AN ADAPTABLE ONE-VALVER —See page 4

A NEWNES PUBLICATION

Edited by F. J. CAMM

Vol. 18. No. 424.

Practical Wireless and PRACTICAL TELEVISION

6D.

EVERY MONTH

October, 1941.

Practical and Wireless
★ PRACTICAL TELEVISION ★

EVERY MONTH.
Vol. XVIII. No. 424. October, 1941.

EDITED BY
F. J. CAMM

Staff:
FRANK PRESTON.
L. O. SPARKS.

COMMENTS OF THE MONTH *BY THE EDITOR*

Radio Correspondence

ONE of the pleasurable aspects of experimental radio is that it creates for its followers friends all over the world—friends that they are never likely to meet, but who become acquainted because of a mutual interest in radio. Amateur transmitters and short-wave enthusiasts have a vast circle of correspondents, and in spite of the war letters freely pass between them. Innocent correspondence, however, can convey information of value to the enemy, and it is necessary to be circumspect in the facts or information sent abroad. In the interests of National Security the Government has found it necessary to prevent certain information concerning the reception of broadcasts and wireless signals from leaving the country.

Radio amateurs and short-wave listeners are particularly requested to note that they may not send to addresses outside Great Britain any letters or cards containing references to the reception of wireless signals or speech (other than correspondence addressed to recognised broadcasting stations in friendly countries referring to reception of their broadcasts); nor any reports prepared by radio correspondents or reporting clubs or societies, or the like, containing lists of stations heard by their members.

Any correspondence coming within these two categories is liable to be stopped by the censorship authorities.

It is to be noted that radio trade correspondence, letters between amateurs about set construction or other technical problems, or any other correspondence on radio topics which does not fall within the restrictions given above are not affected. At the same time it is realised and regretted that the application of a censorship on radio correspondence will interfere with what is in the case of most radio correspondents a harmless and fascinating hobby, but, unfortunately, it is possible for information however innocently sent out of the country by these means to be of value to the enemy, and this must be prevented.

Radio Greeting Cards!

IT is suggested that wireless amateurs who wish to keep in contact with overseas friends might adopt a suitable form of war-time radio greeting cards which would state the name and address of the sender, and would not contain any code group or reports of reception.

We hope that our overseas readers who frequently write to us for information of the sort now objected to by the censorship will understand when we have to send them a letter declining to give it.

The war has affected amateur radio in many ways. Amateur transmitters were the first to suffer, for in the very early days of the war all amateur transmitting licences were suspended and transmitters confiscated.

Shortly after it became illegal to operate a car radio receiver or to transport in a motor car any wireless apparatus capable of being used as a transmitter.

Unobtainable Components

THE limitation of supplies of certain components placed a further burden on set construction and to-day it is practically impossible to obtain certain types of valves, coils, chokes, transformers, condensers and resistances. Now this new ban on correspondence will somewhat stultify the style of radio enthusiasts. Enthusiasm for radio is undying, and in spite of these restrictions constructors are finding a new interest in making their own components, and in "hooking up" receivers from parts retrieved from the limbo. Those parts bring back memories of their early days in radio as they wire them anew into a more modern circuit. We can look forward to a more intense era of set construction when the war is over, and the secret developments which have taken place during it are released to the public.

It is certain that television during the war has made great strides, and it is equally certain that when it resumes activity it will not be on the old system. Let us hope that that period will be soon, when we may return to our wireless dens and experimental benches, and recapture the spirit of adventure which activated us after the last war.

Editorial and Advertisement Offices:
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

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

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

"The Brand New Weapon"

WE were glad to see that our old friend Capt. F. Plugge, a past contributor to this journal, who brings to bear on his duties as a Member of Parliament a considerable knowledge of radio (he was associated with the programmes broadcast from several Continental stations before the war, including Radio Normandie) has made criticisms which should be of value to, and carefully noted by, the Government. It will be remembered that about a year ago Capt. Plugge raised the question in Parliament of our propaganda over the air. In his recent speech he describes broadcasting as the only brand new weapon in this war. It cannot be denied that our overseas propaganda is inferior to that of the Axis Powers and certainly inferior to that of Russia. As we have remarked in a recent issue, we do not like propaganda for the sake of propaganda. We do not want the meaning of the word "warped" to embrace lying over the ether, nor to excuse being careless with the truth. We do, however, need to make the most of the truth, and not to present it with about the same degree of enthusiasm as appears in the eye of a very dead piece of cod on a fishmonger's slab. The truth needs seasoning, it needs to be presented as if we ourselves appreciate the significance and the nuances of the announcement made. We do not need, of course, to overstate the case, to draw false conclusions, nor to be over-optimistic as Mr. Chamberlain undoubtedly was over Narvik and similar incidents. The news needs to be announced also as if it is being *spoken* spontaneously instead of being read in the manner of the schoolboy ordered to read a passage from a book. In some cases the dead hand of some Government departments extends its clammy touch to those responsible for disseminating our news over the air, and chills to the marrow those whose job it is to announce news.

We hope Capt. Plugge will tenaciously continue his campaign to improve our overseas programmes to those countries at present seeking the truth. They cannot hear it from any other country but ours, and it needs therefore to be presented in a style which will cause them eagerly to look forward to the next announcement. To chill them once is to lose their interest for ever.

SHORT-WAVE SECTION

An Adaptable One-valver

A Simple One-valve Circuit, Easily Constructed from "Spares-box" Parts

COMPONENT and valve shortage necessitates the utilisation of "spares box" parts, the wise planning of circuits, and ingenuity. Constructors should not, in the interest of war-time economy, now think in terms of "multi-valvers," nor should they build and use two or three separate units, each employing, say, one valve, when it is possible to secure equal results by the use of one. A single

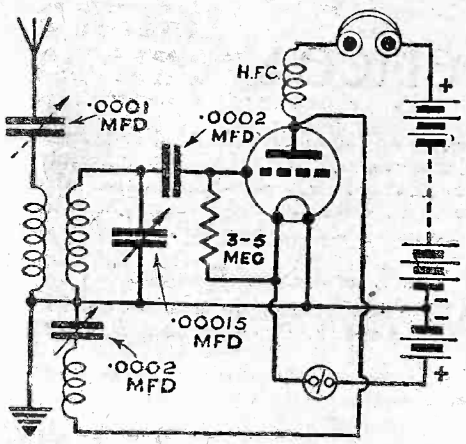


Fig. 1.—The simple one-valve short-wave circuit which is capable of very good results.

valve can give considerably better results than those with which it is normally credited, but, even so, one cannot afford to-day to utilise a valve for a single-purpose circuit, when by a little ingenuity the same valve and components can satisfy three distinct requirements.

There must be many constructors who have a single valve S.W. set, yet they are without an S.W. converter or adaptor. Similarly, many have a converter, but when their broadcast set is required for other purposes, they are unable to fall back on a single-valver for S.W. reception. The position arises owing to lack of valves or components, or the information which this article contains.

A One-valver

The circuit shown in Fig. 1 is that of an efficient one-valve set, primarily designed for S.W. work, using a standard six-pin plug-in coil. It is, however, fundamentally suitable for the reception of medium waves, provided a suitable coil is used. It is not to be recommended, with the component values shown, for long-wave work, unless the 0.0001 mfd. aerial series condenser is removed, and the tuning condenser increased from 0.00015 mfd. to 0.0005 mfd. As we are concerned in this article with the reception of S.W. transmissions, let us see how we can increase the utility value of Fig. 1. As a single-valver, it will give very fine headphone results and receive many long-distance stations if a little care is given to the erection and insulation of the aerial. There comes a time, however, when the operator will wish for loudspeaker results and wonder if he cannot make use of his, say, det. and L.F. or det. and two L.F. broadcast receiver.

As An Adaptor

This is where an S.W. adaptor comes in, and if Fig. 2 is examined, it will show the slight modifications necessary to Fig. 1 to enable full use of the L.F. amplification of the broadcast set to be obtained, thus providing an output of greatly increased volume. The procedure is this: The detector valve is removed from the b.c. receiver and inserted in the valve-holder of the S.W. set. The four-pin plug, which, incidentally, can be made from the base of a defunct valve, is then plugged-in to the det. holder, and the two circuits then operate as a single short-wave set. The headphones in Figs. 1 and 2 are no longer connected as shown in the diagrams; if it is desired to use them, they should be connected to the L.S. terminals of the b.c. set. The batteries in Fig. 1 can also be dispensed with, as the voltage and current required for the anode and filament of the valve will now be supplied by the batteries joined to the set. It should be noted that the *grid* pin of the four-pin plug is left blank, this is necessary, otherwise the medium- and long-wave coil of the b.c. set would still be connected across the grid circuit of the valve. The aerial and earth leads are, of course, removed from the set and connected to the appropriate terminals on the S.W. circuit. All tuning and control of reaction is obtained by adjusting the respective variable condensers of Fig. 1, there being no need to touch the controls on the set. With a little care in arranging matters, there is no reason why

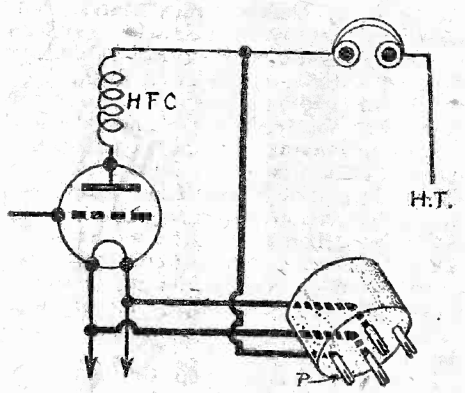


Fig. 2.—How a plug may be attached to the Fig. 1 arrangement to enable it to be used as a short-wave adaptor. Note the grid pin of the plug is left blank.

the plug should not be left connected to the S.W. set, even when it is being used on its own as a single-valver with its own batteries, etc.

Superhet Converter

The adaptor, therefore, is a most useful unit for those possessing a broadcast set of the type mentioned, but when the set is of the H.F., det., and L.F. type, it falls a little short of all that could be desired, because it does not allow use to be made of the H.F. stage. In these circumstances the additional range and selectivity procurable with pre-detector amplification is lost, so it is advisable to make a further slight modification to the fundamental circuit (Fig. 1), so that it will operate as a superhet converter. Reference to Fig. 3 shows the necessary alterations; these consist of wiring a *broadcast* band H.F. choke in series with the H.T. supply and the existing S.W. H.F. choke, and connecting a fixed condenser of 0.0001 mfd. to the junction formed between these two components. One side of this condenser forms the point of output of the new unit, and, as shown in the diagram, it is connected to the aerial terminal of the b.c. set, the actual aerial and earth leads being taken to the S.W. circuit, as in the case of the adaptor. It should be noted that no use is made of the four-pin plug, and no valves are removed from the set, therefore the necessary connections must be made between the appropriate leads of the unit and the batteries supplying the set.

The principle of this arrangement is as follows: The single-valve S.W. unit is tuned to the desired station frequency in the normal manner, with this important exception, the circuit must be maintained—by careful adjustment of the reaction control—*just* in, or, better still, a *shade* below, a state of oscillation, to allow it to act as first detector and oscillator of the superhet circuit now being formed. In a normal type of superhet circuit, the output from the equivalent stage to the above (usually known as the frequency-changer) is taken to one or more H.F. stages, pre-tuned to the "intermediate frequency" of the set. In this simplified arrangement, however, we do not wish to provide special intermediate-frequency transformers, etc., therefore we utilise the aerial and H.F. tuning circuits and the H.F. valve in the b.c. set for this purpose, by tuning them to the most suitable wavelength or frequency on the *long-wave band*. The exact setting of the tuning condensers is best found by experiment, the object being to tune to a point where no interference is experienced by any long-wave transmission. Once this has been done, there is no need to vary the adjustment, as *all* tuning is then carried out by manipulating the tuning condenser of the S.W. unit. This superhet arrangement will give greater range and selectivity than the adaptor, but it must be remembered that it only can be used in conjunction with a b.c. set having one or more stages of H.F. amplification.

Coils

Whichever circuit arrangement is used, the same type of aerial coil can be employed in the S.W. circuit, the only time when it is necessary to change it being when it is desired to cover a different band of frequencies. The use of the aerial series condenser is quite important, as it enables the load imposed by the aerial on the grid circuit of the valve to be adjusted to the most satisfactory value for the elimination of "dead spots" and associated reaction peculiarities.

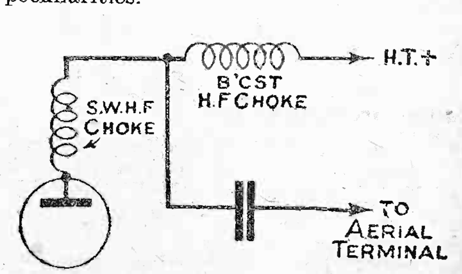


Fig. 3.—The modification of the anode circuit of Fig. 1 to enable the set to function as an S.W. converter when used in conjunction with a set having one or more H.F. stages.

Stereophonic Reproduction from Films

A Method of Recording Music on Film for Broadcasting Purposes

SYMPHONIC music heard over the radio or the loudspeakers of sound-picture systems, although very satisfactory, fails to produce in several respects the effect received by one listening to the original production in an auditorium. A full symphony orchestra utilises air vibrations at nearly all the frequencies the ear can hear, and it uses volumes of sound from about the lowest that can be heard in an ordinary auditorium to volumes one-hundred million times greater. The frequency range of such an orchestra, in other words, runs from the neighbourhood of 40 cycles per second to perhaps 14,000 cycles, and the volume range extends from about 30 Db above the threshold of hearing to 110 Db. a total range of 80 Db. In contrast with these ranges, radio and sound-picture systems usually have frequency ranges of only 5,000 to 8,000 cycles, and volume ranges from 35 to 50 Db. Moreover, a listener in an auditorium receives an added effect from the distribution of the sound in space, a recognition of different sounds coming from different sources.

Limitations Recognised

These limitations have long been recognised by the Bell Laboratories, and some years ago an improved sound-reproducing system was developed. The result of this work was the stereophonic system demonstrated in Washington and Philadelphia in 1933. Besides reproducing practically the complete frequency range of the orchestra and an enhanced volume range, this system went farther in interposing frequency and volume control between the pick-up microphones and the loudspeakers to permit the conductor to secure effects unobtainable from the orchestra alone. The music was picked up by three microphones spaced across the front of the stage, and the output from each microphone was carried through its own channel and control equipment to one of three loudspeakers spaced across the stage of the auditorium where the reproduction took place.

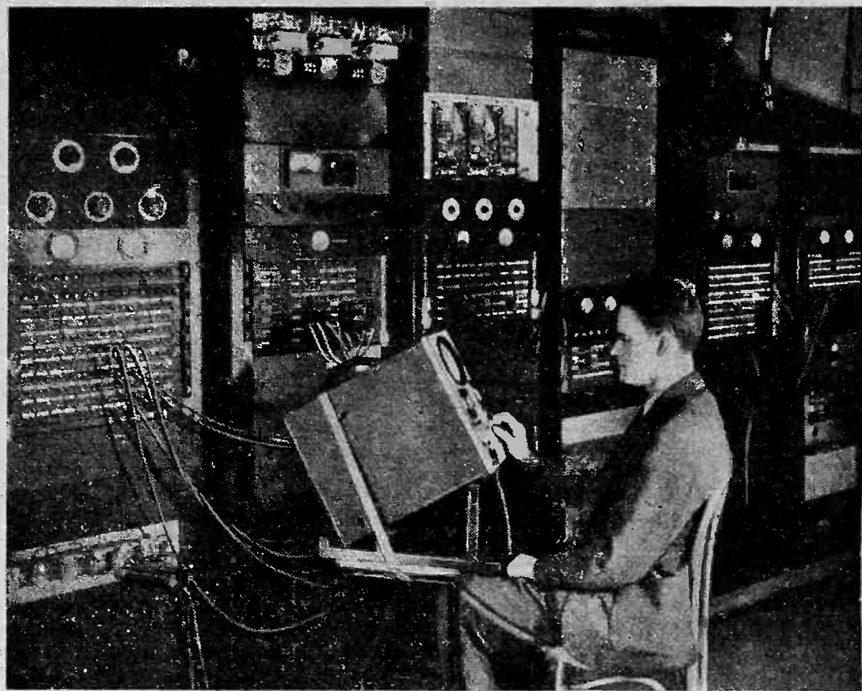


Fig. 1.—Recording amplifiers, low level reproducing amplifiers, and equipment for compressing and expanding the volume range

In the demonstration eight years ago, the music was reproduced at the same time at which it was being played but at a distance from the orchestra. In recent experiments a new stereophonic system was demonstrated in New York city, into which another set of steps has been introduced. The music is recorded on films, and is then available for reproduction from the film at any time. Four sound tracks are placed on a single film; one is used for each of the three programme channels, and the fourth serves for a control signal. A section of the film is shown in Fig. 2.

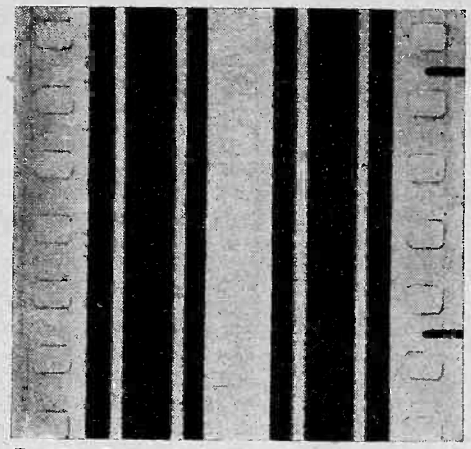


Fig. 2.—Enlarged photograph of the positive film used in its final reproduction.

Recording on Film

This recording on film might seem a simple thing to do. With music and sound so universally recorded on film for sound pictures, there would seem little difficulty to those not technically familiar with sound-picture systems in recording and reproducing a three-channel stereophonic programme. The facts are, however, that ordinary recording and reproduction places no such demands on the equipment as does the stereophonic system. Sound-picture systems transmit a frequency range of less than 8,000 cycles, while the stereophonic system employs a band nearly twice as wide. The entire recording and reproducing system had to be designed for this greater range.

In addition much greater precautions had to be taken to reduce noise and distortion. An extremely quiet system is required so that music at very low volumes, much lower than used in sound-picture systems, is not marred by the noise, and this is made more difficult because of the

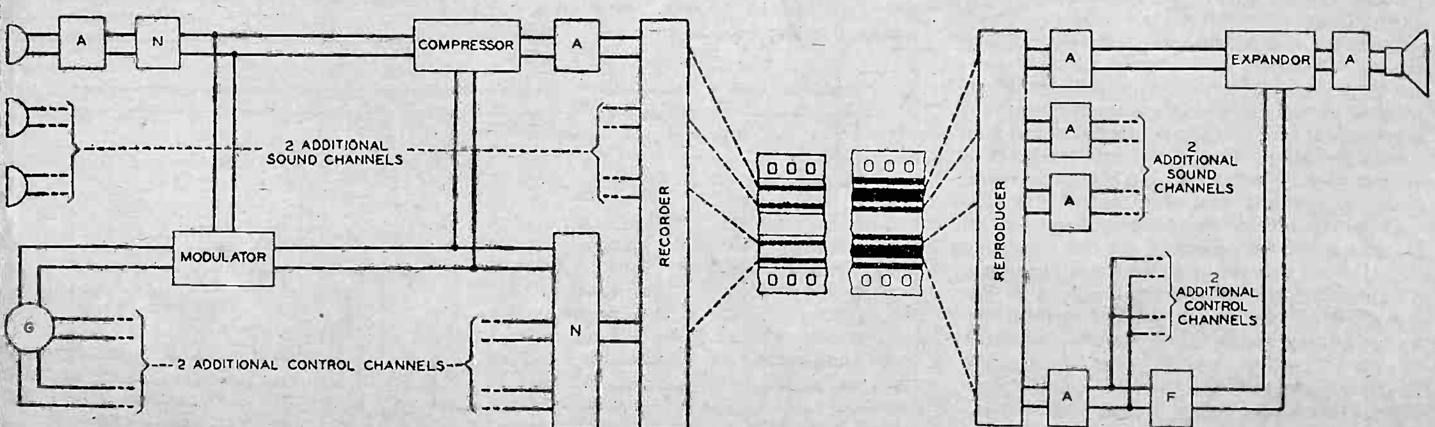


Fig. 3.—General layout and wiring of the stereophonic system.

wider frequency range, which gives a wider band for the entrance of noise. In addition there is the matter of increased volume range. The maximum volume range that can be placed on a film is less than 50 Db, while the stereophonic system, with the 10 Db increase and decrease provided by the enhancement control, requires a range of 100 Db. At the very outset, therefore, the recording of music for stereophonic reproduction seems faced with an insuperable obstacle.

A Very Difficult Task

The very difficult task of recording a programme having a volume range of 100 Db on a film that will receive only a 50 Db range was accomplished by use of compression and expansion devices performing functions similar to those used on certain transoceanic radio channels. The music as it is picked up by the microphones is passed through a compressor, one being provided for each channel. These allow the music currents to pass to the recording equipment in their normal volume range if below about 45 Db; higher volumes are reduced by the compressor so that the limit of the film recording is not overstepped. At the same time a record is made on another track on the film of just the time and extent of these reductions. At the reproducing end, the music currents generated in photo-electric cells from a light beam passing through the film are carried through an expander before reaching the loudspeaker. The action of the expander is controlled by a signal obtained from the additional light track. At any point where the original programme was reduced in volume by the compressor, this signal will cause the expander to increase the volume by just the right amount. In this way the full 100 Db range in volume is reproduced by the loudspeakers without exceeding the 50 Db range that is available on the film.

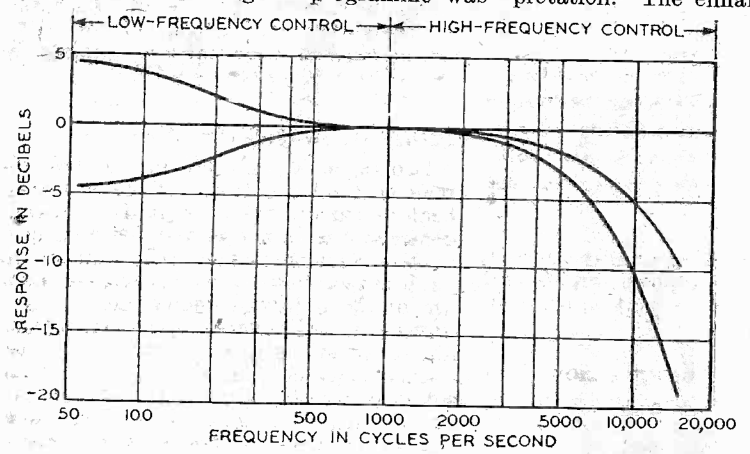


Fig. 5.—Frequency characteristics of the stereophonic system obtainable by manipulating the six keys that are located on the top of the enhancement control unit.

Main Elements

The main elements of the system are indicated in Fig. 3. To control the compressor at the recording end, a small amount of the programme current is taken from the circuit just ahead of the compressor and is rectified. This rectified current modulates a single-frequency current which then controls the compressor and also forms the signal placed on the fourth track on the film. Since there are three channels, and the amount and time of compression will vary from one to another, three control signals must be recorded on the film, one for each of the three channels. These are all recorded on the same track on the film by allowing the three rectified currents to vary independently the strength of three alternating currents of different frequencies. These modulated currents control their respective compressors and are then combined and recorded as the fourth track.

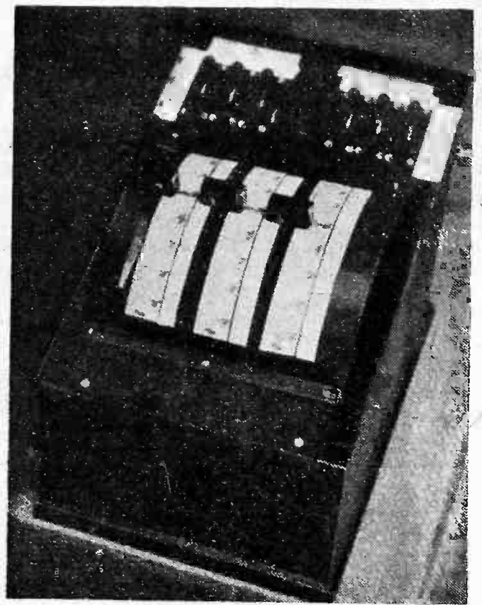


Fig. 4.—The enhancement control unit of the stereophonic system provides both volume and frequency control at the discretion of the conductor.

When the Film is Made

After the film has been made, if the music is then to be enhanced, it is reproduced while the original conductor listens and manipulates the enhancement controls to modify the frequency and volume ranges of the three channels and thus to secure an effect that more nearly suits his interpretation. The enhancement control unit is shown in Fig. 4. At the top are six keys used to control the frequency composition—there is one for each channel for adjusting the high frequencies, and one for each channel for low frequencies. Each key has three positions and gives the control indicated in Fig. 5. The three handles on the front of the control unit are for adjusting the volumes of the three channels. As the handles are moved up from the normal position, the volume is increased, and as they are moved down, the volume is decreased. As the conductor listens to the reproduction of the original recording, he manipulates these controls, and another film record is made of the enhanced programme.

Frequency Characteristics

This phase of the operation is shown in Fig. 6, which shows only one channel, however. The changes in frequency characteristics brought about by the enhancement control are secured by the insertion or removal of electrical filters, marked N1 in Fig. 6, in the circuit for each channel. The volume control modifies the current of the auxiliary channel, which is used to control the action of the expanders. Both networks, N1 and N2, are inserted in the circuit ahead of the point where the monitoring circuit is taken off, and thus modify the programme as heard by the conductor as well as the currents used for making the new film. On the new film, the three programme sound tracks are the same as on the original film except for the frequency modifications brought about by the filters. The control track, however, has been modified by the manipulation of the enhancement control so as to cause greater or less expansion when the programme is subsequently reproduced. The new film made as a result of this process thus represents the enhanced programme, and is the one used.

Incidental Development

Besides the compressors, expanders, and filters required for this new system there has been a considerable amount of incidental development of the associated parts. There had to be provided, for example, a carefully designed source for the three signal frequencies used to control the expanders, and narrow band-pass filters to separate the three frequencies at the reproducer so that each would control its own expander. Other developments were required to secure accurate timing. The signals must cause the expanders to act at exactly the same point on the film that the compressors had acted during the original recording. In addition practically every piece of equipment had to be studied and partly re-designed to reduce noise and distortion that in other circumstances would be unobjectionable.—*Bell Laboratories Record.*

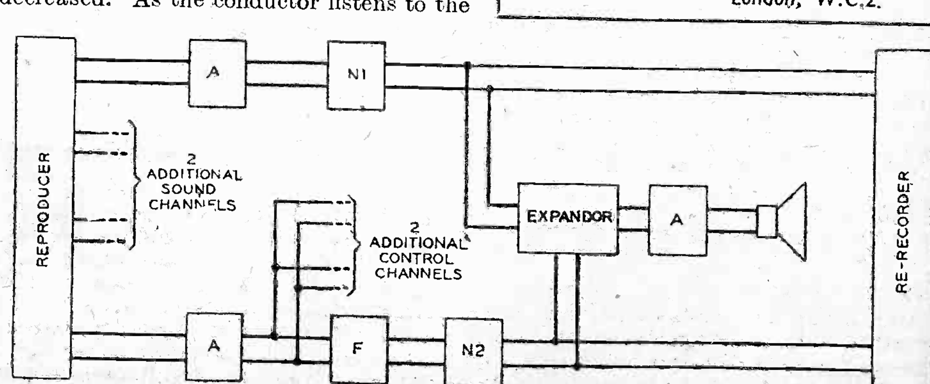


Fig. 6.—Details of the circuit used for enhancing and re-recording.

Problems of Amateur Receiver Design—14

Planning the Power-supply Section of A.C. Mains Receivers: The Output Required; Types and Arrangements of Rectifiers

By FRANK PRESTON

WHEN dealing with the power-output circuit of a mains receiver it was pointed out that its design is to a large extent connected with that of the power-supply system. It was also explained that, in the majority of cases it is desirable, if not essential, to plan both of these circuits at the same time. The reason for this is that the output stage normally consumes by far the largest amount of H.T. current; even in a large superhet, the output stage takes at least as much H.T. as do the rest of the stages put together.

By way of example, we may consider a superhet of the fairly standard arrangement, where there is one H.F. stage, followed by a frequency-changer, and then by one I.F. stage, and by a double-diode triode, which serves as second detector and first L.F. amplifier. In this case the first three valves would not normally consume more than about 25 milliamps altogether, while the triode portion of the double-diode triode might take a further 8 milliamps. Thus, the total H.T. consumption of these valves is less than 40 mA; by comparison, a power tetrode or pentode providing an output of about 5 watts undistorted would require at least 50 mA. Similarly, a large power triode capable of delivering about 3 watts would take a similar anode current. Even if the receiver had a second intermediate stage of L.F. amplification, therefore, the output stage would require more H.T. current than all the preceding stages, especially since in that case a larger output valve would in most cases be employed.

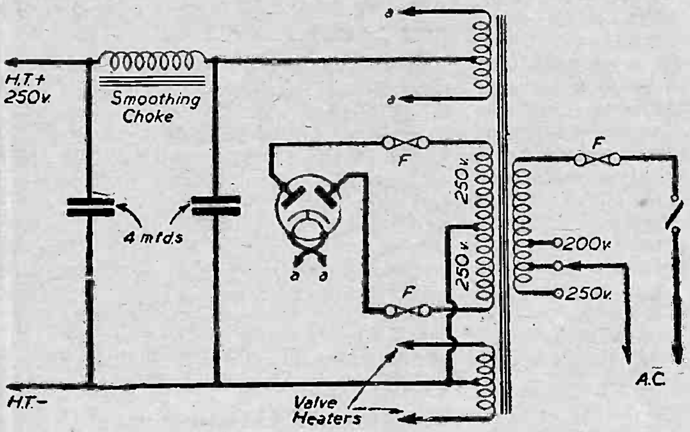


Fig. 1.—The essential circuit of a full-wave rectifying valve. That shown is indirectly heated, but the connection would be identical for a directly-heated valve. A single L.T. winding is shown for valve heaters, but two or more may be required according to the requirements of the receiving valve.

H.T. Requirements

In this series of articles we have been concerned almost entirely with receivers suitable for domestic use, and intended for a maximum undistorted power output of under 10 watts. Even within this range there are a large number of alternative output circuits, as we saw in a previous article, so we cannot deal only with one type of power-supply section. The required output of H.T. will certainly vary from, say, 250 volts 50 mA to 500 volts 120 mA.

Choice of Rectifier

One of the first questions which is likely to arise when planning the power-supply system concerns the type of rectifier to be used (valve or dry-metal) and the form of rectification which will be employed. Here again, however, it is impossible to say that any one is better than any other, unless the specific purpose for which it is required is first fully understood.

The valve type of rectifier is probably most widely employed where a fairly large output is required, partly because the valve required for comparatively heavy currents at large voltages is appreciably more compact than is the corresponding metal rectifier. Again, the valve has normally a somewhat lower internal resistance than has the metal rectifier, and this makes it better for output circuits employing class AB1 amplification—which is increasing in popularity. As readers will remember, with this type of amplifier the valves are heavily biased to cut down the "standing" current. But the current passed increases with the amplitude of the grid swings. To permit of a varying current without the voltage being greatly affected, it is necessary to have a power-supply unit with good "regulation"—that is, with low internal resistance.

Half or Full-wave Rectification

The metal rectifier is very convenient for lower-power work, and we shall study its application later. For the moment, it may be supposed that we have decided to employ a valve rectifier and that we are mainly interested in finding the type which will be most suitable and convenient. Shall we use half-wave or full-wave rectification? In almost every case we shall prefer the latter (Fig. 1) in preference to the former (Fig. 2), since it is more efficient; because of its greater popularity, there is a wider range of valve types to suit it. Another advantage of full-wave rectification is that smoothing is easier because the D.C. "ripple" is at 100 cycles, compared with 50 cycles (or mains frequency) for half-wave. The reason for this is that the full-wave rectifier passes current on each half-cycle—the half-wave only once each cycle. And the higher the frequency the lower the inductance of the choke required for smoothing.

Transformer Output Voltage

One small disadvantage of full-wave rectification is that the mains transformer must have a secondary winding designed to provide twice the R.M.S. anode voltage between the ends, or to supply the anode voltage for each valve on each side of a centre tapping. This point also can be appreciated by comparing Figs. 1 and 2, where output and transformer voltages are given. Actually, the voltage figures indicated are very approximate since they do not take into account the voltage drop across the valve and across the smoothing choke. The latter item may be appreciable, when anode current of 100 mA or more is being supplied.

We will dismiss half-wave valve rectification here, after pointing out that it may prove convenient in a few cases where a particular transformer is readily available, or where the rated output of an easily obtainable half-wave valve is suitable for the receiver being planned.

Indirectly-heated Rectifiers

Looking at Fig. 1 it will be seen that the rectifying valve shown is of the indirectly-heated-cathode type. This is generally obtainable as an alternative to the directly-heated or filament-type valve. Its special use is in receivers having valves all of which are of the indirectly-heated kind. If a directly-heated rectifier were used, without any delayed switching arrangement, the voltage between the H.T. + and − leads would be excessive when the receiver were first switched on, due to the fact that until the valve heaters attained working temperature (usually about 30 seconds) there would be no load on the rectifier and the voltage developed would be at least twice the rated output voltage for the valve employed.

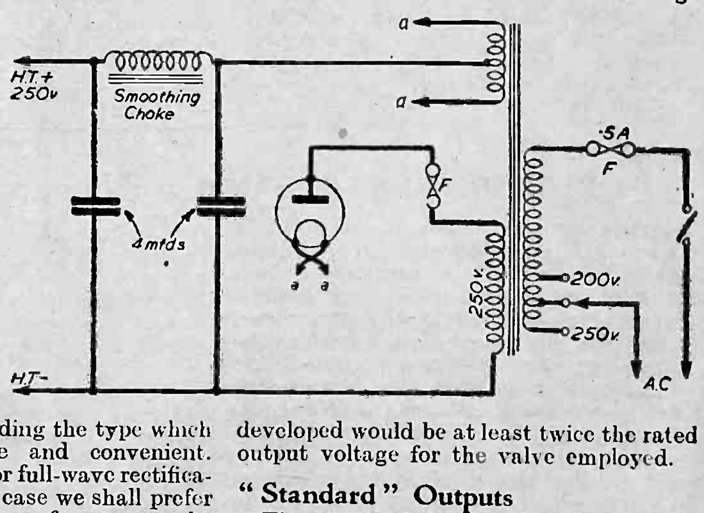


Fig. 2.—A half-wave valve rectifier. The valve shown is directly heated and the heater winding for the receiver valves is omitted for simplicity.

"Standard" Outputs

The directly-heated type of valve is to be preferred when the receiver output valve has a directly-heated cathode, for in this case the valve provides at least a half-load while the other valves are warming up. Full-wave rectifying valves are made in three principal patterns rated to give maximum outputs (unsmoothed) of 250 volts 60 mA; 350 volts 120 mA; and 500 volts 120 mA. There are other types, but those mentioned are most general and therefore should be most readily obtainable. In practice, it is the maximum current output which deserves most attention, since the output voltage can be varied to meet most requirements simply by choosing a transformer of appropriate voltage.

This point is demonstrated by Fig. 3, which shows how the output voltage varies with different applied R.M.S. (or transformer) voltages, and with the current constituting the load. The valve repre- ented by these curves would be rated as having a maximum output of 250 volts 100 mA, but it may be seen that if the transformer supplied only 200 volts to the two anodes the maximum voltage at full current would be only about 150. Similarly, if the current taken from the valve were only 40 mA, and 250 volts were applied to the anodes, the output voltage actually supplied to the smoothing choke would be slightly in excess of 280. Taking another example, if the transformer used supplied 150 volts to each anode the voltage provided at a load current of 50 mA would be about 140.

Similar graphs or corresponding data can be obtained for all rectifying valves from the makers, and it is well to study this information before making a final choice of valve and transformer.

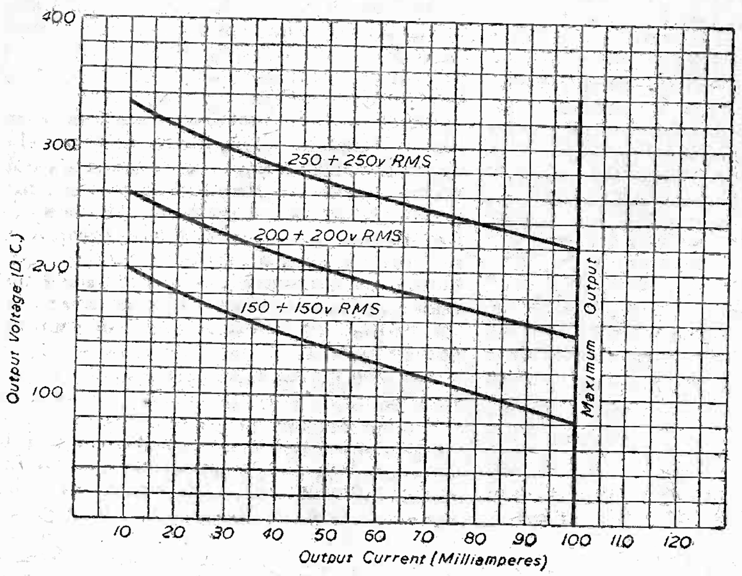


Fig. 3.—Typical output curves showing the relationship between output and input voltages of a rectifier, and between load current and output voltage.

Sources of Voltage "Loss"

Another very important practical point which must be borne in mind in the same connection is that there is a voltage drop across the smoothing choke, speaker-transformer primary and bias resistor, so that the voltage applied to the anode of the output valve may be considerably less than that which constitutes the rectifier output. For example, suppose we used a good 20-henry smoothing choke having a resistance of, say, 250 ohms, that the D.C. resistance of the speaker transformer were 150 ohms, and that the bias resistor had a value of 300 ohms. The total resistance in the H.T. circuit to the output valve would be 700 ohms, and this would cause a voltage drop of 35 volts if the current taken were 50 mA.

That is not the best way of looking at the matter, because in practice we have to consider that the current passing through the smoothing choke is the total current taken by the receiver, whilst that through the speaker transformer is the anode current of the output valve only, and that through the bias resistor is the total H.T. current (anode and screening grid in the case of a pentode or tetrode) of the output valve.

Calculating the Real Anode Voltage

Suppose, therefore, that we are dealing with a receiver taking a total H.T. current of 75 mA, that the output tetrode takes an anode current of 45 mA, and that the screening grid takes 10 mA. Assuming the same values of resistance for the various components as before, it will be seen that the voltage drop (current times resistance) across the smoothing choke would be nearly 20 volts; that across the speaker transformer would be about 7 volts, and that across the bias resistor would be 16.5. The total drop would therefore be in the region of 45 volts, as far as the output valve is concerned, and therefore if the maximum of, say, 250 volts were to be applied to the anode the H.T. supply would have to develop 295 volts. This would probably necessitate the use of a 350 volt 120 mA rectifier fed with about 300 + 300 volts R.M.S.

Suitable Components

Now we can revert to Fig. 1 and deal with the other components indicated. The smoothing choke should always be of good quality and should easily be capable of carrying the total H.T. current; when passing that current the inductance should not be less than about 15 henries. The smoothing condensers, shown as being of 4 mfd. each, are very important, not only for smoothing purposes, but because that nearer to the rectifier affects the output voltage. A value of 4 mfd. is usual, but some makers may specify the rectified output with a condenser of 6 or even 8 mfds. In that case, the use of a smaller condenser would result in a somewhat lower rectified H.T. voltage than that for which the valve is rated. These condensers should have a rated working voltage of not less than twice the rectifier output voltage in the conditions under which it is used. Once again, good quality is the best assurance of safety.

Use of Fuses

It may be considered that the use of three fuses is carrying the question of safety too far, but it is easier and cheaper to replace a fuse than to fit a new rectifier! Those in the anode circuits of the valve safeguard the valve in the event of overload and should be rated at between one and a half and twice the maximum output current. The fuse in the mains lead to the transformer safeguards the transformer and the mains; a rating of 1 amp. is suitable for large rectifiers, or about .5 amp. where the output is below 100 mA at 250 volts; these figures allow for L.T. current as well as H.T. being taken from the transformer.

Transformer Outputs

The lowest of the three secondary windings shown is the 4 volt or 6.3 volt supply source for the heaters of the receiving valves and is included merely to indicate that its centre tap is joined to H.T. –. In practice the choice and specification of the transformer is dependent upon the heater current and voltage (generally 4 or 6.3) required by the valves, when a directly-heated output valve is used a separate winding will be required for its filament.

We must defer the question of using metal rectifiers, and that of providing power for A.C./D.C. receivers until a later article in this series.

(To be continued)

Pronunciation of Foreign Names by B.B.C.

Many people wonder how the B.B.C. chooses the pronunciation of a foreign word to be used by announcers in News Bulletins, and frequently letters are received from individuals who have lived in foreign countries which are much in the news. Perhaps they may write to say that the pronunciation adopted is not correct, or they may say that there are two schools of thought and they think that the B.B.C. has chosen the wrong one. It should not be imagined that the matter is left to chance, and here are the principles on which the final choice is made.

Criticism Welcomed

The first is that the main object is to have foreign names understood by the largest number of people. When a man reads his newspaper and meets a strange name for the first time in print which he has never even heard he pronounces it to himself in the light of his knowledge of similar words. When the pronunciation of a word does not remotely resemble the same form as an English word, it is Anglicised. For example, Lodz is pronounced as the ordinary man would read it, whereas the correct pronunciation is "Wootch." Of course, many of the capitals of the world are already known in an English form, for example, Paris and Rome. In the case of a place like Munich, the English form is also used in preference to München. In the case of "v's" in Russian words, they are always pronounced as "ff," for example, Kieff. Criticism is welcomed by the B.B.C., and any word is considered in the light of any new evidence. In any case of doubt the correct authority is always consulted.

Compliment to Allies

Sometimes a subtle compliment is paid to the Allies, for example, at the time of the Grecian campaign, when the Italians were in possession of Albania, the Greek pronunciation was always given in preference to the Italian.

With regard to the names of individuals the rule is always observed that the name is pronounced as the individual himself would wish.

Here is a final point: Many people say: "Your announcers profess to lay down the law." That is not so. As already explained, the main object is to make foreign names understood by the largest number of people. "We do not set ourselves up as authorities," said John Snagge, Presentation Director.

ON YOUR WAVELENGTH

By Thermion

My Brains Trust

MY criticisms of the Brains Trust seem to have inspired the *Daily Mail* cartoonist, who in a recent issue published a caricature of the Citizens' Advice Bureau with the caption "—and by a strange coincidence our names are Joad, Huxley and Campbell." I listened in again to some of the questions and the answers. One particularly interested me, for I have spent a useful part of my life in teaching others, and I suppose I am as competent as anyone to answer this particular question. The question was "when does a man become too old to learn?" The consensus of opinion of the Brains Trust seemed to be that there was an age at which it was impossible to absorb more knowledge. They seemed to base their views more or less on personal experience, but none of them mentioned the important fact that there must be some limit to the age of learning. As knowledge increases the brain folds up, and the folds are known as convolutions. Obviously, as the cranium has a limited capacity, there must be a limit to the convolutions. However, I propose to formulate my own Brains Trust, and I shall, through the medium of this journal, be delighted to answer serious questions. Only flippant letters will receive flippant replies, so fire in your Brains Trust questions, marking your envelopes or postcards in the top left-hand corner "Brains Trust," enclosing a stamped and addressed envelope if a postal reply is desired.

A New Volume

HERE we are on the threshold of a brand new volume and this at a time when the paper shortage is acute, and many journals are suspending publication for the duration of the war. This will be cheering news to the many hundreds of readers who conclude their letters to me with the hope that PRACTICAL WIRELESS will continue through the war. It will. Many thousands of our readers are now on Active Service, but the journal reaches them wherever they are stationed. When the war is over this journal will return to weekly publication.

This is our ninth Birthday, and you can wish us many Happy Returns without there being an implied joke. Editors do not like returns; they are never happy; the publisher is likely to ask awkward questions. Proprietors gaze with dour mien at the thin red line which divides profit and loss. The fact that this journal goes forth on to the uncharted sea of a new volume is proof of the success of the journal and the policy laid down when it first saw the light of day on September 24th, 1932.

Our Service to the Country

MANY of our readers on Active Service pay graceful tributes to the fact that they owe their knowledge, and therefore their jobs, to this journal. I had a letter the other day from one such who is in charge of a servicing station of the R.A.O.C. I therefore pass along information which will be of value to those who aspire to enter the Services in a radio capacity. The applicant may enlist as a wireless mechanic and pass a Grade 3 Trade Test. This means that he can go to school to be coached in theory and practical work until such time as he can pass a Grade 2 Test, when he is eligible for an Entrance Examination for the goal of the majority of the technicians, namely, the Military College of Science. Any man with sufficient intelligence to pick up things quickly will make progress there. The men are taught from scratch even to the use of a slide rule, although a little previous knowledge of mathematics helps a lot. They are taught theory, general workshop fitting such as turning, milling, brazing and engraving, and then the practical side of radio servicing. This course takes about five months with one examination per month. Those with sufficient marks and with military ability to control men can pass out as Armament Artificer Staff Sergeants.

B.B.C. Jam Enemy Broadcasts

IT is reported that secret measures to jam enemy broadcasts have been put into operation by the B.B.C. in retaliation for German and Italian efforts to interfere with our foreign broadcasts. These B.B.C. measures have already proved extremely satisfactory.

This unseen war of the air has now reached startling proportions. Germany and Italy are doing all they can think of to prevent their own people, and people in occupied countries, hearing British and Russian broadcasts.

Our transmitters and the many stations in Russia's vast radio system are, however, upsetting enemy propaganda plans.

By increasing the power of transmitters and the number of transmissions the B.B.C. are steadily defeating the enemy's efforts to jam.

B.B.C. experts are convinced that, despite all the enemy's efforts, a large percentage of our foreign broadcasts are being heard in the countries, and by the people, we want to hear them.

Our Roll of Merit

Our Readers on Active Service—Nineteenth List

A. C. Newton (A.C.2, R.A.F.), Hereford.
G. G. Vickers (2nd Lt., R.A.), Nottingham
R. Proctor (Radio Mech., R.A.F.), Manchester.
D. Hudson (W/Op., R.A.F.), Northallerton.
G. Hazelwood (Gnr., R.A.), West Thurrock.
C. L. Redshaw (A.C.1, R.A.F.), Dover
A. H. Eaton (A.C.2, R.A.F.), Letterston, S. Wales.
J. R. Burdin (A.C., A.M. Unit, R.A.F.) London.
J. E. Cooper (Cpl., R.E.), Atherstone.

Radiolocation

READERS interested in Radiolocation who wish to join the Service in connection with this new science should get into touch with M.M.1, The War Office, Whitehall, London, S.W.1.

I mention this because very many readers who wrote in response to our recent article seemed unable to get into touch with the right department. We have taken the matter up and are now informed that the address given is the correct one.

The Right Time

THAT was a remarkable broadcast in which Mr. Attlee on behalf of the Government announced the famous eight points which have been agreed between Mr. Roosevelt and Mr. Churchill. The news of the meeting between these two great men had been hinted at in the American and foreign press, but not a word had leaked out here although it was, of course, known to all Editors of journals and newspapers. The only thing I have to criticise about the speech is that it was given at the wrong time of day. Most people are at work at 3 o'clock in the afternoon, and if their works had a wireless set installed the speech meant a loss of thousands of man hours. If the works had not a wireless receiver the workmen had to wait until the evening news, anyway. Most people are at home by 9 o'clock in the evening, and the announcement was not of such vital importance that it could not have been given at a time when everyone could listen to it. It was not a warning of any invasion, it was not an announcement of peace, nor did it bring tidings of an important victory. It was a plain statement of policy which has been reiterated time and again and particularly by the late Mr. Chamberlain; I therefore do not think that production should be hampered by an afternoon broadcast. We were warned in the morning to listen for an important announcement at three in the afternoon. The public indulged in the wildest conjectures as to what would be announced. I suggest therefore that announcements of the sort mentioned should be given due prominence in the press and in the news programmes. They should not be elevated to the importance of a momentous declaration. There is only one momentous declaration for which we all wait, and that is the declaration of the inevitable victory for us. Nothing less than that should prompt the Government to warn the whole nation to listen at a particular hour.

Electradix Radios' New Address

WE are informed by Electradix Radios that the firm have now taken new premises adjoining their works at 19 Broughton Street, Battersea where they will be pleased to see callers in future.

They still have a stock of electrical instruments, testing apparatus, motors, dynamos, chargers, switchboards, and electrical sundries, which have attracted so many of our readers over the past 9 years. Broughton Street is easily accessible from Sloane Square District, or Clapham Common Tube stations. The 137 bus from either destination through Queenstown Road stops very close to Broughton Street.

An Improved Detector Circuit

A Method of Employing a Low-impedance Driver Stage

IT is well known that the A.C. and D.C. loads of a detector should be equal if the detector is to be capable of handling fully modulated signals without distortion. This usually leads to the use of a low load resistance, so that the shunting effect of the networks coupling the detector to succeeding amplifiers, etc., shall not be appreciable, and, consequently, considerable damping is applied to the tuned circuit feeding the detector, with the result that selectivity and gain are reduced.

This difficulty can, however, be overcome by providing a low-impedance driver stage for the detector, and the present article describes some circuits developed by the Radio Corporation of America, which utilise the so-called cathode follower for this purpose.

Referring to Fig. 1, an I.F. amplifier is shown coupled to a diode triode, the cathode 8 of which provides independent electron streams to the auxiliary anode and to the anode 10, and is connected to earth through an impedance consisting of the coil 12 tuned by a condenser 13 to the I.F. The anode 11 is connected to earth through a load resistance 16, shunted by an I.F. carrier by-pass condenser 17, the voltage developed across the resistance 16 being transmitted to an audio-frequency network through the coupling condenser 18. The direct current voltage developed across load resistance 16 is employed for automatic gain control of the valves preceding the driver valve 7.

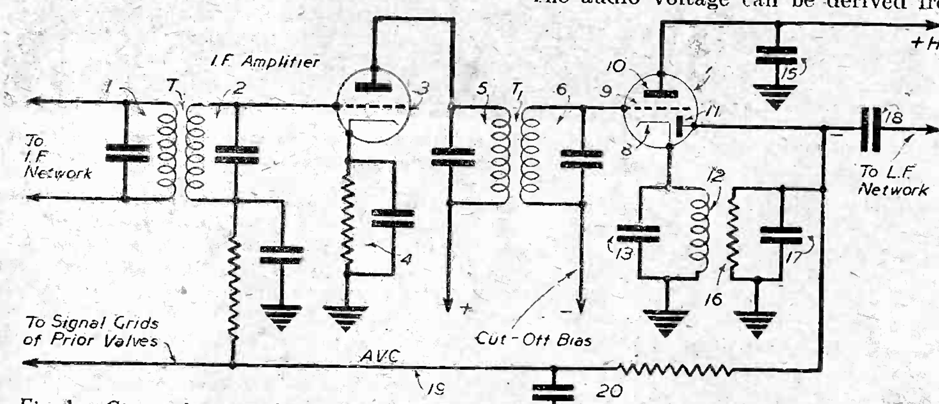


Fig. 1.—Circuit diagram of an amplifier coupled to a diode-triode.

Full Selectivity

With the arrangement shown full gain and selectivity are secured from the driver valve, and from circuits 5, 6, and the same amount of radio-frequency voltage appearing across circuit 6 also appears across circuit 13-12. The triode 9-8-10 is degenerative for the intermediate frequency carrier, and the voltage across the circuit 13-12 is applied to the diode anode 11, the rectified current flowing through resistance 16. The tuned circuit 13-12 may in itself be of infinite impedance, but looking back into the triode 9-8-10, there is an impedance which is equal to the anode resistance divided by mu plus 1. This impedance is very low; for example, it can be as low as 500 ohms. In other words, the diode 8-11 looks into a 500-ohm impedance. For this reason, the load resistance 16 may be small and can be chosen for 100 per cent. modulation capability without regard to loading of tuned input circuits.

Since the diode 8-11 only operates on the positive half-cycles, the driver triode need only supply half cycles to the diode.

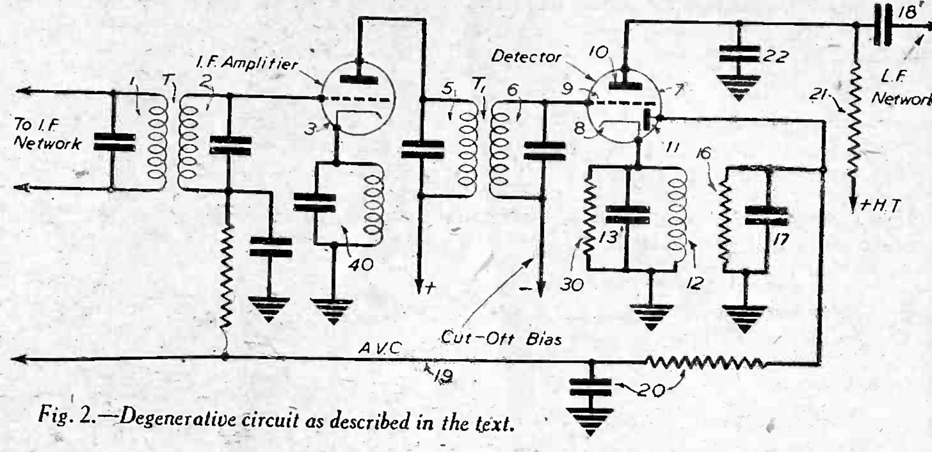


Fig. 2.—Degenerative circuit as described in the text.

For this reason the signal grid 9 is biased substantially to cut-off. Current will then flow through diode 11-8 on the positive half-cycles of waves applied to signal grid 9. This permits driver triode 9-8-10 to handle signals of larger magnitude. It will, therefore, be seen that driver 9-8-10 is actually a Class B amplifier degenerated 100 per cent. for the carrier. If desired, a second auxiliary anode may be used for securing automatic volume control bias, while the anode 11 is used for audio detection and delay bias can be applied to the A.V.C. diode without effect on detection diode.

Degenerative Circuit

The audio voltage can be derived from the anode circuit of the triode 9-8-10, and Fig. 2 shows a load resistance 21 of about 0.1 megohms connected in the positive potential supply lead to the anode 10. The triode detector is similar in action to the square law, or power detector, with the exception that it is degenerative at the carrier. If circuit 13-12 is tuned exactly to the carrier, as in Fig. 1, the circuit is degenerative (100 per cent.) to the carrier. It may be expected that the triode detector in such a case is linear for the carrier, as well as the audio. Very little carrier voltage will appear in the anode circuit, hence, a small by-pass condenser 22, about 100 mmf., can be connected across the resistance 21. The carrier voltage which appears in the detector anode circuit will depend on the ratio of resistance 21 to the impedance of the tuned circuit 13-12. If desired, coil 12 may be employed without use of the tuning condenser 13. The untuned coil may build up across it enough degenerative voltage to linearise the detection characteristic for small-amplitude signals; for strong signals the 100 per cent. degeneration is not required to linearise the characteristic, since the power detector is linear for such high-amplitude signals. Further, there would be sufficient voltage developed across the untuned cathode impedance to supply the diode rectifier and produce good control action.

If the tuned circuit (13-12) impedance is high (high Q coil) it may augment the anode resistance to such a high value that the output across the load 21 is very small and almost zero. To prevent this the tuned circuit 13-12 may be shunted by a resistance 30. Quite a low value of resistance for 30 may be used without reducing the voltage applied to the diode. This follows from the fact that the diode looks into an impedance of, say, 500 ohms. A value of 50,000 ohms for resistance 30 would have small shunting effect on the 500 ohms impedance.

ROUND THE WORLD OF WIRELESS

Suitcase Radio S O S

A SUITCASE radio transmitter, powerful enough to be heard up to 200 miles, is now carried in most ships in case the lifeboats have to be used. It is stated that every ship will soon be equipped with one.

Pictures by Radio from Moscow

THE first direct Moscow-London wireless picture from the Russian front was recently received in London. It shows a Soviet battery in action blasting out concentrations of German troops.

Police Radio Men

SCOTLAND YARD are to release a number of their radio experts to meet the special needs of the Forces in developing radiolocation.

Netherlands Broadcasting

SINCE the occupation of Holland by Germany the various broadcasting systems, which were under the auspices of a number of different organisations, have been dissolved and replaced by a State organisation. A licensing system has also been introduced, the fee being 9 gulden (approx. 18s. at par) per annum.

Cinema Television in U.S.A.

A SCOPHONY rear-projection mechanical television receiver with a 12ft. by 10ft. screen is being installed in the Rialto Theatre, New York, which will then be the first American cinema to offer television in addition to motion pictures. It is understood that the apparatus is similar to that installed in the Monseigneur News Theatre, Marble Arch, London, in March, 1939.

New B.B.C. Governor

THE appointment was recently announced of Mr. Harold Nicolson—lately Parliamentary Secretary to the Ministry of Information—to a B.B.C. governorship. There are now seven B.B.C. governors.

B.B.C. Listeners in Germany

"MANY Germans are still listening to the B.B.C., although they should know that the B.B.C. is lying and that the German radio is reliable and true," says the *Koelnische Zeitung*, of Cologne. Recently, six people were sentenced to a total of 37 years' hard labour for listening to the B.B.C. broadcasts.

U.S. Radio Lifeboats

THE United States is equipping all its Coastguard lifeboats with two-way short-wave radio systems capable of accurate communication to distances up to 25 miles. Thus these craft will be able to keep in constant touch with cutters, aeroplanes, and shore stations in co-operating in rescue work at sea. The land station transmitters are rated at 50 watts output, while the lifeboat transmitters have an output of only 15 watts. A standard Coastguard loudspeaker is located on both shore station and lifeboats.

N.B.C. Short-wave Transmitters

ACCORDING to a recent report from America, the N.B.C., at the request of the U.S. State Department, is shortly to operate its short-wave transmitter for 24 hours a day. Recent experiments, in which the two 50-kW. transmitters WRCA and WNBI operated simultaneously on the same wavelength, resulted in a signal equal to that from a 100-kW. station. As a result, it has been decided to use the dual output for at least a part of the N.B.C.'s new international schedule.

Nazi Gunfire—By Radio

DISCOVERY of a trick in which the Germans used microphones and loudspeakers to try to make the Russians think that they were facing a bigger force than they actually were, was reported by Moscow radio recently.

"A German detachment which was forced to withdraw during a Russian counter-attack," said the announcer, "took cover in a forest, and when the Russians prepared to launch a bayonet attack suddenly opened heavy machine-gun fire. The sound of the machine-guns was so terrific that it seemed they were hidden behind every tree. Russian patrols penetrated into the forest, where they discovered loud-speakers hanging from the trees and microphones set up near the German machine-gun posts."

Ship's Emergency Receiver

IT is reported that an emergency crystal receiver is part of the radio equipment to be installed by the Radiomarine Corporation of America on nearly 100 United States vessels now under construction.

American Industry Uses P.A. Systems

AS American industry changes over to Defence production, applications of sound apparatus are finding extended uses for speeding up the manufacture of munitions. All over the new war plants, loudspeakers are being installed for the purpose of speeding-up communication between executives and section managers, and between departments. In workshops where there are a large number of employees, principally women, the loud-speaker system is also used for providing music from records.

Police Radio Too Heavy

BUENOS AIRES detectives complain that the two-way radio sets they carry under their coats are so heavy that they cannot chase thieves or other culprits when the occasion arises.

Why Newswriters Grow Old Early

THE newsroom boys at station WLW (Cincinnati) were caught off their guard the other day when the 'phone carried a request for information.

"Who's the new British Minister of State?" a voice demanded.

Hurried conference among the writers produced no result.

"I'm sorry, but we don't have that information," the spokesman said.

The voice came back firmly. "Well, what's wrong here? I've called all the stations and all the newspapers, and none of them can tell me. If I can't find anything out at a radio station or a newspaper, where can I?"

"Is it necessary that you have the information immediately?" the harried spokesman answered. "We could call you back. For what purpose do you want the information?"

"Well, I'm working out a crossword puzzle and . . ."

And they swear it's true.

Variety Producer on Holiday

JAMES DYRENFORTH, the B.B.C. variety producer, who was born in Chicago and is an American citizen, is now in the United States for a well-earned and much-belated holiday. It is expected that his stay will last for two months.

Since joining the B.B.C. staff early in the war, Dyrenforth has written and compèred over a hundred productions, in addition to writing dialogue and lyrics for innumerable others. While in the States he will give four broadcasts, possibly including material that he has already used over here, chiefly designed to show the American people, not how the British "can take it," but how their saving sense of humour enables them to take it—and give it back.

B.B.C. Prize for Arabic Competitor

EMIL FAKHOURI, of Safad, a 20-year-old soldier in the Trans-Jordan Frontier Force, is the winner of the First Prize in a competition just completed for poems in the Arabic language. The subject of his poem was Shakespeare.

Mr. Winston Churchill recently paid a visit to Scotland where he inspected troops and equipment. He is here seen watching two soldiers using a portable transmitting and receiving set.

A Variable Permeability Tuner

A Method of Inductance Variation by Current Control

IN the tuner to be described, the inductance of a coil having a magnetic core is varied by superimposing on the core a controlling flux, which is adjustable in accordance with the inductance desired. However, if the coil carrying the controlling current is coupled to the radio frequency, winding losses will be produced in the radio-frequency winding. The constructions described in this article permit both the radio-frequency coil and the control current winding to produce flux in a common portion of their magnetic circuits without thereby introducing any coupling between the two coils, provided that the one coil carries radio-frequency current and the other coil only direct or slowly varying current.

Details of Construction

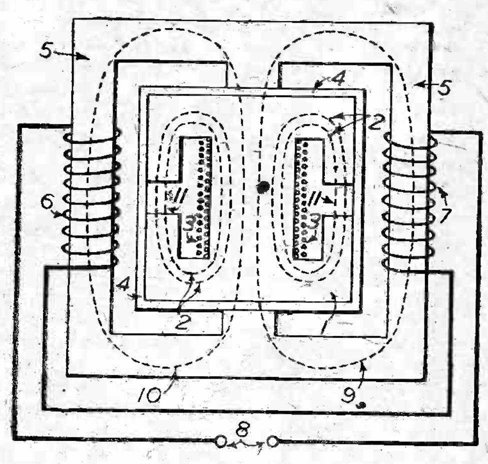
Referring to Fig. 1, the numeral 1 represents a high-frequency core made up of a material such as powdered iron, and the dotted lines 2 bearing arrows indicate the magnetic lines of force produced by current in the radio-frequency coil 3. The core 1 is provided with a cylindrical copper shield 4, which surrounds the magnetic core 3, and this shield prevents radio-frequency variations of magnetic flux from leaking outside the core 3. Member 5, which is made of ordinary iron, has mounted thereon control windings 6 and 7. This arrangement forms a magnetic circuit which is completed by the magnetic material inside the shield 4. Typical lines of flux are shown by lines 9 and 10. Due to the fact that the control flux represented by lines 9 and 10 is at most only slowly varying, the copper shield 4 is ineffective to prevent the control flux from passing through the shield, and acts merely like a small air gap. In addition to its primary purpose of preventing the radio-frequency field from linking the control winding or the solid iron portion of the control circuit, the shield also acts in the usual way to prevent coupling between the radio-frequency coil and other coils adjacent thereto.

Small Air Gap

A small air gap 11 is left in the high-frequency magnetic circuit so that the control flux will pass mainly through the central portion of the high-frequency core 1, where its effect is the most pronounced. Windings 6 and 7 are connected to a suitable source of control current through terminals 8.

A Modification

Fig. 2 shows another arrangement operating similarly in principle to the arrangement shown in Fig. 1, but the high-frequency coil 12 and core 13 are elongated, and a single control winding 14 is wrapped upon the shield 15. An air-gap may be left in the high-frequency magnetic circuit if desired, but in this case an air gap will not increase the flux through the interior of the high-frequency coil.



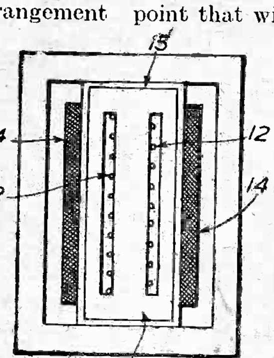


Fig. 1 (Left)—Diagram indicating lines of force of a coil with a magnetic core. Fig. 2.—A similar coil with single control winding.

Fig. 3 shows the application of a controlled inductance of the type described to the input circuit of a radio receiver, for the purpose of preventing overloading of the first valve. The aerial circuit 16 is normally unbalanced in the presence of weak signals, but when the signals are strong enough to produce a predetermined detector input current, this predetermined current flowing through the control winding 27 of the aerial coil 18 makes its inductance decrease to a point that will bring the bridge circuit 17, 18 and 19 in the aerial system to balance, thus preventing any voltage reaching the first valve 24. Obviously, the detector input can never quite reach this value, and hence the input to the first valve 24 can never exceed a predetermined amount. In addition to this type of automatic control of input voltage, the rectified voltage developed across resistor 29 may be also applied to one or more of the grids of the amplifier valves, shown generally at 30, to control the gain thereof in the usual way.

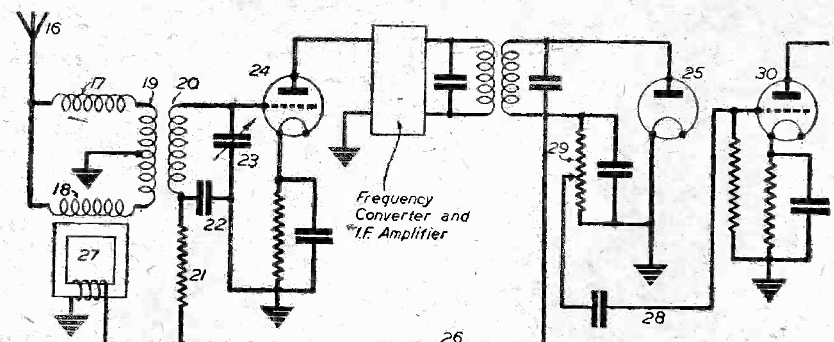


Fig. 3.—Circuit diagram, incorporating a controlled inductance of the type described.

For Use with A.F.C.

Fig. 4 shows the application of a coil, in accordance with the system, to automatic frequency control. The coil is used in the oscillator 30 of a superheterodyne receiver, the frequency of which is approximately adjusted by the variable condenser 31. If the frequency is not quite correct a voltage will be developed by the discriminator circuit 32, and will thus produce a flux in one direction or the other in the control magnetic circuit 33, according to the direction of the misadjustment. A third winding 34, energised to a constant amount by a battery 35 is employed, with the result that a flux in one direction produced by the discriminator increases the total flux in the control core 36, while the flux in the opposite direction decreases the total flux. Thus the effective inductance of the oscillator coil 37 is increased or decreased according as the mistuning is in one sense or the other. The action in other respects is identical with that of known A.F.C. circuits employing a, so-called, "reactance valve" for controlling the oscillator frequency. The advantage in the present arrangement lies in the elimination of the extra valve.

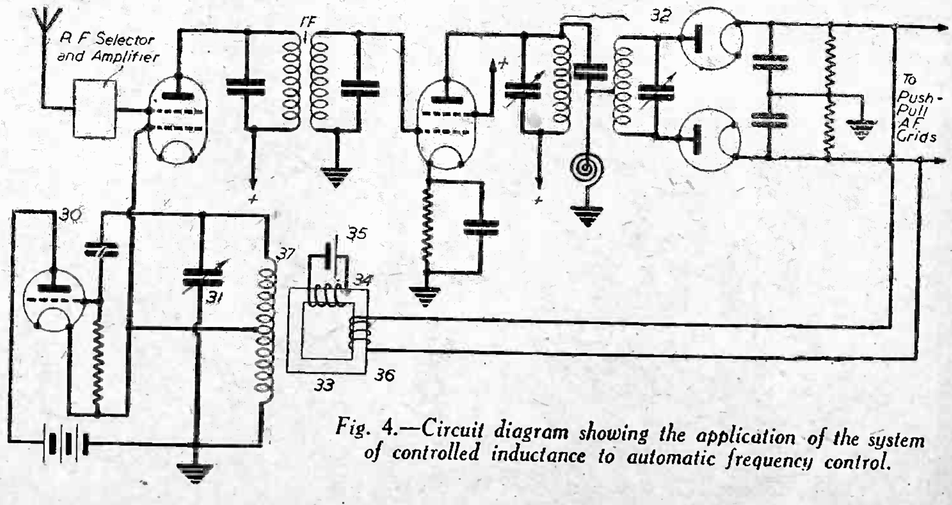
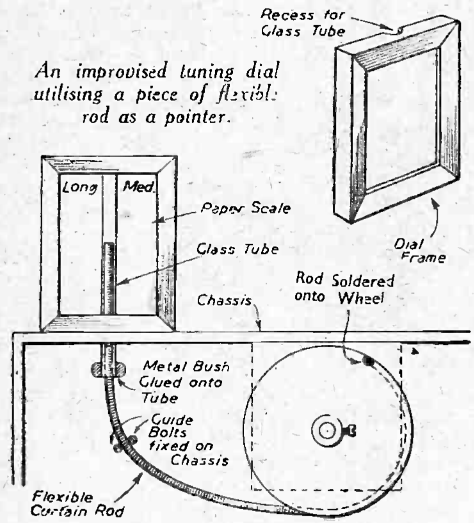


Fig. 4.—Circuit diagram showing the application of the system of controlled inductance to automatic frequency control.

Practical Hints

A Novel Tuning Dial

WHEN requiring a tuning dial for a set I found that I could not buy one to meet my requirements, so I devised the one shown in the accompanying sketch. This dial arrangement was made from a length of flexible curtain rod, a piece of glass tube, a 3in. diam. wheel with ¼in.



An improvised tuning dial utilising a piece of flexible rod as a pointer.

diam. spindle hole, and a dial frame made from wood. When the dial was made up I fixed to it a temporary paper scale and on to this marked the stations as they were received. This scale was then removed and a copy of it neatly typed on to a suitable piece of thin cardboard.—D. A. ROXBURGH (Fenham).

A Multi-purpose Switch

HERE are details of a multi-purpose switch which I have constructed and found to give great satisfaction. The switch is composed of a disc of cardboard which has been dried and impregnated with shellac varnish. Round the circumference of the disc, and about ¼in. inside, are punched a number of small holes. Each hole is diagonally opposite another. A central hole is cut in the disc, and this is occupied by a brass bush. With an eyeletting tool, some eyelets and soldering tags, the contacts for the switch arm are made. The spindle is an old one taken from a differential condenser. The spring between the bush and the end of the spindle maintains a steady pressure of the arm on the contacts. To enable contact with the eyelets, two round-headed bolts are soldered to the switch arm. Many ways of wiring this switch make it useful for almost any purpose.

THAT DODGE OF YOURS!

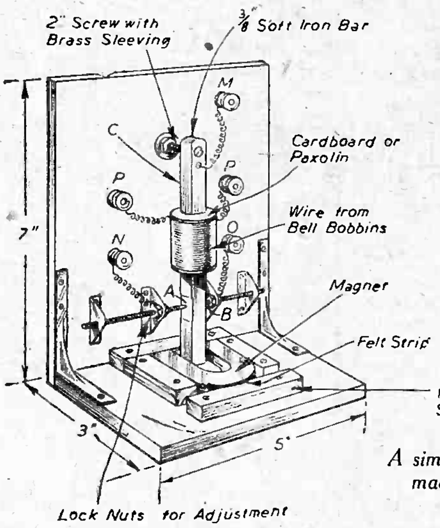
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending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

SPECIAL NOTICE
All hints must be accompanied by the coupon cut from page iii of cover

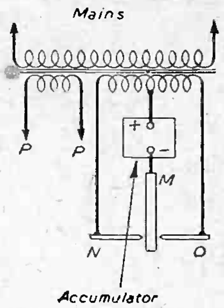
It will be obvious that the switch can be ganged, and that is how it is utilised in my A.C.3 receiver. The switch can be mounted on a component bracket with its duplicate mounted similarly, but behind it.—JOHN BRIDGES (Durham).

A Vibrator-converter

THE accompanying sketch shows a vibrator-converter I have made out of odd parts, primarily for charging my accumulator, but it is very useful for other experimental purposes, e.g., running low-voltage D.C. motors.



A simple vibrator-converter made from odd parts.



I removed the H.T. winding from a wireless transformer and replaced it by a winding to give 10-0-10 volts (centre tapped), approx. 1 amp. Two bobbins were unwound from an old bell and rewound in one bobbin, as indicated, which was energised by a 4-volt secondary. The gaps A and B should be adjusted so that when the armature C is hanging vertically they are equal and quite small (about 1/16in.). The lock nuts should then be tightened. I took the horseshoe magnet from an old magnetic pick-up. The magnet must be firmly fixed on all sides so that the armature hangs dead centrally between the poles of the magnet. Care should be taken to find which way the current is flowing in the circuit when first connecting up.—D. JOHNSON (East Dulwich).

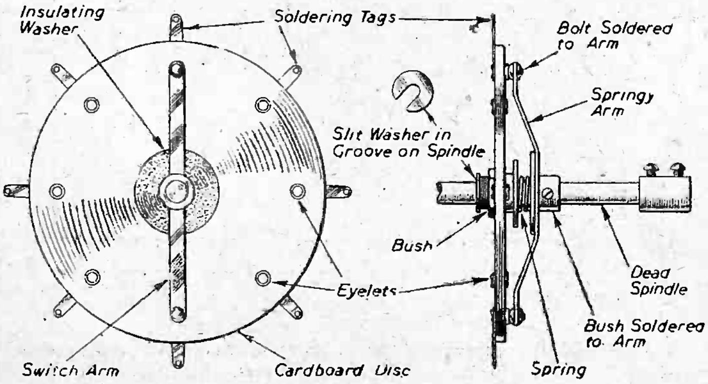
Improvised Band-set Dial

SOME months ago I required a band-set arrangement for a S.W. set with bandspread tuning, and, being unable to obtain one, built the device shown in the accompanying sketch.

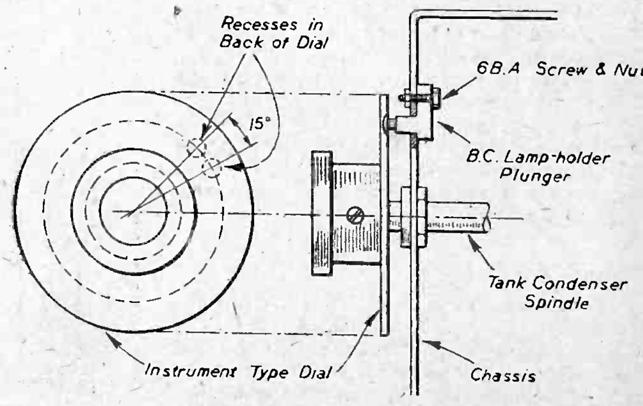
An instrument-type dial was prepared by drilling a number of "points" on the back of the dial, using a drill the same size as the end of a spring plunger from an old B.C. lampholder (in my case 5/32in.), just "bottoming" the drill, as shown. A hole was then drilled in the correct position in the front of the chassis to take the plunger, this being secured by drilling a second hole and fixing with a 6 B.A. screw and nut.

In the case of a wooden chassis or panel, the plunger could be soldered to a small brass strip and fixed by two screws.

This arrangement has worked well for some months without any trouble. The tank condenser was 160 mF. and the bandspread condenser 15 mF., so I used 12 "points," each 15 degrees apart, which allows about 1mF. overlap in each "band," and readings can be duplicated within about 2 deg. on the bandspread dial.—E. V. DAY (Barnehurst).



Details of a multi-purpose rotary switch.



A band-set dial for a S.W. set.

P.A. EQUI

Miscellaneous Amplifiers fo

By "SE

THE wide range of P.A. equipment is well shown by the representative amplifiers illustrated in this article. Fig. 1 is a 400-watt rack for a large factory installation while Fig. 5 shows a single-stage deaf-aid cinema amplifier for supplying up to 30 pairs of headphones which are made available to patrons who are hard of hearing. A description of the main types of amplifying equipment will help the engineer to more easily submit suitable estimates when called upon to do so, as he will have a wider knowledge of equipment in general which he can modify to suit his own particular requirements.

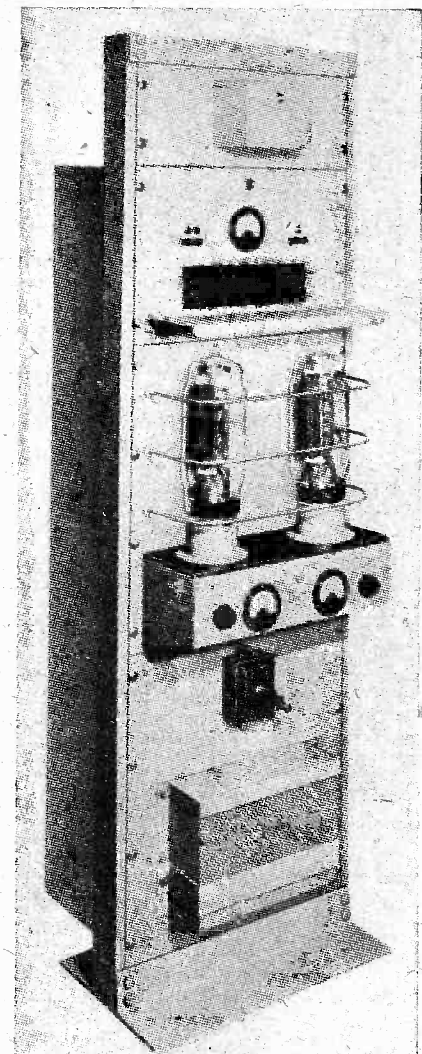


Fig. 1.—A large 400-watt amplifier rack.

Fig. 1 is a typical example of the large type of power amplifier which was dealt with in the last article. The two large valves, each having an output of 250W. and arranged in push-pull, will be seen on their decks with the milliammeter recording their anode currents, and the bias controls beneath them. The bias controls are adjusted until the anode current of each valve is of the same value, and the output of the two valves balanced.

Immediately above the output valves is the driver stage; on the left of the milliammeter will be seen test sockets for headphones. Beneath the meter is a small control panel with a rotary switch for connecting the milliammeter in the various valve anode circuits, a volume control, and two tone controls (one for bass and one for brilliance).

Rectifying Valves

Right at the bottom of the rack is a ventilated compartment with a deck for the four mercury vapour rectifying valves. Immediately above this cage may be seen the mains supply switch and fuse box.

As stated in the last article in this series it is often advantageous to employ two medium-powered amplifier units each feeding a certain number of loudspeakers, rather than to go to the expense of one large amplifier having sufficient output for feeding all the loudspeakers.

Economy of working may be employed when two separate amplifiers are used, as by intermingling the loudspeakers connected to the amplifiers one unit may be switched off when full volume is not required, leaving half the number of speakers operating from the remaining power stage.

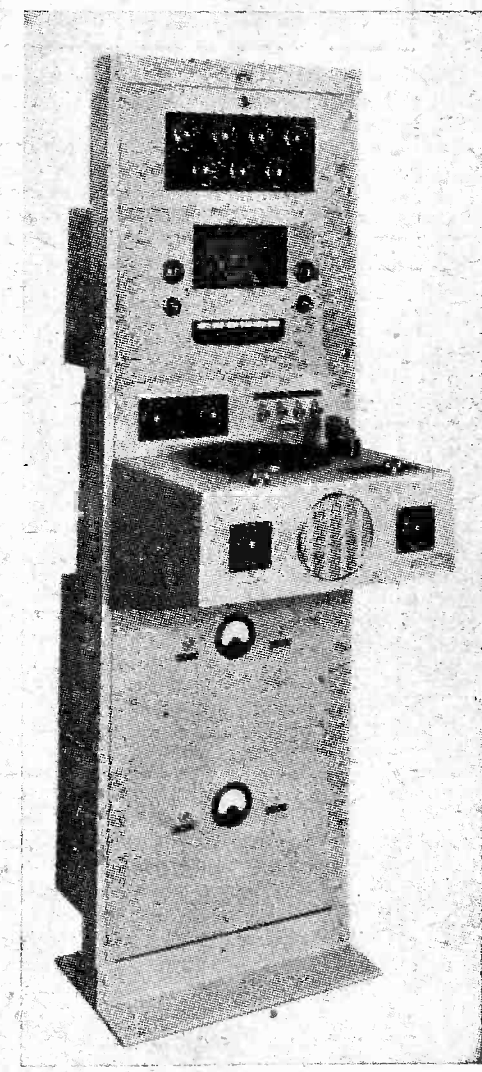


Fig. 2.—A general-purpose amplifier rack suitable for dual-channel working.

This arrangement could be carried out with the rack illustrated in Fig. 2. This general-purpose rack comprises a three-stage microphone amplifier with a four-way microphone mixer at the top of the panel, a push-button radio receiver, and an automatic record player. Beneath this are two 30-watt amplifiers. In front of the playing desk is a monitor loudspeaker with a control switching it on to the output of each amplifier for test purposes. A volume control for the monitor loudspeaker is on the right.

In this particular rack it would be possible to feed two programmes for a dual channel working. For example, a radio programme could be fed into one of the power amplifiers, and an alternative programme (records or microphone) into the second amplifier.

Dual-programme Amplifiers

In factory installations generally only one programme is fed into the various buildings at one time by the P.A. equipment. In hotels, blocks of flats, etc., however, it is often arranged to have alternative programmes available to the listener. This dual programme arrangement necessitates a complete duplicating of equipment which would normally be installed for single programme networks. All wiring from the amplifiers to the various loudspeaker points will have to be duplicated and each loudspeaker point must be terminated by a two-way switch arrangement which will not only connect the loudspeaker to the wiring giving the programme required, but will also automatically insert a dummy load across the unwanted programme network, thus compensating for the loudspeaker load.

In this way the total load on the amplifier is kept constant and other users do not notice any variation in signal strength from their loudspeakers when changes are made at other listening points. How the switching is accomplished will be described in a later article dealing with wiring of installations.

Reverting to the amplifiers themselves, in small installations most of the equipment can be accommodated on a rack 7ft. or 9ft. high. On this rack might be a radio receiver, automatic mechanism for reproduction, an input mixer control panel for microphones, and at the bottom of the rack could be two separate 30-watt amplifiers.

By means of the mixer control panel each one of these amplifiers could be fed with either microphone, gramophone or radio input, the duplicate amplifier being available for any one of the other two inputs not being taken by the first amplifier. Each amplifier would be connected to its own loudspeaker wiring network.

Radio or Television

There is another type of installation applicable to blocks of flats and hotels which does not, strictly speaking, come under the category of "Public Address," but which, as stated above, will most likely concern P.A. service engineers should they happen to require attention.

It is the feeding of an H.F. signal to each apartment or suite of rooms, so that separate radio receivers or television sets may be used by the occupier. The latter would have complete control of their programme entertainment, and they have the communal use of the best possible aerial that could be erected in the circumstances.

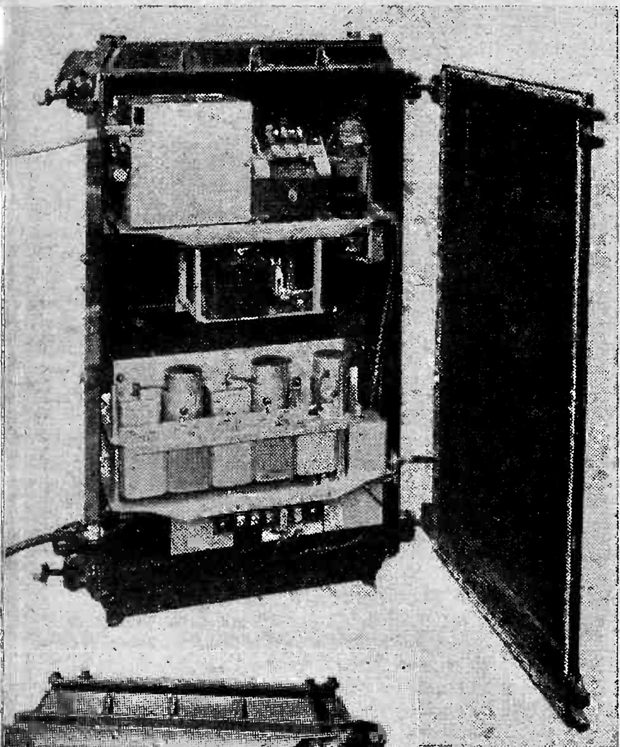
The arrangement is that a really good anti-static aerial on high masts is erected on the roof of the building, and the signal voltages from the aerial are fed into an H.F. amplifier which has a straight-line frequency characteristic over the whole of the broadcast wave-bands.

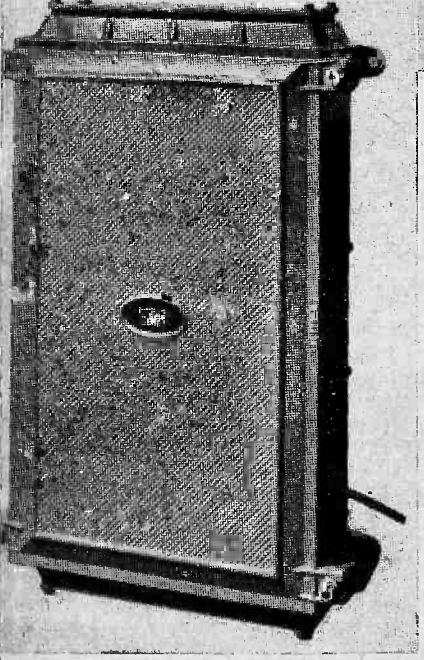
PMENT—5

nema and Theatre Use

CE"

he gain of the amplifier is sufficient ive a good signal voltage on each of the nination points in the system, which will prise a high quality, low capacity wiring work. As such a system has to be stantly in operation the H.F. amplifier t also be constantly at work, but as it uires no attention it is often housed in ompletely enclosed case and located in e convenient pent-house or cupboard





he top of the building as near as possible the aerial.

rial Amplifier

typical amplifier of this type may be n in Figs. 3 and 4. The case used in this mple is of the heavy iron variety often employed for fuse boxes and distribution points in electrical work. Inside the case will be seen the mains transformer, rectifying valve and smoothing components on the upper deck, while beneath this assembly is a 3-valve H.F. amplifier.

In this type of amplifier it is essential that the mains input to the amplifier is thoroughly filtered by H.F. chokes and condensers. If this is not done trouble will be experienced due to the H.F. signal feeding on to the mains wiring of the building, from which signals may emanate, to the consternation of people trying to receive on their own radio receivers in the locality.

In modern blocks of flats television networks are installed, and these are fed by a separate aerial amplifier covering the television frequencies. The wiring network in this case will generally be carried out in heavy lead-shielded, concentric cable terminating at a suitable socket adjacent to the aerial and earth terminations for the broadcast receivers.

Television aerial amplifiers of this kind may be of similar construction to the broadcast aerial amplifier illustrated, and a pair of amplifiers is often mounted side by side with a time switching mechanism, which switches the amplifiers on for a predetermined period and then switches off the mains supply at the end of broadcasting for the day.

Figs. 3 and 4.—Open and closed views of an aerial amplifier covering all broadcast frequencies, except television.

Deaf-aid Equipment

There are many thousands of people whose hearing is far below normal standards and who are, therefore, deprived of the enjoyment to be derived from the theatre and the cinema, and who are unable to fully join in church services.

Modern establishments often provide deaf-aid equipment for the assistance of these people, and it generally falls to the P.A. engineer to install and maintain apparatus.

In most cases the equipment is very simple, comprising a microphone and L.F. amplifier of, sometimes, only one stage, and simple wiring networks feeding supply points into which may be inserted headphones.

Output valves of the KT41 and KT63 type will provide sufficient wattage to operate up to 30 headphones, and it is not usual for establishments to set aside more than this number of seats for people who are hard of hearing.

In the case of cinema deaf-aid equipment it would appear at first a simple matter to connect the headphone wiring network to the cables running from the projector room to the loudspeakers behind the screen. This method, however, is hardly ever used owing to the high output on the speaker cables, and the possible deterioration of the quality of the speakers due to the introduction of the headphone circuits.

For Theatres

Where deaf-aid equipment is installed into a theatre after the talkie sound equipment has been installed, clauses in the agreement covering the hiring and/or maintenance of the sound equipment often prohibit the connection of any apparatus to the talkie wiring. To overcome all these points a common method is to suspend a high quality microphone behind the screen so that the microphone can pick up the sound from the talkie loudspeakers, and feed it via a cable to the deaf-aid amplifier. The latter, as it requires very little attention beyond switching on and off, is often housed in a small metal case (Fig. 5) similar to the aerial amplifier previously described, and is generally under the control of the attendant, who switches it on at the request of the patrons.

There is generally a headphone socket on the amplifier itself into which the attendant may plug his or her own pair of headphones so as to make sure that the amplifier is operating correctly. The attendant can also control the output by a master volume control.

In some cases a separate volume control is fitted to each headphone point. For use of lady patrons special lorgnette earphones are often provided, and in these a volume control is sometimes fitted into the handle.

Deaf-aid equipment for use in churches may follow similar lines to those already de-

(Continued on next page)

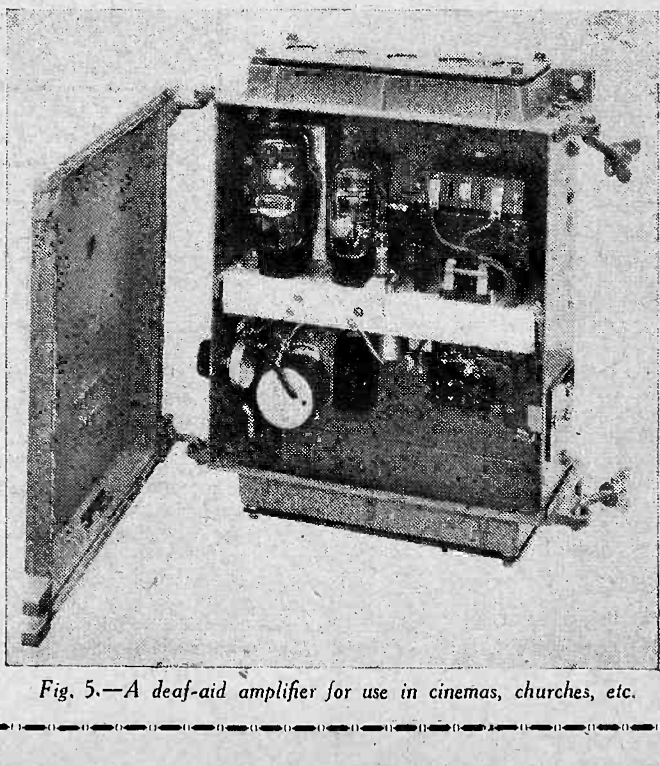


Fig. 5.—A deaf-aid amplifier for use in cinemas, churches, etc.

scribed. A microphone of the carbon granule type is used with large capacity dry cells to provide "hum-less" polarising current.

Carbon microphones can be made very small, and are therefore very suitable for use in churches and academical institutions, etc., where it is desired to conceal the microphones as much as possible.

Special A.R.P. Installations

Apart from the equipping of factories for "Music While You Work" programmes, many P.A. equipment manufacturers make apparatus which enables various watching functions of the A.R.P. personnel to be carried out automatically, or which augment the A.R.P. watching staff.

Installations are similar in characteristics to the more normal type of P.A. jobs, and they comprise the distribution of sound from some point where it will be picked up by microphones to a more distant location, where it is received by an operator or alarm device.

For example, some country houses, small factories, etc., may be some distance removed from the nearest public air-raid warning siren and when weather conditions are unfavourable, such as when the wind is in the wrong direction, or when climatic conditions or black-out necessitate the closing of most of the windows in the building, then the warning of the siren may not be heard.

Parmeko Limited have a system which comprises a special directional sound locator which is fitted, generally, on the roof of the building and directed towards the nearest siren.

This locator is connected to a sensitive amplifier which amplifies the sound of the siren and distributes this through one or more loudspeakers situated in places of importance in the building.

Photo-cell Installations

Designs have been registered and patents applied for covering systems where, instead of a microphone picking up sound, simple photo-electric cells or selenium cells are affected by a sudden change of light intensity in the locality, such as might be caused by an incendiary bomb. The voltages of the photo-cells brought about by the change of light intensity are applied to the amplifier and distributed as a warning signal to certain positions in the building where the A.R.P. staff are positioned.

In large factories which occupy an extensive area of ground, bomb detector devices are sometimes used on the same principle, but individual microphones are used instead of photo-cells. All cables coming from the various microphone points are fed through the amplifier with an indicator in each microphone circuit, so that when a bomb falls close to, or even on, a particular microphone a signal is heard in the watch-room and the signal indicator tells which microphone circuit has been affected. Repair squads and other A.R.P. personnel can then proceed to the place even in total darkness, knowing roughly where the bomb has fallen even should there be no illumination caused by fire to guide them.

The same arrangement of wiring network is applicable to photo-cell installations.

We have now gone over most types of P.A. equipment with which the service engineer may come in contact, and in the next article we will deal with the many varieties of loudspeakers employed in P.A. work, and their various uses.

Wireless Arithmetic

Specially Written for Beginners, This Article Deals With the Most Important of the Calculations Involved in Wireless Constructional Work

THERE are many constructors who do not enjoy their hobby to the full because they will not take the small amount of trouble necessary to enable them to make the few simple calculations required to determine, say, the correct value for a decoupling or bias resistance, the wavelength range which can be covered when using a certain coil and variable condenser, or the sizes of resistances required to form a fixed potentiometer. It is often thought that the arithmetic involved is of a difficult nature, or that the equations are for mathematicians only, whereas the calculations are often a good deal simpler than those required to draw up a cricket analysis or in working out the sums that are regularly done at school by boys of twelve; the only real difference is that a little knowledge of wireless practice is required in addition to that of arithmetic.

Ohm's Law

Of all the calculations that must be made time after time that in connection with resistance values is the commonest, as well as being the easiest. All calculations involving resistance, current and voltage, are based on Ohm's Law, which states that the current flowing in a circuit is always equal to the voltage causing the flow divided by the resistance which tends to oppose it. Thus, if a voltage of 100 were applied to the simple circuit shown in Fig. 1, the current passing through it would be 100 divided by 20,000, which is 1/200 of an amp. It is generally more convenient to work in terms of milliamps, which are one-thousandths of an amp., so that the figure becomes 5 mA. The simple circuit shown is typical of all valve anode circuits, and the fixed resistance might be a coupling resistance or it might represent the resistance of a transformer or other component.

The formula for Ohm's Law which we have just used is written, in mathematical terms, thus: $I = \frac{E}{R}$, where I is the current in amps., E is the voltage, and R is the resistance in ohms. This simple and useful formula can be re-written in at least two other ways in order to make it more convenient when the voltage or resistance is required, the other two factors being known. For example, we could write:

$$R = \frac{E}{I}, \text{ or } E = I \times R.$$

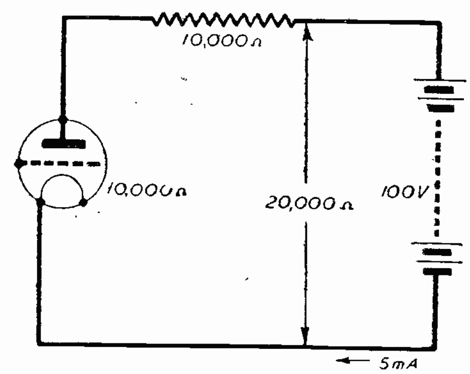


Fig. 1.—A simple circuit showing the relationship between current, voltage and resistance.

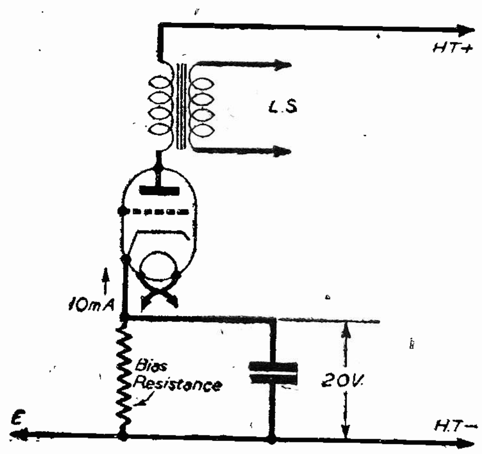


Fig. 2.—The method of determining the correct value of a bias resistance can be understood by reference to this circuit.

Bias Resistance Value

Let us see how it works out when we want to find the value of the bias resistance shown in Fig. 2. In this case it is known that the current passed by the resistance (the anode current of the valve) is 10 mA., and that the required voltage drop across the resistance—the bias voltage—is 20. The required resistance is obviously found by dividing 20 by 10 and multiplying by 1,000 (to change the milliamps into amps.), and the answer is 2,000 ohms.

Now suppose that in the circuit shown in Fig. 1, we know that 5 milliamps is required to flow through the valve and that the resistance of the valve is, say, 5,000 ohms, while the anode resistance has a value of 10,000 ohms; we want to know the voltage necessary to ensure the correct current. All that we need to do is to multiply the current in amps. by the resistance in ohms, and we get $5/1{,}000 \times 15{,}000$, which is 75 volts.

Once we have seen these applications of Ohm's Law it is not difficult to apply it to all resistance, voltage and current calculations, when two of the values are known and the third is required.

Resistance-wattage Rating

There is another application of Ohm's Law which must be used when it is required to find the correct wattage rating for a resistance. Power, in watts, is actually the product of the voltage and the current, in amps., but we often know the current passing and the resistance value of, say, a coupling resistance, without knowing the exact voltage dropped across the resistance. But it is not difficult to see from the above equations that wattage can be determined from the formula: $W = I^2R$. In words, this formula reads: the wattage is equal to the current in amps. multiplied by itself and by the resistance in ohms. Thus, in Fig. 3 we have a resistance value of 25,000 ohms and a current of 10 mA., or 1/100 amp. We see, therefore, that the power in watts which is dissipated (or lost) is $1/100 \times 1/100 \times 25{,}000$, or $\frac{25{,}000}{10{,}000}$

which is obviously 2.5 watts. Having made this calculation we know that the resistance used in this circuit must be rated at not less than 2.5 watts, and we should generally use a 3-watt component to provide a sufficient factor of safety; a resistance of lower wattage rating would be liable to burn out in use, due to the resistance being overloaded.

It might not be clear to some readers how the expression I^2R was found from the original Ohm's Law equations to be the same as ER — voltage multiplied by resistance

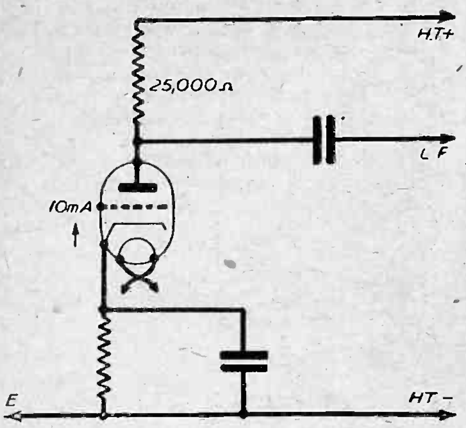


Fig. 3.—In order to determine the wattage rating of an anode resistance, it is necessary to know its resistance rating, and the current passing through it.

—or, in other words, how I^2 was found to be the same as the voltage drop. But we saw that the voltage drop (E) is equal to I multiplied by R, and if we also multiply this by I we get the expression I^2P.

Finding the Wavelength Range

Now let us turn to another simple piece of arithmetic which is not difficult to follow. Suppose it is required to find the highest wavelength that can be reached when a coil of 2,200 microhenries (a typical longwave coil) is used in parallel with a .0005 mfd. tuning condenser. The wavelength is found by using the equation: wavelength $= 1.884 \sqrt{L \times C}$ where L is the inductance of the coil in microhenries, and C is the capacity of the condenser in microfarads, the wavelength being in metres. We have, first of all, to multiply together the inductance and capacity, and then to find the square root of the result, and finally to multiply this by 1,884. Taking the first step we get 2,200 × .0005, or

$$\frac{2,200 \times 5}{10,000}$$

which works out to 22/20; when this is multiplied by 1,884 we get as the result 2,082.4, this being the wavelength in metres.

If the required wavelength and coil inductance were known, the correct capacity could be found by reversing the calculation, and in the same manner the correct inductance could be determined from a knowledge of the wavelength and capacity. These calculations are slightly more involved, however, and since it is rarely necessary to use them, we will not consider them further.

Screening-grid Potentiometers

In the opening paragraph mention was made of finding the values of resistance required in forming a fixed potentiometer, and this is a problem which often crops up in connection with an S.G. valve, of which the screening grid is supplied from a potentiometer as shown in Fig. 4. If the screening grid did not pass any current, the two resistances would have values proportional to the maximum supply voltage and the voltage required. In other words, if the H.T. supply delivered a voltage of 200 and 80 volts was required for the screening grid, the upper resistance, marked R.1, could have a value of 60,000 ohms and the lower one, marked R.2, a value of 40,000 ohms. Alternatively, values of 30,000 and 20,000 ohms could be used. It will be seen from this that the first step is to decide upon the approximate total resistance; with a mains set a maximum value of 50,000 ohms is generally suitable, and with a battery set, 100,000 ohms can be used successfully.

In the above assumption of no current we simply made the lower resistance of such a value that its proportion to the total was the same as the proportion between the required voltage and the total H.T. voltage—2 to 5, but let us see what would happen if the screening grid passed 1 mA. The voltage drop occasioned by the upper resistance would be 1/1,000 multiplied by, say, 30,000 or 30, and thus the voltage actually applied to the screening grid would be 80 less 30, or only 50 volts. Consequently, either the resistance marked R.1 must be reduced in value, or that marked R.2 must be increased. This apparent peculiarity is due to the fact that the cathode screening-grid circuit is in parallel with the lower resistance, thus reducing its effective value. It is possible to evolve an equation from which the exact values of resistance could be determined but it is generally better for the non-mathematical constructor to use trial-and-error calculations, and working on the lines indicated above, until suitable values are found.

Series and Parallel Resistances

In dealing with resistance calculations above we did not consider the effect of connecting resistances in series and in parallel. If resistances are placed in series the effective value is, as might be supposed, equal to the sum of the resistances. Thus, if resistances of 500, 1,000 and 20,000 ohms were joined in series the total value would be 21,500 ohms. When they are joined in parallel the result is entirely different, and the effective resistance of the combination is, mathematically speaking, equal to the reciprocal of the sum of the reciprocals. This expression is simplified if written:

$$\text{Total R} = \frac{1}{1/R1 + 1/R2 - 1/R3}$$

etc. This means that if the three resistances mentioned above were connected in parallel the effective value could be found by adding together: 1/500, 1/1,000 and 1/20,000, which equals 61/20,000, and reversing this is 20,000/61, which gives the result as approximately 330 ohms. It will be noticed that this is less than the value of the smallest resistance.

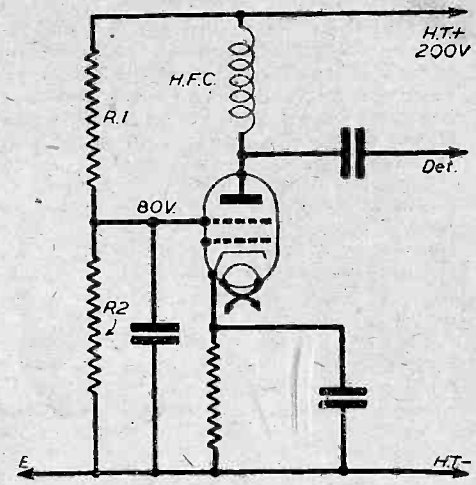


Fig. 4.—Several interesting points arise when calculating the values of resistances required for a fixed screening-grid potentiometer.

Condensers in Series and Parallel

When two or more condensers are used together the effective capacity is found by reversing the methods described in respect of resistances. Thus, when condensers are joined in parallel, the total capacity is equal to the sum of the capacities of the individual components. When condensers are in series the resulting capacity is equal to the reciprocal of the sum of the reciprocals. If, for example, a .0005-mfd. condenser is connected in series with one of .0003-mfd. the resultant capacity is

$$\frac{1}{1/.0005 + 1/.0003}$$

which is $\frac{1/8}{.0015}$ or $\frac{.0015}{8}$ which is .0002-mfd. approximately.

RADIO LOCATES UNDERGROUND RIVER

A BLIND wireless enthusiast, H. J. McFerren, of Tiffin, Ohio, assisted by a group of fellow amateurs, has successfully begun a job by radio which has defied scientists for years—the tracing of Ohio's famous underground river, which has never been seen by human eyes. A two-valve ultra-short wave radio transmitter was used, and the helpers assisted Mr. McFerren in the manipulation of directional antennæ, which which he took cross-bearings on the little transmitter as, safely sealed in a rubber ball, it rode the subterranean currents of the river.

The transmitter used sent out a 112,000 kilocycle carrier wave 2½ metres. Besides the oscillator valve was a modulator which put out a note of about 1,500 cycles. The entire radio set, with battery and rubber ball in which it rode, weighed only 2lb. The tiny radio set fitted snugly in the 8in. ball, and a steel antenna, about 18ins. long, extended from the top of the ball.

McFerren and his helpers launched the ball in the Seneca Caverns, near Bellevue, Ohio, after several months of preliminary tests. Several thousand persons, including scientists, radio amateurs, and curious spectators, watched the proceedings from the surface. The principal direction finder was a home-made goniometer, which consisted of two aluminium rods, each one wavelength long. The rods were placed on a frame in parallel positions one-quarter of a wavelength apart. Tappings were taken one-quarter of the rod length from one end. The frame was equipped with a suitable compass for taking bearings. The receiving set was a standard commercial transceiver.

After the ball was launched a strong note was picked up, and bearings were taken every five minutes. The direction was seen to change 5 or 10 degrees with each bearing. After some time the signal appeared to weaken and be interrupted, and this was attributed to a possible lowering of the cavern's ceiling, which would, of course, partially submerge the steel antenna, thus interrupting the signal. After about three-quarters of an hour the signal stopped, and did not come in again until another hour had passed. McFerren and his assistants took a bearing, loaded the equipment into a car and started off in the indicated direction—toward distant Lake Erie and the Blue Hole. They took another bearing, and from the cross-references determined that the ball must have stopped at a point 1.1 miles from the starting point. Later the signal stopped and did not appear again. There appears to be no doubt that the method is feasible, and the experiment was judged a success.

Resistance Reaction

A Novel System for Controlling Positive Feedback

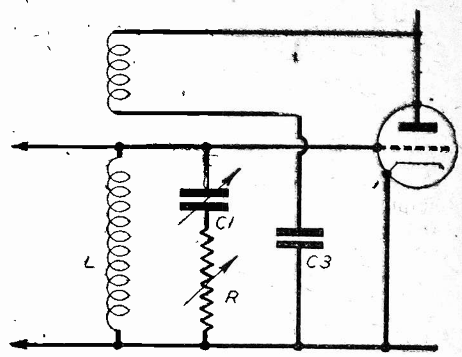


Fig. 2.—The modified circuit.

ONE of the standard methods of controlling reaction is shown in Fig. 1. The output from the valve is fed through a coil and condenser, the coil being coupled to the main tuning coil in the grid circuit of the valve. The amount of feed-back then depends on the value of capacity C2, and is controlled by this.

Negative Resistance

Consider a signal applied to the main tuning coil. The effect it produces at the grid of the valve will depend not only on the properties of the coil and condenser L1 and C1, but also on the amount of feed-back. As this is increased the effect of a given signal is increased.

Thus reaction may be looked upon as introducing negative resistance into the tuning circuit L1 C1. The greater the reaction, the greater numerically this negative resistance will become. If it becomes equal to the ordinary positive resistance of the tuning circuit then oscillation will take place.

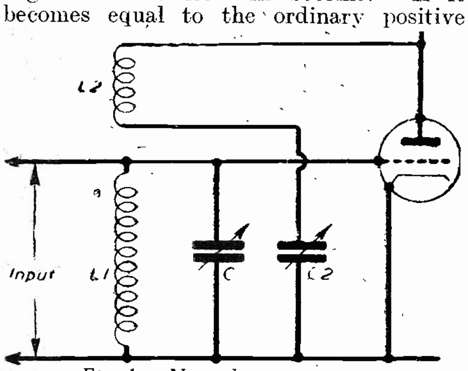


Fig. 1.—Normal reaction circuit.

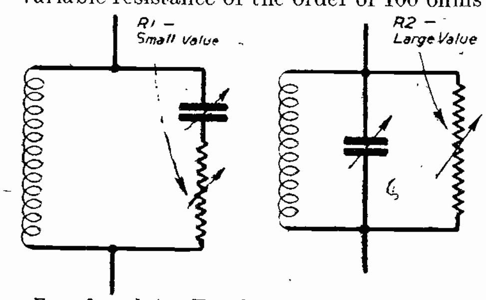
Basis of the New Method

The method here described (see Fig. 2) takes as its basis the circuit of Fig. 1, but instead of the variable condenser C2, introduces a fixed condenser C3. This is sufficiently large to cause oscillation, whatever the setting of C1.

From what has been said above, it will be seen that this is equivalent to having a coil and condenser circuit with a negative resistance. Absurd though this sounds it is quite true, since the smallest applied signal will produce a very large current, the extra energy being supplied by the valve.

Clearly, therefore, if we introduce a variable positive resistance somewhere into the coil and condenser circuit, with a maximum value greater than the negative resistance, we can control the feedback.

This is effected by inserting R, a small variable resistance of the order of 100 ohms or so, in series with either the coil or the condenser.



Figs. 3 and 4.—Tuned circuits with series and parallel resistances respectively.

With R at maximum there is little effective feedback, but with R at minimum the circuit oscillates, and somewhere in between the best position is obtained in which the resistance of the LC circuit is almost, but not quite, zero, and the valve is just on the point of going into oscillation.

Alternative Resistance Connection

It can be shown that the effect of connecting a resistance R1 in series with a tuned circuit is the same as connecting a much larger value of resistance R2 across it. Thus, instead of controlling feedback by a small series resistance of the order of 100 ohms, we may control it by a large parallel resistance of the order of 50,000 ohms. This will probably be found the more convenient method in practice. (Figs. 3 and 4.)

Damping

At first sight it might be objected that the damping effect of the resistance causes the circuit to lose in efficiency. But at the best working point, when the valve is just about to oscillate, the entire effect of the resistance is cancelled out, and the net resistance of the circuit is almost zero. High efficiency is therefore attained.

New Radio Posts for Women

Details of the B.B.C.'s Scheme for Employing Women at Transmitting Stations, and for Other Work

IT is interesting to note that one of the latest developments in women's war-time work is the decision of the B.B.C. to employ them as operators in control rooms, recording centres and at transmitters.

In the first category—control-room work—the women will handle the controls on the transmission panels and, while the job is somewhat analogous to telephone switchboard work, a good deal more is actually involved. Programme sense is needed in handling controls, so that, for instance, a *prima donna* is not faded-out in the middle of an aria. The quantity of sound coming from the studios must be watched on the volume meters and the quality checked on headphones. A strictly accurate log must be kept of even the most trivial happening, for much may depend on it. Orders must be obeyed immediately, without question, so that programmes may run without a hitch. Take, for example, a programme coming from B. Lines may be down between B and the central control room, but still intact by a roundabout route X, Y, Z. The senior engineer calls "Take your Variety on GM 144 instead of PF 252." The operator knows the programmes should be coming from PF 252. If she stops to argue the whole complicated routine falters in its stride. Promptly she must plug GM 144 and all will be well.

For this work only a limited amount of electrical engineering knowledge is required, but the second category—that of recording engineer—calls for a somewhat higher degree of technical skill. Here the women will handle the various types of recording systems—disc, steel tape, or film.

Transmitting Stations

At the high-power transmitting stations women will be employed on much the same kind of work as in the studio control rooms, switching programmes to the different transmitters. Many stations have a number of transmitters, which may all be carrying the same programme, as in the case of a world-wide broadcast, such as that of the Prime Minister, or each one may be broadcasting a different programme at the same time. Each programme in turn may originate at half a dozen different points and this naturally means that care must be taken constantly to see that the correct programme is switched to the correct transmitter. B.B.C. programmes, for Home and Overseas, now cover the whole of the twenty-four hours, during which hundreds of programmes must be switched from studio to central control rooms, from there to the transmitter control and thence fed to the transmitters themselves.

The B.B.C. has set up its own training school for the candidates who are now being admitted. The first part—or "A" course—is the same for everyone, both men and women. It lasts two weeks, the syllabus covering both theoretical and practical work. Pupils are given lectures on the organisation of the Engineering Division, on the war-time system of wireless transmission, on studio equipment, microphone control desks and panels, outside broadcasting, and so on.

Recording Operators

Following this "A" course, students will be posted to control or recording rooms, where they will work under an expert instructor, watching the programmes being handled on the transmission positions, switching studios on and off the air, and gradually taking over the real work, which they have previously practised. Recording operators also will graduate under the eye of an expert until they are competent to handle recordings on their own account, while transmitter operators will be trained at a high-power station. This second "B" course lasts another four weeks, after which the students will be drafted to their permanent work in different parts of the country.

Age limits at present are twenty-one to thirty-five, and the whole scheme is in the nature of a war-time experiment, which will be watched with interest.

Impressions on the Wax

A REVIEW OF THE LATEST GRAMOPHONE RECORDS

ALL the artists featured in the latest H.M.V. list are top-of-the-bill in the entertainment world. They are helping the public to carry on with songs and humour. Pat Kirkwood, who is doing much useful work by keeping the Forces in good spirits, has launched the nation's new song, "Victory Roll," written in praise of the Royal Air Force. The author and composer got the idea for the song through watching the 'planes do the victory roll on their return from a successful blitz of the enemy. It is coupled with "South American Way" from the film "Down Argentina Way" on *H.M.V. BD*935.

Doreen Stephens (she is only 18) is rapidly making a big name for herself by her singing of current popular numbers. Her latest recording is "I Understand," and "Singing a Song to My Mother" on *H.M.V. BD*936. This artist has been singing since she was 9, was working in a music store at 14, engaged by Jack Hylton at 15, appeared with Arthur Askey at Blackpool, and was singing to the troops in France in 1940. Now she is vocalist in Maurice Winnick's band.

Vic Oliver opened his "Happy Days" broadcast on July 1st, in which, besides wisecracking in his own brilliant style, he actually played the piano. He does this for you in his latest record, *H.M.V. B*9181, with "Tickling the Ivories." The other side, "Tickling Your Fancy," contains some of his finest humour, including one particular joke which he confesses won't be heard on the wireless.

Believe it or not, Arthur Askey was once a choir boy! When he left school he tried office work in his native Liverpool, but his sense of humour got the better of him, and he joined up with a concert party. Then pantomime, variety, the B.B.C. and films claimed him, not to mention "His Master's Voice," for whom he has recorded all his best hits. His two new titles are "Thanks for Dropping in, Mr. Hess" and "The Stuttering Sergeant." Other humorous records are supplied by Jackie Hunter, who is styled as radio's new funny man, with "The Life of the Party" and "Down by the Winegar Woiks" on *H.M.V. BD*921, and Ronald Frankau, with "A Bevy of Beauty for Bevin" and "I'm Afraid I'm Too Old for that Now." In the latter recording he is supported by Renée Roberts. The number of the record is *H.M.V. B*9168.

The Möller Organ

THE latest recording by Reginald Foort on the Möller organ is "Tunes of the Times, No. 3" on *H.M.V. BD*937. He introduces such tunes as "It's Foolish, But It's Fun," "A Little Steeple Pointing to a Star," "Falling Leaves," "The Things I Love," "Let There Be Love" and "Boa Noite." The Möller organ, on which Reginald Foort records for H.M.V., cost £13,000, and arrived in England in 1939. A press demonstration at Drury Lane preceded its public début at Manchester Hippodrome. The organ is transported by a fleet of special lorries. It is the world's mightiest organ, and weighs about 20 tons, occupies a stage space 42ft. wide, is 18ft. high and 15ft. deep. It has five manuals, over 2,000 pipes ranging from one smaller than a pencil to one large enough to hold five men end to end, a 30 h.p. blower, 30,000 miles of wiring, 259 stop-tablets, allowing for more than 5,000 tone combinations.

This month another radio personality joins the ranks of H.M.V. star entertainers—Bunny Doyle, famous for his broadcasts as the "Racketeer of Laughter." He has recorded "Sergeant Sally" and "Hey, Little Hen" on *H.M.V. BD*939.

Leslie A. Hutchinson ("Hutch") has made yet another successful recording this month with "Boa Noite" (Good-night) from the film "That Night in Rio" and "There Goes That Song Again" on *H.M.V. BD*938.

Vocal

OLD Scottish airs are featured in the latest recording by Jeanette Macdonald. On one side of *H.M.V. DA*1735 she sings "Annie Laurie" and "Comin' Thro' the Rye," whilst on the reverse she sings in French "Les Filles de Cadiz" (The Maids of Cadiz). Other female voices to be heard this month are Barbara Mullen singing "I Know My Love" and "The Verdant Braes of Skreen" on *H.M.V. B*9187, and Gwen Catley singing "Angels' Serenade" and "The Pretty Mocking Bird" on *H.M.V. C*3233.

In the male voice section we have Webster Booth singing "Passing By" and "Drink To Me Only With Thine Eyes" on *H.M.V. B*9193, Allan Jones singing "Donkey Serenade" and "Giannina Mia" on *H.M.V. B*8714, Peter Dawson with "The Winding Road" and "Waltzing Matilda" on *H.M.V. B*9191, and, finally, Paul Robeson sings four songs from the film "Proud Valley." They are "Land of My Fathers" and "Ebenezer" on *H.M.V. B*9020, and "Deep River" and "All Through the Night" on *H.M.V. B*9021.

Decca and Brunswick

THIS month the Decca Company follow up their series of World War No. 2, by recording the ninth episode, which is written and produced by Dick O'Connor. It deals with the Italian adventure in Greece and Africa, and appears on *Decca SP*48. The narrator is Kent Stevenson.

A number of fine orchestral recordings are also produced this month. The first is supplied by the Bournemouth Municipal Orchestra, conducted by Montague Birch, with "Chanson Triste, Op. 40, No. 2" and "Dance of the Tumblers" on *Decca F*7885. Secondly, the Royal Artillery String Orchestra, conducted by Lieut. O. W. Geary, play "Tales of Autumn" and "Fiesta Argentina" on *Decca F*7801, and finally, the Royal Artillery Band (Woolwich), conducted by the same conductor, render "Army of the Nile" and "Lochinvar Overture" on *Decca F*7831.

Vocal recordings are supplied by Vera Lynn with "The London I Love" and "The Day I Meet His Majesty the King" on *Decca F*7904, Adelaide Hall with "I Hear a Rhapsody" and "Mississippi Mama" on *Decca F*7918, Tony Martin sings "They Met in Rio" and "Boa Noite" (Good-night), both of which tunes are from the film "That Night in Rio," on *Decca F*7913, and, finally, Donald Peers has recorded "When They Sound the Last 'All Clear'" and "Dolores" on *Decca F*7917.

Deanna Durbin has chosen two songs from her recent films for her latest recording on *Brunswick O*3163. The first is "It's Foolish, But It's Fun," from the film "Spring Parade," and the other is "Old Folks at Home," which was featured in "Nice Girl." Bing Crosby sings "San Antonio Rose" on *Brunswick O*3171, and, on the reverse, "Mister Meadowlark." The latter tune is a duet between Crosby and Johnny Mercer.

Personal Paragraphs

Sir Noel Ashbridge, M.I.E.E., controller of the engineering division of the B.B.C., has been elected president of the Institution of Electrical Engineers.

Oliver Lucas has been elected a director of Electric and Musical Industries, Ltd. He is deputy chairman and joint managing director of Joseph Lucas, Ltd., and a director of CAV and Rotax.

Two important appointments in the management of the G.E.C. are announced. **Dr. A. H. Railing** and **Leslie Gamage** are now general managers of the company. Each has been a director for many years.

News and Notes

Cossor Employees' Contribution

IN the last twelve months employees of Messrs. A. C. Cossor, Ltd., have contributed over £1,000 in pennies to the Red Cross Penny-a-Week Fund. Up to date, 5,000,000 regular contributors to the Fund have raised more than £850,000 for the vital work of the Red Cross at home and overseas.

"Dive Bombing" Broadcast

"DIVE BOMBING" — using novel "bombs" consisting of two-pound bags of lime—was described in a recent broadcast from station WLW (Cincinnati) from the Seventh Annual Air Meet of the National Intercollegiate Flying Club, which took place at Middletown, Ohio. Representatives of 66 college and university flying clubs throughout the United States took part in the meet, which this year was sponsored by the Ohio State University Flying Club.

The "bombing" operations formed the main event of the first day of competition in the meet. Fliers were required to release their bombs from a minimum height of 500 feet, endeavouring to land as close as possible to the centre of a huge circle chalked on the field below.

P.A. System Aids Construction

DURING the construction of the vertical aerial of radio station WJBO in Baton Rouge, La. (U.S.A.), which is a 485-foot steel tower with a 20-foot base, much trouble was experienced with the cord and signal bell system of communication between the steel crew and the engineer operating the hoisting engine.

The customary two-wire telephone was tried, but that, too, was a bother rather than dependable, as both top and bottom men had to wear telephone sets to keep in contact with each other.

Finally a P.A. system was used. A double button carbon microphone was installed in a heavy wood case to prevent damage and short circuits when the mike came in contact with the steel tower. The frame of the mike was connected to a large battery clip with a three-foot lead wire, this clip was clipped to the steel and the mike hooked over a nearby beam. A twisted twin cable was run from the mike buttons to the P.A. amplifier and speaker located in the hoisting engine house on the ground below.

B.L.D.L.C. The British Long-Distance Listeners' Club

IT is interesting to note that many members are carrying on with their experimental and constructional work, and this month we publish a selection of the many letters received from members describing their activities. We cannot, for obvious reasons, publish all the letters we receive, but will all those who have written us, and whose letters do not appear on this page, please accept our thanks for their communications, which are fully appreciated.

A Neat Den

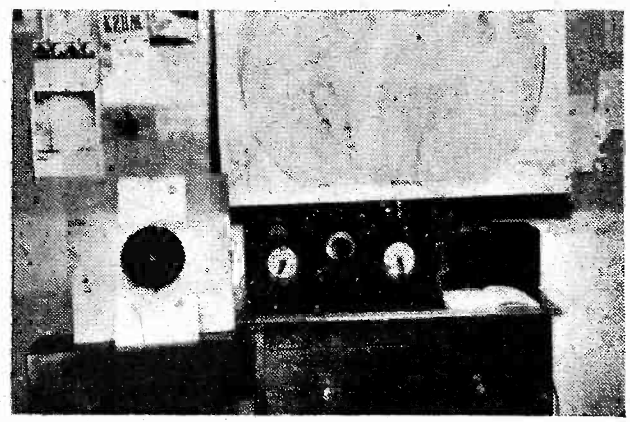
THE illustration on this page shows the radio den owned by member 6732 (Hull), who writes as follows:

"I enclose a photograph of my radio den, together with a description of same, which may interest other members.

"The receiver in the centre is a 1-v-2 TRF short-wave type which tunes from 10 to 100 metres with band-spread tuning. The first valve is a 'Mazda SP.210' for RF amplification. The detector is also an 'SP.210' which is followed by an 'Osram L21' triode. A Varley-Niclet transformer of 3 : 1.5 ratio is used, and the output valve is a 'Cossor 220 OT' tetrode. Four-pin plug-in Raymart coils are used in the detector stage. A tapped coil with switch is used as the HF coil. The tuned aerial and tuned HF stages are link-coupled. To the right of the RX is a Heayberd A.C. battery eliminator for H.T.—150 volts. A 2-volt accumulator is used for L.T. Just to the left of the RX is a m/c speaker mounted on a baffle board. On the wall are various QSL cards and above the table can be seen a great-circle map. The very necessary log book is on the table. This RX was designed by a fellow-member, number 6711 of Hull. At present my aerial is only an indoor 28ft. long arrangement, but I'm hoping to erect an outdoor one soon.

"I am now constructing the wavemeter published in the April issue of PRACTICAL WIRELESS. I now have a regular correspondence with five 'P.W.' readers and B.L.D.L.C. members on radio matters, and member 6711 and I visit each other's den twice a week, and do morse practice.

"Finally, I should like to mention that MTCY—Hsinking—is now operating for Europe from 21.00 to 21.50 G.M.T. on a new wavelength of 19.59 metres, in English. WBOS 25.26 metres now gives a quarter-hour English news-commentary at 20.00 G.M.T. in his new European transmission."



A corner of the den owned by member 6732

Aerial Tuning Experiments

HERE is a brief account of the experimental activities of member 6940 (Sidcup):

"I have of late been experimenting with simple aerial tuners of various types, used in conjunction with my three-valve and rectifier mains short-waver. The aerial is of the 'inverted-L' type about 30ft. long (horizontal portion).

"After many trials I have come to the conclusion that attempts at tuning an aerial are useless unless a fairly good earth is available. For instance, using the metal chassis of the set as an 'earth,' the results were weird. The set develops chronic hand-capacity, a trouble never before experienced, and appears to be most unstable—this, however, may be due to the hand-capacity effects.

"I should explain that my set is generally used in a first-floor room where the best, but rather doubtful, earth available is a water-tap some distance away. The performance of the set is generally better without it. I should be very interested to hear of any other readers who may have been conducting similar experiments.

"For the sake of general interest I may remark that I am not a D.X. fan. My idea of S.W. listening consists of really *listening* to stations. I listen almost as regularly, for instance, to some American commercial stations (particularly WRUL) as to our own B.B.C. I put this remark in as a contrast to listeners who collect excellent and extensive logs, but do not, in my opinion, derive full enjoyment from their sets."

Well, 6940, it will be interesting to know what other members think concerning listening and logs.

A Fine Log

MEMBER 6416 who, incidentally, is a W/Op in the R.A.F., sends us the following interesting letter:

"I have been a member of the B.L.D.L.C. now for a few years, but up to the present have never taken an active part in it. I have watched other members' logs come in time after time and have decided it is about time I got down to it, once in a while. Well, I send along my first log of 20-metre DX 'phone and W/T stations, heard between 03.00 to 06.30 hrs. on July 27th. W1—LTX, AXA, DCV, WE, LTC, CUR, AFN, W2—HSG, NMG, KGY, XLV, MBV, YME, IXP, LZM. W3—GSE, HLS, EPI, EFV, HUS and DMG and DMZ on CW. W4—EFS, DCL, DEN, VEP, PYB, SAI. W5—CTN. W6—AN, GVV, BMN, EFC, PXU, GVC, AM, OI, RMP, WQ and ZS OMV on CW. W7—HRV, HRE. W8—BDC, EPI, VSQ, IMC, RMP, VRZ. W9—FFE, GUI, GUY, RIL, MYJ, RFG. You will notice that I managed to get a catch from every State, from W1 to W9. W5 seemed to be the hardest to get, for as you will see, I only heard one, W5—CTN. The band was exceptionally free from static or indeed any form of X, and listening was a real pleasure. Is it still possible to send logs to our American 'ham' friends over the pond, or has this been discontinued?"

Thanks for your fine log, 6416. With regard to your query it is not permissible to QSO any stations abroad during the present emergency.

An Invitation

THE following letter has been received from member 6686 (D. A. Steward, 9, Weymouth Street, Apsley, Hemel Hempstead):

"As I have been a member of the B.L.D.L.C. since March, 1936, I think that it is time that I wrote thanking those of my fellow-members who have contributed such interesting letters to our club page. Now, I have a very interesting station at the above address, and any S.W. fan or B.L.D.L.C. member is always welcome on Sundays. My receiving gear here is a Trophy 6, an American-made U.H.F. receiver (tuning 4-7 metres) with 5 valves, an 0-v-1 battery receiver, and a Lissen rotary receiver outfit, at present used as a 4-valve superhet. I also have a valve-testing outfit, a Hunts cond. tester, and plenty of spare gear.

Good Listening: "Lone-Wolfing"

HERE is an interesting letter from member 6899 (Swansea), who writes as follows:

"I have been very interested in the activities of the B.L.D.L.C. since I became a member, and take this opportunity of adding my contribution.

"All reception here is carried out on a 3-valve home-constructed set, a detector and two R.C.C. L.F., fed by two parallel inverted 'L's, 20ft. long, and 2ft. 6ins. apart. Compared with the single 'L' this arrangement cuts out a lot of interference from Europeans, although the aerial points dead on Italy. To obtain good quality reproduction without doing away with 'phones, I use 'phones and a P.M. speaker in parallel, which give a very pleasing effect.

"Since last April, when I started listening seriously, I have received very consistently the ten best-known W's, and Leopoldville and Brazzaville, and occasionally I hear XGOY about R5-6, JLG4 (19.86 ms. at 21.30 G.M.T.) at R6, VUD2 and VUD4 about R5, and LRU several times at R7. Only once have I heard LRA5. On 14 mcs. I have received all W's except W7, several K4's, YV's, LU and CE.

"I have written to some of the 'Correspondence Wanted' addresses and have found two fine pals, who are fairly experienced and are mines of information. They have forcibly brought home to me the fact that 'lone-wolfing' is no good to oneself, or to the rest of the listening community."

Contacts Wanted

MEMBER 7020—J. A. Bird, 79, High Street, Hadley, Wellington, Shropshire—wishes to get in touch with any member interested in S.W. radio, and who has built the "Fleet" S.W.-Two.

Member 6932—L. G. Smith, "Uplands," Leigh Gardens, Andover—would like to contact another member in the Southampton or Andover districts.

Member 7012—J. Aiston, 4, Aske Road, Redcar, Yorks—is desirous of getting in touch with a member in India, about 15 years old, who is interested in DX reception.

CLUBS AND SOCIETIES

BRITISH SHORT-WAVE LEAGUE

Hon. Sec.: E. H. Trowell, 27, Unity Street, Sheerness, Isle of Sheppey, Kent.

THE secretaryship of this league has just been taken over by Mr. E. H. Trowell, to whom all communications in future should be addresed.

SIDCUP AND DISTRICT RADIO SOCIETY

Sec.: G. V. Haylock.

THE secretary of this society, which has closed down owing to the war, sends his kind regards to all its old members, and hopes to hear from them some time.

B.B.C. WAVELENGTH ALTERATIONS

THE B.B.C. made a number of wavelength changes in their European Service recently, and one of the chief aims is to provide increased signal strength over France. Station GSE (25.29 m.) is now using an aerial directional over France, which will result in an improved signal over the southern part of the country. GRT (41.96 m.) now employs an aerial directional on the whole of North and Central France.

The wavelengths which are at present in use in the European and World Services for the transmission of news in English and the times (BST) at which they are radiated, are:

00.00	49.59,* 41.49,* 30.96.*
00.45 / 02.00 / 02.45 / 06.30	31.32, 31.25, 25.53.
08.15	42.46, 31.55, 31.25, 25.53, 19.82, 19.66.
10.00	49.59,* 41.49,* 42.46, 31.55, 25.53, 25.29,* 19.82, 19.66, 19.60.
13.00	31.25, 25.53, 19.82, 16.84, 16.64, 13.97.
15.00	19.82, 16.84, 16.64, 13.97, 13.93.
15.30	49.59,* 41.49,* 25.38,* 25.29.*
18.00	31.75, 25.53, 19.82, 16.84, 13.93, 13.92.
20.00	31.25, 25.53, 24.92, 19.82, 19.66, 16.84.
22.45	31.25, 25.53, 19.82, 19.60.

Wavelengths marked with an asterisk are used in the European Service.

Prize Problems

Problem No. 424

THOMPSON wanted to convert his output stage for push-pull operation, but had no push-pull-input transformers available. How could he have used an ordinary L.F. transformer in place of the push-pull type? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 424 in the top left-hand corner, and be posted to reach this office not later than the first post on Monday, September 15th, 1941.

Solution to Problem No. 423

The fault in Baxter's receiver was an open-circuited bias resistance in the cathode circuit of the output valve.

Only one reader successfully solved Problem No. 422, and a book has accordingly been forwarded to J. Robertson, Aukengill, Wick, Caithness, Scotland.

BOOK RECEIVED

THE CATHODE-RAY OSCILLOSCOPE. By W. E. Miller, B.A. (Cantab.), M.Brit.I.R.E. Second Edition. Price 2s. net., by post 2s. 2d.

SINCE the publication of the first edition of this practical manual little, if any, change has taken place either in commercial oscilloscope design or use, and it has therefore not been felt necessary to make any alteration to the text. Although the book was originally intended mainly for the use of radio service engineers, it has since been found of particular interest to those who in technical colleges and in the Services training schools are coming into contact with cathode-ray tubes and oscilloscopes for the first time. The book is written in a simple and practical style.

Comment, Chat and Criticism

Outline of Musical History–24

By Our Music Critic, MAURICE REEVE

WE have seen how bravely Beethoven fought, and won his battle against the physical destiny that suddenly loomed up on his horizon. The crisis of 1814 and the tragic sequence of events from then onwards, together with the music of his third period, form the pages of this story.

According to Czerny, the three Sonatas for piano, op. 31, were preceded by a remark by Beethoven: "I am by no means satisfied with my works hitherto, and I intend to make a fresh start from to-day." If this is true, it was said at the same time as he wrestled with, and overcame, his deafness. He doesn't seem to have done much about it in the Sonata in G, op. 31, No. 1, but the other two open up new worlds. The second, in D minor, is magnificent, and one of the best of the series. The introduction, "Largo," of less than two bars, is orchestral, the "Adagio" D1 profound and lovely, and the finale D2 a veritable *tour de force*. With the exception of one quaver, the whole movement of 399 bars is in an unbroken rhythm, of semiquavers, yet, so unobtrusive is the technical effect of this great feat that one hardly notices the fact. He was visiting Ober-Döbling at the time, for his health, and the rhythm is said to have been inspired by a horse galloping past his window. The third of this opus is also a great favourite.

Violin and Piano Sonatas

The sonatas for violin and piano, op. 30, written in the same year, are notable, with one, as in the case of the op. 31, standing out above its two companions. Beethoven was no mean diplomatist. In both these instances of three works in one opus, he has placed the undoubted masterpiece in the middle of the three, doubtless to compel the attention of a would-be purchaser who might otherwise have changed his mind after examining the first two and thinking the remaining one to be on the same level of quality. The C minor is elemental in its grandeur and is Beethoven smiling, growling and raging alternately. The four movements are almost symphonic in plan.

Kreutzer Sonata

After these come the celebrated violin and piano sonata in A major, op. 47, known the world over, as so many other of Beethoven's works are, by the name of the lucky person who received the dedication—Rudolph Kreutzer. The "Kreutzer" Sonata is undoubtedly the favourite of all violin and piano sonatas with violinists, pianists and audiences.

The story goes that the "Kreutzer" Sonata was written for an English violinist, Bridgetower, then living in Vienna, and that it was to be ready for his concert. As usual, Beethoven was late. Czerny says that the first movement was written in four days. Perhaps this accounts for its change of mood half-way through, and is the reason why the same terrific intensity is not maintained throughout. At the concert Bridgetower played it from the manuscript practically at sight. However, the infectious rhythm of the Presto has proved irresistible ever since, and can anyone say that even Liszt himself was more brilliant and dashing than Ludwig was in such movements as this, the op. 53 already mentioned, and the piano trio, op. 97 ?

The Third Symphony

In reaching the production of his third symphony in E flat, op. 55, we arrive at a stage in his career which, for the number as well as the quality of the works pro-

Notes on Some Favourite Beethoven Sonatas, and the Third Symphony

duced, must rank with that of any other creative artist in the world's history. Shakespeare himself cannot show any one period in which he created more beautiful and mighty works than these few years in Beethoven's life. A recital of their mere names is astonishing. 1803 saw the composition of the Kreutzer Sonata, and the Third Symphony, already mentioned, as well as sacred songs and the commencement of "Fidelio"; 1804 witnessed the mighty "Waldstein" and "Appassionata" Sonatas, op. 53 and 57. The F major, op. 54, and the Andante Favori and further songs; 1805 the Leonora Overtures Nos. 1 and 2, the triple concerto, op. 56, for piano, violin, 'cello and orchestra; 1806, the opera "Fidelio," and the Fourth Piano Concerto in G, op. 58; 1807 the 32 Variations, the Violin Concerto in D, op. 61, the Fourth Symphony in B flat, op. 60, the Third, "Leonora," Overture, and the three "Rasonmowsky" Quartets, and 1808 saw the completion of the 5th and 6th Symphonies, op. 67 and 68, the Overture to "Coriolan," the Mass in C and the arietta "In Questa Tomba."

The Third Symphony is one of the landmarks of musical history. One famous modern critic has said that it, and Wagner's opera "Tristan and Isolde," are the only two works in all music that definitely changed the current of men's thoughts, and that, after their production, it took the new road once and for all. Another bases his division of Beethoven's music by it, into just two parts, pre-"Eroica" and post-"Eroica" (meaning before and after).

The idea for a symphony in admiration of Napoleon is believed to have been suggested by Bernadotte, the French Ambassador. At that time Napoleon, who had not long previously concluded his victorious Italian campaign, was looked upon as the saviour of the French Revolution, and the only person who was not only likely to bring order out of the chaos that then reigned in France, but who would also establish the principles of "Liberty, Equality and Fraternity" far beyond the borders of the new Republic. At the time of its first performance it bore the dedication:

Sinfonia Grande
Napoleon Bonaparte
804 im August
del Sigr
Louis van Beethoven
Sinfonie 3 Op. 55

When it was just about to be published, in October, 1806, the news reached Vienna that Bonaparte had proclaimed himself Emperor of the French. Beethoven was in a rage. His idol fell, shattered, to the ground. He was, after all, only seeking to increase his own personal power and satisfy his vanity and greed, and was not working for the improvement and the benefit of mankind. Ries, who, to Beethoven was something like Boswell was to Dr. Johnson, says that he rushed to the table where the manuscript was lying and wrenched off the dedicatory page, substituting for it the inscription: "*Sinfonia eroica per festeggiare il souvenire d'un gran uomo.*" And thus it came to possess its title of "eroica" —heroic.

No symphony before it had ever been planned on such a vast scale, nor had any ever contained so many departures from accepted custom. The first movement contains subjects and themes far in excess of the number prescribed up till then in the accepted laws of "first movement form," and adhered to by Mozart and Haydn. Each one is of supreme beauty and loveliness. In spite of his later works—six more symphonies were yet to come—it still remains the favourite of many, and more than one critic considers it the greatest of all his works. Even the opening subject G1 may not have been an accident but a deliberate gesture pointing to his beloved Mozart as the real hero, for it bears a strong resemblance to Mozart's early opera, "Bastien et Bastienne G2," as well as being based on those same arpeggio notes we have found in his work so often. Here again, Beethoven defied convention by placing his slow movement before his menuet and trio, or scherzo, which form his third movements henceforth took. He did the same in his piano Sonata, op. 26, the slow movement of which it may be remembered was also a funeral march.

Opera "Fidelio"

In 1804 Schikaneder commissioned Ludwig to write an opera for the Theatre au den Wien. On November 20th, 1805, "Fidelio" (Fidelity) was produced, seven days after the French entered Vienna, and twelve days before the battle of Austerlitz. Trafalgar, which probably hadn't interested Beethoven in the slightest degree, was fought the previous month. They were days of turmoil in Vienna. Most of the palaces to which he had entrée, were in the occupation of the various generals of the French Army; Murat was in the Archduke Albert's, Hulin in Prince Lobkowitz's, Napoleon himself was in the greatest of all—the castle of Schonbrunn. At the first performance, the audience mainly consisted of French officers. The production was a failure, partly owing to some defects in the libretto, and partly to the disturbed times. It was the only great opera he wrote, but, in spite of frequent performances and acknowledgment of its many merits, it does not rank in public favour with the great masterpieces of Mozart, Wagner and some others. It was withdrawn after three performances.

After a very unpleasant experience, Beethoven agreed to the sacrifice of three whole numbers, and the work was reduced to two acts. Stephen von Breuning was entrusted with the revision of the libretto. In its revised form, and with the overture now known as Leonora 3, the opera was repeated the following year, and several times afterwards to larger and more appreciative audiences.

Open to Discussion

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).

Our Helpful Radio Books

SIR,—I've been in the R.A.F. as a radio-mechanic for over three months now, and I should like to thank you for the invaluable help three or four of your radio books have given me.—R. PROCTOR (Manchester).

Station Identification

SIR,—I shall be glad if any reader can help me identify a station heard on the 31 m. band on July 9th, time 23.30 B.S.T. (R6), calling WDA, New York, U.S.A. It is the first part of the call that I had difficulty in understanding. I shall be glad of any information concerning this station. —L. H. DESMOND, 76c, Alexandra Road, Hampstead, London, N.W.8.

The Wish to Serve

SIR,—Being a regular reader of PRACTICAL WIRELESS it was inevitable I should read about Radiolocation in the August issue. I registered recently under the Employment scheme, but was amazed that the exchange authorities were not interested in any technical qualifications I possessed. I am at present employed on one of the chief railways in the capacity of locomotive fireman. It certainly is a reserved occupation, but I believe I could be spared easily. I have applied twice to the railway headquarters to be released to serve, but have been refused on account of reservation. My reason for wishing to serve is on account of my previous experience in the world of radio. I served from 1914 to 1920 in H.M. Navy. Went through the naval training school for radio operators and passed. Served as operator from 1915 to 1920 in different types of ships when I obtained a free discharge, wishing to return to civil life. Granted the apparatus in use in those days was spark telegraphy and crystal detection, but in 1917 we entered the field of superheterodynes and C.W. transmitting. You know, it gets in the blood, and I have never lost interest in radio in civil life. I don't think I have missed any one of your weekly or monthly publications, but have never bothered to join the B.L.D.L.C., or even to apply for the P.M.G.'s certificate as an amateur. But not on account of lack of interest. However, there is my position and I am still hoping that my services will eventually be accepted. —M. R. H. WILSON (Goole, Yorks).

Frequency Modulation Circuits

SIR,—May I suggest that a series of articles on F.M. radio sets would be welcomed by many readers. Not so much on the theory, but about the valve types used, theoretical diagrams of discriminator stage, and explanations. This system is very popular in the United States. The intermediate frequency selected by the R.M.A. of America is 4.3 mc/s, as a frequency above 4 mc/s precludes the possibility of image frequency interference within the band of 42-50 mc/s, and also a guard band between the amateur band, 3.5-4 mc/s, and the 75 kc. transmitter frequency excursion.—P. DICKENSON (Holt, Norfolk).

[*What do other readers think of this suggestion?*—ED.]

Phonetic Sound of Morse Symbols

SIR,—I wonder how many readers who are learning Morse realise that unless certain letters in the code are "swung" they are unreadable. For instance, if a learner sent out this sound on his buzzer, DARR-DIT-DARR-DIT for a letter "C," it would read to the other fellow T.E.T.E. so to make it sound like the alphabetical C you must swing the letter and give it its correct phonetic sound. DARDIT-DARDIT.

The following table indicates the correct phonetic sound of each letter or figure symbol of the Continental code.

CONTINENTAL CODE.

A	.—	ditdarr.	N	—.	dardit.
B	—...	darr dirrit dit.	O	———	dardardar.
C	—.—.	darditdardit.	P	.——.	ditdardardit.
D	—..	darrdirrit.	Q	——.—	dardarditdar.
E	.	dit.	R	.—.	ditdardit.
F	..—.	dirritdarrdit.	S	...	dirritdit.
G	——.	darrdarrdit.	T	—	darr.
H	....	dirritditdit.	U	..—	dirritdarr
I	..	dirrit.	V	...—	dirritditdar.
J	.———	dirdardardar.	W	.——	ditdardarr.
K	—.—	darditdar.	X	—..—	darrdirritdarr.
L	.—..	ditdardirrit	Y	—.——	darditdarrdarr.
M	——	darrdarr.	Z	——..	darrdarrdirrit.

NUMBERS.

1	.————	ditdardardar.
2	..———	dirritdarrdarrdarr.
3	...——	dirritditdarrdarr.
4	....—	dit dit dit dit darr.
5	.....	dit dit dit dit dit.
6	—....	darr dit dit dit dit.
7	——...	dar dar dit dit dit.
8	———..	darr darr darr dirrit.
9	————.	darr darr darr darr dit.
10	—————	darr darr darr darr darr.

—WILLIAM J. GREY (Newport, Mon.).

Crystal Experimenters

SIR,—I have been a reader of your very fine publication since 1934, and am a member of the B.L.D.L.C. PRACTICAL WIRELESS has given me all my knowledge of wireless. I was a keen experimenter in the short-wave sphere, but have now gone over to crystal reception and can receive the B.B.C. Home Service from 11.30 p.m. on a 60-turn coil casing, 3in. former, .0005 condenser and a crystal. My aerial is about 30ft. I should like to get in touch with "crystal" experimenters and anyone who could tell me where I could obtain crystals of different kinds for the purpose of experiment. I will gladly reply to all crystal experimenters who write to me with a view to exchanging notes.—PHILIP RYAN, 115, Ashburton, St. Luke S., Cork City, Eire.

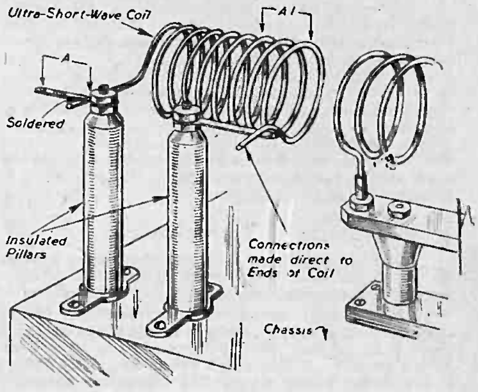
Correspondent Wanted

ALAN McGUGAN, Gleke, Agherton, Portstewart, Co. Derry, N. Ireland, wishes to get in touch with any S.W.L. or keen constructor in the district.

Mounting U.S.W. Coils

SIR,—It is necessary to experiment as regards the position of ultra-short-wave coils, for maximum results. When dealing with these higher frequencies, however, it is most vital that the whole coil assembly should be fixed and perfectly rigid.

Therefore, for experimental work, the following idea may be of interest to readers, which arrangement was most useful in the writer's experiments in the reception of the television transmissions before the war. As will be seen from the sketch, the coils



An efficient method of mounting ultra-short wave coils.

are mounted rigidly on insulating pillars, having fairly long and stout soldering tags, arranged as shown. The coil ends are soldered to these tags, but the position of the coil in relation to its neighbours can be varied by soldering it at different points along these tags. The distance of variation is shown in the sketch at A and A1, and will, of course, be equal to the actual length of the tags.—R. L. GRAPER (Chelmsford).

Simple M.C. Microphone

SIR,—The accompanying sketch shows a simple moving-coil microphone which was made from an old speaker. After removing the cone, etc., the speech coil and the spider were carefully detached with the aid of a razor blade, and the paper cone glued to them. A tobacco tin was then cut as shown in the diagram and

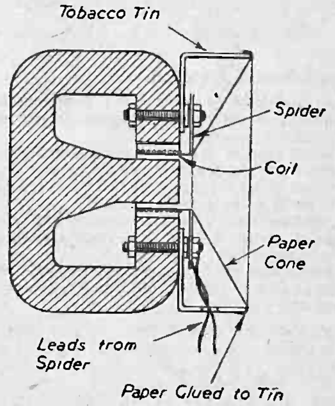


Diagram showing how a small moving-coil microphone was made from an old speaker unit.

bolted in position. Whilst gluing the cone to the tin the mike was connected up to the L.S. terminals of a radio set so that the tone indicated when the correct tension of the paper had been obtained. The speaker used had a fairly light spider outside the speech coil; if, however, the spider was found to be too stiff, it could be easily replaced by a paper one. This microphone was found to give excellent results far superior to the transverse current carbon type.—G. M. JONES (Bolton).

Replies to Queries

Converting M.C. Speaker to Microphone

"Can you give me any information on converting a midget M.C. loudspeaker into a microphone?"—J. S. Webster (Broadstairs).

TO convert a midget permanent magnet moving coil speaker to an M.C. microphone, the following modifications are necessary. Remove speaker transformer, taking care not to damage the two leads from the secondary side going to the speech coil. Obtain a microphone transformer, having a ratio of 70:1 or 100:1 and to its primary connect the leads from the speech coil. The secondary of the transformer can then be connected to the input of the amplifier. As the output from this type of microphone is weaker than that obtained from a carbon model, it is usually necessary to incorporate an additional stage of L.F. amplification in the amplifier.

Modernising a Three-valver

"I want to modernise a 3-valve short-wave wireless set. It is an R.C.C. coupled set with an L.F. transformer, and has two detector and one power valves.

"I believe that considerable improvements can be made to such a set by substituting the first valve by a 7-pin H.F. pentode, and the power valve by a 5-pin output pentode. If this is so I should be greatly obliged if you would kindly suggest the alterations necessary to enable these more modern valves to be fitted.

"In the set I have recently installed a .00016 tuning condenser, but I notice that this condenser, unlike the old one it has replaced, goes all 'round the circle.' Is there any reason for this? I find with this condenser that I am unable to tune in (on the 'half-circle' basis) the London stations on the 49-metre band, and I wonder if there is anything in being able to run the moving plates all 'round the circle' instead of only half-way, as is usual."—A. H. Burton (Lewisham).

AS we cannot undertake to provide circuit diagrams to individual requirements, we hope that the details given below will be sufficient to enable you to modify the set.

In the first place, the first and third valveholders must be replaced by those of the 7-pin and 5-pin type respectively.

An H.F. pentode of the "straight" type should be used as the detector, the connections to the valveholder being taken from the valve maker's instruction leaflet. The screen-grid will not require more than 36 volts H.T., whilst the anode will be connected to the L.F. coupling, and 120 volts H.T. in the normal manner.

For the output stage, the only modification will be a connection to the fifth pin of the valveholder, from the 120 volt H.T. supply, and a .01 mfd. condenser in series with a 10,000 ohm resistance across the loudspeaker transformer.

You should note that with the new pentode output valve it will be necessary to see that suitable matching is provided between valve and speaker, i.e., by using correct ratio speaker or output transformer.

Amplifier Queries

"As I intend to build your Experimental 6-Watt Amplifier I would be very grateful if you will answer the following questions:

"What type of Ferranti output transformer is used, and what are the secondary impedances?

"What is the resistance of the Partridge L.F. Choke, and is there an equivalent of this?

"Can I use an 8-4 mf. and separate 4 mf. electrolytics, or must I use an 8-8-4-4 mf. condenser as specified in the component list?

"Also where can I get a metal chassis of the following measurements: 14in. x 9in. x 3in.?"—A. Gilmour (Cromarty).

THE Ferranti output transformers are made in various ratios; therefore, it will be a question of selecting the right one to suit your speaker. If the speaker is fitted with a multi-ratio transformer having a centre tapping, the Ferranti model would not be required.

The choke resistance is approximately 800 ohms. Premier Radio can supply a suitable alternative.

Yes, separate condensers can be used. A metal chassis can also be obtained from Premier Radio.

Operation of C.R. Oscillograph

"I shall be glad if you will kindly inform me by what circuit arrangement the special oscillator required to examine H.F. response curves via a C.R. oscillograph operates.

"I understand that oscillations are produced which start below, pass and rise above the frequency to which the circuit under examination is tuned, so as to produce the X-deflection as a function of frequency, but I cannot see how an oscillator can be made to vary in this manner the frequency it is working on."—Geo. D. Roberts (Wisbech).

FOR the work concerned, it is usual to use in conjunction with a C.R. oscillograph an H.F. oscillator of the "wobbly" type, i.e. where the frequency is made—by electronic or mechanical means—to vary over a predetermined frequency. The oscillator is, in itself, frequency modulated.

It is not possible in the space here available to give a detailed explanation, therefore you might like to communicate with, say, Messrs. Cossor Ltd., who produce such apparatus and who might be able to supply literature on the subject.

Amplifier R.C. Coupling

"I am trying to design a quality amplifier with an output of 6 to 8 watts. I propose to use R.C.C. throughout and to make use of two K.T.63's in push-pull with negative feedback in the output stage. I understand that with negative feedback a valve requires a much larger voltage on the grid to load it fully. Will it be possible to get the output required using the K.T.63's, or must I use valves with a higher slope such as K.T.61's? I was thinking of using a 6F8 twin-triode as voltage amplifier and phase inverter but am not sure if this combination will be successful."—Norman Cherry (Stamford).

THE K.T.63's will be satisfactory provided that the R.C. couplings are designed to give maximum gain to ensure full loading on the estimated minimum input signal. The Listeners' 5-Watt Amplifier (Blueprint No. W.M.392) uses R.C. coupling, and it was designed for high fidelity when used in conjunction with a good make of pick-up. It is intended for A.C. mains.

RULES

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

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

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

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

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

Resistance and Wattage Rating

"Could you please tell me what value resistance and what wattage rating I should require to cut down the output of an eliminator giving 150 volts 30 mA, so as to be able to run a receiver requiring 120 volts at an average of 10 mA?"—R. H. A. Powell (Reading).

IF you wish to obtain 120 volts at 10 mA, the resistance value is calculated thus:

$$R=\frac{E}{I}\times 1000=\frac{150-120}{10}\times 1000$$

$$=\frac{30,000}{10}=3,000 \text{ ohms.}$$

Wattage rating $=I^2R=0.01^2\times 3,000$
$=.0001\times 3,000=.3$ watts.
Say .5 watts.

Extra L.S. Circuit

"Would it be in order to couple the extra L.S. leads of an Ultra "121" to an extra L.F. amplifier (P.U. sockets of another set)? Will it give more volume on S.W. stations, or does it need elaborate alteration to the circuit?"—H. A. Tobias (Scunthorpe).

THE extra L.S. circuit is designed for use with a low resistance speaker; therefore, for the work you have in mind it would be necessary to connect an output transformer between extra L.S. sockets and input to amplifier. A ratio of, say, 45:1 would be satisfactory.

Transformer Windings

"Can you please supply me with the following information: (1) The number of turns, gauge of wire, and amount needed to wind a transformer core to work off 230 volts, 50 cycles? I wish, if possible, to have 100 volts on the secondary, tapped at every 20 volts for working small motors, etc.

"(2) Is it possible to wind the magnet core to work off 230 volts, 50 cycles, 5 amps. without it becoming too hot?"—R. J. Pettit (Birmingham).

WITH the transformer core stampings which you have it will be satisfactory to use 9 turns of wire per volt, for both primary and secondary. Thus, for the primary you will need 2,700 turns, and for the 100-volt secondary 900 turns, tapped at every 180 turns. The wattage drawn from the secondary (output volts times amps) should not exceed 40, and it would be desirable to keep well below this figure if the transformer is to be used for long periods.

For the secondary use 26-gauge enamelled wire, and for the primary, 30-gauge enamelled. Assuming that the windings are placed side by side on the spool (adequately insulated, of course) you will require approximately ¾lb. of 30-gauge for the primary, and about ½lb. of 26-gauge for the secondary.

We are afraid that the electro-magnet "pot" of which you give details would tend to become very hot if wound for 230 volts, 5 amp., since you would need to use 16-gauge wire, of which you could accommodate only about 330 turns. It should run quite cool enough if filled with 24-gauge wire, but this has a current rating of only 0.76 amp. at 2,000 amps. per sq. in.

Testing Fixed Condensers

"I have an A.C. mains set which has suddenly developed a loud howl, which I think is due to one of the condensers breaking down. Altogether there are 13 condensers in the set, three of them being electrolytics. Could you tell me how I can test for faulty condenser without any special testing-board? The set, which is a commercial radiogram, works quite normal except for the howl, which is on both radio and gram."—W. Heard (Perry Barr).

ORDINARY fixed condensers can be tested by applying, say, 120 to 150 volts across their terminals for a few seconds, and then seeing if a minute spark is produced when the terminals are short-circuited. If this happens it is usually safe to consider the condenser as being in order. With electrolytic condensers, this procedure cannot be adopted, and it is better to use a sensitive milliammeter in series with a voltage applied to their terminal in the manner mentioned above, taking care to see that correct polarity is observed. The idea of the meter is to note the value of the leakage current, and if this is excessive, i.e., above that quoted by the makers, then the condenser is not satisfactory. In all these tests it is necessary to apply a low voltage at first in case a short-circuit exists.

Noises in Mains Set

"On tuning to the 'Forces' programme on my all-wave mains receiver recently bad crackling noises developed in my set before the station comes in finally O.K. I tested the ganged condenser for a 'short' at that point, which seemed the obvious cause, but this I found O.K. The receiver is now developing the same trouble on the 'North Regional' station. The receiver occasionally goes 'dis' for a few seconds, and then becomes O.K. again. Can you please advise?"—H. Greenwood (Bradford).

IN view of your remarks we are not inclined to suspect the ganged condenser. We would rather suggest that some fault must exist in one of the components, valves or wiring. It would be advisable to examine all switches and connections. Test volume control for faulty element or wiper, pay particular attention to any resistances in H.T. supply, and make sure that all valve pins are making perfect contact. If you have not already tried removing the aerial lead-in from the set, it would be advisable to do so in case the fault is on that side of the installation. Smoothing, decoupling and by-pass condensers should, of course, also be examined if the above-mentioned tests do not reveal the fault.

Frame Aerial Details: Coil Windings

"Would you please inform me of the number of turns of wire required to make an inductance (frame aerial) of 170 microhenries on a former 9½ ins. by 2 ins. and also the number for 1.2-m.henries on the same former, which is about an inch wide.

"Also instructions for winding the following coils on a former of 2-in. diameter:—0.5 microhenry, 5.5 microhenry, 37.5 microhenry, 310 microhenry, 2,200 microhenry and 200 microhenry."—Sidney Arbus (Willesden).

ON a frame 9½ins. by 2ins. you will require 32 turns of 32 S.W.G., each turn spaced the thickness of the wire.

We cannot undertake, especially at the present time, calculations and designs to satisfy individual requirements, therefore, in this instance, we must refer you, for the other questions, to the data and formulæ contained in our "Radio Engineer's Vest-Pocket Book," price 3s. 6d. (by post, 3s. 9d.).

"Reversed Valves"

"I have built up a circuit as described in a recent article on 'Reversed Valves,' but due to certain circumstances, I find that the two stations cut in on each other. Can you tell me how this comes about?"—J. Lockhead (Denny).

WITH a circuit of this type, selectivity is bound to be poor, owing to the single-tuned circuit between aerial and valve, and the absence of any form of reaction. You can experiment with smaller valves of capacity for the condenser.

The coupon on page iii of cover must be attached to every query

SUSPENSION FOR DIRECTING SOUND DOWNWARDS—
—TO THE LEFT—
—OR TO THE RIGHT.

Practical Wireless

BLUEPRINT SERVICE

PRACTICAL WIRELESS

CRYSTAL SETS

Blueprints, 6d. each.

	Date of Issue.	No. of Blueprint.
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.

All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93

Two-valve : Blueprint, 1s.

The Signet Two (D & LF)	24.9.38	PW76

Three-valve : Blueprints, 1s. each.

Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	—	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	—	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	—	PW62
The Centaur Three (SG, D, P)	—	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	—	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	—	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen)	—	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	—	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	—	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92

Four-valve : Blueprints, 1s. each.

Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	—	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90

Mains Operated.

Two-valve : Blueprints, 1s. each.

A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19

Three-valve : Blueprints, 1s. each

Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW32
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, (Pen))	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70

Four-valve : Blueprints, 1s each.

A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47

SUPERHETS.

Battery Sets : Blueprints, 1s. each.

£5 Superhet (Three-valve)	—	PW40
F. J. Camm's 2-valve Superhet	—	PW52

Mains Sets : Blueprints, 1s. each.

A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42
Universal £5 Superhet (Three valve)	—	PW44
F. J. Camm's A.C. Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	—	PW73

Four-valve : Double-sided Blueprint, 1s. 6d.

Push Button 4, Battery Model Push Button 4, A.C. Mains Model	22.10.38	PW95

SHORT-WAVE SETS. Battery Operated.

One-valve : Blueprint, 1s.

Simple S.W. One-valver	23.12.39	PW88

Two-valve : Blueprints, 1s. each.

Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91

Three-valve : Blueprints, 1s. each.

Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	—	PW68

PORTABLES.

Three-valve : Blueprints, 1s. each.

F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77

Four-valve : Blueprint, 1s.

"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86

MISCELLANEOUS.

Blueprint, 1s.

S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.

Blueprints, 6d. each.

Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated

One-valve : Blueprint, 1s.

B.B.C. Special One-valver	—	AW387

Two-valve : Blueprints, 1s. each.

Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409

Three-valve : Blueprints, 1s. each.

£5 5s. S.G. 3 (SG, D, Trans)	—	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	—	WM327
Economy Pentode Three (SG, D Pen)	—	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	—	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct. '35*	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400

Four-valve : Blueprints, 1s. 6d. each.

65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Cl. B)	*Aug. '33*	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb. '35*	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr. '36*	WM404

Five-valve : Blueprints, 1s. 6d. each.

Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

These Blueprints are drawn full size.

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

Practical Wireless (issues dated prior to June 1st, 1940). 4d. Post Paid
Issues dated June 1st to July 27th, 1940. 5d. Post Paid
(Issues dated September, 1940 and after) 7d. Post Paid
Amateur Wireless ... ... 4d. ,, ,,
Wireless Magazine ... ... 1/4 ,, ,,

The index letters which precede the Blueprint Number indicate the periodical in which the description appears : Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

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

Mains Operated.

Two-valve : Blueprints, 1s. each

Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394

Three-valve : Blueprints, 1s. each.

Home Lover's New All-Electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF, Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan. '36*	WM401

Four-valve : Blueprints, 1s. 6d. each.

All Metal Four (2 SG, D, Pen)	—	WM329
Harris' Jubilee Radiogram (HF, Pen D, LF, P)	*May '35*	WM386

SUPERHETS.

Battery Sets : Blueprints, 1s. 6d. each.

Modern Super Senior	—	WM375
'Varsity Four	*Oct. '35*	WM395
The Request All-Waver	*June '36*	WM407
1935 Super Five Battery (Superhet)	—	WM379

Mains Sets : Blueprints, 1s. each.

Heptode Super Three A.C.	*May '34*	WM359
"W.M." Radiogram Super A.C.	—	WM366

PORTABLES

Four-valve : Blueprints, 1s. 6d. each.

Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367

SHORT-WAVE SETS. Battery Operated.

One-valve : Blueprints, 1s. each.

S.W. One-valver for America	P.W. 15.10.38	AW429
Roma Short-Waver	—	AW452

Two-valve : Blueprints, 1s. each.

Ultra-short Battery Two (SG, det, Pen)	*Feb. '36*	WM402
Home-made Coil Two (D, Pen)	—	AW440

Three-valve : Blueprints 1s. each.

World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July '35*	WM390

Four-valve : Blueprints, 1s. 6d. each.

A.W. Short-wave World-beater (HF, Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	P.W. 22.7.39	WM383

Superhet : Blueprint, 1s. 6d.

Simplified Short-wave Super	—	WM397

Mains Operated.

Two-valve : Blueprints, 1s. each

Two-valve Mains Short-waver (D, Pen) A.C.	P.W. 13.1.40	AW453
"W.M." Long-wave Converter	—	WM380

Three-valve : Blueprint, 1s.

Emigrator (SG, D, Pen) A.C.	—	WM352

Four-valve : Blueprint, 1s. 6d.

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	—	WM391

MISCELLANEOUS.

S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM 392 (1/-)	—	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	—	WM403
New Style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May '36*	WM405
Wilson Tone Master (1/-)	*June '36*	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

Classified Advertisements

ADVERTISEMENTS are accepted for these columns at the rate of 2s. per line or part of a line. Minimum charge 4s. All advertisements must be prepaid. Each paragraph will commence with the first word in bold face capitals. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

CABINETS

WE regret that, owing to all our employees having joined H.M. forces, we are unable to accept orders for cabinets except to callers. Limited stock only. We have a large stock of radio components. H. L. Smith & Co., Ltd., 289, Edgware Road, London, W.2. Tel.: Pad. 5891.

COMPONENTS FOR SALE

A. C. ELIMINATORS, as new, 25/-. We pay carriage. Bunton, 12, Yewcroft Avenue, Newcastle-on-Tyne, 5.

VALVES. 150 only, P2020 5-pin, side connection, universal Pentodes (can be used as rectifier). Brand new Dario, boxed. Complete parcel to clear, £55. Also, 80 only, 1A4E brand new Philco 2v. battery S.G., 4-pin, £12 the lot.—Gee Electric, 15, Little Newport Street, W.C.2.

LITERATURE, MAPS, etc.

AMATEUR Radio Handbook. Second edition now on sale. 328 pages, price 4s.—Radio Society of Great Britain, 16, Ashridge Gardens, London, N.13.

WEBB'S Radio Map of the World. Locates any station heard. Size 40" by 30", 4/6, post 6d. On linen, 10/6, post 6d. WEBB'S Radio Globe—12" model. Radio prefixes, zones, etc., 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: GERrard 2089.

RADIO SOCIETY OF GREAT BRITAIN invites all keen amateurs to join. Reduced war-time subscriptions. Send 1s. for current issue "T. & R. Bulletin" and details.—16, Ashridge Gardens, London, N.13.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make, moderate prices.—Sinclair Speakers, (New Address), 12, Pembroke Street, Copenhagen Street, N.1.

MISCELLANEOUS

PRINTA-SIGN Stencils, showcard outfit, 4/6. Poster 6/6 on appro.—"Printa-Sign," 23, Blackburn Street, Glasgow.

MORSE EQUIPMENT

FULL range of Transmitting Keys, practice sets and other equipment for Morse training.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: GERrard 2089.

MORSE TRAINING

FREE. "Book of Facts," tells you all about The Candler System of Code training. Courses for Beginners and Operators.—Write: Candler System Co. (LO). 121, Kingsway, London, W.C.2.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised, 4in. to 14in., including several Epoch 18in.—Sinclair Speakers (New Address), 12, Pembroke Street, Copenhagen Street, N.1.

PUBLIC APPOINTMENTS

MINISTRY OF AIRCRAFT PRODUCTION.
Aeronautical Inspection Directorate: Vacancies for Women.

Interesting Jobs are open to women involving the inspection and testing of various aircraft parts, including aero engines, wireless and electrical equipment, kites, balloons, parachutes, dinghies, etc.

Candidates should be of not less than School Certificate standard in physics or general science and mathematics, or have had reliable practical experience of engineering testing and inspection. Ability to read engineering drawings, interpret specifications, use micrometers and other measuring instruments is desirable.

Age limits: Normally 21 to 40 years.
Rate of Pay: Assistant Examiner, £2 17s. 6d., plus Civil Service bonus 7s. 6d. per week.
Overtime payable.
Promotion: Prospects of promotion to posts as Examiners at £220 plus Civil Service bonus £19 12s. 0d. per annum.

Accepted candidates will be given a one month's course of special training comprising lectures and demonstrations, followed by practical works instruction. Pay commences on entry into Training School, which is at Bristol. Accommodation available near School at approximately 30s. per week. On completion of training women will, as far as possible, be drafted to factories near their homes.

POSTCARD ONLY to Ministry of Labour and National Service, Employment Exchange (Room 24) 20, Nelson Street, BRISTOL, 1.

More OPINIONS from Students taking CANDLER Code COURSES

"As a student of the Candler System I would like to say how pleased I am that, thanks to the excellent training I have received, I now hold the PMG Certificate in Wireless Telegraphy." Ref. 1412. A.W.G., Glasgow.

"And may I say how pleased I am at my progress. At first I could send and read 0 w.p.m. Now I am doing 15 w.p.m. easily." Ref. 2674. J.L., Atherton, Lancs.

"In conclusion I should like to inform you that the course is proving beneficial to me, and I no longer have to consciously 'think' about signals. My receiving speed is now around 20-21 w.p.m. for plain language." Ref. 3069. J.H.C., Morden, Surrey.

"I have just completed the third lesson of your Junior Code Course. Starting from 0 w.p.m., I can now send 12 w.p.m. and receive 10 w.p.m. comfortably. Besides teaching me the necessary fundamentals of learning code, it has made my learning interesting and given me great confidence in myself." Ref. 4278. V.G.W., Wembley Mddx.

All original letters can be inspected.

There are Complete Candler Code Courses for Beginners, and for Operators who desire to improve their speeds and technique.

Courses supplied on Cash or Monthly Payment terms.

COUPON

Please send me Free and without obligation a copy of the Candler "Book of Facts."

NAME ....

ADDRESS ....

Post coupon in 1d. unsealed envelope to London Manager

Room (SLO) 121, KINGSWAY, LONDON, W.C.2.

CANDLER SYSTEM CO.

Candler System Co., Denver, Colorado, U.S.A.

1041

FOR THE RADIO SERVICE MAN, DEALER AND OWNER

The man who enrolls for an I. C. S. Radio Course learns radio thoroughly, completely, practically. When he earns his diploma, he will KNOW radio. We are not content merely to teach the principles of radio, we want to show our students how to apply that training in practical, every-day, radio service work. We train them to be successful!

INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 94A, International Buildings, Kingsway, London, W.C.2.

Please explain fully about your Instruction in the subject marked X.

Complete Radio Engineering
Radio Service Engineers
Elementary Radio
Television

If you wish to pass a Radio examination, indicate it below.

Institute of Radio Engineers
P.M.G. Certificate for Wireless Operators
Provisional Certificate in Radio Telephony and Telegraphy for Aircraft
City and Guilds Telecommunications

Name.............................. Age.....

Address ....

....

(Use penny stamp on unsealed envelope.)

PUBLIC APPOINTMENTS

WIRELESS TECHNICAL INSTRUCTORS REQUIRED IN ARMY UNITS

Emoluments.—Pay 8s. 9d. per day (7 days a week). Clothing, rations and accommodation or, if this cannot be provided, allowances at authorised rates. If married and otherwise eligible family allowance payable in respect of wife and children, subject to allotment from pay.

Candidates should preferably be under 35 and over 24 and—

(a) Hold one of the following qualifications:
Graduateship of the Institute of Electrical Engineers.
Final (Grade III) Certificate of City and Guilds of London Institute Examination in Radio Communication.
Higher National Certificate in Electrical Engineering.
Certificate of City and Guilds of London Institute in Radio Service Work.

OR

(b) Be able to pass an examination on the following syllabus:
Simple algebra, including quadratic equations; simple trigonometrical ratios and identities; vectors.
Properties of electrical currents; heating of conductors; magnetic fields; unit of current; Ohm's Law; resistance in series and parallel; potentiometers.
Magnetic effect of current; fields due to parallel wires; field due to a solenoid; electro-magnets. Meters.
Induction; effect of rotating a coil in a magnetic field.
Mutual and self induction and inductance; effect of inductance on growth and delay of current.
Capacity; charging storage and discharge of condensers; through resistance and inductance.
Alternating currents; vector diagrams; effect of resistance variation; effects of L and C in A.C. circuit; phase difference of currents; resonance in a series circuit; parallel circuit of L and C; Q factor.
Elementary knowledge of valves; simple theory of amplifiers; oscillators and detectors; general principles of radio practice.

Suitable Candidates will be interviewed at local centres, and, if successful, will be enlisted and appointed Acting Sergeant Tradesmen. For those who are on the Schedule of Reserved Occupations, special arrangements will be made to enable them to be enlisted. In the event of any applicant found to be reserved under Schedule of Reserved Occupations special application will be made for relaxation of the Schedule. No guarantee can be given that this application will be successful.

Application Forms may be obtained by post card from the Under Secretary of State, The War Office (A.G.6c), Whitehall, S.W.1.

RADIO SERVICING

SPECIALISTS in service and repair home-constructed radio and multi-valve sets.—Harris, 37, Edgeworth Crescent, Hendon, N.W.4. Tel: Hendon 7153.

READERS' BARGAINS

ALLWAVE superhet coils with I.Fs. enquiries with offers to Murison, 59, Arthur Street, Dunfermline.

VALVES! Hundreds always in stock. Many tax free. —J. Bull & Sons, "Radio House," 4, Melthorne Drive, Ruislip.

V.G. synchronous-recording motor with P.U. and tracking gear. Motor alone cost 8 gns. last October. What offers?—R. H., 21, St. Bedes Road, Kingswood, Bristol.

RECEIVERS AND COMPONENTS

"RADIO Bargains." Few brand new 1940/41 models in makers' sealed cartons with guarantees, and used models at reduced prices, also valves. State requirements.—"Radio Bargains," 261-3, Lichfield Road, Aston, Birmingham, 6.

COULPHONE RADIO, New Longton, Preston.— Tungsram and American valves. Latest type P.M. Speakers, with transformer. 8in. Goodmans, 18/6. 10in. Rola, 22/6. Electrolytics, 500v. 8 mfd., 2/9; 8+8 mfd. (4 leads), 4/9; 16+8 mfd., 6/3; 50 mfd. 50v., 2/9. Goldring Pick-ups, with volume control, 17/6. Erie and Dubilier 1-watt resistors, 6/6 doz. Volume controls with switch, 4/3. Tubulars, valve holders, etc. S.A.E. new list.

SOUTHERN Radio's Wireless Bargains.
Most lines previously advertised still available. New list to be advertised shortly.
Southern Radio, 46, Lisle Street, London, W.C. 'Phone: Gerrard 6653.

RECEIVERS AND COMPONENTS

ENGLAND'S GREATEST BUYERS OF SURPLUS RADIO AND ELECTRICAL GEAR. STOCKS ASSEMBLED FROM GOVERNMENT, G.P.O., ARMY, R.A.F. AND PROMINENT RADIO AND TELEVISION MANUFACTURERS. PRICES ARE RISING, BUT ALL FREE OF PURCHASE TAX.

VALVES are in short supply. Stock of Mullard TSP 4's and HVR 2's to be cleared at **15/-** each. First come, first served.

TELEVISION diode valves. Surplus quantity to clear at low price. Unused Mullard Type EA50, midget type, size 69 mm. x 12 mm. overall. 6.3 v. heater at .15 amp., 10/6 each.

CONDENSERS.—Special offer of metal cased paper condensers, 300 v. working. Made by big and well known government contractor. All brand new and unused. 2 mfd., 1/9; 1 mfd. x 1 mfd., 1/9; 1 mfd., 1/-; .5, .25 and .1 mfd., 8d.

TUBULAR condensers, paper type 186. .5 mfd. 450 v. D.C. working, to clear, 5/6 doz.

RESISTORS, 10 watt, 100 ohm vitreous enamelled mains resistors, 1/3 each.

EX-BAIRD. Paxolin squares, 2⅜in. x 2in., to clear, **9d.** doz. Wax impregnated cardboard panels, 10½in. x 6in., **1/3** doz. 30 ohm volume controls, wire wound, **1/3** each. Short-wave coil 7.23 metres mounted on ceramic trimmer, **1/-** each. A big range of volume controls, 30 ohms, 200 ohm, 1,000 ohm, 2,000 ohm, 5,000 ohm, 1 megohm, all values **2/3** each. All above items are high quality television components, new and unused.

FLEXIBLE DRIVES. Well made, shielded cable drives for remote control. Ideal for radiogramophones. Approx. 2' long. To clear, **4/-** each.

ELECTRO-MAGNETIC COUNTERS. Resistance 500 ohms. Counting from 1-12,999. Size 4½" x 2" x 1¼". Ex-G.P.O. Invaluable for countless purposes, **9/6** each. A smaller type, 1-1,999, size 4½" x 1¼" x 1¼", **5/6.** Cannot be repeated, and doubtful if they can be purchased brand new to-day.

SMALL MECHANICAL COUNTERS, with striker arm registering up to 9,999. Heavily constructed to stand any amount of hard wear. To clear, **3/6** each.

VALVEHOLDERS. Belling-Lee special H.F. 5-pin, chassis mounting in black bakelite, **1/-** each, **10/6** doz.

PLESSEY Small block type condensers, two tappings, .0005 and 0.1 mfd., 350 v. test, **1/-** each, **10/6** doz.

SINGLE Earpieces. A good line for experimenters with flexible metal sheathing, chromium-plated. Only a few to clear, **2/6** each.

VARIABLE CONDENSERS. Well made heavy 3-gang superhet condensers. Die cast frames in first class condition. Low price to clear stock, **1/3** each.

SMALL REVERSIBLE A.C. MOTORS (as used for motor tuning). 25-30 volts A.C. Built-in reduction gear spindle. Speed about 60 r.p.m. A first-class job with hundreds of applications. **8/6.**

AUDAK PICK-UP HEADS. High resistance coil, made by the famous Audak Company of New York. Extensively used in sound recording and laboratories. Ideal for gramo turntable amplifiers, **6/6** each.

AUDAK CUTTING HEADS. Heavy duty type. 3-5 ohm coil. A really high-class instrument, **17/6.**

YAXLEY type switches, 2-way, **1/-**; 2 bank 4-way, **2/-.**

SCREENING shields in aluminium, 6½in. x 5in. x 5½in., brand new and unused, **2/6** pair.

COILS of wire. Approx. 30 gauge stranded sleeved wire, in coils weighing 12¾ oz., **2/-.** Also scanning coils, similar gauge, 9¼ oz., **1/6.** Also 17-gauge stranded cotton and rubber covered, 2 lbs. 11½ oz., **4/-.**

BULGIN 250 v. 5 amp. socket with plugs mounted on bracket, unused, **1/-** each.

OUTPUT TRANSFORMERS. Primary 300 ohms D.C. Secondary .5 ohm D.C. Brand new, manufacturer's type, **4/6.** Also new chokes, 30 henry, 150 ohms, **3/-** each.

RESISTANCES. Assorted values and makes, Erie, T.C.C. American, etc. Resistances are in short supply—get a dozen or so while you can. Low price of **1/6** doz.

WESTINGHOUSE Rectifiers. The popular type H.T.S. Slightly used, but guaranteed in good condition and working order. Only **8/6** each.

B.I. CONDENSERS. Block type oil filled in metal cases with terminals. High quality components. 4 mfd. 450 v. d.c. test, **3/6** each. Also .1 mfd. 1,000 v. d.c. test, **2/6** each and 0.25 mfd. 1,000 v. d.c. test, **2/6** each.

RELAYS. Small relays for operation on 2 v. D.C. with 6-way make and break switches. Brand new, many useful applications, **5/-** each.

TRIMMERS. Twin trimmers on ceramic base, brand new, to clear **6d.** each, **5/-** doz.

WEGO CONDENSERS. Tubular type, .1 mfd., 5,000 v. working, **5/6** each.

COIL FORMERS. Cardboard and Paxolin. Assorted sizes, useful for experimenters, **1/6** doz.

CONDENSERS. Metal-cased non-inductive, .5 mfd., **1/6**; 1 mfd., **1/9**; 1 mfd. x 1 mfd., **2/-**; 2 mfd., **2/-.**

SEE ALSO OUR DISPLAY ADVT. ON PAGE 1. SUFFICIENT POSTAGE MUST BE INCLUDED. REGRET NO C.O.D. ORDERS ACCEPTED.

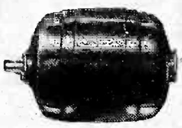
LONDON CENTRAL RADIO STORES, 23, LISLE ST., LONDON, W.C.2. 'Phone: Gerrard 2969

ELECTRADIX RADIOS

19, BROUGHTON STREET,

Queenstown Road, Battersea, S.W.8.

DYNAMOS



110 volts, .8 to 1 amp., D.C. ball-bearing, semi-enclosed, 15lb., 6in. x 5in., **15/6.** 200 volts, ½ amp., **21/-**, 200 volts, 1½ amp., **36/-.**

Double Current. Two commutators, D.C., 6-8 volts, 3-5 amps. and H.T. 400-600-volts, 100 m.a., 5½in. dia., 12in. long, 17lbs., 4,000 revs., ball bearings, **25/-.** Large size, 500 watts, 18 volts, 20 amps. and 460 volts, 200 m.a. **£5.**

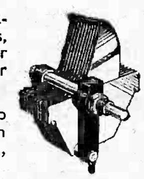
MICRO MOTORS

A.C. split phase motors, squirrel cage rotor, ⅜in. dia. Dog-clutch drive to reduction gear from 2,000 revs. to 58 r.p.m. Voltage 15 to 20 volts, 50 cycles, reversible, double shaft, enclosed, laminated, new. **8/-.** Post free.

SMALL D.C. MAINS MOTORS. 1/40 h.p. Type 60, 220 volts K.B. series, 1,750 revs., **15/-.** Ditto, 1/12 h.p. Croydon 110 and 230 volts shunt 1,700 revs., **30/-.** M.G. for A.C., 220 volts to 100 volts, 1 amp., D.C., **77/6.** 100 volts, **15/-.** All fully guaranteed.

ENGINE SETS

500-watt single cyl. 2-stroke water cooled Pelapone engine, mag. ign., coupled to 50-70 volts, 10 amps., shunt dynamo, 1,000 r.p.m., **£17/10/-.** Douglas twin engines, **£12.**



A.C./D.C. MAINS MAGNETS, 2-poles wound, 110 volts or 220 volts, lifts 7lbs., **4/6.** Hand-drive alternator magneto, 80 volts, .25 m.a., useful for A.C. tests, **10/6.**

CONDENSERS. Variable air solo Formo Condenser, .0005 mfd., boxed in original carton, **2/6.** Fixed. G.P.O., 2 M.F. smoothing, **2/-.**

NEW VALVES

General-purpose valves at a low price. "Weco" Peanut Midgets, 1-vol. fila., 4-pin base, **3/6.** Cossor 6-volt Power valves, AT40, **4/6.** Both these are Triodes. Neon lamps, standard, letter Cathodes 230 volts, **2/6.**

EDISON STEEL CELLS A4 & A8 also "NIFE"

RECTIFIER & BATTERY CHARGERS

All sizes. From one cell to 200. Westinghouse 1, 2 and 4 circuit chargers. R.C.G.I, D16, etc., in stock.

METERS

Weston and Turner moving coil, flush 2in. dial, 0-50 m.a., also 0-200 m.a., new, 3in. dial Lesdix meters, 0-1 m.a. At list prices. Elliott Model 108 Ammeter and Rheostat in case, bargain, **37/6.**

SIGNAL GEAR

MORSE KEYS. Type B.1, **5/-.** Type M., **6/6.** Type P.F., plated, balanced, **9/6.** The best key is Type IV. **12/6.** Govt. Fuller Service Key, few only, **17/6.** 8-way Switch-boxes, **3/6.**

BUZZERS. Cambridge-Townsend High-Note Model, "T" diaphragm blade, Smallest Buzzer made, **10/-.** Practice buzzers, **3/6.** Neat brass-cased, **4/6.** Heavy type, Bakelite, **5/6.** D.3 Buzzers, multiple windings, no contacts, **5/-.**

MORSE INKER Tape Recorders for sigs. on paper tape, new captured contraband, latest continental high-speed model. Also G.P.O. PHONE RECEIVERS for BUZZER SIGNALS L.R., fitted small horn, **7/6.** Wall, table and portable phones and field wire. Bakelite handcorns, **27/6.**

CRYSTAL SETS, 6/9. Many other bargains are available at our new offices and stores.

COME AND SEE US AT OUR

NEW ADDRESS

We have left Upper Thames Street, and our new offices adjoin our Works at Battersea, 19, Broughton Street, Queenstown Road, S.W.8, on No. 137 bus route. 2d. fare from Sloane Square or Clapham. Nearest Rly. Station: *Queens Road*, Battersea (S.R.).

ELECTRADIX RADIOS

Please send stamped envelope for all replies.

TELEPHONE: MACAULAY 2159

RECEIVERS AND COMPONENTS

SPECIAL CLEARANCE OFFER OF:—

AUTOMATIC Morse Code Senders. Useful to those learning the Code. Used in place of ordinary key to operate buzzer, etc. Instrument complete, assembled, **4/6.** Ditto, unassembled, **2/9.**

MORSE Tapping Keys, plated brass, ebonite knob on polished wood base, **1/6, 12/-** doz.

CERAMIC Ribbed Coil Formers, 2in. x 1⅛in., 3 for **1/-.** 3/6 doz. 1,000 ohm Resistors, **6d.** doz., **3/6** gross.

MICROPHONES, Standard G.P.O. Insets (not buttons), **2/-, 18/-** doz. Super-sensitive type, **2/9.**

TRANSFORMERS, Microphone, 100-1, uncased, **2/-, 18/-** doz. Line Cords, 6ft., **3/9.** Telsen, .002 fixed, **1/9** doz.

CRYSTALS, boxed, with Catswhisker, **6d., 4/6** doz. Permanent detector refills, **1/-.** Detectors, glass type, **1/9.**

WAVEMASTER S.W. Conds., .00016, **3/6**; .0002, **4/-.** 4 assorted dials, coloured transparent 3-band and S.W., **1/-.**

INSTRUMENT WIRE, 26 s.w.g., D.C.C., **5/6** lb. 10 lb. reels, **50/-.** 32 s.w.g., Enamelled, 2lb. reels, **10/-.**

PICK-UPS.—"Truvox" Super Amplifier Type, bargain, **17/6.** Finest Resin-Cored Solder, **4/-** lb., **48/-.**

KNOBS.—Brown Bakelite, 1⅜in. diam., 3/16in. spindle, **1/-** doz., **10/-** gross. Telsen ½ meg. Grid Leaks, **1/-** doz.

PUSH-BUTTON Units, 6-way, **1/6.** Ditto, plus manual drive, **1/9.** Buzzers, bakelite case, 2-6 volt, **2/6.**

SPEAKERS.—Goodmans P.M. with transformer, 8in., **17/6.** Ditto, little used, **15/-.**

Orders over **10/-** post free.

MIDLAND INSTRUMENT CO.,

18, HARBORNE PARK ROAD, BIRMINGHAM, 17.

GALPINS ELECTRICAL STORES

ELEC. LIGHT CHECK METERS, small, late type, good makers, fine condition, electrically guaranteed, 200/250 volts 50 cy. 1ph. A.C. 5 amp., **10/-**; 10 amp., **12/6**; 20 amp., **15/-**; post free.

D.C. ELEC. LIGHT CHECK METERS, 200/250 v., 5 and 10 amps., **7/6** post free.

THREE-WAY press button switches, fitted paxolin terminal strip, **2/-** post free.

AUTO. CHARGING CUT OUT AND VOLTAGE REGULATOR, ex-R.A.F., suit any dynamo up to 20v. at 15 amps. fully adjustable, with wiring instructions, complete in metal case, **3/6**, post **9d.**

WIRELESS CHASSIS (bomb surplus), containing many valuable modern components, shortly unobtainable, late type only, satisfaction guaranteed, **7/6** each, carriage paid.

SOLID BRASS LAMPS fitted small B.C. double contact holder and 12-volt bulb, price **3/-** post free.

110 VOLT D.C. MOTOR, totally enclosed, rated at 8 amps., ball bearing, in new condition, make good slow-speed dynamo, weight approx. 75lbs., price **45/-** carriage forward.

FLOODLIGHTS, 12in. dia., multi mirror, margin reflector in centre, take any bulb, **15/-** carriage paid.

ONE DOZEN A.S.S. wire end resistances and tubular condensers, all guaranteed sound, **2/6** per doz., post free.

MILLIAMPMETER by "Werton," 2½in., flush fitting, moving coil, reading 0-3 m/a, **40/-**; 0-50 m/a, **30/-**; and 0-200 m/a, **30/-**, all post free.

TRANSFORMER, 230v. input; output 2,000-0-2,000 v. at 200 m/a and two L.T.s, price **50/-**, carriage forward.

BLOCK CONDENSER, large size, 1, MF., 4,000 v. working, **10/-**, carriage **2/-.**

2 kW Transformer, complete with clamps, suitable for rewinding, **25/-** each; 1 kW. ditto, **17/-**, both carriage paid.

STEEL CABINETS, suitable for amplifiers, partly fitted racks, size 40ins. high, 24ins. wide and 16ins. deep, in clean condition, price **30/-** each, carriage forward.

DYNAMO for lighting or charging, shunt wound and interpole, output 110 volts 66 amps., price **£20,** carriage forward.

SIGNAL GENERATOR, maker "Philco," model 088, price **£5.**

ROTARY CONVERTOR, D.C. to A.C., input 24 volts (twenty-four) D.C.; output 220 volts at 3½ amps. 50 cycles, single phase, maker Electro Dynamic, price **£12 10s.**

ZENITH VITREOUS Resistances, assorted, useful sizes, all good **12/6** per doz., post free.

1,000 YARDS of hard drawn bare 14 G. copper wire on drum, suitable for outdoor telephone use, etc., price **£3 10s.,** carriage forward.

GALPINS ELECTRICAL STORES, 21, WILLIAM STREET, SLOUGH, BUCKS. Cash or C.O.D.

GEE GEE GEE GEE GEE GEE

15, LITTLE NEWPORT STREET, W.C.2.

THE HOUSE FOR FIRST QUALITY COMPONENTS AT LOW, COMPETITIVE PRICES.

AMERICAN AND B.V.A. VALVES. These are getting very short. We have many types available. Send us your lists for a quotation.

SPEAKER TRANSFORMERS. Now available, at 3/6 each. Perfect condition.

SOLDER. Very best quality resincore solder, 50 per cent. tin, 12 gauge, **6d.** a length.

ROLA SPEAKERS. P.M. 8", brand new, less transformer, **15/-** each.

CONDENSERS. T.C.C., .1 mfd., tubular, 350v. working, **7/6** doz.

VALVE-HOLDERS. 5-pin, 7-pin, 8-pin (octal), chassis type, **6d.** each.

STAMPED ENVELOPE must accompany all enquiries.

GEE ELECTRIC, 15, LITTLE NEWPORT ST., W.C.2.

FREE ADVICE BUREAU
COUPON
This coupon is available until October 4th, 1941, and must accompany all Queries and Hints.
PRACTICAL WIRELESS, October, 1941.

FREE!

THIS IMPORTANT GUIDE TO SUCCESSFUL ENGINEERING CAREERS

After months of intensive effort and research we are pleased to announce that the new edition of our handbook, "ENGINEERING OPPORTUNITIES," is now out of the publishers' hands and ready for *free distribution.* Containing 208 pages of practical guidance, this book is, beyond argument, the finest and most complete handbook on Successful Engineering Careers ever compiled. It is a book that should be on the bookshelf of every person interested in engineering whatever his age, position or experience.

The Handbook contains, among other intensely interesting matter, details of B.Sc., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.I.A.E., A.M.I.R.E., A.M.I.P.E., CIVIL SERVICE, and other important Engineering Examinations; outlines courses in all branches of CIVIL, MECHANICAL, ELECTRICAL, AUTOMOBILE, RADIO, TELEVISION, AERONAUTICAL and PRODUCTION ENGINEERING, DRAUGHTSMANSHIP, TRACING, GOVERNMENT EMPLOYMENT, *BUILDING* (the great after-war Career), *R.A.F. MATHS.*, etc., etc., and explains the unique advantages of our Employment Department.

R.A.F. PILOTS OBSERVERS ETC.

Special rapid Home-study courses in the essential branches of Mathematics. For full details of this scheme apply or write

B.I.E.T. (Dept. M409)
17, Stratford Place, LONDON, W.1.

WE DEFINITELY GUARANTEE "NO PASS—NO FEE"

If you are earning less than £10 per week you cannot *afford* to miss reading "ENGINEERING OPPORTUNITIES." In your own interests, we advise you to write (or forward the coupon) for your copy of this enlightening guide to well-paid posts—NOW. *There is no cost or obligation of any kind.*

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Principal: Professor A. M. Low

409a, SHAKESPEARE HOUSE,
17, 18 & 19, STRATFORD PLACE, LONDON, W.1.

TEAR OFF HERE

FREE COUPON

To B.I.E.T.,
409a, SHAKESPEARE HOUSE,
17, 18 & 19, STRATFORD PLACE,
LONDON, W.1.

Please forward, **Free of cost or obligation** of any kind, your 208-page Handbook, "**ENGINEERING OPPORTUNITIES.**"

Name ....

Address ....

....

....

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by THE NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rates including postage: Inland 7s. 6d. per annum, 3s. 9d. for six months; Abroad 7s. per annum, 3s. 6d. for six months. Registered at the General Post Office for the Canadian Magazine Post.