, ZT6J, ZU6T, ZU6J, ZU6D, ZS6AJ, CN8AV, CN8AN, and VP9R. All "W" districts have been logged, including W6ERT, W6NLS, W6HX, W7EMP, W7GGG, W7DVY, etc., whilst all continents were logged in under three hours.

Hoping other readers will send in their logs, giving details of receiver and antenna, also whether telephony or telegraphy stations.

Thanking you for many hours of pleasure derived from your very instructive journal.—ERNEST J. LOGAN (Hertford).

CUT THIS OUT EACH WEEK.

Do you know

—THAT in mains units and similar apparatus the A.C. ripple which is superimposed on the D.C. supply must be borne in mind when choosing components.

—THAT L.F. transformers designed for parallel-fed circuits should not be used in a direct-fed circuit unless the current flowing is very small.

—THAT the size of an L.F. transformer is no indication of its efficiency as the core material will govern the overall dimensions.

—THAT all forms of earth connection need replacing periodically, and should also be kept moist.

—THAT the ideal speaker opening is quite plain, with no intricate fretted design which will affect the free flow of the sound waves.

—THAT the capacity of a condenser is inversely proportional to the separation of the conducting plates.

CLUBS AND SOCIETIES

(Continued from page 563)

Maidstone Amateur Radio Society

THE first annual general meeting of the society was held in the clubroom, 244, Upper Fant Road, Maidstone, on Tuesday, January 11th, 1938, with a record attendance.

Mr. D. W. Carr (G8UC) continued with the morse practice from 7.45 to 8.30 p.m., when the formal meeting began.

Next the committee for 1938 was elected, the result being as follows:—Chairman, Mr. A. J. Page; Vice-Chairman, Mr. D. W. Carr (G8UC) (re-elected); Hon. Sec., Mr. P. M. S. Hedgeland (2DBA) (re-elected); Hon. Treas., Mr. R. Brooker (2BFW) (re-elected); Ex officio, Mr. J. Dodd and Mr. E. T. Sands (2BXW). The President is, of course, still Mr. Harold W. Goldsmith.

New members will be very welcome, and are invited to attend the meetings or, if they so desire, to get in touch with the honorary secretary, M.A.R.S., P. M. S. Hedgeland (2DBA), 8, Hayle Road, Maidstone.

Brentwood Amateur Radio Society

THE second annual general meeting of the above society was held on January 9th. The meeting was very well attended by members of the society. The following officers were elected for the ensuing year:—Chairman, Mr. C. F. Turner (2ATU); Vice-Chairman, Mr. W. C. Goult (G2WG); Hon. Secretary, Mr. J. R. Deane Sainsbury (2CYW, B.S.W.L. 352); Hon. Publicity Secretary, Mr. N. K. Read (2BNK); Members elected to serve on committee, Mr. S. Duniam Jones (G8KM) and Mr. J. F. Holloway; Hon. Auditor, Mr. E. D. Hellyer.

All readers of this journal in the Brentwood district are invited to communicate with the hon. secretary, J. R. Deane Sainsbury (2CYW), "Brunook," Crossways, Shenfield, Essex.

Eastbourne and District Radio Society

THE annual general meeting took place on Friday, January 7th, 1938.

The election of officers was the chief business. Mr. S. M. Thorpe, who has been honorary secretary of the society almost since its formation some fifteen years ago, now relinquishes the post to become chairman. He is succeeded as honorary secretary by Mr. J. P. Glickman. The other officers are as follow: — Vice-Chairman, Mr. T. G. R. Dowsett; honorary treasurer, Mr. J. Harris.

A keen ballot for committee resulted in the election of Messrs. J. A. Penfold, R. Davis, A. Clayden and W. Morgan.

Hon. sec., J. P. Glickman, "Kersal," Brodrick Road, Hampden Park, Eastbourne.

Bradford Short-wave Club

AT the club rooms on Friday, January 14th, a large amount of work was proceeding. The club battery receiver was in use, as also was Mr. Murfitt's new all-mains receiver.

A new club transmitter was commenced, and it is hoped that, after the usual experimenting with it at the club on our artificial aerial, we shall make arrangements to have the rig tested on the air.

Construction of a new mains receiver has also been begun, and the club receivers are loaned to members whenever they require them. Everyone in the district who is interested in short waves should communicate with the secretary, S. Fischer, Edenbank, 10, Highfield Avenue, Idle, Bradford, Yorks.

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Issues of Practical Wireless ..	..	4d. Post Paid
Amateur Wireless ..	..	4d. ,, ,,
Practical Mechanics	..	7½d. ,, ,,
Wireless Magazine	..	1/3 ,, ,,

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, PM to *Practical Mechanics*, W.M to *Wireless Magazine*.
Send (preferably) a postal order to cover the cost of the blueprint and the issue (stamps over 6d. unacceptable), to PRACTICAL AND AMATEUR WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

PRACTICAL WIRELESS

CRYSTAL SETS.

Blueprint, 6d.

	Date of Issue.	*No. of Blueprint*
1937 Crystal Receiver	9.1.37	PW71

STRAIGHT SETS. Battery Operated.

One-valve : Blueprint, 1s.		
All-wave Unipen (Pentode)	—	PW31A
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
The Signet Two	29.8.36	PW76
Three-valve : Blueprints, 1s. each.		
The Long-range Express Three (SG, D, Pen)	24.4.37	PW2
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-mark Three (SG, D, Pow)	12.6.37	PW41
Hall-mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D, (Pen), Pen) (All-wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (Trans))	*June '35*	PM1
Cameo Midget Three (D, 2 LF (Trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.36	PW66
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.36	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
All-Wave "Corona" 4 (HF Pen, D, LF, Pow)	9.10.37	PW79

Mains Operated.

Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF. Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	5.12.36	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
A.C. All-Wave Corona Four	6.11.37	PW81

SUPERHETS

Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	13.7.35	PW52
F. J. Camm's £4 Superhet	—	PW58
F. J. Camm's "Vitesse" All-Waver (5-valver)	27.2.37	PW75
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73

SHORT-WAVE SETS.

Two-valve : Blueprint, 1s.		
Midget Short-wave Two (D, Pen)	—	PW38A
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2LF (RC and Trans))	7.8.37	PW63
The Band Spread S.W. Three (HF Pen, D (Pen), Pen)	29.8.36	PW68
F. J. Camm's Oracle All-wave Three (HF, Det, Pen)	28.8.37	PW78

PORTABLES.

Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	19.6.37	PW77
Four-valve : Blueprint, 1s.		
Featherweight Portable Four (SG, D, LF, Cl.B)	15.5.37	PW12

MISCELLANEOUS.

S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	12.12.36	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver	—	AW387
Twenty-station Loudspeaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det., Pen).	—	AW392
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-built Coil Three (SG, D, Trans)	—	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
1934 Ether Searcher; Baseboard Model (SG, D, Pen)	—	AW417
1934 Ether Searcher; Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans)	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All-Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	—	WM318
Simple-tune Three (SG, D, Pen)	*June '33*	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct. '33*	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar. '34*	WM354
Iron-core Band-pass Three (SG, D, QP21)	—	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	*June '35*	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct. '35*	WM396
All-wave Winning Three (SG, D, Pen)	*Dec. '35*	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402
2HF Four (2 SG, D, Pen)	—	AW421
Crusader's A.V.C.4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class B Outputs for above: Blueprints, 6d. each)	25.8.35	AW445A
Self-contained Four (SG, D, LF, Class B)	*Aug. '33*	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5s. 5 Battery Four (HF, D, 2LF)	*Feb. '35*	WM381
The H.K. Four (SG, SG, D, Pen)	*Mar. '35*	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr. '37*	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May '33*	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	*Dec. '33*	WM344
New Class B Five (2 SG, D, LF, Class B)	*Nov. '33*	WM340

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home-Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
S.G. Three (SG, D, Pen) A.C.	—	AW390
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399
A.C. Pentaquester (HF Pen, D, Pen)	23.6.34	AW439
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan. '36*	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All-Metal Four (2 SG, D, Pen)	*July '33*	WM326
Harris Jubilee Radiogram (HF Pen, D, LF, P)	*May '35*	WM386

SUPERHETS.

Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
Varsity Four	*Oct. '35*	WM395
The Request All-Waver	*June '36*	WM407
1935 Super Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C.	—	AW425
Heptode Super Three A.C.	*May '34*	WM359
"W.M." Radiogram Super A.C.	—	WM366
1935 A.C. Stenode	*Apl. '35*	WM385

PORTABLES.

Four-valve : Blueprints, 1s. 6d. each.		
Midget Class B Portable (SG, D, LF, Class B)	20.5.33	A.W.389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Two H.F. Portable (2 SG, D, QP21)	*June '34*	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367

SHORT-WAVE SETS—Battery Operated.

One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (Price 6d.)	—	AW329
S.W. One-valve for America	23.1.37	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG det., Pen)	*Feb. '36*	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
Experimenter's Short-waver (SG, D, Pen)	*Jan. 19, '35*	AW463
The Carrier Short-waver (SG, D, P)	*July '35*	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-Beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-Waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	*Mar. '35*	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-waver Super	*Nov. '35*	WM397

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453W
"W.M." Band-spread Short-waver (D, Pen) A.C.-D.C.	—	WM368
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprints, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug. '35*	WM391

MISCELLANEOUS.

Enthusiast's Power Amplifier (1/6)	*June '35*	WM387
Listeners' 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v) for WM392	*Nov. '35*	WM398
Harris Electrogram (battery amplifier) (1/-)	*Dec. '35*	WM399
De-Luxe Concert A.C. Electrogram	*Mar. '36*	WM403
New Style Short-Wave Adapter (1/-)	*June '35*	WM388
Trickle Charger (6d.)	*Jan. 5, '35*	AW462
Short-Wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May '36*	WM405
Wilson Tone Master (1/-)	*June '36*	WM406
The W.M. A.C. Short-Wave Converter (1/-)	—	WM408

QUERIES and ENQUIRIES

Bending Aluminium

"I have been trying to make an aluminium chassis, but although I have tried several different thicknesses of aluminium I have been unable to get a neat edge so that the chassis will stand firm. I wonder if there is any 'trade secret' or workshop wrinkle which I could get to enable me to make a respectable job of this."—H. D. E. (Portsmouth).

THE bending of this metal is quite a simple job, and the best plan is to get two strips of angle iron, or if you cannot obtain this, two strips of really stout hardwood. Mark out your chassis carefully, and use a square to get the corners correct. When marked out go over the lines (using a straight edge) with a sharp, pointed tool, such as the corner of a chisel, so that a score is made, but do not cut it too deep. Then clamp the metal between the angle irons or the pieces of wood, and bend up the metal. Strong clamps should be used—the type known as a picture cramp is quite useful, or failing this, the pieces of iron or wood may be screwed to the bench with a substantial screw. When bent, hammer along the edge over the angle irons, placing a thin piece of wood between the aluminium and the hammer to avoid hammer marks.

Our Blueprint Service

"I am looking for a blueprint of a set and would like your advice on a short-wave one or two-valver. What do you mean is out of print when you say a dash by the blueprint indicates that the issue is out of print? Is it the issue, the blueprint or both?"—J. B. (Southwick).

THE dash indicates that the copy of PRACTICAL AND AMATEUR WIRELESS in which constructional details were given is out of print. The blueprint itself is still available if it is shown on our Blueprint page. The best set for your requirements would be the Simplest S.W. One-valver described in our issue dated December 12th, 1936, and you could add a single L.F. stage to this to convert it to the two-valver which was described in our issue dated April 3rd, 1937.

Erratic Tuning

"I am experiencing some difficulty with my set, due to the fact that stations do not come in at the same place from time to time. That is to say I might get London right on the mark three nights running, but then when I come back to it the next night it may be four or five degrees higher up the scale. Can you account for this and tell me how to cure it?"—F. K. (York).

THERE are one or two faults which could cause a fault of this nature, but the most likely is that the condenser drive is loose, and the grub screw used for locking the dial to the condenser spindle is loose. Due to stiffness in the condenser, the drive slips now and again and comes back to its original position at which it locks owing to the small indentation made by the locking screw, which acts as a locating device. On the other hand, the condenser bearings may be loose and the condenser may rock slightly, thus bringing the fixed and moving plates in closer proximity to each other and giving the same effect as a further rotation of the drive. Have these points checked and if they are in order the trouble must be due to a frequency shift (if the set is a superhet) caused by temperature or other troubles, and the I.F. transformers and oscillator coil should be checked.

Baffle Material

"I am building a radiogram in a home-made cabinet and should like to know the best material for the inside of the cabinet to avoid boom. I cannot afford a lot of money but should like to make the most effective use of my A.C. Hall-Mark Four as a radiogram."—B. R. (Cardiff).

> **RULES**
>
> We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—
>
> (1) Supply circuit diagrams of complete multi-valve receivers.
> (2) Suggest alterations or modifications of receivers described in our contemporaries.
> (3) Suggest alterations or modifications to commercial receivers.
> (4) Answer queries over the telephone.
> (5) Grant interviews to querists.
>
> A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.
>
> Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.
>
> Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

IF the cabinet is made from good heavy timber there should be no need to worry about lining it. But if it is made from any material less than ¾in. thick you will be able to improve results by lining it with some kind of material to prevent the thinner wood from vibrating and giving rise to boom. The cheapest material would be ordinary corrugated cardboard, glued to the inside, and the pieces on the sides and front being so placed that the corrugations are at right angles to one another. This will assist in breaking up the sound waves. Alternately you can line the cabinet with several layers of ordinary newspaper as mentioned in a recent article on the subject in these pages. Some handicraft stores sell a form of compressed fibre which is used for baffles, and this is about ¾in. thick and could be attached to the inside of the cabinet for a similar purpose.

Lead-in Connection

"I have often tried to overcome the difficulty of having to drill through the window-frame in order to get the lead-in wire to the house, and have wondered whether there would be any sale for an idea which I have worked out for using the glass as a connecting medium. One end of the lead-in would be stuck to the glass outside the window, and the other end stuck on the inside and the glass would act as a small condenser. Is this idea any use for the purpose?"—G. B. (Perth).

YOUR arrangement is not new and a device was marketed some years ago in which two discs fitted with suction cups and terminals were employed. The discs were of celluloid coated on one side with foil and thus the capacity effect formed by the metal discs and the glass of the window was not too small to prevent good signal transference, but we cannot trace that the arrangement is still available. You could, of course, make up a similar idea, varying the size of the discs to get the desired capacity. Another idea which was also available at one time to avoid drilling the window frame, was a flat double strip of fibre containing a flat metal lead inside, and terminals at each end. This could be placed across the window sill and the window slammed down on to it, when the fibre strip bent to conform with the contour of the window frame, sill, etc., and the thickness was not sufficient to allow a draught to enter the room. Connections were attached to the two terminals and thus no condenser effect was introduced.

Spaced Wiring

"In making a lead-in for my short-wave set I wish to keep capacity as low as possible, but do not want to go to the expense of buying the special transmission line which is sold for the purpose. How can I reduce the capacity between ordinary wire and a large diameter screening cable which I have available? This is hollow right through, fairly rigid and of sufficient length to be used without joining."—S. H. (N.16).

IF the lead-in you intend to use is sufficiently thick you could kink it at intervals of 9ins. or so, and then thread it through your screened tubing, the kinks serving to keep the main portion of the wire more or less centrally disposed through the cable. Alternatively, if the walls of the inside of the screen are sufficiently true you could make small "spiders" from ebonite or other insulating material and thread these on your lead-in, passing this through the tubing and relying upon the spiders to hold the wire in the necessary position.

American Nomenclature

"A friend has given me a cutting showing a good short-wave set which I should like to make up, but I cannot understand one or two of the items on it. For instance, it has an A and a B battery and I do not know what these are. There is also a part marked 'tickler,' and I should like to know what these are before I start to build the set."—M. E. R. (Gloucester).

THE terms referring to the battery are the standard American references to the L.T. and H.T. supply, the former being known as the A battery and the latter as the B battery. Where a grid-bias battery is employed this is known as the C battery. The tickler, or tickler coil, is simply the reaction winding or separate reaction coil. There are many other American terms which are not used on this side, the main ones being "antenna" for aerial, "ground" for earth, and "binding post" for terminal.

> **The coupon on page iii of cover must be attached to every query.**

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PLESSEY 3-valve Battery Sets, complete in sealed cartons with three Mazda valves, moving coil speaker, Pertrix batteries and accumulator, in exquisite walnut cabinet; 57/6.

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TELSEN A.C./D.C. Multimeters, 5-range (tests anything radio or electrical), 8/6; loudspeaker units, 2/6, Ace (P.O.) microphones, complete with transformer ready for use with any receiver, 4/6; headphones, 4,000 ohms, 3/- pair.

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BARGAIN Parcels of Assorted Components, including coil, resistances, condensers, chokes, wire, circuits, etc., value 21/-; 5/- per parcel.

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CONVERSION UNITS for operating D.C. Receivers from A.C. Mains, improved type, 120 watt output at £2/10/0. Send for our comprehensive list of speakers, resistances and other components. WARD, 46, Farringdon Street, London, E.C.4. Telephone: Holborn 9703.

HEADPHONES.—Brown, Ericsson, G.E.C., B.T.H. Standard Telephones, Nesper, Western Electric Sterling, etc., 2,000 ohms, 2s. 6d.; 4,000, 5s. Postage 6d. **SPECIAL.** Ericsson, 4,000 ohms, as new, 7s. 6d. Telefunken, lightweight, adjustable, 7s. 6d. **CRYSTAL SETS**—Burne-Jones. Complete, Guaranteed, 5s. 6d. Ditto, double circuit, 8s. Sensitive permanent detectors, 1s. 6d. Crystal Detectors, complete, 1s. Crystals with silver cat's-whisker, 6d. Postage 1½d.—Post Radio, 2, Copenhagen Street, London, N.1.

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MISCELLANEOUS

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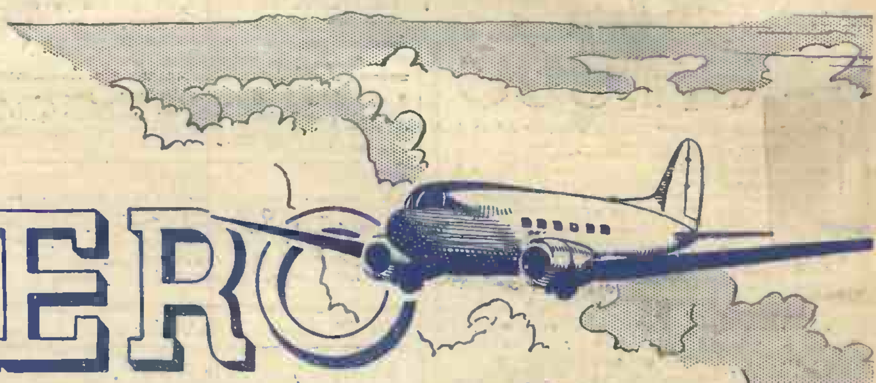

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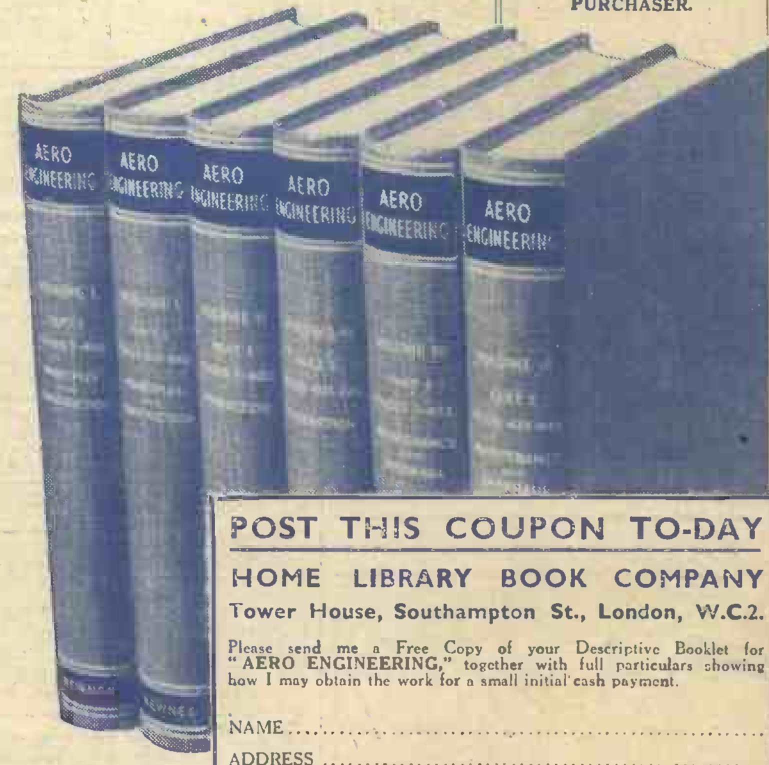

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