JUST OUT!

WIRELESS COILS, CHOKES AND TRANSFORMERS: AND HOW TO MAKE THEM.

By F. J. CAMM.

An important new Handbook for every home constructor and anyone interested in radio. With Special Chapters on Selectivity, Break-through, Coil Winders, Coil Troubles and their Remedies. 180 pages, cloth bound, with 126 easy-to-follow illustrations.

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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. It is a matter of record that this journal has been responsible for the many innovations in wireless construction for which this journal has been responsible. It is a matter of record that this journal has been responsible for the many innovations in wireless construction.

The Diode Detector.

In order to make radio signals audible in 'phones or loudspeaker, it is necessary to rectify, or more correctly to 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 ordinate 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.R.G. 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 0.35 metres.

New Swedish Transmitter

SSMSX, 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, XR4, 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 13d. per oz. 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

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.R.G. transmitter, and details are anxiously awaited.

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)

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.C.C. Appointment

We are informed that Mr. John Coatman, C.I.E., Chief News Editor, has been appointed North Regional Director. Mr. R. T. Clarke, 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 Mowmay and his Band from the Empress; 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 compile 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, Doris Nicholls, Denis Fellow and Godfrey Baseley, with the little Revue Orchestra, conducted by Jack Hill.

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. 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 grandiose display of electronics 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 ZBB 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.

When Hoskins purchased his new H.P. valve he overlooked the fact that this type of valve is now manufactured in two patterns.

When he switched on one day no signals could be obtained, but he was audible from the speaker. After some attempts to tune a station, he turned the chassis tip 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 received. Address your attempts to the Editor, PRACTICAL AND AMATEUR WIRELESS, 442 Islington; or to the Postal Ministry at the Tower House, Southampton Street, Strand, London, W.C.2. Envelopes should be marked "Solution to Problem No. 276."
SUPERHETS AND AERIALS

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

I f 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, perhaps, a gain fifty times greater having, perhaps, a gain fifty times greater than strictly necessary, that a piece of disguised clothes line (metaphorically speaking) is unnecessarily generous aerial equipment. Those people who must get China says, "get China," and are content with a couple of dozen European stations, feel that expenditure on aerial equipment would be a wicked waste.

When the bogey 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 outlet, 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 was done on the subject be made available to users of superhet.

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, which are carriers of 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 superhet as it was when using a crystal detector in the early days, although the reasons for so doing are not the same. For convenience the writer has cited a small indoor aerial, or the lead-in section of such a set, the efficiency of the aerial being of normal proportions, it will not impair selectivity.

Indoor Aerials

This is apparent, therefore, that a highly efficient aerial will not impair selectivity, 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 superhet as it was when using a crystal detector in the early days, although the reasons for so doing are not the same. For convenience the writer has cited a small indoor aerial, or the lead-in section of such a set, the efficiency of the aerial being of normal proportions, it will not impair selectivity.

Outdoor Aerials

It is generally considered that the most efficient aerial to use with a superhet is that illustrated in Fig. 1, it is obvious that a 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 aerial will operate the automatic volume control and reduce the sensitivity of the set. Thirdly, the aerial being of normal proportions, it will not impair selectivity.

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 ear electrical equipment will be reduced to a minimum, and if any electrical signs are nearby they will also be reduced in intensity if not removed entirely by the use of a vertical aerial.

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

Fig. 2. A long, lean 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, whether the correct tension is used or not, will set off the same sound which we know as E when bowed or plucked. But if we take a string made from some other 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 mainst it is struck the finger is removed, the string will vibrate in two separate vibrations, 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 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 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 their 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 loud-speaker.

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.

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 multiplied 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, 900 metres, the electrical wave will give rise to harmonics in just the same way as the musical strings already mentioned, and these will be found at 290, 1295, 625 and so on, being referred to as the second harmonic, etc. Consequently, you can often tune to a medium wave station on some 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.

DIODE valves were the first type to be used and were made long before the introduction of vacuum tubes. They are still used and are very satisfactory for many applications, especially where the simplicity of the circuit and the reliability of the valve are important.

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.

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 .0002-mfd. fixed condenser. at any rate, that the moving junction of the condenser is 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.

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 tuning 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.

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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.

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 stronger 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. 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...
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 water end becomes negative in respect of the lower when a signal is tuned in. Moreover, the magnitude of this 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 opposition to the A.V.C. anode D2, as 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 1,000-ohm resistor and a .0003 mfd. condenser. That would give a delay voltage of roughly, 1.5 volts with 150 volts P.T.

A corresponding but alternative circuit is given in Fig. 5, where corresponding resistors are given the same references as in Fig. 4. In the circuit shown, a .002 mfd. condenser is used for the preceding circuit.

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 X.

Avoiding Delay Voltage

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 L.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 use 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—voltages from 1 to 6 volts—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 the 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-

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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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Now Ready!

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AND HOW TO MAKE THEM

By F. J. CAMM

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GEORGE NEWNES, LTD.
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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 scriber. If I did so the pro-croonirtics 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 lydite (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
A LAD 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.

"Hate those Crooners!"

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 watts! 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 Seaforth: "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-valver 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
Do Dealers Ever Listen In?

R. 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!

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 utterly piffl 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."

Drawing the Waves

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

"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.'"
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 may be mentioned erratic reaction and excessive background noises. They experience may be found effective in reducing background or static noises. Unfortunately, the simple type of receiver by the aerial-earth system may result in some trouble with the reaction control. 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 may 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.

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 0.001 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 utilizes 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.

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.

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 CMBX, is now confirmed as COX, re-transmitting CMBX, a medium-wave station of the Cuban Broadcasting Company. The channel used is 52.61 m. (9.2 mc/s), the power being given as 900 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 Estaciones CMRX y COX, San Miguel, 194, Havana, Cuba.

Two U.S.A. Expeditions

OXYQ, is the call-sign of the McGregor Expedition radio station in Greenland; transmitters are made irregularly on 20.56 m. (14.58 mc/s). VP3TH, 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 a transmitter on 21.83 m. (13.745 mc/s) between GMT 23.30 and 00.30.

Algers 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 Algers medium-wave broadcasts. They have not only been heard well throughout Europe, but also in the United States. Announcements in Spanish and English have been received from the United States.

Opera Broadcasts from New York

Every Saturday, from GMT 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, Schenectady, on 19.56 m. (15.33 mc/s) and 31.48 m. (9.53 mc/s), respectively, and through W1XK, Millis (Mass.), on 31.36 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 GMT 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 21.00 m. (9.06 mc/s) and LSY, Monte Grande, on 16.26 m. (18.115 mc/s). The latter is a commercial station used for regular public telephone service with Europe, and the United States.

SHORT-WAVE SECTION

In connection with this main 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 not shown as a picture in 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 one 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.

For Calibration Purposes

IUD, Addis Ababa (Ethiopia) on 18.42 m. (18.27 mc/s) now a 15-kw. transmitter, re-constructed by the Italian authorities, may be heard on the afternoon and early evening hours, and in telephonic communication with Rome.

L9F4, Monte Grande (Buenos Aires), on 15.08 m. (11.09 mc/s), gets into touch daily with Paris at GMT 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 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 heard 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 (GMT 6.00-13.00), which will ensure good reception of the programmes in Manila from 4.0 to 10.0 p.m., in Tokyo, from 5.0 to 11.0 p.m., in Shanghai, from 6.0 to 12.0 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 FZBS, 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 GMT 13.15-13.35. For those readers who care to look up the map the geographical position is 4° 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 3LJ 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.

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 cases 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 values 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 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 indication. A wooden plate mounted flush over it so that the stem can pass through. Another hole the size of the rivet is then drilled in the center issue. A magnet-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.

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 aluminum, as, this being soft, they can be easily printed, and then pricked with a needle. The metal caps from milk bottles are ideal for the 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 13/32 ins. in diameter, this measurement ensuring a close fit for average holders. The holes for the caps, in my case, were done with a 1 in. bit, and then sand-papered down to obtain a tight fit; glue is not necessary if the top panel is thin, this giving firmness to the caps, which are sweated into position.

- A. J. Ward (Edgware).

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 the odds and ends I had in my junk box. The accompanying sketches show the result.
Although the past year has not been marked by the appearance of new equipment during the past few months, it is certain that the effect of the depression on the sale of all-wave receivers has been considerable. Last year a large number of leading manufacturers, in addition to the normal broadcast bands, produced a number of receivers which are inaudible on the loudspeaker. We have used these new sets, and we are satisfied that these sets are suitable, and that they will be popular. We have used these new sets for some time, and we are satisfied that they are suitable.

1937 in Retrospect

An Account of the Developments of the Past Year, and Some Forecasts of the Trend of the Industry

New Tuning Devices

There has 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 idea of such a dial has been explained in this page, and it has been stated that the same dial should be used 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 of the receiver.

Receiver Design

In the newly-built receiver, it is noted that there has been a much greater percentage of all-wave sets built than broadcast-band receivers, and the growth of this type of receiver is due to the fact that there are more and more people who are interested in listening to the air waves. More people are using headphones, as this often enables long-distance stations to be heard which are inaudible on the loudspeaker. Furthermore, this fact is that interference is more troublesome on the air waves, there has been a greater tendency against the use of interfering apparatus, and it is to be hoped that Parliament will not delay the passing of a suitable bill to make it illegal to use such apparatus. In an attempt 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 set to be erected out of the field of interference. A long length of screened wire employed without loss of sensitivity. These aerials consist in the main of a single length of aerial wire joined at one point to a special matching transformer. From this to the receiver a long length of screened cable is connected, and it has been found to be very effective to connect the receiver directly to the line.

An anti-interference aerial kit.

The cable may, of course, be cut to any desired length and owing to this screening does not pick up interference.

For the reception of television, special aerial systems of suitable type, have been produced for two or three firms, and they have not been seen since.

All-stage Valve

A special type of valve was perfected during 1937, and it is now available for use in all types of receivers. From this, it has been named the "All-stage Valve," and it is a special H.T. valve which should greatly simplify receiver design. The new valve is already producing a modern superhet to which this particular valve is bound at every stage, from the frequency changer to the output stage.

Another type of valve which has also been developed during the past year to the set. This is a special type of two-valve grid 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 of the set.

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For the Battery User

An interesting 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 T.C. accumulator in good condition, but very difficult to use with ordinary gas supplies and this gives to the listener who has no electric light mains facilities the same advantages as his more fortunate neighbour may possess. This unit has been produced by the makers of the well-known H.T. receiver, and it is possible to be right out of date so far as concerns the apparatus which one is using.

This is the battery charger, which incorporates the latest all-wave and unit.

Television

Towards the close of the year large sets of television demonstrations, and other television pictures were well received. The main demonstration was with an H.T. unit which is kept in good condition by means of an accumulator to which is connected to it. A change in this case enables the accumulator to be put in the charging position, and it is then possible to be right out of date so far as concerns the apparatus which one is using.

The Hotter All-stage valve, which simplifies receiver design, is to be seen at any stage of a receiver.

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1937 IN RETROSPECT

An Account of the Developments of the Past Year, and Some Forecasts of the Trend for the Coming Year

New Tuning Devices

There has 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 idea consist which is illustrated on this page has been to span a 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 the market.

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.

Receiver Design

In the well-built receiver market, it is noticed that there has been a much greater percentage of all-wave sets than of the two-band, two-unit receivers, and the general effect has been to introduce designs which are inaudible on the loudspeaker. More people are now using these aerials, as they are easier to handle, less complicated to construct, and enable long-distance stations to be heard to an extent which was not possible before. Among the most popular designs are the so-called all-wave receivers, and the Trident receiver we used a B.T.S. coil—a B.T.S. product, in fact, it is much smaller than some others we have seen.

In the Trident receiver we used a B.T.S. coil—a B.T.S. product, in which no screening is employed, but the unit also incorporates its own switching mechanism.

Television

In the United States television sets are being added to the existing radio receiver, and many of these are being sold as complete sets. The sets are made in two sizes, one for the home receiver, and one for the car. In Europe, television sets are being added to the existing radio receiver in the same way, and many of these are being sold as complete sets.

Television sets are being added to the existing radio receiver in the same way, and many of these are being sold as complete sets.

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 receiver. This was a changing unit for keeping the I.T. accumulator in good condition, but was designed for use with ordinary gas supplies and thus gives

The illustration shows the mechanism of the Hivac All Stage valve. The device has been cut away (A) to B, and four, which is a H.T. connection, and both active and neutral position, 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 other television pictures have been demonstrated. It would be 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 scattered places whilst that event is taking place. Whether or not the home television receiver will be induced in print, or whether the size of picture will be increased, will depend upon the general public’s tastes and needs. Broadcast, as it is impossible to mount the apparatus on a suitable portable television receiver.

The Hivac All Stage valve, which simplifies receiver design, as it can 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 compete favourably with their mains counterpart—both in performance and in the short wave-band covered. So many battery superhet do not include the 16-metre band, but by employing a separate oscillator this receiver covers a short wave-band of 16-32.5 m. They have been developed in the Cossor laboratories, and are new this year to the market.

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 over-coupled 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 double 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 final adjustment the Cossor works with the aid of cathode-ray oscillograph apparatus, the coils are sealed in wax with wax, and frequency drift is virtually impossible.

While both first and second I.F. transformers are constructed as above, the first transformer does not incorporate the much 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 off 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 shrirk 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 performance of this receiver was quite up to expectations, the sensitivity being the striking point mentioned in the mains receiver, and the selectivity extremely constant over all wavebands. Some idea of the high sensitivity can be gained from the fact that the input of the largest signal (the scale) to produce 50 milliwatts output was only 48 micro-amperes on long waves, 45 micro-amperes on medium waves, and 50 micro-amperes 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.

Tone and Volume Controls

The performance of this receiver may be summed up by saying that it is an outstanding example of the latest technique. 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 condenser it is amply sufficient for stations coming all round the dial had remarkably even volume.

The cabinet in the Cossor receiver is the comparatively recently introduced Cossor quartz 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.

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 11s. guineas, which is moderate for the performance. Hired purchase terms are available at 17s. 6d. down and eighteen monthly payments of 8s. 6d. or twelve monthly payments of 20s. 8d.
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January 1st, 1938
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 encyclopedia, 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 these units 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 electric circuits, 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 condenser 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 could be licenced 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 x 10^-28 grammes, 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 or a certain quantity of electricity, the weight of the electrons passing is relatively considerable. To take a case in point, if a valve passing 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 0.002 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 to the anode 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 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 not vary. Destinable 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 that a bowling ball, a ton of iron, can move through an insulator. Ten volts may be sufficient to pull a certain number of electrons across 1 mm. of vacuum, but it takes approximately 1,000,000 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 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 Gidley.

MIDLAND (296.2 m.)

Wednesday, December 29th.—Arab and Gezira: Resolutions for Nineteen Thirties Eight.

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

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

Saturday, January 1st.—Symphony Concert.

NORTHERN (449.1 m.)

Wednesday, December 29th.—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 Colston Hall, Bristol.

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.—200 Band concert.

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

WELSH (375.1 m.)

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

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

Friday, December 31st.—Carols from St. Mellons County Club, St. Mellons.

Saturday, January 1st.—My New Year's Gift, or the Dance 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.—Junon 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.
January 1st, 1938

PRACTICAL AND AMATEUR WIRELESS

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.

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.

"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 manoeuvre 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. 2.

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)
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 necessity for the transmitter to give the receiver unmistakable information for the purpose of picture synchronisation.

At the instant of picture-synchronising the signal the cathode-ray spot will travel in a vertical direction, but at the same time it will continue in the line direction about eight times, so that its actual course is a slightly unsymmetrical zigzag, 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 waveform 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 waveform should give a clear insight into the basic working of the modern television receiver.

A Multiplier Cell Precaution

MULTIPLIER photo-cells are finding an increasing application for a large number of commercial purposes. In many cases it is desirable to have the single cell with its associated amplifier, thus representing a saving in cost, space, and electrical 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.

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.
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, this is 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 the page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may obtain a membership card, a replica of which is shown here. This will give you free admission to all meetings and visits arranged by the A.E.L. upon you. In addition to this, you will receive confidential reports to distant stations for the various useful items of stationery which you may obtain. Printed notepaper for your private correspondence, pads of verification sheets upon which you can record 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. member when you receive a station in each of the five continents, and have obtained verification sheets upon which you can obtain stamps or to be broken. If you are not already a member of this club, chief of which are the many useful items of stationery which you may obtain. Printed notepaper for your private correspondence; pads of verification sheets upon which you can record 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. member when you receive a station in each of the five continents, and have obtained verification sheets upon which you can obtain stamps or membership or admission fee, all that is necessary being to complete the Enrolment Form at the foot of the page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may obtain a membership card, a replica of which is shown here. This will give you free admission to all meetings and visits arranged by the A.E.L. upon you. In addition to this, you will receive confidential reports to distant stations for the various useful items of stationery which you may obtain. Printed notepaper for your private correspondence, pads of verification sheets upon which you can record 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. member when you receive a station in each of the five continents, and have obtained verification sheets upon which you can obtain stamps or membership or admission fee, all that is necessary being to complete the Enrolment Form at the foot of the page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may obtain a membership card, a replica of which is shown here. This will give you free admission to all meetings and visits arranged by the A.E.L. upon you. In addition to this, you will receive confidential reports to distant stations for the various useful items of stationery which you may obtain. Printed notepaper for your private correspondence, pads of verification sheets upon which you can record 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. member when you receive a station in each of the five continents, and have obtained verification sheets upon which you can obtain stamps or membership or admission fee, all that is necessary being to complete the Enrolment Form at the foot of the page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may obtain a membership card, a replica of which is shown here. This will give you free admission to all meetings and visits arranged by the A.E.L. upon you. In addition to this, you will receive confidential reports to distant stations for the various useful items of stationery which you may obtain. Printed notepaper for your private correspondence, pads of verification sheets upon which you can record 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. member when you receive a station in each of the five continents, and have obtained verification sheets upon which you can obtain stamps or membership or admission fee, all that is necessary being to complete the Enrolment Form at the foot of the page and send it to us. In return you will receive a Membership Certificate, and if you require it, you may obtain a membership card, a replica of which is shown here.

A loudspeaker which had by him. He was building a radiogram and did not know which speaker to incorporate, his main requirement being a low-note response to assist in obtaining balanced reproduction from a quality receiver. He was utilising 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, 240 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 by joining up each speaker in turn you will be able to judge as to whether the speaker will take the load or whether it is suitable for low-note reproduction, remembering that the A.C. supply is at 50 cycles, and the speaker will thus give a 50-cycle note.

A Renovation Hint

There is a very simple way in which one can renovate a cabinet which is shown here. This illustration shows how a cabinet may be renovated as explained above. 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 defects. 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 defects in this material are very easily removed. Take a damp cloth and a piece of hot metal of suitable dimensions (which 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. Provided 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 4 mm thick. After the bruise 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.

NOW READY!

WIRELESS COILS, CHOKEs, AND TRANSFORMERS, AND HOW TO MAKE THEM.

Parlophone

Of the many new records issued by the Parlophone Company for the month of December, I draw attention to "Stars Calling" on Parlophone E 11347. It is a 12in. disc competed by Ronald Fraser and the Macmillan orchestra, singing "Villa," Gitta Alpar, "I Give My Heart," Joseph Schmidt singing "My Song Goes Round the World," "Heart of Gold" played by Harry Roy, "Rhythm in Our Business" by Nat Gonella, "I'll See You Again" by the Tugger-Bagmuiffins, and finally Hughie Green 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 2089 singing "O Mia Bella Napoli," an Italian version of "A Little Rendezvous," and "First had ihr Komplinent gemacht" (Sweet Compliments) from the original "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 have this month issued an 8in. disc, Franklin Pangborn singing "La Traviata" (Act 2, "Di Provenza il mar") and "Ballo in Maschera," both songs in Italian, from the maschiovitt'i, on Parlophone PX 081. This record was originally recorded in 1909.

In the classics we have "Walzer of Words," a record set of two parts by the Orchestra Mascotte on Parlophone R 2463, "Samson and Delilah" by Dajos Bela and his Orchestra on Parlophone R 2460, and "Value Blasee" 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 980, and "After All These Years" and "For Only You" on Parlophone F 990.

Mugatroyd and Winterbottom, two muids with not a single thought, aided by the Quintette of the Hot Club of France, give a talk to the members at their meeting on December 14th, in St. Peter's Hall, S. Croydon. His quality of voice is excellent, his range is enormous, and the impression is left that he is a "ham" and an army operator in the Egyptian desert. He said he was the first amateur in Egypt who gave a talk to the members at their meeting on December 14th. Mr. Corbett said the meeting was held at the club headquarters at Beechroft Settlement, Whetstone-Lane, Birkenhead, on January 5th.

Deco Novelty Records

RECORDS that will be extremely popular with radio hounds are two new records 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 1000 counters for 1.50. For football fans there is Decca Football Pools, a twelve-track record complete with board, indicator and full instructions, Pools 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.

U NDER the impressive title "A Symposium of Swing" an album includes four of the best records ever heard on Parlophone's 12in. disc, each 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 Benny Goodman. His Chambalake Seven play "All You Want to Do is Dance," and "After You Played" on H.M.V. B 8676, Tommy Dorsey and his Chambalake Seven play "All You Want to Do is Dance," and "After You Played" on H.M.V. B 8676, Tommy Dorsey and his Orchestra play "Sugarfoot Stomp," and "I Can't Give You Anything But Love," on H.M.V. B 8671. The new set was given by Mr. H. J. Walters of the Bell Telephone Company. After discussing the differences of interference, and their cure, Mr. Walters demonstrated a cure for a particularly vicious electric fan. It was impossible to hear the fan in a receiver even though the aerial was touching it 1.
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 other readers that are of 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 method employed in our P.B.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 coil winding in series with the main secondary a double-peak response curve is obtained, whilst with this winding out of circuit the coupling is reduced to below optimum, resulting in a single-peak 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 the article "Variable Selectivity Circuits." Each 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 variable winding methods.

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

In view of the simplicity of the method employed in the P.B.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 P.B.124 were more widely known.—M. A. B. (Woolwich).

**An S.W. Log from Brighton**

SIR,—I am enclosing my 28 and 56 m/cs log for the past few weeks, trusting it will be of interest to other readers also. My log as follows: 56 m/cs on 0-v-1 super-reg.: G2HG, G2HV, GsO5, GsO6, GsO7, GsO8.

28 m/cs on 0-v-1 straight: OGLK, GND, AMATEUR WIRELESS, GLSE, YKOD, SPHH, E5SD, OHIN, OHNB, OSNF, OHNR, OHNK, UICO, UZNF, U2FB, FASJO, VEIDT, H7G, YVSAJ, VN2CQ, VN2FF, VXKGG, ZBIP, ZBC, ZBD, CNAJ, and numerous W's.

I should very much appreciate hearing from any reader who is using a battery at straight 56 mcis or super-reg.

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. FAIRCILD (1a, Dover Road, Brighton, 6, Sussex).

**CUT THIS OUT EACH WEEK.**

Amateur Wards—New Zealand

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 yard" and my neighbours are the only ones within half a mile.

On the said neighbours finding I was building an all-warver, they too decided that they also must have an all-warver.

It had to be a shop-built one, however, as they kindly informed me "a home-built one isn't any good."

I finished building my set and we then had some competition, resulting in me pulling in stations he can't hear 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 (Bentbridge).

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 (Toronto). On the 9th I heard a straight 56 mcis receiver. It was a new one on me.—G. ISHERWOOD (Bentbridge).

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January 1st, 1938

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 inexpensive 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, thus giving the beheading effect. Instead, 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 made a breakthrough in 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. Real artists as well as coloured picture block superimposers. Real artists as well as coloured picture stills have been featured, and no anachronistic 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 high-screen working deals with. As in colour film working, it is found quite often that details are revealed in colour pictures which cannot be seen with monochromatic pictures.

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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 the control has no effect upon the volume. Are you aware of the instructions as to where exactly 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 switch, and others prefer the volume to be at minimum. You can, however, easily alter the effect merely by changing the connections to 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 to G.B.—3 and the other to the metal terminals 3 on the two rear sections of the chassis. If this is so would you recommend another circuit? Regarding selectivity, could you receive, say, the North and Midland regions 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 H.T. current of about 0.5 amp. By obtaining a good H.T. battery you should not find that replace- ment is needed so 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 re- ceived, and the Midland should be clear of the two London stations.

Carrier Interference

I find that there is a terrible whistle which I listen to Luxembourg, and a kind of rocking 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.—H. R. (Romford).

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

Fury Four Modification

I am making up a 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 0.003 mfd. fixed condensers on the underside of the chassis have to be disconnected on one side—the first from the grid terminal of V2, and the other 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 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. F. R. (New Mills, N. Stockport).

The readings you give tend to show that you tested the output from your eliminator with an ordinary type of volt-meter. The two low outputs are intended for the screen of an S.G. valve, and the deter- mined anode voltages in each case is only a few milliamps. The highest output is intended to supply up to 600 or so, and this is so small that it would be taken by a small "pocket" type volt-meter. Consequently, as the low voltages are obtained by means of the voltage drops through series resistors of additional current taken by your meter will result in a much greater voltage drop than intended and so give the readings you mention. The output tapping would be more or less correct. Thus, to test this type of unit you must measure 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 lack of space, or because the replies are strictly of general interest.

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

S. W. (Hendforth).—You could add a crystal tweeter, and it would be connected as a crystal detector in line with the aerial in accordance with the manufacturer’s instructions.

A. B. (Nottingham).—The transformer 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 triode- charging output for operating battery-valve flashtubes.

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

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

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

D. C. H. (Chadderton).—As you increase the L.F. output so would you notice the effects of poor selectivity. The E and B stage could be replaced as an additional eliminator in the F.M.A.V. valve. An aerial volume control would be simple, consisting of a differential condenser across the aerial coil (fixed plates), with the moving plates to a.m. coil, and the F.M.A.V. coil.

W. J. A. C. (Immingham).—There is no receiver in our brochure list which contains this frequency. The most recent receiver (A.C.—all-wave) is the "Corona 4," but this would not give 4 watts output, the most recent receiver (A.C.—all-wave) is the "Corona 4," but this would not give 4 watts output, and the "Corona 4," but this would not give 4 watts output.

G. W. F. (Chadwell St. Mary).—The address in question is 64 Valley Road, Sherborne, Kent.
MISCELLANEOUS ADVERTISEMENTS

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black and italic capitals are charged double this rate (minimum charge 3p. per year). Display lines are charged at 6p. per line. All advertisements must be proofed. All communications should be addressed to the Advertisement Manager, "PRACTICAL AND AMATEUR WIRELESS." Phone: 3775. 3/9.

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VAUXHALL. T.C.C. electrolytic condensers, 8 mil. and 4 mil. 500 volt, 2d. 5d. 500 volt, 1d.

VAUXHALL. Iron-cored coils, 3-gang, on base, with circuit, 12s. J.B. driven with station meter scale, 50.

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Cover iii 464

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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, January 8th, 1938

Edited by F.J. CAMM

The JOURNAL for BEGINNER AND EXPERT

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- **OSRAM U31**
  - Indirectly Heated
  - 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.

The OSRAM U31 is a Rectifier for use in D.C./A.C. Receivers where the heater is wired in series with the heaters of the remaining valves at a constant current of 0.3 amp. The cathode is Indirectly Heated and the output of 120 milliamps is adequate for all normal receivers of this type.

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

CHARACTERISTICS OF OSRAM KT32

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Heater Current</td>
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</tr>
<tr>
<td>Heater Voltage</td>
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<tr>
<td>Anode Voltage</td>
<td>135 max.</td>
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<tr>
<td>Screen Voltage</td>
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<tr>
<td>Anode Current</td>
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<td>Screen Current</td>
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<td>13/6</td>
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CHARACTERISTICS OF OSRAM U31

<table>
<thead>
<tr>
<th>Characteristic</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
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</tbody>
</table>

*LOOK FOR FURTHER "POINTS OF TECHNICAL IMPORTANCE" IN FUTURE ANNOUNCEMENTS.

Write for Osram Valve Guide.
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 the trouble and rectifying it, is of itself 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 Is. 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.

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 replacement of a fuse to the modernizing of an old-fashioned house.

"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 conductor, Mr. 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 piano 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 Debos, 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 session 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.
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.

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 four organ works. On January 30th Maurice Vinden will give a recital from St. Mark's, North Audley Street, in a new series "Round the London Organs."

Duetists

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 19th 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 of concerts 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.

ORGAN RECITALS

Duo Recital at St. Mark's

Dorothy Curless and Bert Varrett, 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 shortwave 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.

PRACTICAL AND AMATEUR WIRELESS

January 8th, 1938

ROUND the WORLD of WIRELESS

(Continued)

INTERESTING and TOPICAL NEWS and NOTES

Londop 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. 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.

Western Pantomimes

EXCERPTS from two West of England pantomimes will be broadcast on January 13th; "Mother Hubbard," produced by Percy Dansford, 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 Asyar (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.
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.)

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 method of incorporating a diode detector 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 grid-leak 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 put a diode circuit across it, or to use a transformer.

The Battery-operated grid detector represents an easy proposition. Fig. 72 shows a simple method of incorporating the 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 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 gramophone.

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 brought out by the switch S1, and the switch S2 is open. The resistance R in the anode circuit of the I.F. valve functions 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 detector) to the volume control stage. So long as the decoupling condenser C is not made too large a capacity there will probably be no necessity for switching it in on gramophone.

(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 de-coupling at the L.F., but not too big 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 .002 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" or "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 arrangement that a particular case may demand, the general idea of "radio" or "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 pick-up transformer should 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. inter-valve transformer, or L.F. coupling choke, if any, however, requires 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 valve holders. 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. intervals.

In a mains receiver the possibility of an L.F. inter-valve 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 spare 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.

Important Broadcasts of the Week

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

Wednesday, January 6th.—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 6th.—Theatre Royal, Cheltenham, a page of theatrical history.
Thursday, January 6th.—An excerpt from "Puss in Boots," from the Alhambra Theatre, Glasgow.
Friday, January 7th.—Variety from the Hippodrome, Bournemouth.
Saturday, January 8th.—The Clyde, feature programme.

MIDLAND (296.2 m.)

Wednesday, January 6th.—Theatre Royal, Cheltenham, a page of the shakespeare.
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, Park 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 Gallico; adapted as a radio play.
Friday, January 7th.—Variety from the Hippodrome, Bournemouth.

Saturday, January 8th.—Sing-Song from the Guest Night at the Top H Area Festival, from the Civic Hall, Exeter.

WELSH (373.1 m.)

Wednesday, January 6th.—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 Mustard," 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.—Lifting Lays, a Gaelic programme of songs and dances.
Friday, January 7th.—Aye! B' in, a programme of old Yule customs.
Saturday, January 8th.—The Clyde, feature programme.
Experimental I.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. 

W. J. DELANEY

The keen experimenter is always on the lookout 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 stage where such a gain would be of the utmost value?

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 potential-meter supply across the H.T. battery, or from H.T. positive to H.T. negative, and although such a circuit could be adopted in the L.F. 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 resistor 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.F. 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 a 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 point (Continued at foot of next page)

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

Fig. 2.—The same circuit as used when a battery valve is employed.
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 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 fault, save 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 milli-amps, 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 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 the valve is in receiver service, and if it is used on a step feed, will get the full H.T. voltage on the screen, which might be, say, 300 volts, and pass quite fantastic anode curent, capable of breaking out the coupled resistance, and generally behaving in a most puzzling manner.

Perhaps the most curious item of all is 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, when fed from a 300-volt H.T. supply through a series screen resistance and anode decoupling resistance, it passes 47 time the prescribed 100 volts, after which it gets so hot that it must be switched off to prevent total collapse of the electronic assembly. The cure is obviously a potentiometer feed to the screen, but where this is undesirable, the only cure is replacement.

EXPERIMENTAL L.F. AMPLIFIERS

(Continued from previous page)
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.

By Thermion

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 Encyclopedia" 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.

Songs You Might Never Have Heard

THE B.B.C. tells me that 11,109 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:

2. "Bells at Eventide," 1,128.

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.'"
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 he wonders whether 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, reduce the losses introduced by a long feeder — either of the twisted or the screened type.

Quality Alterations

S EVERAL 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 emphasized 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

T HE 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.

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 scrun of everyday life we are gradually developing a sense of appreciation for the humour behind our workday existence, even if the laugh is against ourselves.

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

L ISTENERS 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 Theisger joins the ranks of radio-dramatists with a slight but amusing sketch, entitled "The Elixir of Count del Bosco." Other newcomers include E. Dunning Oribille 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 T." 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, Charles de la Boë, Agnes Mary, and G. K. Chesterton.

Radio in the Bush

T HE 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 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 interior 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. Traeger, 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 £7 5s., and every one of them is equipped throughout with Philips valves.

To operate them, and a child can do it, one simply peddles and speaks, and thus, through the magic aid of the 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.
OVER 75,000 N.T.S. D.X. RECEIVERS IN USE THROUGHOUT THE WORLD

BARGAIN 1-valve S.W.KIT
LIST PRICE 35/- BARGAIN 19/6

Complete Kit of parts comprises M铲al Hypo-120mm, 3rd harmonic, 120 condenser, switch, test cards and coals. Suitable for low variable, L.F. detector, tuning, and complete grid iron. A.M. and F.M. operation. Conditions as 30/- but with $5/- deposit and 11 monthly payments of $5. END.

New 4-valve BANDSPREAD
Battery SHORT-WAVE KIT
List Value £4.9 BARGAIN 42/-

650-1,000 metres: Bargain £2.9, 264-510 metres: £2.9 down and 11 monthly payments of 2/6.

2-valve BANDSPREAD S.W. KIT
List Value 59/6 BARGAIN 32/6

A BOTHY, and for world-wide listening and reception. Bargain £2.9, 264-510 metres: £2.9 down and 11 monthly payments of 2/6.

SHORT-WAVE COILS
These highly efficient coils are wound on a form of low loss material and supplied with 6- or 9-pin bases for testing 3 and windings respectively.

4-PIN TYPE

6-PIN TYPE

AMERICAN VALVE SPECIFICATION of this marvel will be appreciated by all who use the set

N.T.S. D.X. SHORT-WAVE SET

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

BARGAIN 4-valve BANDSPREAD
New 3-valve BANDSPREAD

*SHORT-WAVE KIT
LIST VALUE £3 BARGAIN 3/6

Kit 14/6 comprises every part for assembly including 4-pin coils, wiring and assembly instructions, less valve only. Kit 24/6. Cash 15/- or 2/6 down and 11 monthly payments 2/-.

New 3-valve BANDSPREAD

37/6

RELAYED SHORT-WAVE.KIT

List Value £3 BARGAIN 3/6

KIT 14/6 comprises every part for assembly including 4-pin coils, wiring and assembly instructions, less valve only. Kit 24/6. Cash 15/- or 2/6 down and 11 monthly payments 2/-.

NEW DESIGN! WONDERFUL PERFORMANCE
The latest bandspread world-wide listening system incorporates the 3-valve BANDSPREAD SPECIAL and NEW BANDSPREAD SPECIAL. This is the latest in bandspread, and this new kit is yours at almost half the list value! Kit 14/6. Cash 7/-, or 2/- down and 11 monthly payments 2/6.

New 3-valve BANDSPREAD

37/6

SPECIAL OFFER!
Light-weight super-type HEADPHONES, recommended for short-wave work and testing. List Value 15/- BARGAIN 5/6.

BARGAIN 5/6

SPECIAL OFFER!
Light-weight super-type HEADPHONES, recommended for short-wave work and testing. List Value 15/- BARGAIN 5/6.

VALVES.

AMERICAN VALVE SPECIFICATION of this marvel will be appreciated by all who use the set

N.T.S. D.X. SHORT-WAVE SET

AMAZING BARGAINS—5-V. A.C./S.HET RADIOMATIC RECEIVES with excellent quality of tone, volume and selectivity. Being and Perfect Transistor Front-end and Reflector with Markable Reception. BARGAIN £2.9; 5/-, or 5/- down and 12 monthly payments of 5/-.

LIST PRICE £28: 7: 0

BARGAIN £10: 10: 0


K.B. RECEIVERS
OFFERED AT ONE-THIRD LIST PRICE. LIMITED SUPPLY. ORDER NOW.


LIST PRICE £28: 7: 0

BARGAIN £2: 19: 6

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


LIST PRICE £11: 0: 0

BARGAIN £4: 1: 0

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

WONDERFUL BATTERY S.G.S. OFFER

LIST VALUE £6: 6: 6

BARGAIN 5/6

K.B. RECEIVERS
OFFERED AT ONE-THIRD LIST PRICE. LIMITED SUPPLY. ORDER NOW.


LIST PRICE £28: 7: 0

BARGAIN £2: 19: 6

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

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.

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 bulky 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 ear 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 base end of the frequency response, as well as at the top end, 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.

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 Cl across the primary of the transformer. So that, with the switch in one position, capacity C is short circuited, with Cl left open, giving full speaker range, and in the other position C is put into circuit with Cl 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 Cl 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.

Peak 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 this peak 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 I.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 10-
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.

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 filament, 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 in the junk box, was originally part of a pair of earphones. It answered the purpose.

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.

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.

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).

Special Notice

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

Adapting American plugs for standard plugs and sockets.

A simple wire gauge, and details of construction.
In this First Article of a New Series, the H.F. Stage, General Testing Methods and Valves are Dealt With

**Systematic Fault Finding**

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), 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 work 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 currents. 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 voltmeter 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. 1 is shown a variable-mu H.F. 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 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 screen, 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 locate until the faulty component is discovered.

In Fig. 1, for example, suppose there were no volts 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 inter-valve 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 inter-valve transformer. The obvious method to test is the transformer for continuity of the windings. If there is a break, it will 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 oscillating from the stage gain of each stage. This method not only allows a service engineer to locate a fault in the output stage,
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 various components one methodically. 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 band 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 valveholder, etc.

Connect the ohmmeter across terminals 1 and 2, 3 and 4, 5 and 6, 7 and 8, 9, 10, and 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:

- 1 and 2: Aerial coupling...0.5-4.5 ohms
- 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.F. 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 0.0 volts, and the coil would be taken as being in order, whereas an ohmmeter would show zero resistance, thus indicating the fault.

The tuning condensers C1 and C2 should be tested for shorts by applying a voltage across the plates and connecting a voltmeter in series. Rotation of the vane's will show where the failure occurred as a momentary reading of the voltmeter would be obtained. Also, test the coil as a whole for shorts by moving 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 equipment 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 5, 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

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 of selectivity.

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

Check for correct coupling between the aerial and the tuned circuits 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.

(b) 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 to the cathode and not earth, in many cases.

(To be continued)
A New Dispute

It would appear that the B.B.C. and the Cinematograph Exhibitors' Association are having some big differences which only a great 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 notified the B.B.C. of an excellent time for providing listeners with some really first-class variety artists. On the other hand, however, it 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 undoubtedly novel 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 cinema pictures, 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, is necessary. In this case 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 the R.A.M. 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

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**PRACTICAL AND AMATEUR WIRELESS**

January 8th, 1938

PRACTICAL AND AMATEUR WIRELESS

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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 panel for easy manipulation by the engineer. 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 1925 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 disk exploiting devices. The fundamental scanning definition is 20 lines, but by multiple interleaving to overcome the effects of 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 superimposing these pictures on a remote screen to give a colour-blended picture. Technical difficulties and cost, however, made 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 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 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 indoor 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 4ft. 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 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 increasing the metal coating thus applied, and the glass, and thus avoiding the mirror effect, which would prevent the escape of heat by radiation which is desirable, as the vacuum should run 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 atomised metallising gun, shown in the accompanying illustration, actually propels the atomised metal at a speed of 1,200ft. per second.

PRACTICAL AND AMATEUR WIRELESS

January 8th, 1938
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.

We mentioned recently that several of our reader-friends have experimented against our giving—as they consider—to 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 a battery supply.

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 estimate. 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 replaced by 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 those doubters and sceptics we can say definitely that a well-designed mains set usually can be made completely free from hum. What is most 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 from experience with all types of receiver.

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 200, 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 not less than 120 mA, and that the valve should be one such as the Osram MUI2, 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 100 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 230 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.

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 250-0-250-volt supply and when

(Continued overleaf)
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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 the untapped 350-ohm secondary, and without the load resistor an output of 260 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 appreciatively, 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 deplore the idea of using "junk" parts, or those bought at "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 cover to suit 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 connection 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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Bulgin Lock-switch

ALTHOUGH primarily designed for use with a radio receiver, this 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 fitting already provided. The price is 3s., and spare keys may be obtained at 6d. each. The makers are Messrs. A. F. Bulgin.

Webb's Radio Globe and Map

LONc DISTANCE listeners should make a point of obtaining either the map or globe supplied by Webb's radio for 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 relation-ship 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 ascertian 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.

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

THE WEEKLY FOR THE AMATEUR
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 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 E1 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 40-metre 'phones, using directional systems for transmission and reception, and from details given it was found that in all instances such arrays were of gigantic size, and they were not always easily controllable. A receiving aerial system was provided, which was capable of working in any band, and not 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 in all cases the 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 spillover of the detector valve if adjusted to maximum gain on G, GM, EI and other strong European stations. The same applies on 20 and 10 metres. The effect 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 over 80 and 160 metres. The experiments outlined prove conclusively that elaborate and complicated arrangements requiring considerable space are unnecessary, 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 cut 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 50 volt .2 amp. type. Consequently, in using a 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 mains 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 set 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 shows a three-valve A.C./D.C. set which will serve to illustrate the points mentioned.

SHORT-WAVE SECTION (Continued from page 474.)

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

It is believed that for short-wave reception there are still many of the smaller sets available, with a three-valve, 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 CI. This in itself, as well as cutting the top frequencies, has the effect of tuning the circuit over a certain frequency range, therefore the most suitable capacities in both instances will have to be determined experimentally. The same choke and capacity type which will serve to illustrate the points mentioned.

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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).

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 my local stations, without going to the trouble of making a special quality set. I bought an old pattern tone-control L.F. transformer, arm soldered to the moving spindle comes 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 tone control and reaction, and the .01 mfd. suits my speaker best. No doubt the idea will be of use to other readers.—J. PRIMROSE (Hendon).

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. He quotes as his ideal, a good Class A receiver (battery), and by this I take it he means the straight cut-constructor who has taken pains to get the best from it. I agree that if properly constructed, fair results can be obtained from a battery set. He has not numbered 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 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, say 25 or 55W, properly fed, is required for real quality. Has he compared against either of these valves? He must bear in mind that many constructors 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 call ourselves "quality" fellows. "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 to our high F.H. amplification.

Referring to page 302, PRACTICAL AND AMATEUR WIRELESS, dated November 14th, Mr. Savegar's so-called "Novel quality coupling," and Fig 2. Mr. Clarke's similar L.F. coupling, caused me to wade back through your stacks of old PRACTICAL AND AMATEUR WIRELESS and old Amateur Wireless to AW, Vol. xxxvi, No. 667, page 34, to an article by Mr. Noel Bonavita-Amat and his quality battery L.F. circuit. Truly a quality L.F. circuit for the battery user. It gave me hours of pleasant listening until I constructed a battery version of the quality Amplifier given in PRACTICAL AND AMATEUR WIRELESS, Vol. ix, No. 223. This has proved a fine piece 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.

—FRANK B. HORSFALL (Leeds).

Good 10-metre Log

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

Ten-metrephone stations: SV1BCX, SV.ICA, SP10W, YYL2BB, LY1J, G5ML (Europe); ZT6J, ZUGF, ZE1JR, ZE1AP (Africa); VY5AA, VY5AK, K4EMG (South America); UV2UQ (Asia); W7JL, W7JX, W7RQ, W6JXJ, W6JW, W6JX, W6JKW, W7DYY, W7FDE, VESIAS, W7UHL, VE1DC, AND ZRSTY.

The receiver is an 0-1-1 (modified "Simplest Short-waver"), with a 660ft. long 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. ROXES (Swan-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 in a woman was singing "The Moscow, Schenectady, Rome, Lisbon, CS2WA, Daventry, etc., are all strong signals when operating. Thanking you for an instructive and interesting weekly.—FRED G. BIRKETTLE (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 to try 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).
The index letters which precede the Blueprint Number indicate the period in which the description appears. For example, 31.7.35 refers to sets advertised in the Wireless, IR to W.I.R. Wireless, or W.T. to W.T.I.R. Wireless.精装版に添付のポスターを参照し、このページに記載されている装置については、価格が掲載されている。
January 8th, 1938

PRACTICAL AND AMATEUR WIRELESS

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 then 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. (Harrow).

I am building one of your sets from a blueprint and note you refer to the possible connection of this to the earth terminal, and that there may be earth return leads. Do they refer to the speaker or the chassis?" - H. R. E. (York).

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 I am uncertain whether this can be included in my set, which is H.F., frequency changer, I.F., D.D.T. and punchboard. If I can fit the device would you recommend a suitable make and give connections, as I am unable to trace an reference to it in your past issues?" - F. R. (Harrow).

"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 I am uncertain whether this can be included in my set, which is H.F., frequency changer, I.F., D.D.T. and punchboard. If I can fit the device would you recommend a suitable make and give connections, as I am unable to trace an reference to it in your past issues?" - F. R. (Harrow).

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

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

Lack of Bass

"I am using a band-pass circuit, valves V.M.S.4, M.H.4, 244V. PP3/250. 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).

"I am using a band-pass circuit, valves V.M.S.4, M.H.4, 244V. PP3/250. 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).

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 set which would be suitable for this particular case?" - H. R. E. (York).

"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 set which would be suitable for this particular case?" - H. R. E. (York).

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 from general wireless models. We regret that we cannot, for obvious reasons- (1) Supply circuit diagrams of complete multi-valve receivers. (2) Suggest alterations or modifications of circuits described in our contemporaneous issues. (3) Suggest alterations or modifications to commercial receivers. (4) Answer queries by telephone. (5) Grant interviews to querists. A stamped addressed envelope must be enclosed for the replies. All sketches and drawings which are sent to us should bear the name and address of the sender. Requests for blueprints must 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 Street, London, W. 1.

The coupon on page 488 must be enclosed with every query.

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 one of general interest.

M. H. (Chartham). The circuit and use was dealt with in our series of articles on Transmitting W. S. (Bristol). 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 Simplex 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 rectifier to increase the H.T. on the valve. Perhaps the detector valve is not up to it and does not oscillate easily.

F. B. (Hammondsmith). 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.

E. C. H. (Cyprus). We have no blueprints of transmitting apparatus. We published a series of articles on Transmitting commencing in November, 1937, and covered 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 watt D.C. amplifier. The latter would be suitable for your purpose.

F. G. (Bournemouth). The serial will be very inefficient as shown, and you should cut out the various short lengths. It was extracted 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. R. (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.

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PRACTICAL AND AMATEUR WIRELESS

January 8th, 1938

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Towards Valve Standardisation

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 its purpose in many different directions and the main reasons is that of expense, and it, or modify it in some small way.

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 718 ft., 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.

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.

New B.B.C. Governor
THE King has approved the appointment of Miss Sara Marjery 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.

R.A.F. Re-union Dinner
ROYAL AIR FORCE, Electrical and Wireless School (one time No. 1 "T" Thameborough and Flowerdown) Officers' Re-union Dinner. R.A.F. Club, 19th, Piccadilly, 7 p.m. for 7.30 p.m., Saturday, January 22nd. Those interested please write—F.L. F. S. Wainscot, Cranwell, Lines.
ROUND the WORLD of WIRELESS (Continued)

Broadcast by Redsikins

We are informed that arrangements have been made in Canada for a series of broadcasts by members of redskin tribes. The talks have been written by the Indians themselves, and will deal with their customs and the future of the In- dians, the Cree, 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 on 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 Listeners

It appears that the Polish Broadcast ing 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 Become a Listener," etc.

Big Circus Broadcast

ONCE again Northern listeners looked in to a television programme from the Circus. The programme is called "Allez hop," and it will come on January 22nd from the circus 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 wired 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 "Men's Hockey Broadcast"

ON January 15th, in the Midland pro-

area, there is a recorded summary of Cedric Johnson's commentary on the men's hockey match, North v. Midlands, at Nottingham, with Edward and Allan at the piano forte, will be the artists of the

Leeds University Midday Concert which is included in the main Regional programmes of January 13th.

INTERESTING and TOPICAL NEWS AND NOTES

Leeds University Midday Concert which is included in the main Regional programmes of January 13th.

Dance Cabaret


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 km (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 220 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 the memory of the distin-

guished French composer, Maurice Ravel, whose death was recently announced, "has been dead Infanta," as well as his "Bojero," originally included in the pro-

gramme, 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, Swansea- 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 champion of Edmonton," received from Mr. F. A. Boeing, 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, 162 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., 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 Tottonschool's football.
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

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, to the same remarks regarding poor performance, instability, etc., arise. In Fig. 6 is shown a typical battery operated 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 in Fig. 3) or else I.F. instability, when a stopping resistance should be included in the grid circuit of the I.F. valve.

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

Further, adequate by-passing of screen, anode, cathode and oscillator anode, is essential by means of non-inductive by-pass 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 of any 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., I.T., and bias supplies and the current consumed by the valve, and also to test any coils and leads to the tuning condenser at minimum and the strength of this should be increased, the standing bias should be raised by increasing the value of the bias resistance (R in Fig. 3).

Superhets

The more usual troubles with a triode detector are:

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

Detector distortion is often accompanied by an accentuation of the aiblants and up-shift 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 input 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 is excessive, it is

(Continued overleaf)
obvious that the detector will be overloaded, for, 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 0.001 mf 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.

Extra decoupling should be added without, if possible, altering the anode voltage applied to the valve, and this is most easily done by adding another decoupling condenser in parallel with $C_5$ in Fig. 7. It may also be necessary to increase the value of the decoupling resistance $R_2$ or to add another in series with it if the resistance is used for coupling purposes, but this should be done with great care as the anode current may 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. valve should be removed from the circuit.--In the circuit shown in 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 11th, 1938, 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.

When ganging a straight receive with a triode detector and reaction, if done with the essential precautions, the reaction reduced to a workable minimum and the reaction control advanced so that the reaction is on the steepest rise.

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 the overloading and badly mismatched tuning circuits.

Diole detectors and A.V.C. --All diode detectors are subject to the same faults, at least as far as reaction and distortion are concerned, and only differ in that some are used simply as detectors and others incorporate the A.V.C. in the detector circuit. We shall consider here a double-diole 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 de-coupling resistance. We will assume that the I.F. valve is tested and approved, and that the I.F. transformer is in good order and correctly set. The simplest method of testing a diode detector is to feed a signal to the I.F. valve with the A.V.C. circuit cut out, and observe the gain of the I.F. amplifier and whether the actual control bias is being read off and hence can be determined, and thus the A.V.C. is functioning properly. Should it not be, tests should be made on the A.V.C. circuit as described in this article.

It is probable, then, that a fault in the A.V.C. circuit will have no effect other than to remove the control, but failure of the A.V.C. to work or the presence of a faulty resistance will isolate the grids of the control valve from the earth line, and result in severe 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 superhet 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 connected to the earth side of the control valves that it was noticed that there was no change in anode current even when the control voltages used were a kilovolt and were 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 detector may easily be located.

(To be continued)
Towards Valve Standardisation

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, high-frequency pentodes, tetrodes, and rectifiers—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 obsolete 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 standardize a particular form of base with a certain number of pins or other means of connection? Such a step would be greatly in the interest 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 memorize 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.

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 octal base valves with octal base connections if pins in certain positions were used, has been a step in the right direction. 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.

Complete Ranges

A full range of valves requiring a heater current of 3 amp. is obtainable, from a pentode frequency-changer to an output tetrode and rectifier. This means that they can conveniently be used in a D.C.

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

Fig. 2.—Under-base connections for a few typical “International” octal valves.
or A.C./D.C. receiver, especially since there is a wide range of 1.5-amp. barrettes. In this case, however, the output tetrode has a 26-volt heater, the rectifier having a 38-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 octal rectifiers 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 transformer winding would in any case be required, and this could be designed for 6 volt units 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 slight increase in amplification provided by each valve in the set results in a few types of octal valve.

Connecting components. It is remembered that pin number 1 is above 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. The grid is joined to terminal 2, the control grid to the top cap, and the screen grid to diode anode ; the anode is joined to terminal 4 ; the anode is joined to terminal 4 in the triode. Little difficulty will be found in connecting the triode if it is remembered that pin number 1 is above and just to the right of the key on the connector, 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. As can be seen, one or two slight exceptions, but these apply only to valves not fitted with a top cap.

The Hislop 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.

**PRACTICAL AND AMATEUR WIRELESS**

January 15th, 1938

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 ear 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 Superintendant 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.

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 190 volts.

The modern receiver is a sensitive device—particularly the superhet—and not 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 1000 ohms or more. 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.
Before we settle down to our task of describing a few suitable types of L.F.-amplifier unit we want to take the task the draughtsman who prepared the drawings for our article in the issue dated December 28th. 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 news.

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.

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 .002-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.

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.F. 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 200,000-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 them, but if you do the effects 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...
transformer. The few components required can be of any standard type, the condenser being tubular for the 0.002-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 1/2 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 un-distorted output. For the Fig. 1 circuit, a pentode such as the Cossor 220 L.P.T. is suggested, and for Fig. 2 we suggest a valve of the class represented by the Cossor 200 P.T. If you wish to use the more modern pentodes you can choose an Oerum K.T. 21, or a Hivac Y 220 in place of the Cossor 220 L.P.T., as there is no Oerum equivalent of the Cossor 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 pentodes; in the pentodes this is internally joined to the grid, 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 total anode and auxiliary grid current and appropriate G.B. voltage obtained from the transformer-coupled pentode, assuming a fairly high input, but it will probably be rather greater when using the transformer-coupled circuit. 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 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 similar type which can satisfactorily be used as alternatives. When employing the valves mentioned the total anode-current consumption with 150 volts applied to the H.T. will amount to about 13 mA when the first is given 1.5 volts G.B., and the second, 71 volts. By reducing the H.T. voltage to 120 and cutting down the voltage to G.B.2 to 4 volts 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.

This completes the particular series of articles, which we believe has added 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 transmitter. 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 or more of these lines, tell us about them so that we can pass along the information to fellow readers.

In the meantime we 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 the Thomas diagram in Fig. 6. One of the most interesting features is that the outfit was built at a total cost of 10s. 8d.

A few of the details culled from our correspondent's letter are as follows: Coil L1 is wound on a valve base, and consists of 12 turns of 22-gauge enamelled wire; you can be any battery power valve; jacks can be inserted at X—X in the H.T. lead for a key, and X in the grid lead 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 the complete details supplied by Mr. Thomas, but if any readers require more complete particulars we shall be glad to forward same.

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 put forward 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 255.7 metres (1,000 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 radiation over the sea to the south, and to give a corresponding increase in other directions. It is anticipated that this station 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 Slough, near Newentale, 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.

The station, which will be called Clevedon, will, if desired, 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. It is intended that 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

3½, or 4½ in., by 6½ from

George Newnes, Ltd., Tower House,
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 super-hets, 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 Ferry-hill:

"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' Encyclopaedia'). 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 felt 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 proposes 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 £30 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 install 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.
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 bewildermger and scratched my head. 'Stuck?' asked my friend. 'No! Technical hitch,' 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 am 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 ringing up some circuits, when a bead of perspiration flowed 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, when you use a combination of heat and positive elements for your nom-de-plume?"

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

A New 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.

TO FIND THAT FAULT!

THE WIRELESS CONSTRUCTOR'S ENCYCLOPEDIA

5/- or 5/6 by post from

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, 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 the Editor, "PRACTICAL AND AMATEUR WIRELESS," 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 3 in.

—D. CRUST (Harrow).

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 using three iron meat hooks, as shown in the accompanying sketch. Having procured the meat hooks, I obtained the thinnest section 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 fitting 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 fitting in the hole in the concrete and re-cemented it into position, leaving it to set before fixing the aerial.—G. J. DOUGLAS (Hythe).

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 dust cover—which can be of the type shown in the sketch, or of the completely enveloping type.—N. E. WILSON (Bradford).
Changing Valves

If the receiver is of the simple type with a triode output valve it will be quite possible
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 0.01-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 com-
pared, 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 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 use 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
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 directly 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 versions 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
through second-hand sources. Unfortunately, although it often appears a simple matter to
add odd parts to an existing set there are often many unforeseen points which will in-
troduce 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.

Fig. 2.-A tone control will generally be found
advisable with a pentode output valve, a 0.01-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.

NATIONAL (261.1 m. and 1,500 m.)
Wednesday, January 12th.—Symphony Concert.
Thursday, January 13th.—Cav'cet Paris, a
comedy production.
Friday, January 14th.—Orchestral pro-
gramme.
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 pro-
gramme.
Thursday, January 13th.—Royal Philhar-
monic Society's Concert, from the Queen's
Hull, London.
Friday, January 14th.—The Princess of
Parapheanalia, 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
Thursday, January 13th.—Choral singing
in the Midlands, a talk.
Friday, January 14th.—The Princess of
Parapheanalia, a piece of nonsense for all
children under a hundred.
Saturday, January 15th.—Siibletia : Or-
chestral programme.

NORTHERN (449.1 m.)
Wednesday, January 12th.—Variety from
the Lyceum Theatre, Sheffield.
Thursday, January 13th.—Midland Par-
liament : Trade Unionism and Industry,
a round table discussion.
Friday, January 14th.—Variety from the
Alexandra Theatre, Hull.
Saturday, January 15th.—Choral pro-
gramme from the City Hall, Newcastle.
hat old set

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 overrun 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 the necessary 2 volts. The supply for such valves must be perfectly smooth and the current from the H.T. section is insufficient to drive the filaments, which must be driven by a low-voltage winding on a mains transformer and a low-voltage rectifier. Hum will be experienced in nearly every case. Therefore the nearness of 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 given the necessary "topping-up"

\[ \text{\textbf{Fig. 3.}} - \text{The simplest way to convert a "straight" straight line (H.T. and L.T. negative) and the other terminal to the end tapping of a 9-volt grid-bias battery. You can use the same battery as is employed for the L.F. stages.} \]

\[ \text{\textbf{Fig. 4.}} - \text{When a variable-mu valve is used, as shown in Fig. 3, the existing two-point on/off switch may be replaced by a three-point component adopting the connections shown above. In some cases the H.T. lead may be joined direct to earth. The original two-point connections are indicated by the broken line.} \]

\[ \text{\textbf{Table of the Week}} \]

| 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 (385.7 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 part of the ice hockey match, Bristol Bears v. Private Rovers, from the Coliseum Ice Rink, Bristol. |
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 modeled 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 position of the tuning pointer 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 smaller 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 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 the highest efficiency at 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, i.e., being necessary in many instances to keep the volume control back. Selectivity was good, the only trace of interference being experienced being around Kalandborg.

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,

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, cycles and station names, visible from all angles.

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 pointer is spun, one hears clear-cut fragments of the programmes from the stations which the cursor passes over during its travel across the scale.

It is pleasing to note that the stations shown on the scale are those which can be received at worthwhile entertainment volume, which is vastly different from stations being on the dial in name only.

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—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

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Austrian Broadcasts on High Power

To carry the Vienna radio programmes across the Atlantic, the firm proposes to build on a new site a 30-kilowatt transmitter at a cost of well over fifty thousand pounds. In due course this station will replace the 14-kilowatt plant at present in use at Vienna-Rosenheugel. It is hoped to open the transmitter towards the end of the year.

Italy Tries Out Two New Channels

From Prato Smeraldo (Rome) the E.I.A.R. is carrying out experimental broadcasts daily with the new 1240-kilowatt short-wave transmitter on 19.62 mc/s (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.

Spanish Stations with Regular Schedule

The Spanish short-wave stations which are now daily broadcasting war news bulletins are the following: EAIQ, Madrid, 30.43 m. (9.86 mc/s), G.M.T. 18.00-19.45; EA2Q, Madrid, 31.65 m. (4.85 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. (6.955 mc/s), G.M.T. 19.20; PFI, Barcelona, 41.63 m. (7.206 mc/s), G.M.T. 20.00; Radio Nacional, 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 m. (6.818 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 letters as YV1RL,relaying YV1RK, and using the additional slogan Radio Populare. The wavelength was 50.59 m. (5.93 mc/s) and time when heard between G.M.T. 04.05-08.00.

A Powerful Colombian Transmitter

HJ1ABB, Cartagena, now logged regularly on 31.68 m. (9.5 mc/s) is stated to have increased its power to 14 kilowatts. The studio gives out its call, YV1RL, with the additional slogan At-cha hola es ah hoy ayer, La Vue de los Laboratorios Fuentes en Cartagena (phon: Carta-hayma), Colombia; and in English: Ladies and Gentlemen, this is HJ1ABB, of Cartagena, calling you. The studio opens with a bugle call, sometimes repeated during programming 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 Dominicanas, is expected to relay programs from Lima under favourable conditions on 51.87 m. (5.75 mc/s). The broadcasts are preceded by a wailing siren, the signal being A.Lat.14.67 in. (7.2 mc/s), 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—call-letters—followed by the playing of a fragment of another Peruvian station, Radio OX4D y OAX4C, Avenida 23 de Julio, 950, Lima (Peru), South America.

Leaves from a Short-wave Log

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.

Neaces

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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

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 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 21/2 inches, diameter, 6 inches long, to be wound with 30 turns of 14-gauge tinned copper wire, spaced 3/16 inch between turns. The simplest method of construction was to use 1-inch 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 tension in 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 3/16 in. 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, saving 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 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 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 0.001 mfd. tuning condenser in conjunction with a low-capacity band-spread condenser. The following data will therefore be of use:

Four-pin coil wound on standard machine

threaded former, such as Eddystone, B.T.S., etc.

Grid, 21 turns—20-gauge tinned copper wire.

Reaction, 21 turns of same gauge wire, spaced between turns as per standard groove. Distance between windings, one-sixteenth inch.
January 15th, 1938.

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 may be 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 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 method has been employed quite successfully at the transmitting end for television 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 exhibit 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.

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. This apparatus 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 Themerson'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.
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 letter-name key, as illustrated, upon which the Morse code is embossed, the correct code may be employed for any particular 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 headphone 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 up 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.

Insulation Problems

Many members seem to find difficulty in weaving 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, in reverse, it jams up at the top, 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 which 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. Whether or not a 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 cumber-some 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 frequency which is very far removed from that of the aerial input, and it is impossible to do it owing to the fact that the aerial input circuit is inductive with a high Q, and thus the system is highly selective at that frequency. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage. As a general rule, the aerial input circuit is not used except in the first stage, and the inductive system of the aerial is not used except in the first stage.
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, understandable, because 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 Cosmos 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 are here 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. If 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 voltage is to be measured at the point nearest the cathode, whereas the letter following the V indicates the particular electrode to which the voltage is applied; therefore Vg indicates anode voltage, Vg grid voltage, Vsg screen-grid voltage, and Vag auxiliary grid voltage. It is usual to use Yg when referring to screen-grids and H.F. pentodes, and Vg 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 between several grids a small figure is placed after the letter, i.e., Vg1, Vg2.

It is always the grid nearest the cathode, Vg, the grid immediately next to it, and so on. A few examples will make this form of notation quite clear; the characteristics of a valve measured at Va 200, Vg 0, 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 in the case of a negative slope is greatly reduced. Alternatively, could anything be more absurd than rating a valve on anode current. An increase in anode current will bring about a decrease in impedance, and, worse yet, in the case of an anode current it is desirable that the impedance should be as low as possible.

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 stage is necessary, valves are employed with relatively high impedance. For intermediate I.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 amplification factor 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, 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. Where 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, 10 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. The valve has an amplification factor of 20, 1 volt on the grid will change the anode current.
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 (pro-

nounced "mu"), but it is as well to remember that the same Greek letter also means "one thousandth of" and also "per-

meability." With the exception of a diode detector, the prime use of the valve is to amplify; i.e., it multiplies, 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 im-

pedance or amplification, since both factors must be considered simul-
taneously; for this reason the word "conductance" is used. If a valve is measured by a factor which is a com-

bination of both factors, in other words mutual conduc-
tance. 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.

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 such a figure as 1, let us assume this figure to be 15 milliamperes. 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 milliamperes, we have a slope of 50 milliamperes per volt, written 3 mA/V. If the decrease is 4.3 milliamperes, then the slope is 13.9 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 9, divide this into 9 and we get 2.58, 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 changes.

The merit of a frequency changer is measured by conversion conductance, which is a useful 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.E. 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 6th, 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- or 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 11 per month. The average American instrument gives good quality reproduction outside, 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 was not unpleasant, 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 "68" 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 choose American instruments and component parts.—M. POTTELEER

(Port Elizabeth, S. Africa.)

"The Overseas Market" (Continued)

Sir,—In my 14 years old, and have just recently taken up B.W. listening. To begin with, I built your "Simplest Short-Wave," and afterwards purchased an instrument unless it is a 6- or 8-valve

commercial superhet.

Wishing yourself and the staff of your excellent paper the compliments of the season.—THOMAS CROSSFIEELD (Halton, Lancs.)

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: 8-27, T.S.A.: Radio Renascence, Rua Capelo, 5, Lisbon.

The announcee does not give the call, but frequent reference is made to "Radio Renascence." I regularly receive the following stations: WIXAL, W2XAX, W2XAF, VK3ME, DJN, DZA, 2RO, JVM, EAJ, and BBJ.

I am sure that I would not have met with this success if it had not been for your excellent journal.—R. PHOCTOR (Watford, Herts.)

Do you know

THAT ordinary iron (such as iron bolts and screws) is unsuitable for inclusion inside a receiver providing as an earth coil?

THAT the movement of inter-connecting wires in a short-wave set may cause effects similar to taking 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 'phonos.'

THAT in a D.G. or Universal receiver a dial light may be included in series with the heater to indicate when 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 faulty heater in the rectifier or output valve.

THAT an accumulator and M.T. batteries should be kept well clear of the aerial lead in a short-wave set.

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 A4 paper only, and should contain the name and address of the writer. 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 addressed to the Editor should be addressed: The Editor, PRACTICAL AND AMATEUR WIRELESS, George Newsom, Ltd., Tower House, Southampton Street, Strand, W.C.2.

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On the Best and Cheapest Terms.

GASHOR" ORDER now by RETURN
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 peripherally 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-wave 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 outside, to find a sandwich layout which will give the desired high performance on the short waves. Suitable switches may be obtained from Morses, 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 200-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 on my H.T. B.T.S. or Bulgin.

If you add small coils in series with the existing coils, although this will give you the desired increase in wavelength it will also increase the risk of hum which was caused was no doubt due to the construction of receivers arising from the fact that the Queries Service is intended only for the solution of problems or difficulties experienced with the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret we cannot answer requests (1) Supply circuit diagrams of complete multi-valve receivers. (2) Suggest alterations or modifications of circuits or suggested multi-valve receivers described in our content (3) Suggest alterations or modifications to constructional practice (4) Answer queries over the telephone. (5) Examine and demonstrate apparatus.

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Increasing the Tuning Range

"I have a commercial set which only tunes up to 520 metres. This means that Athlone on 551 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 make them in." —W. H. (Neath).

I am just starting on short-wave work I have had a number of stations on the medium waves and three on the long and I get Walsall 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. (Llandrffoeth).
SITUATIONS VACANT

ENGINEERING—FREE OFFER. THE NEW INSTITUTE OF ENGINEERING GUIDE explains how all the best jobs are secured. It shows how to obtain such money-making qualifications as A. M. I. E. C., A. M. I. Mech. E., A. M. I. E., etc., and describes numerous higher positions in Electronic, Aero, Wireless, Engineering; Govt. Service, etc. Write for Free Book on application to NATIONAL INSTITUTE OF ENGINEERING (Dept. 3), Staple Inn Bldgs., W.C. 1.

WANTED—ambitious young men to prepare for well-paid posts in TELEVISION, the great new industry. See the free booklet from BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 187, Stratford Place, W. 1.

ENGAGING TO CYCLISTS! Your wheels will NOT stick or slide, and your braking power will be increased, unless the spokes are tied up. The FLUXITE Fun prevents this, and so does FLUXITE on the handle bars and front wheel. Write for Free Book on the art of "soldering"—complete with full instructions, 7/6. Government works and by leading engineers. See that FLUXITE is always by you— in the house—garage—workshop—wherever you go.

ALL MECHANICS WILL HAVE

FLUXITE, IT SIMPLIFIES ALL SOLDERING

Write to-day for this great Guide, containing 2,000 photographs illustrating the full range of home-study courses in engineering covering all branches, including Radio, Televison, Bound Reproduction, etc., and which outlines the Regulations for Qualifications as A. M. I. R. E., A. M. I. E., A.M.I.E.E., C. & G., etc. The Chassis is complete, and guarantees a really good job, only 8/- each. Free illustrated catalogue, 7/6.


20,000 Successes

FREE ADVICE BUREAU COUPON

This coupon is available until January 31st, 1929, and must accompany all queries and want ads. PRACTICAL AND AMATEUR WIRELESS, January 15th, 1938

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PRACTICAL AND AMATEUR WIRELESS

3

January 15th, 1938

High Efficiency plus Economy!

5-VALVE ALL-WAVE SUPERHET

Price

£6.17.6

(Complete with B.V.A. Valves)

This mid-price rated Deluxe-Simplex all-wave receiver utilizes a remarkably efficient superheterodyne circuit which provides reception quality on all three wavebands—AM, 1000-1,000,000 cycles, short wave—3,000-1,000,000 cycles. Dual electrolytes. Latest type side-band-frequency tuning transformers, pentode U.P. amplifier, double diode-detector operating as double-detector and R.F. multiplying unit (44 L.O. stage, 2 step output pentode). Wave-change and grid-switch, automatic, but with new type switch, for quick change between wave-bands, etc. Price includes 7 days' approval. Free illustrated sheet with battery guarantee free.

Price

(Complete with B.V.A. Valves) £6.17.6

Performance: Tube range, 3 to 13,000 cycles, with three wavebands; circuit quality, equal to or better than any other receiver in the price range. Reception: Reception is equal to or better than any other receiver in the price range. Quality: Quality is equal to or better than any other receiver in the price range.

All McCarthy receivers supplied complete with valves, audio, tuning etc., and styled in a handsome Walnut Cabinet of handsome finish. Features: Four standard H.T. valves, and 50 standard H.T. and R.R. valves. Detectors: Tetode detector and L.P. amplifier. D.A.V.C. applied to 3 pretesting the Chassis is complete, and guarantees a really good job, only 8/- each. Free illustrated catalogue, 7/6.

Received by a four-valve detector, band-pass I.F.T. coupled L.F. amplifier, double diode—detector, operating as double detector and R.F. multiplying unit (44 L.O. stage, 2 step output pentode). Wave-change and grid-switch, automatic, but with new type switch, for quick change between wave-bands, etc. Price includes 7 days' approval. Free illustrated sheet with battery guarantee free.
See what's blown in?

It's blown in regularly at the B.B.C. It's a soprano saxophone. If you can scarcely recognise its soprano note on your set just fit an Exide Battery. Sets with Exides tell no lies.

Exide BATTERIES FOR RADIO

Still keep going when the rest have stopped

EXIDE ‘HYCAP’ BATTERY (High Capacity L.T. Battery)
For modern multi-valve sets — lasts longer on one charge. For small sets use the Exide ‘D’ Type. Both have the Exide Charge Indicator. Your dealer will tell you which to use.
For High Tension use Drydex.

From reputable dealers and Exide Service Stations. Exide Service Stations give service on every make of battery.
The Chloride Electrical Storage Co., Ltd. (Exide and Drydex Batteries), Clifton Junction, near Manchester. Also at London, Manchester, Birmingham, Bristol, Glasgow and Belfast.
JUST OUT!

WIRELESS COILS, CHOKEs AND TRANSFORMERS: AND HOW TO MAKE THEM.

By F. J. CAMM.

An important new Handbook for every home constructor and anyone interested in radio. With Special Chapters on Selectivity, Break-through, Coil Winders, Coil Troubles and their Remedies. 180 pages, cloth bound, with 126 easy-to-follow illustrations.

2/6 By post 2/10.

GEORGE NEWNES, LTD., Tower House, Southampton Street, Strand, LONDON, W.C.2.
“What I like about Wills's GOLD FLAKE is their distinctive flavour— in a word, their personality”

WILLS'S GOLD FLAKE CIGARETTES

PLAIN OR CORK TIPPED
10 for 6d. 20 for 1/-
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 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 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.

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.

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.
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., will be made known to incoming pilots by broadcast on request from incoming pilots.

**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 broad cast 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, “Cinematic.” 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 least 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 (302.9 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 8.50 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 famous Harbour Bridge, in Sydney, this broadcast a commentary will be given 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 Broadcast House. It is officially known as the Studio Allocation Book, but is often referred to as Big Bertha. When opened, the book occupies the whole of the top of a desk seven feet long, and to facilitate the assistant’s movements, when opening the book, a special chair is provided which runs on rails laid on the floor.

**ROUND the WORLD of WIRELESS (Continued)**

**INTERESTING and TOPICAL NEWS and NOTES**

**Radio Beacon Guide**

The time signals in the Ekco factory stamp sheet-metal struts, brackets, laminations, and other chassis fittings. The chassis are produced on still larger machines.

**Solve It!**

**PROBLEM No. 279.**

Rajan 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 three correct solutions opened. Envelopes sealed and 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, before 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 a frequency which was different from that of the I.F. transformers which he obtained, and consequently it was impossible 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.
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 foolish idea of extemporised notes to a common rhythm—will ever 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 a man of art! It would be insulting "applied even to a dog-train!"

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 get-offs 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.

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.
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 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 continuing 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 yesteryear; 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, Blackpool, did not succeed in a bold criticism 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 a stiff letter. He has accompanied the address of Kirway, Accrington, Blackpool, however, what the public does not know, 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, Blackpool, did not succeed in a bold criticism that he could give the correct address.

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Components are Specified for the “TRIBAND THREE”

The turned helically slotted resilient sockets of Clux Valveholders guarantee perfect full surface contact.

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5-pin .. 9d.
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with Terminals and Engraved A.1, A.2, E.

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CLIX Solid Plugs
should be used with these strips.
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BRITISH MECHANICAL PRODUCTIONS LTD

FOR EVERYONE INTERESTED in SHORTWAVES

You can get first-class headphones reception of World-wide shortwave broadcast and experimental amateur transmissons with this Eddystone battery operated “All-World Two.” It will consistently receive many American, European, Australian and other long distance shortwave stations at good volume and quality. It is fitted with special Eddystone bandspread tuning. Wave range 15.5 to 32 metres. Price, with valves and coils, guaranteed aerial tested and ready for immediate use.

£3.17.6

Send for full details

EDDYSTONE ALL-WORLD TWO

STRATTON & CO., LTD., Eddystone Works, Bromsgrove St., Birmingham.
LONDON SERVICE: WEBB'S RADIO STORES, 14, SOHO ST., OXFORD ST., W.1

THE SUM TOTAL OF A GOOD CIGARETTE

PLEASURE SATISFACTION VALUE QUALITY

PLAYER'S

Specified in the “TRIBAND THREE”

POLAR BAR TYPE 2-GANG CONDENSER
Steel frame. Low minimum capacity.
PRICE 12/-

Available with ceramic insulation - 2/- extra.

Send for fully illustrated Catalogue of Polar and Polar N.S.F. Components

WINGROVE & ROGERS, LTD.
188-189, STRAND - LONDON - W.C.2
Telephone: Temple Bar 2244
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 such a failure in the majority of cases is 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 jack-sets are still obtainable from a number of manufacturers and may, of course, be used for many other experimental purposes.

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 Transform-ers" gives all the necessary data for building up and standing on other 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 purposes of reference. 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 wire gauge is to be as indicated in the accompanying illustration. It will be noted that the long-wave winding is divided into three sections; these being subdivided again for 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 on the medium-wave winding—in this model a centrestrip 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 connection 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 advice on how to improve it. For such a case we could not do better than recommend the substitution of a modern tetrode for the single beam tetrode. A suitable valve for this purpose is the new Tungsram type 6Y6G, which costs 13s. 6d. This has a 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 82 and impedance 65,000 ohms, and with a single valve operated correctly an output of 320 watts may be obtained. If two of these valves are employed in a push-pull circuit it is possible to obtain 13 watts when they are fully loaded.

Using a Piezo Pick-up

Several complaints have recently been received from members who have substituted an ordinary piezo switch for 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 type of output or 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. In such a case it is possible to obtain 13 watts when they are fully loaded.
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.

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.

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 transmission 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. 1.—Connections for a microphone and microphone transformer to provide the audio frequencies.

Fig. 2.—Connections for a microphone and microphone transformer to provide the audio frequencies.

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 100 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.

(Continued overleaf.)
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 base-board 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.

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 wave meter 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 which for transmitting a special permit is required in connection with the transmitting licence).

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, 0 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 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 may 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 this 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 quench 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.

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 no more than a comprehensive outline, but we should like to have copies of the circuits, with values indicated. You have proved 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., Amateur House, E.C.
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TRIBAND 3

Described in this issue.

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Est. 1919
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 appear unsuitable for use with loudspeakers. In fact, the efficiency of an output valve a little of the note G approximately one and a half octaves higher.

It is generally accepted that third harmonic distortion is decidedly unpleasant, whereas second harmonic distortion is more tolerable.

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. second harmonic distortion, i.e., 5 per cent. second harmonic distortion if it is a triode, 10 per cent. second 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 exceptions 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, as apart from considerations of quality. A useful analogy may be taken from the ordinary steam engine. If a locomotive runs 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 ran with the minimum load—a single passenger sitting on a buffer—it is obvious that all the power is being used in the locomotive and a minimum of power is being devoted to the task for which it was intended. Almost exactly the same thing happens in a valve. If the load in its anode circuit is in the extreme, the valve is so harnessed 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 loud-speaker.

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.

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. Fortunately, the optimum load is found by a somewhat elaborate graphical calculation on the anode—volts/anode—current curve (Fig. 2). Fortunately, the optimum load is found 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 6,300 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 therefore, that the question of optimum load and power output may be ignored within reasonable limits and also the importance 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.

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

Increasing second harmonic distortion.

Third harmonic distortion, on the other hand, will be selected solely to avoid distortion.

The choice of load value is a matter of personal taste, but the writer considers the second harmonic content while maintaining an economic figure of output. As the triode is extremely simple as there is no complications.

Choice of Load Value

The selection of an optimum load for a triode is extremely simple as there is no complications. It is purely 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 P.C. 30 station in Amsterdam. The following changes have been made:

On Monday, Tuesday, and Thursday, from G.M.T. 13.00-13.30, to the U.S.A. and Central America; on Friday, from midnight to 02.00, to the U.S.A. and Central America; on Saturday, from midnight to 02.00, to the U.S.A. and Central America; on Sunday, from midnight to 02.00, to the U.S.A. and Central America.

On the longer channel four programmes, given between G.M.T. 02.00-03.30, to the U.S.A. and Central America; on Friday, from midnight to 02.00, to the U.S.A. and Central America; on Saturday, from midnight to 02.00, to the U.S.A. and Central America; on Sunday, from midnight to 02.00, to the U.S.A. and Central America.

The National broadcasting station at Salamanca, Spain, now controls a network of personal taste, but the writer considers the second harmonic content while maintaining an economic figure of output. As the triode is extremely simple as there is no complications.

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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 6878, and also an attractive selection from the new film “Damsel in Distress”—“H.M.V. BD 436.

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 444. Selections from “Double or Nothing” and “The Commandant Performance” are played by Al Bollington on the organ of the Paramount Theatre, London, on “H.M.V. BD 477.

Valve

Vocal

USSI 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. BD 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 1389. 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 1388. In the first of these his is assisted by the Balladeers.

Songs from the Films

SONGS from the films are naturally well represented in this month’s output. Frances Day sings “Because You Are You” and “Midnight and Music,” from the film “The Rose of Your Lady Friend” on “H.M.V. B 8079. Patricio 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 Vagabonds of 1938,” and “Moonlight on the Waterfall”—“H.M.V. BD 478. Monte Reys sings “Sailing Home” and “Water Lilies in the Moonlight” on “H.M.V. BD 483. 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 “Chapsy Chappie,” has two good laughter makers in “Ain’t Love Grand” and “The Farmer’s Daughter” on “H.M.V. BD 492.

Dancing Time

THERE are some really good tunes in this section, including “Remember Me” and “That Old Feeling”—“H.M.V. BD 5290 and “Roses in December” and “Things are Looking Up”—“H.M.V. BD 5309, all played by Roy Fox and his Orchestra, by 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 “Decca X 106,” “BD 3304. With Elsie Carlisle and Sam Browne as vocalists, Jack Harris has also recorded “How Many Miles to Babylon” on “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 8860, 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 Romanian Dances by Bels Bartok. Interesting music superbly played by Szekely in association with Geza Frid. On Decca K 872, B 8641 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 already popular, has recorded for his latest disc “I Can Forget You” and “Mine Alone,” on Decca F 654. 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,” “Sep- tember in the Rain,” “Cherry Blossom Lane,” “Moon at Sea,” “You’re Here, You’re There,” “Swallow in the Moonlight,” and “I Can Forget You.” I am quite certain you will enjoy this.

George Formby, the popular radio star, has made a new recording on Decca F 5589, of “Fanlight Fanny” and “Share and Share Alike.”

TELEVISION AND SHORT-WAVE HANDBOOK

By F. J. CAMM

3/6, 10/- by post.

By George Newnes, Ltd., Tudor House, Southampton Street, Strand, London, W.C.2.
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 swashbuckling and possibilities of future war. 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 reeling what television really means and taking advantage of its fantastic possibilities. 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 theatre or music hall will never be permitted to stay away from the theatre or music hall where they can enjoy the atmosphere of mass enter-

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.

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 cooperation 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.

(Continued overleaf.)

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 attention by the authorities at home. The radio trade are convinced that 1938 is destined to be a “Television year,” and Government co-operation in recent years has been long overdue. (Continued overleaf.)
PRACTICAL AND AMATEUR WIRELESS

January 22nd, 1938

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
natural in view of great prominence in the
early pioneers of that nation. Bearing
in mind the class co-operation between
the Science 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 modu-
lation, the visitor is able to see the develop-
ments made by the leading television firms
of Ferrarch, Telefunken, Loewe, etc. The
Karolus lamp screen and Kerr cell, as
well as Mihaly's "Teleisor," are all dis-
played, while modern technique is repre-
sented by electron cameras and inter-
mediate film equipment. It is amusing to
see the progress which has been made
during the last few years, and if develop-
ments are maintained at the same rapid
tempo the Munich show will be held
privileged spectators of the show. Such
are these pictures. A movie camera is
shown to have the same properties in a
large number of electric lamp bulbs arranged
in a trapezium shape to one of rectangular
form, with a predetermined aperture under
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 control the
degree of correction necessary to restore the
trapezium shape to one of rectangular
outline identical with that at the transmit-
ting end of the system.

SECRETS OF THE GRAMO-
PHONE STUDIOS

Few members of the public ever have
access to gramophone studios, but
recently the English Electric Company
recently performed a concert in the
H.M.V. studios at St John's Wood
on January 26th. 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 instru-
ments, 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.

Important Broadcasts of the Week

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

Wednesday, January 19th.—London Pier,
Decca record, programme 9.

Thursday, January 20th.—Edward Grieg: a
programme of Norwegian music.
Friday, January 21st.—Mauon, an opera by J.
Massenet.

Saturday, January 22nd.—National League:
Wemby Lions v. Harringay Racers, a
radio play by T. Thompson.

WEST OF ENGLAND (285.7 m.)

Wednesday, January 19th.—The Case of
Lady Talon, 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.—Richard Savage,
from Goody Two Shoes, from the
Prince of Wales Theatre, Birmingham.

Friday, January 22nd.—Meet the Family,
a force with music by The Melvish
Brothers.

Saturday, January 22nd.—Shakespeare
Songs: choral programme.

NORTHERN (449.1 m.)

Wednesday, January 19th.—The Whistle
Blows, a radio play by H. Thompson.
Thursday, January 20th.—Halle Society's
Concert, from the Free Trade Hall,
Manchester.

Friday, January 21st.—Dance and Duet: an
orchestral concert.

Saturday, January 22nd.—Deeds of
Aladdin, from the Palace Theatre,
Plymouth.

SCOTTISH (391.1 m.)

Wednesday, January 19th.—Gaelic Concert.
Thursday, January 20th.—Choral pro-
gramme.

Friday, January 21st.—Orny o' Mine, a
Scots comedy by Andrew P. Wilson.
Saturday, January 22nd.—Orchestral con-
cert, from the St. Andrews' Hall, Glasgow.

NORTHERN IRELAND (307.1 m.)

Wednesday, January 19th.—Dance Music
at the Plaza, Palais de Dance, Belfast.

Thursday, January 20th.—Organ recital
from the Cathedral Church of St. Columb,
Bantry.

Friday, January 21st.—Meet the Family,
a force with music by The Melvish
Brothers.

Saturday, January 22nd.—Choral pro-
gramme.
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 (Q) would be a practical proposition to try to convert the set in question to an all-wave model.

A. J. S. (Sheffield). We do not state why you do not test the set. Can you supply further details? We do not supply blueprints for receivers, but we have a blueprint for a transmitter-receiver of the type you require. We are also unaware of any source from which you could obtain one.

E. M. (Bournemouth). The valve you have is a 6-volt type, with a 1 amp filament. The impedance is 3,550 ohms and amplification factor is 8. It is rated 5-watt A.C. blueprint, WM 399, would be suitable for your purpose if 

H. H. (Aylesbury). A list of the type you refer to will be found in our Encyclopaedia.

F. R. (Bristol). Paid details for your requirements will be supplied upon receipt of a stamped, addressed envelope.

E. R. G. (Acton). Either the output valve or the L.F. transformer is faulty according to the indications 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.

J. H. W. (Birmingham). The Harris Radiogram blueprint, WM 206, would be suitable for your purpose if you need battery apparatus. We can also supply a 5-watt A.C. blueprint, WM 392.

R. B. (Aylesbury). The amplifier should meet your requirements and is battery operated. What you require. We are also unaware of any source from which you could obtain one.

We cannot understand your difficulty in using the microphone. We recommend the Bandspread S.W. Three, which you have is 3,550 ohms and amplification factor 8. The amplifier should meet your requirements and is battery operated. What you require. We are also unaware of any source from which you could obtain one.

R. F. B. (Aylesbury). The valve you have is a versatile, high-grade tube. It is rated 5-watt A.C. blueprint, WM 399, would be suitable for your purpose if you need battery apparatus. We can also supply a 5-watt A.C. blueprint, WM 392.

R. M. (Sheffield). We cannot supply a blueprint of a portable transmitter.

E. G. N. (Newport). The Prefect S.W. Three is a versatile, high-grade tube. It is rated 5-watt A.C. blueprint, WM 399, would be suitable for your purpose if you need battery apparatus. We can also supply a 5-watt A.C. blueprint, WM 392.

F. R. B. (Aylesbury). The amplifier should meet your requirements and is battery operated. What you require. We are also unaware of any source from which you could obtain one.

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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).

Logged at Hull: Correspondent Wanted

SIR,—I have not seen a report of S.W. 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, France, Germany, Denmark, French Indo-China, Norway, Russia, Finland, French Morocco, Brazil, Veddah, cold, Spanish Congo, Puerto 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, C8M2J, OQ5AE, PY2KT, PY3AL, PY2KX, YV2A6, VOIP, VK7X, ZL44, V878, YV976, YV17ED, ZL3MR, VE4SM, ZLAOE, VE7X, VE7K, YV7SM, SU1NK, SVCA, UL1DA and ZL6FX.

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 reaction and has been rebuilt about 30 times in one year. At present I am using a 0-v-1 receiver, with 60 volts H.T., which I find gives ample headphone strength.

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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 of June 1937?

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 and stated that the station, which I 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 your district who would care to co-operate in more 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 and if they will add their names to hold the A.A. licence.—F. HULME (7, Moorland's Crescent, Micklehurst, Mossley, Lancs).

CUT THIS OUT EACH WEEK.

Wireless giving particulars of the "150-mile Crystal Set" (blueprint AW 490), which I will pay for. This particular issue is out of print, hence this request.—Edward Saxe, 60, Gregory Place, Wellwatta, Ceylon.

Amateur Transmitting: Correspondent Wanted

SIR,—In addition to being very interested in S.W. listening I am also interested in amateur transmitting and use; I have a provisional licence for transmitting under the call-sign of 2CYI. I should be very pleased, therefore, to get in touch with an amateur transmitting 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 and construction together with the ether, with someone who has had some experience.—Arthur A. Jones (2CYI), 14 Lyndhurst, Warren Lane, Chapeltown, nr. Sheffield.

NOW READY!

WIRELESS COILS, CHOKES AND TRANSFORMERS, AND HOW TO MAKE THEM.

2½, or 2½ by post from Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.
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 concerts at New York, which are being relayed through the U.S.A. short-wave stations, the programmers 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. 13.00-14.00, 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), soo-doh-me-do-me-soh-doh, the call being: This is the experimental transmitter situated at Tampico (Mexico), on 31.13 m. (9.637 mc/s). It 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 on coffee, and specially destined to listeners in Europe and United States of America.

To order the auspices of the American Radio Relay League, live short-wave transmitters are being erected at Newington Gardens (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.

A Memorial to Famous Amateur Transmitter

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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 found to work on 19.79 m. (10.16 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 (ay-ki-say-doo-vee), 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 on coffee, and specially destined to listeners in Europe and United States of America. The station will be of one kilowatt in power, and it is hoped to bring them on the air within the next three months.

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 the Infantry 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 purpose the B.B.C. has engaged the Chief Announcer of the Cairo station as extra. The transmissions start at 9.58 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 at 5.13 metres (11.657 kc/s) from 5.20 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 relayed through Rome. In Rome, 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.

STUDY AT HOME IN YOUR SPARE TIME

JOURNALISM

Do ANY of THESE SUBJECTS INTEREST you?

JOURNALISM

STUDY AT HOME IN YOUR SPARE TIME

JOURNALISM

There is money and pleasure in Journalism and in Story Writing. No apprenticeship, no pupillage, no examinations, no outfit necessary. Writing for newspapers, novels, poems or pictures, is not a gift; it is a science that can be acquired by diligent application and proper guidance. It is the most fascinating way of making pastime profitable. Trained ability only is required, we do the training by post. Let us tell you all about it.

PRACTICAL AND AMATEUR WIRELESS

January 22nd, 1938

DEPT. 104, THE BENNETT COLLEGE LTD., SHEFFIELD

LET ME HELP YOU INTO A KEY POSITION

DO ANY of THESE SUBJECTS INTEREST YOU?

JOURNALISM

STUDY AT HOME IN YOUR SPARE TIME

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There is money and pleasure in Journalism and in Story Writing. No apprenticeship, no pupillage, no examinations, no outfit necessary. Writing for newspapers, novels, poems or pictures, is not a gift; it is a science that can be acquired by diligent application and proper guidance. It is the most fascinating way of making pastime profitable. Trained ability only is required, we do the training by post. Let us tell you all about it.

PRACTICAL AND AMATEUR WIRELESS

January 22nd, 1938

DEPT. 104, THE BENNETT COLLEGE LTD., SHEFFIELD
A GOOD JOB IN RADIO FOR YOU

The Radio Industry is short of trained men. You may still be an untrained assistant in a wireless shop, or doing a dead-end job on the bench, yet you have a grand opportunity to get a progressive, high paid post—if you equip yourself for it by spare-time study.

Whatever branch of the Industry appeals most strongly to you, the International Correspondence Schools have a Course to fit your needs. Under I.C.S. direction, you study when and where you like. You are guided throughout by highly qualified instructors, whose advice and assistance is yours just as often as you care to ask for it. Nearly half a century of unrivalled experience is at the back of this work.

The I.C.S. are the creative pioneers of vocational training by the postal method, and by far the largest, greatest and most successful correspondence institution in the world. You can trust I.C.S. Instruction. It is sound, practical and profitable.

Write for our free "Radio" booklet, stating your subject—or use the coupon below if you wish.

THE ADVISORY DEPARTMENT
INTERNATIONAL CORRESPONDENCE SCHOOLS LTD., 94, INTERNATIONAL BUILDINGS, KINGSWAY, LONDON, W.C.2

Complete Radio, I.W.T. Exam.
Elementary Radio, F.M.G. Cert.
Radio Service and Sales, Air Ministry Prov. Cert.
Television.

Mark X in front of Courses in which you are interested.

Name.................. Age..............
Address..................

READ WHAT THEY SAY—

"After tests several members will not be satisfied until they obtain a premium. Mr. G. C. Amin, Editor of Practical and Amateur Wireless.

We shall certainly not one at its price to date. Mr. R. Adam, Perib Radio Club.

A.W.B. Landsmen's embody these Radio Receivers as the Automatics of this time. The 和 Lake Westby Telephones and Shorth.

AND NOW THE NEW Stentorian

is specified for the "3 band battery" set

WHITELEY ELECTRICAL RADIO CO., LTD. (technical dept.), MANSFIELD, NOTT.

Practical and Amateur Wireless BLUEPRINT SERVICE

Three Blueprints are drawn full size. Copies of appropriate forms containing descriptions of these sets can in some cases be obtained of the following action, which are additional to the cost of the Blueprints. Select one Battery Blueprint Number identifies in which the description appears. Blueprint Dept., Whiteley Electrical Radio Co., Ltd., Kingsway, W.C.2.

A.C. 1/3, 4d.
A.C. 1, 1/3, 4d.
A.C., 1, 1/3, 4d.
A.C. 3, 1/3, 3d.
A.C. 6, 1/3, 3d.
A.C. 9, 1/3, 4d.
A.C. 12, 1/3, 5d.
A.C. 15, 1/3, 5d.
A.C. 18, 1/3, 6d.

A.D. 1/3, 4d.
A.D. 1, 1/3, 4d.
A.D. 3, 1/3, 4d.
A.D. 6, 1/3, 4d.
A.D. 9, 1/3, 4d.
A.D. 12, 1/3, 4d.
A.D. 15, 1/3, 4d.
A.D. 18, 1/3, 4d.

Two-Fraine Three (D, LF, Pen)...
Three-Fraine Three (D, LF, Pen)...
Four-Valve Three (D, LF, Pen)...

January 22nd, 1938

PRACTICAL AND AMATEUR WIRELESS

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George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.
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, as I will not switch on and the wave-change does not make any difference." — G. S. (Greswold)

For your trouble, I suspend 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 moulding 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 longer have 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 which runs across the heater winding has become unbalanced, but now that longer leads are employed was employed. There is only one probability which can correct this. — G. S. (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 centretapped potentiometer or two pilot lights across the heater winding, 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 potentiometer needed readjusting. Alternatively, it may be desirable to remove them from the mains pack and place them near the valves, then adjust the centretap to balance out the hum. We assume that you have so placed the loud-speaker that there is no possibility of interference between the speaker transformer and the mains transformer or smoothing choke.

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 that this is what would be the best way of curing the trouble?" — J. N. (Gateshead).

If your switch is of the type having a lever or 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 movement has caused a break. 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 trouble it would be advisable to have the set examined by the makers or their local service agent.

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 these stations, 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 shall be glad if you could help." — 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 much better than they have ever been since you first came out, and I modernised this set, but I am finding, however, that the distortion as no doubt the frequency-applied by the A.V.C. system is Tower at the A.V.C. output terminals. As a result, the distortion or A.V.C. distortion. If this is so, how can I overcome it? Is there a larger accumulator?" — D. 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. consump-

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SOUTH'S RAYO Guaranteed Wireless Valves, post paid.

PHONES in SPECIAL Telephone Box, complete in sealed cartons with three Mauds valves, moving coil speaker, Pertrix batteries and A.C./D.C. Multimeters, 5-range (tests any-thing radio or electrical), 6/6; Loudspeaker units, 2/6; band-limit transformers ready for use with any receiver, 4/6; headphones, 4,000 ohms, 3/- pair. DRAGAIN Parcels

MAGNAVOX P.M.'s, 10/6.

PHILLIPS, 6v, Superhet 272B (Class B), £4/10.

TAYLOR, Air AT, 41/E, P.A.M. 175, £4/10.


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PENTRIX BATTERIES, 4,000 ohms, 3/- pair.

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Coil formers, 4-6 pin low-loss, 1/- each.
BARGAIN SALE!

The following are stop-charged, but good working order:

**Mccarthy CHASSIS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Availability</th>
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<tr>
<td>900</td>
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<tr>
<td>800</td>
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<tr>
<td>400</td>
<td>£4/10/0</td>
<td>Sold out</td>
</tr>
</tbody>
</table>

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- **S.T.900** Speaker Units: £1/0/0 each, fitted with hand-built Magnavox speakers. Lowest price, £2/10/0.
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Heater Voltage ............ 6.3
Heater Current ............ 1.27 amp.
Anode Voltage ............. 400 max.
Screen Voltage ............ 300 max.
Mutual Conductance ........ 6.3 mA/v.

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PRICE EACH 25/-

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Write for Osram Valve Guide.

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Type KT66—An Output Valve in the "International" Range having widespread application

THE OSRAM KT66 is an Aligned Grid Output Beam Tetrode which can be applied with equal success for A.C. Mains-operated broadcast sets to give an undistorted output approaching 7 watts for 250 volts H.T., or to multi-stage Class 'A-B' output circuits for Power Amplifiers, Public Address, etc., to give outputs up to 32 watts per pair at 400 volts H.T.

Owing to careful alignment of grids in the KT66, the screen current is much lower than for a conventional pentode valve to give equivalent output, and thus the valve gives a greatly increased power efficiency.

The KT66 is equally suitable in a single valve Class 'A' amplifier, or in push-pull, with or without negative feed-back. It may also be employed as an Indirectly Heated Triode with limited anode dissipation.

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

TYPICAL OPERATING CONDITIONS FOR OSRAM KT66.

<table>
<thead>
<tr>
<th></th>
<th>Single Valve Class 'A'</th>
<th>Two Valves Class 'A-B'</th>
<th>Four Valves Class 'A-B'</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Anode Voltage</td>
<td>250</td>
<td>400</td>
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<tr>
<td></td>
<td>Screen Voltage</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Signal Input Voltage for full output</td>
<td>12v, peak</td>
<td>58v, peak</td>
<td>58v, peak</td>
</tr>
<tr>
<td>Optimum Load Resistance</td>
<td>2,200 ohms</td>
<td>6,000 ohms</td>
<td>3,000 ohms</td>
</tr>
<tr>
<td>Power Output</td>
<td>7.25 watts</td>
<td>32 watts</td>
<td>50 to 60 w.</td>
</tr>
</tbody>
</table>

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OSRAM VALVES - DESIGNED TO ASSIST THE DESIGNER

WORLD'S RECORD LOG

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B.T.S.

SHORT WAVE RECEIVER

247 STATIONS — 12-52 METRES

TROPHY 3

BATTERY

and A.C.

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Wave-range 12-52 metres. Effective wave-range 6.2 metres (Television)-500 metres with B.T.S. ONE-SHOT Inductors available

AND NOW... the amazing B.T.S. Trophy Three, confidently presented for the approval of the experienced DX fan and newcomer to the Short Waves.

It's records we've aimed at and achieved with the Trophy Three. Enjoy the thrills of Short Wave listening with a receiver incorporating features proved in open competition to be unexcelled... note the special features, the low price, agree with us that experience counts, see about your Trophy Three NOW...


SPECIAL OFFER: B.T.S. Lightweight Headphones for use with Trophy 3, complete with plug. £5:15:0

Here is F. Lanaway, who has just succeeded in winning from America the coveted Short Wave and Television Craft Trophy. A 2-valve Headphone set was used for this contest—open to the world, F. Lanaway logging no less than 247 stations between 12 and 52 metres.

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BRITISH TELEVISION SUPPLIES LTD.

FARADAY HOUSE (Pr.W.1), 8-10, CHARING CROSS RD., LONDON W.C.1.
Reaching Out on the Short Waves

See page 555

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 installed 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 receiver that 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, outline 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.

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 Linnenthal Street West, Ormeau Avenue, and Dublin Road at a cost of more than £70,000.

Canadian Broadcasting

A recent conference at Havana resulted in an agreement giving Canada sufficient channels for all present and projected high-power stations using 9 kW. 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 Cafe 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.

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 1,000 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.

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 "Congress Dances," and will be heard on the National wavelength on February 5th 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.

Rounding the World of Wireless

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.

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?
ROUND the WORLD of WIRELESS (Continued)

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.

Eakimo Radio Enthusiasts

AN interesting story comes from far-away Labrador, where a teacher in the Mission School reports that several Eakimos 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 amateur listeners in the countries who are always grizzling about the B.B.C. programmes!

Pitcairn Island Station

LISTENERS who are also cinema goers, I and who remember that fine film the Mutiny of the Bounty, will be interested to know that through the generosity of a number of American 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 PTC, 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 0.5 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 pianaccordionist, 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. Pettes, and Mr. E. H. Ward, who have now taken up duty at Broadcasting House. After leaving Cambridge, Mr. Pettes studied singing and elocution at the Royal College of Music. Mr. Ward was with Messrs. Reuters, Ltd., in London and China from 1931 to 1938.

Melodies from the Comedies

LISTENERS to the Midland programme on February 1st will hear tunes from stage and screen played by the Royal College of Music. The programme will be compéred 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 Sam Grossman and his Dance Band, with Edward Slade.

Caught by Radio

A NOTHER smart piece of work by the mobile police was recently reported. A dramatic class of 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—

5.50.—Car reported stolen and police wireless description broadcast.

6.3.—Patrolling police car, having re-
ceived 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 rejoin.

Pantomime Broadcast

LISTENERS who like a little light entertain-
ment will enjoy the broadcast, from the Midland Regional on February 4th, when excerpts from the Birmingham Theatre Royal pantomime, Mother Goose, will be heard. The 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 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 Miekoy Mose’s Christmas Party is one of the most popular features.

Radio "Rehearsal"

ON the morning of February 3rd, Regional listeners will get an aerial glimpse of preparations for the broadcast that evening from the Argyle Theatre, Birkbeck, Mool. Most people have no experience of, nor opportunity for, seeing or overhearing the preparation of the shows whose finished performances delight them. On February 3rd they can do some radio-saves-dropping, and will find the show relayed later in the day the more interesting.

Solve It This Week!

PROBLEM No. 280.

Hoskins was using a straight three (S.G., Detractor and Pentode) receiver and decided to convert it to the variable-mu type. He therefore bought a 4-pin variable-mu H.F. valve, a 1,000-ohm 1% watt fixed resistor, a 5,000-ohm 1% watt potentiometer which he joined across the U.B. battery, with the contacts 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, Ltd., Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

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. Elyvant, Sharnbrook Cottage, School Hill, Peth, Lanarkshire; and W. 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

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 today, 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 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 anode 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 latter arrangement is specially included in the common anode 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.

(Continued overleaf)
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 11 to 3 volts negative.

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.

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 set so that 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 "low-impedance" tubes. The "standing" bias and "low-impedance" current is desirable and generally essential—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.

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-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 PX25A a somewhat simpler circuit can be used, but in all cases it is desirable and essential—

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 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, 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.

Fig. 5.—A low-impedance-loading, or class A-B circuit, using a pair of Osram PX25A valves.

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-pentodes, 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. 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.

THE WIRELESS CONSTRUCTOR'S ENCYCLOPAEDIA


Wireless Construction, Terms, and Definitions explained and illustrated: concise, clear language.

From all Booksellers, or by post 5/6 from George Newnes, Ltd., Tower House, Southamp ton Street, Strand, London, W.C.2.

January 29th, 1938

PRACTICAL AND AMATEUR WIRELESS
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 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 this 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.

Output Ratings

The majority of A.C. units are rated to deliver so many volts at so many milliamperes, 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-ramping. 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 wiring 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 the receiver wiring is at fault and the component in the anode circuit to which the resistance is joined. This is shown in Fig. 6, 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.

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 work with a mains unit, the mains unit 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
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 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 Ohm’s Law is used, the voltage required at the anode being deducted from 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. 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 = 16,000 ohms. This could be 5 made up by using two or more resistances 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 BLATNERPHONE

The accompanying illustration shows the apparatus which is familiarly referred to as the Blatnerphone, 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 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.
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, clanging 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 £300,000 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 374,000 for 1936 and 624,000 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, modernization 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 re-
recei

er 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 5½in., 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 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

I t 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 918 appeals for witnesses of accidents 472 (53.05 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 (36.00 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.

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.

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 a tuning 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 interconnection is taking place, but if carried out exactly in accordance with the wiring diagram the set should work perfectly stable throughout all the wavebands covered, with the volume control at maximum.

LIST OF COMPONENTS
One metal chassis, drilled and fitted with coils, switches 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) (I.B.).
One microfused and holder, 100 mA (Microfuse).
One socketstrip, B, A1, A2 (Clips).
One potentiometer with switch (3-point), 50,000 ohm, NM 36 (R2) (Bulgin).
One L.F. transformer, "Senneter" (Bulgin).
One all-wave H.F. choke, H.F. 15 (Bulgin).
One reed condenser "Dilecon", 0005 (C3) (G.B.).
FIXED CONDENSERS
One 0.005 mfd., type 300 (C10) (T.C.C.).
Three 0.001 mfd., type 300 (C4, C7 and C9) (T.C.C.).
Two .1 mfd., type 250 (C5 and C6) (T.C.C.).
One 0.2 mfd., type 300 (C8) (T.C.C.).
RESISTANCES
One 2 meg. 10-watt (R3) (Erie).
One 1,000 1-watt (R1) (Erie).
One 250,000 1-watt (R5) (Erie).
One 50,000 1-watt (R6) (Erie).
VALVEHOLDERS
One 4-pin chassis-mounting valveholder.
One 5-pin chassis-mounting valveholder (standard (Clips) valveholder.
One 7-pin chassis-mounting valveholder.
VALVES
One 220 H.P.T. (V1) (Cossor).
One 210 D.q. metalised (V2) (Cossor).
One 220 H.P.T. (V3) (Cossor).
PLUGS
H.T-, H.T.-+ (Belling-Lee.).
G.B-, G.B.+ (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 power transformer, 2-capital (Exide).

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 milli-amps, 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.

18-Valve Chassis
C. F. WARD, of Farrington 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 is a medium power output, with its indirectly heated filament, which 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.
S

O great is the diversity of shapes and sizes, spirals and hairpins, that a valve can assume, that manufacturers have come to be aware that valves must vary greatly to suit their

TheFilament

The filament, or in the case of a mains valve the cathode, must fulfill 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 crystaline structure, which would result in premature breakage.

Metal, in the generally accepted sense of the word, will not emit electrons unless heated to a high temperature, so filaments are always coated with a substance that will allow the profluse emission of electrons at a relatively low temperature. Whatever the method of coating, the substance actually has a base of earth coating, or cathode, which is electrically remote from the filament, or cathode, but need not necessarily be 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.

Fig. 1.—Sectional view of two triodes. Although mechanically different they are electrically similar.

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 fast.

Electrode Assembly and Efficiency Factors are Dealt With in this Fourth Article of the Series

Spacing of Electrodes

In order to decrease the safe spacing of these electrodes the grid supports are very closely spaced, a method which 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, niobium, 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 freedom from heat, and 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, being 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 different, in fact, are 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 and the factors being equal.

Output

The structure of the 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 if 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)
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 in the illustration, the clock is 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 the line corresponding to any country or town the correct time. 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, illustrated here, showing the dial divisions and markings. The dial is 9½ ins. in diameter.
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 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, 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 consequent 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 to an anchor close to the head of the ear-piece. This may be modified to suit individual headphones, the only important point being that the faulty swivel connexion be substituted for by a piece of soft steel strip, and not to hand, ordinary pencils will answer.

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 fittings required are three hinges, and two brass or steel binding pieces. I fashioned these 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 to run holes in the binding pieces with one corresponding hole in the wooden coil block to prevent the whole assembly moving when in use. - D. W. Erwells (Blackheath).

A Headphone Tip

For a long time I was troubled by a cracking 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 consequent 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 of the ear-piece. This may be modified to suit individual headphones, the only important point being that the faulty swivel connexion be substituted for by a piece of soft steel strip, and not to hand, ordinary pencils will answer.

A useful change-over switch for safeguarding filaments.
Systematic Fault Finding

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.

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 at points 18, 19, 20, and 21, in that order.

You should now be in a position to

(Continued on page 557)
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 obsolete 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 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 leaving 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 those "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 L.F. transformers make up four more fixed-tune circuits and ensure adequate selectivity. The first stage is that of an 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 L.F. stage, which should be used with transformers tuned to 405 kec. A second L.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 L.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 phases are employed by the 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 delay voltage for the A.V.C. circuit is obtained across the 25,000-ohm variable resistor 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 variable 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 Coswer 4XP.

(Continued on next page)
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 some 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 either an ohm or so, or in a universal receiver the filament wires 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 electrode 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 the end of the chain that is connected directly to the earth 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-beove, 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, if it is at a position, any hum introduced will be amplified by every valve of the set, and any instability may set up a range of which it may interfere with the corresponding large number of stations. The suggested arrangement so far is end, and other points on the chain, may be found an advantage.

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 from the earthend, but actually to the earthend 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 frequency changer 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 a considerable H.F. voltage to build up across the heater terminals.

Leaves from a Short-wave Log

Test Broadcasts from Brazil

From PSB, Marapicu (Rio de Janeiro), Brazil, experimental broadcasts are being carried nightly between G.M.T. 00.00 and 02.00. The following announcement is regularly broadcast: This is short-wave station PSB transmitting a special programme originating in the station of station PRA8, Rio de Janeiro. We ask our listeners in the United States of America, and all over the World to report on receipt conditions. Further programmes of a similar nature will be given from this station of 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. PSB 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 RBA9, at Pernambuco. The transmissions are carried out through the Zeecen (Germany) transmitters: DZC, 20.15 m. (14.888 mc/s); DZE, 24.73 m. (15.13 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 Reinwardt (760 miles from the North Pole), may now be heard working between G.M.T. 01.00-04.00 on about 20.80 m. (14.39 mc/s).

Circuit diagram showing the sequence of heater connections that is generally the most satisfactory for a universal superhet.

...M4.4111,1
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The owner-driver’s journal which tells you how to repair, overhaul and get the best performance from your car.
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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, and 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 in this way discharge immediately any H.T. condensers through a fixed resistance, and in this way discharge immediately any H.T. condensers through a fixed resistance. When the H.T. power unit is switched on the contacts are short-circuited, and 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 in this way discharge immediately any H.T. condensers through a fixed resistance.

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 cognition 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.R.C. television staff in televising the Bertram Mills Circus from Olympia has been the subject of commendation from nearly every section. The sensitive camera "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

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 641 lines can be handled by the cable, and that the development work taken 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.

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
the resulting data being employed by the engineer 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 factors 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 this arrangement, a neutral density wedge placed in the front of each projector, the balance of contrast as well as the optimum brightness adjustment for each individual requirement. This was effected by a Bowden wire control from the front, and the output of either of the equipment show the range of variation in a most efficient manner but it was possible to record the individual's accepted picture characteristic. These values were then recorded 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 instrument in some form if the maximum of satisfaction is to be secured by each purchaser.

**N.T.S. SHORT WAVE SPECIAL OFFERS**

**NEW SPECIAL OFFERS**

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List Price 35/- **BARGAIN 19/6**

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Less valve. Cash or C.O.D. Carriage Paid 19/6, or 2/6 down and 8 monthly payments of 2/6.

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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.

**3-VALVE BANDSPREAD S/W KIT**

$25/- up to 12-94 metres inclusive, including three coils. List value 40/-/4. BARGAIN, 2/6 cash or 2/6 down and 11 monthly payments of 2/6. Three excellent valves FREE.

**4-VALVE BANDSPREAD S/W KIT**

$25/- up to 12-94 metres. Pedestal Output, with a Matched set of short-wave entertainment. Complete Kit, including 3-4 coils, 4 valves, 4 matched, BARGAIN, 32/-, or 2/- down and 12 monthly payments of 2/6. Four matched valves FREE.

**5-VALVE BANDSPREAD KIT**

$25/- up to 12-94 metres. Entirely new design. Guaranteed world wide reception. BARGAIN, 32/-, or 2/- down and 12 monthly payments of 2/6.

**NEW AVAILABLE**

**B.T.S. TROPHY SHORT-WAVES**

on EASIEST of EASY TERMS

Assembled and Tested, READY for IMMEDIATE USE

TROPHY 1, a wonderful Short-wave instrument for reception provided on 12.52 metres and additional pre-vision reception. Assembled and Tested, READY for IMMEDIATE USE.

Cash or C.O.D. Carriage Paid, £4 : 15 : 0, or 7/- Deposit. Balance in 12 monthly payments of 8/3.

**TROPHY 2.**

A beautiful Short-wave instrument for reception provided on 12.52 metres and additional pre-vision reception. Assembled and Tested, READY for IMMEDIATE USE.

Cash or C.O.D. Carriage Paid, £5 : 15 : 0 or 7/- Deposit. Balance in 12 monthly payments of 8/3.

**TROPHY 3.**

A beautiful Short-wave instrument for reception provided on 12.52 metres and additional pre-vision reception. Assembled and Tested, READY for IMMEDIATE USE.

Cash or C.O.D. Carriage Paid, £6 : 6 : 0 or 7/- Deposit. Balance in 12 monthly payments of 8/3.

**AMERICAN VALVES.**

Over 150 types In Stock.

Types, A.C., H.L., 5/-.

Types, A.C., H.L., 9/-.

Types, A.C., H.L., 15/-.

AMERICAN VALVES.

These purchases enable us to supply at greatly reduced prices.

**BATTERY MODEL**

*Less Free Shipping.*

Cash or C.O.D. £5 : 15 : 0 or 7/- Deposit. Balance in 12 monthly payments of 8/3.

**A.C. MODEL**

25000 volt, 4500 cycle. List value £5 : 15 : 0.

Cash or C.O.D. £6 : 6 : 0 or 7/- Deposit. Balance in 12 monthly payments of 8/3.

**N.T.S. NEW TYPE LIGHTWEIGHT HEADPHONES, 7/6**

4-watt BATTERY AMPLIFIER

B.F.P., output: 1 watt at 1000 cycles.

For original music or for use with broadcast receiver.

Dimensions: 2' long, 1' deep, 1' high.

Complete kit, including 3 coils, 0/85, £1 10/-.

115-120 volt. With 2 valves, fully tested. List Value £1 10/-.

BARGAIN. Cash or C.O.D., £0 10/- down and 12 monthly payments of 10/-.

**BARGAIN 1-valve S.W. KIT**

List Price 35/- **BARGAIN 19/6**

Comprises Metalax baseboard, variable and fixed condensers, switch, valve-and-coil holders, H.F. choke, terminals, quick close-up, 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.

**NEW HAND-HELD VALVE AMPLIFIER**

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.
The technicalities of radio—where shall we begin?

A good starting-point is represented by a chart on the constitution of the "signal" voltage developed in the receiving serial 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 pulse in the broadcast programme, i.e., while the microphones are idle. The transmitter is still actively radiating, and the voltage produced in the receiving serial 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 at once the necessity for variable receiver "tuning," and also indicates where lies the problem of avoiding interference between different transmissions. The selectivity problem is not a simple one, however, as we shall see.

Kilocycles, Megacycles—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 wavelengths of stations adjacent in the list. The allocation of frequencies has, as a matter of fact, been planned to give 9 kilocycles per second as far as possible.

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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 also are the result 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 × 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 second, unmodulated, which is what one might at first suppose. The analysis shows that three unmodulated components to-gether 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, and F + M cycles per second, unmodulated, which is what one might at first suppose. The analysis shows that three unmodulated components to-gether 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, and 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.
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 and 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 fair balance of high and low notes. Consequently, to obtain an improvement from a speaker of this type an 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 of the 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 these. In the first place where two audition points are provided, the receiver 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. In the second place the receiver might have been fitted with a speaker of this type any additional speaker must be remembered that the commercial model—that is, one which gives a fair life to the reproduction from the high notes, and thus a balanced reproduction of the whole range is obtained. In this case the extra speaker has been included in series to ascertain that the whole 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 and the speech coil and the bulb 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 the bulb which in many cases will offer no safeguard to ordinary 2-volt filament. 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. Brunt, 19, Ponnell Street, Woolwich, S.W.18.

THE BRITISH LONG-DISTANCE LISTENERS' CLUB

T. W. A. S. (Exeter)—The tuning condenser is joined across the points 1 and 2. The serial (or the ammeter if the coil is used) is placed in series. It is joined to either 1 or 2, the latter giving better selection of the coil connected. The condenser used for suction or aerial coupling should be the high pitch version of the coil.

N. K. (Lisburn-on-Zea)—We are afraid there is no more modern look than the one mentioned by you.

J. R. (Perth)—You would need an ultra-short-wave set for the lower band mentioned and an ordinary set for the higher waves. You would do well to see if you can obtain a receiver, however, by examining the details of the valves on more than one occasion. They 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 the bulb which in many cases will offer no safeguard to ordinary 2-volt filament. Fuse bulbs are obtainable from any good radio dealer, and the current which they will pass is clearly indicated on the box.

A Safety Hint: We recently-mentioned the importance of fuses in battery receivers some 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 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 and the speech coil and the bulb 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 the bulb which in many cases will offer no safeguard to ordinary 2-volt filament. Fuse bulbs are obtainable from any good radio dealer, and the current which they will pass is clearly indicated on the box.

How to Wire: A double fuse for protecting voice filaments from H.T. and G.B. shorts.

REPLIES IN BRIEF

The following replies to queries are given in accordance with our rules, because the point raised is not of general interest.

S. V. (St. Albans)—We cannot recommend a circuit without details of the coils, such as type number, etc.

J. R. (Perth)—You would need an ultra-short-wave set for the lower band mentioned and an ordinary set for the higher waves. You would do well to see if you can obtain a receiver, however, by examining the details of the valves on more than one occasion. They 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 the bulb which in many cases will offer no safeguard to ordinary 2-volt filament. Fuse bulbs are obtainable from any good radio dealer, and the current which they will pass is clearly indicated on the box.

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Accurate Fault Tracing

The D.C. AvoMinor makes both A.C. and D.C. tests.

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The D.C. charging lasts for ages. Price 1/6

This ingenious instrument makes both A.C. and D.C. tests. It gives no fewer than 22 ranges of direct readings—current, voltage, and resistance.

Write for descriptive pamphlet.


Pictorial 1934/1935.

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The UNIVERSAL

AVOMINOR

This negotiable instrument makes both A.C. and D.C. tests. It gives no fewer than 22 ranges of direct readings—current, voltage, and resistance.

Write for descriptive pamphlet.


Pictorial 1934/1935.

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 "I'm Afraid to Dream," and "Good Night to You All." For his recording of "My Irish Song," and "Angel I've Got Something in My Eye" on Rex 9186, and "You've Got to Take Your Pick and Swing," and "Calling All Cars" on Rex 9197.

Panachord

Of the many dance tunes recorded by Panachord this month, "I'll Get Some FLUXITE," by Ted Rito and his Orchestra, coupled with "Moon at Sea," by Harry Sosnik and his Orchestra on Panachord 25924, is perhaps the most popular of the new releases. The latest release from Panachord is "My Irish Song," and "Angel I've Got Something in My Eye" on Rex 9186, and "You've Got to Take Your Pick and Swing," and "Calling All Cars" on Rex 9197.

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," and "Whispers in the Dark," "Horsey Horsey," "Afraid to Dream," and "Good Night to You All." For his recording of "My Irish Song," and "Angel I've Got Something in My Eye" on Rex 9186, and "You've Got to Take Your Pick and Swing," and "Calling All Cars" on Rex 9197.

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The Croydon Radio Society

The Croydon Radio Society's New Year meeting was held 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 has 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 cutting ability of high frequencies, and the cutting ability of high frequencies, having a resonance factor.

There were, of course, many applications for diathermy, as, for instance, in cases of rheumatism, and indeed with the method currently used it can be used to cut flesh. 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 conclusion of the lecture.

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.

The demand for CAPSTAN increases daily - say W.D. & H.O.WILLS

"They don't 'arf keep us busy, they don't"...

"'Oo do?" . . . . "They don't!"

WILLS' CAPSTAN CIGARETTES. 10 FOR 6d, 20 FOR 1/10.
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-wave set 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 5-valve 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.—W. L. FORSYTHE (Bank House, Aveoch, Ross-shire).

Quality from Battery Sets

SIR,—I was interested in the letter of Mr. F. B. Horfall in your issue of January 8th. I can fully endorse what he says, having built up a 5-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-valve 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 200 and 40 phones, KAIAN, KAIAK, KAIN, VS6AF, VS6AS, VK3KZ, VK6AJ, VK3UD, VK4X, VK4A, PK4OA, PK9HA, PK1XM, J3EM, J4CD, J7CH, J8GJ, UX33F, UX3MF, and WXJY. I also heard ZKU, ZBW, ZEO, K2RM, K2A, P17A, P16, SSF, SSB, SSC, and 300 sets. On 10 metres: WIZIE WJL6, WIZF, W2ZCO, 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 enjoy 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 simpler circuits, and one had only two valves. Now I'm told that you are going to describe in the paper how this set could be built up into a five or six valve set, something like your last article. One of the points I find for tuning and oscillation can be obtained quite easily, and the range of a small set would be very good for a beginner; later he could add more IP's or a preselector, etc.

Another 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., L.F. type, although costing little more.

I am looking forward to your new articles on transmitting. Having followed your last articles with great interest, as one day I hope to have a transmitting licence.—D. SEFTON (East Sheen).

Logged on an O-v-2 Receiver

SIR,—I note in a recent issue of PRACTICAL AND AMATEUR WIRELESS a request from A. Rosier (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 you. All are telephony stations, received during the past few weeks on an O-v-2, home constructed receiver, using a 33 ft. top antenna, 30 ft. high, pointing north and south. TFGC, YL2CD, SR1X, K4EMG, K4JEG, K4NY, LUY7A, ZEQI, CO9OM, T2FG, T2IC, VK3QG, HT7G, VOM2QG, CO2FO, FAJY, ZE1JA, ZE1JR, ZT6J, ZU0T, ZUGJ, ZU6D, ZS6AJ, CN26H, and CN25N, and all "W" districts have been logged, including WE9RT, W6LNS, W63FX, W7TP, W6QG, W7DYY, etc., whilst all continentals are heard within 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.—ERNST 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 parallelised 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. The 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 trellis design which will eventually become detached.

—THAT the capacity of a condenser is inversely proportional to the separation of the condensing plates.
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 14th, 1938, with a record attendance.

Mr. D. W. Carr (G8UC) continued with the more practical sessions from 2.45 to 4.30 p.m., when the formal meeting began.

Next the committee for 1938 was elected, the following Mr. W. J. Page, Mr. R. Brooker (2BFW) (re-elected), Mr. P. M. S. Hedgeland (2DBA) (re-elected), Mr. A. J. Page; Vice-Chairman, Mr. D. W. Carr (G8UC) (re-elected); Hon. Secretary, 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. Godamith.

A 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. J. A. Penfold, B.S.W.L. 352; Vice-Chairman, Mr. W. C. Goul (G2WG); Hon. Secretary, Mr. J. P. Glickman. The other officers are as follow:—Vice-Chairman, Mr. W. G. Read (2BHN); Hon. Auditor, Mr. E. D. Holloway. Members elected to serve on committee, Mr. S. Duniam Jones (GSKM) and Mr. J. F. Hollofamily, Hon. Auditor, Mr. E. D. Holloway.

All readers of this journal in the Brentwood district are invited to communicate with the honorary secretary, J. R. Deane Sainsbury (2CYW), “Brunock,” 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 above society 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.


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.
**PRACTICAL WIRELESS**

**CRYSTAL SETS.**

- **Blueprints, 6d. each.**  
- **Mains Operated.**

**SHORT-WAVE SETS.**

- **Battery Operated.**

**CATEGORIES.**

- **Experiments:**
  - Three : Blueprints, Is. each.
  - Four: Blueprints, Is. each.

**SHORT-WAVE SETS.**

- **Battery Operated.**

**AMATEUR WIRELESS AND WIRELESS MAGAZINE.**

- **CATEGORIES.**

**SHORT-WAVE SETS.**

- **Battery Operated.**

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**CATEGORIES.**

- **Experiments:**
  - Three : Blueprints, Is. each.
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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 exactly, and cut a square to 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 that, 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, or if you haven't got these, 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 it the issue, the blueprint or print?"—B. R. (Cardiff).

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

Rules

1. Supply circuit diagrams of complete commercial receivers.
2. Suggest alterations or modifications to multi-valve receivers.
3. Suggest alterations or modifications to commercial receivers.
4. Answer queries over the telephone.
5. Send your queries to the Editor, PRACTICAL AND AMATEUR WIRELESS, Strand, London, W.C. 2.

Erectic 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 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 one another 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 use with the baffle. There are so many kinds on the market I have been unable to get a neat one or two-valver. What do you mean is it the issue, the blueprint or print?"—B. R. (Cardiff).

We wish to draw the reader's attention to the fact that while we are 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 and from queries 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.
3. Suggest alterations or modifications to commercial receivers.
4. Answer queries over the telephone.
5. Grand answers to queries.

Spaced Wiring

"In making a lead-in for my short-wave set I wish to keep capacity troubles to a minimum, but do not want to go to the expense of buying the special transmission line which is suitable for the purpose. How can I reduce the capacity between the ordinary wire and 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 six or seven and 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 shotgun or other insulating material and thread these on your lead-in, passing this through the tubing and relying upon the spider 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 is the coil employed for the purpose of exciting the receiver, either by a reaction winding or separate reaction coil. There are many other American terms which are not used on this side, the main ones being "antenna," "grounding post," "earth," and "binding post."
PRACTICAL AND AMATEUR WIRELESS

January 29th, 1938

PREMIER SUPPLY STORES

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