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By F. J. CAMM

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ROUND THE WORLD OF WIRELESS

The demands made upon the civilian population by the Military Service Act have resulted in a shortage of service engineers, and it is important to bear in mind that it is quite possible that many listeners will, for reasons of national economy, make their receivers last longer.

This means also that service problems will undoubtedly be more acute and thus there will be a great demand for service men and others capable of dealing with the problems which will arise. We have in the past given great prominence to questions of servicing and therefore continue in this issue with some further details on the subject.

There are many young readers who have been taking a very keen interest in radio construction and who would like to enter the service field, but who are not fully aware of some of the methods which may be adopted. It is not, of course, essential to have elaborate test equipment, although it is highly desirable if really comprehensive work is to be carried out. As an instance of what may be done with home-made apparatus we give in this issue details of a tester in which an ordinary beehive night-light type of electric lamp is employed. There are many other similar devices which can be made up and these will be dealt with from time to time.

H. V. Morton on Palestine

On June 21st H. V. Morton is to tell the schools about the people of Palestine. "The life of the village people," he says, "has changed very much since the time of Christ. Shepherds still watch their flocks on the hillsides... and the Arabs with their flocks and herds are still living like Abraham."

"Moonlight and Splash"

James Dyrenforth was recently responsible for the script of a crazy show called "Nuts in May." This was so successful that Tom Ronald, the producer, immediately asked Dyrenforth to get to work on another piece of madness. The result is to be heard on June 28th, when "Moonlight and Splash" (not "Nuts in June") will be broadcast with Joyce Grenfell, Billy Milton, Dick Francis, Helen Clare and Dorothy Summers in the cast.

An unusual type of television serial which was experimented with in America. It was claimed that better definition could be obtained by means of the paddle-like elements.

Children's Miscellany

The Children's Hour from Scotland on June 22nd has something for children of all ages and tastes. Christine will read "The Handkerchief Hero," a story by Mary Manners Simpson for very young listeners. A talk for stamp collectors will be given by A. K. Macdonald, an old favourite of children, and Summer Saturday Variety will include songs by Kathleen and Elliot Dobie.

"Film Festival" (3). "Shall We Dance?"

The third production in Douglas Mowle's "Film Festival" will be a revival of the radio version of "Shall We Dance?" which was first broadcast in December, 1938, and is to be heard again on June 24th. This is surely one of the best of the Fred Astaire-Ginger Rogers series, and contains one of George Gershwin's loveliest numbers, "In the Mood," a large favourite with listeners of all ages and tastes. A talk for stamp collectors will be given by A. K. Macdonald, an old favourite of children, and Summer Saturday Variety will include songs by Kathleen and Elliot Dobie.
All-dry Receivers

Details of the New Valves and Receivers which May Be Built Round Them  By W. J. DELANEY

It was announced some time ago that special valves were to be produced which dispensed with the accumulator, and thus simplified receiver construction and brought in less use the portable type of receiver. These valves are now available for the home-constructor, and as a result a new field of experiment is opened to him. The ordinary type of "battery" valve is designed for a filament supply of 2 volts, and the current taken is generally of the order of 1 amp. This means that when three or more valves are used a fairly substantial accumulator has to be employed or only a very short period of listening may be indulged in before the accumulator has to be recharged. When real long-distance reception is desired it is necessary to adopt a superhet type of circuit, and this means that at least four valves have to be employed. This adds to the filament current, and when the normal H.T. battery is used, this 9 volts is subtracted from the total available H.T. voltage, leaving in series. These units have been produced for deaf aids, and similar small receivers, and accordingly are not only very light in weight but also compact.

Valve Characteristics

The "all-dry" valves, as they are called, are designed with a filament rated at 1.4 volts, and there are five types, four having filament current ratings of 0.05 amp., and one a .1 amp. rating. The standard dry cell is rated at 1.5 volts compared with the 2-volts of a wet cell or accumulator as it is more properly termed. It will thus be seen that the new filaments are all right for a single cell, and it is thus possible to use four such valves with a total current consumption of only 2 amps. Although this is rather on the high side for small cells, it is quite within the bounds of a properly-designed single cell, and these are obtainable now incorporated in an H.T. battery. In some cases a number of the ordinary cells are connected in parallel, and these are, of course, then deduced from the total H.T. voltage, leaving in many cases only 90 volts or so for H.T. This combination of 1.5 volts and 90 volts is now much used in general use, and the battery in thus no larger than the ordinary type of 100-volt H.T. which is normally employed, although various ideas are incorporated to permit the overall dimension of the 2nd detector and A.V.C. stage.

Valve Types

The new valves have been produced in six types—a pentagrid frequency changer and an H.F. pentode, both of which are available as a straight-valve or fixed-value type, a single diode triode and two types of pentode output valve. It will thus be seen that the valves have been designed primarily for use in a superhet circuit, thus offering the widest range of possibilities in receiver design and also in efficiency for small receivers of the portable type. The type numbers of these valves are IATG (or IATVG for the variable-mu) frequency changer; INSG H.F. pentode (or INSVG for the variable-mu); 1HGC for the diode-triode; 1CGG for the output valve and 1AGG for the other output pentode. The latter has a .35 amp filament and is rated to deliver 100 milliwatts, whilst the former has a .1 amp filament and is capable of an output of 240 milliwatts. By using 5 of these valves in combination it is possible to have a superhet with a total anode current of less than 12 mA and this, combined with a total L.T. current drain of only 1.5 amps, means a considerable saving in all directions, whilst still giving a remarkable output and range of reception.

Receivers

The general design of receivers using these new valves is practically identical with that using ordinary valves, the only point of difficulty likely to be experienced by the average amateur being in the design of the 2nd detector and A.V.C. stage. On account of the fact that the valve used in that stage is a single diode-triode and not a double diode-triode which is more usually employed. A typical circuit is as follows, given the idea that the arrangement is quite simple, the usual loud resistance being eliminated and the L.F. volume control being used for this purpose. It thus combines a simplicity, a procedure which is quite satisfactory and which at the same time eliminates at least one component. In practice, the circuit is actually simplified in other directions.

Another interesting point in regard to these valves is that they are of the octal type, which means that they are not only standardised for valve base design, but that they are also extremely small—again adding to their usefulness in the sphere of portable design. It is almost unnecessary to indicate that grid-bias batteries are usually dispensed with in receivers employing these valves, the usual automatic biasing scheme being included. There is, however, just one point in this connection which should be borne in mind. The high current output valve requires a battery of 9 volts and, obviously, if automatic bias is used, this 9 volts is subtracted from the total available H.T. As the valves are already rated at 90 volts total, this loss of 9 volts might be found ill-considered in some receivers, and thus where extreme portability is needed (as in a transportable or a standard home-receiver), the high-efficiency output pentode would be used, together with a separate biasing battery. In that case, too, one of the larger 1.5-volt cells (a small bell cell, for instance) would be employed.

Characteristics

Below will be found the general characteristics of the valves already mentioned, although it must be appreciated that there may be slight differences in the products of different firms, whilst the type numbers are also slightly modified by some makers.

We shall shortly be describing a receiver using these valves, but in the meantime for those who wish to build up their own receiver, we include a complete circuit of a 5-valve combination superhet with H.F. stage and using the 1CGG output pentode.

The layout is not critical, but should follow the general lines of superhet circuits, paying particular attention to the screening of the H.F. stage and of the various I.F. leads and the L.F. volume control being used for this purpose. It thus combines a simplicity, a procedure which is quite satisfactory and which at the same time eliminates at least one component. In practice, the circuit is actually simplified in other directions.

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A Neon-lamp Tester

Details of a Novel Resistance Test Instrument

The ordinary neon lamp as sold for domestic lighting has applications other than that of an "electric night light." Perhaps its greatest sphere of usefulness is as a testing device for the radio constructor. Continuity and insulation tests, condenser tests, and the determination of the values of resistances are all possible with the aid of one of these useful gadgets.

Before carrying out any work with the lamp it is just as well to mount it in a holder on a small wooden base. A small "charging" board as used for accumulator charging from D.C. mains will answer the purpose very well. Such a board is illustrated in Fig. 1 and the wiring underneath is given in Fig. 2.

A "Flashing Sign"

The usual application of the lamp by the radio constructor is as a circuit tester and indeed, in this direction it is very useful. However, the purpose of this article is to give not only these tests but also a further use of the lamp, namely, a means of finding out the values of grid leaks and high resistances. By a suitably arranged circuit the lamp will give a series of intermittent flashes, the speed of the flashes determining the value of the resistances under test. Besides being a very interesting experiment in itself—it provides quite a novel "flashing sign"—it may be carried out by placing the prods across the suspected part. For instance, the insulation between the windings of a transformer or potentiometer is working properly, or potentiometer is working properly.

Testing Condensers

Owing to the comparatively high voltages used the lamp will provide a very stringent test of insulation and is, therefore, particularly useful in testing condensers.

Useful Tests

Before going into details of the "flashing sign" tests here are some of the more common applications of the lamp.

By fitting two insulated test prods to the ends of a length of twin flex taken from the terminals on the lamp board the lamp may be quickly connected to any part of the circuit or component under test without fear of the conductivity of the constructor's hands upsetting the results. The prods can be bought or are easily made from pieces of vulcanite rod with the flex passing through the centre and connecting with metal contacts sticking from the end of the prod. A couple of old fountain pens will make excellent prods. A hole should be drilled in the top of each pen for the flex to pass through while the original nib or a cheap brass one will do as the contact. The wire is soldered to the nib before it is inserted in the feed, as in Fig. 4.

To make the lamp glow it will have to be either connected to an H.T. battery or plugged into D.C. mains. When buying the lamp the voltage required should be stated. On touching the two prods together the circuit will be completed and the lamp will glow.

Fig. 2—The wiring connections for a board for test prods.

Testing the insulation of a fixed condenser with the neon lamp.

Fig. 1.—The neon-lamp tester ready for use.

The test prods are held in contact with the terminals of the condenser for a minute or two, as in Fig. 3. If the condenser is leaky a series of flashes will occur in the lamp, that is to say, that after a short time it will glow momentarily, and then go out again immediately, and then after a similar period of time it will suddenly flash again. If this only occurs at long and regular intervals, say once every minute, the condenser may be considered as O.K., although, of course, a perfect condenser would give no flashes at all. However, in a test of this sort allowance has to be made for any slight leakage in the lamp holder, wiring, and test prods, which would give the same effect as leakage in the condenser, so that an occasional flash does not mean the condenser is a "dud." In fact, this test is so searching that a flash every minute or half minute represents a leakage resistance of not less than several million ohms. It is when the flashes occur several times per minute or when they gradually increase in frequency that the insulation may be taken as very poor or broken down. This test may be applied equally well to fixed or variable condensers, but cannot, of course, be used for the electrolyte type.

A multitude of other insulation tests may be carried out by placing the prods across the suspected part. For instance, the insulation between the sockets of a valve-held lamp can be tried by placing the prods in the sockets themselves, or again, the insulation between the windings of a transformer may be checked by connecting one prod to one of the primary terminals and the other to one of the secondary terminals.

Continuity Tests

To test for breaks in the wiring of coils, transformers, etc., the prods should be connected across the terminals of the component in the same way as with a condenser. A continuous glow indicates that there is no break in the wire, but erratic glowing or no light at all means that there is respectively only a partial connection or else a complete break.

Another use for the neon tester is in determining whether a variable resistance or potentiometer is working properly. If the two terminals of the variable resistance, or, in the case of a potentiometer, the terminal joined to the slider and one of the other two, are connected to the lamp and the slider is moved slowly round, then any place where there is a faulty contact will be (Continued on next page)
A NEON-LAMP TESTER
(Continued from previous page.)
When the current is switched on there should be no glow or flashes from the lamp until the resistance is connected up. On placing a resistance in series with the lamp it will flash at regular intervals. There may be five, ten, twenty, or more flashes per minute until the lower values are reached. Along the base we mark the number of flashes per minute from 0 upwards. Now taking the first figures in the table we see that a resistance of 3 megohms gave 14 flashes, and one along the vertical line marked 14. Where they intersect at A we put a small point is illuminated. Instead of the variable resistance several fixed resistances may be tried. It will be noticed that each one will give a different amount of glow according to its value. This in itself will provide a rough means of finding out the value of an unknown resistance. As an example we may find that a grid leak of two megohms makes the lamp just glow, whereas a ¼ megohm leak makes about a quarter of the total area of the electrodes light up. If a leak of unknown value is then submitted to the test and found to give a glow area smaller than that of the ¼ megohm leak but more than that of a 2 megohm one, then we may fairly safely assume its value to be in the region of 1 megohm.

Obviously this method gives only approximate results, and has the drawback that a large number of known resistances is needed in order to be able to determine the value of any unknown one. A far more accurate and reliable method is that mentioned earlier, namely, the "flash" method.

Measuring Resistances
The circuit necessary is shown in Fig. 5. It consists simply of a large fixed condenser in series with the lamp, and an H.T. battery or other direct current source, while the resistance under test is placed across the condenser. A good idea is to divide the prods and connect the condenser with two wires to the lamp as in Fig. 6. Grid-leaf clips or stiff wires can be fitted to the condenser terminals to facilitate the quick attachment and removal of the resistances. A good quality condenser of about 2 mfd. capacity should be used, and when the current is switched on there should be no glow or flashes from the lamp until the resistance is connected up.

Fig. 5.—The circuit used when testing resistances by the method described in the text.

Example
From this it is a very simple matter to make the graph. For the benefit of those readers who may not be familiar with plotting graphs, this is how one is made. The results tabulated above were those actually obtained with an "Osglim" neon lamp and several good quality resistances. You will see that the resistances chosen vary from ¼ megohm to 3 megohms, therefore we divide the graph vertically into equal increments of resistance to cover this range. Along the base we mark the critical results, and that is there is sometimes a time lag between the flash and the voltage producing it. This means that although the upper critical voltage necessary for producing a discharge is reached, yet the discharge does not immediately take place. This is due to insufficient ionization within the lamp itself. However, it may be overcome by having a bright light, or another neon lamp glowing in the near vicinity of the test lamp, when the work is in progress.

BRITAIN'S VICTORY DRIVE
CONTINUING the new B.B.C. feature programmes describing Britain's drive on land, on sea, and in the air, and in the workshops of the country, a second series will tell the story of the part that Britain is playing in the Allied war against Nazism. These programmes, entitled "Marching On!," the first of which will be broadcast on June 21st, are to be put on the air at fortnightly intervals, alternating with the "Go To It" series. They will be under the general editorship of Laurence Gilliam, of the B.B.C. headquarters staff. Among well-known B.B.C. script writers and producers who will contribute to this series are Robert Kemp, Francis Dillon, Stephen Potter, A. L. Lloyd, Denis Johnston, and D. G. Bridson.

Fig. 6.—Measuring resistances by the "flash" method.

The idea behind this second series is that of a radio magazine showing the progress of the war for each preceding fortnight, throwing into relief by dramatised presentation or narrative the outstanding events which have happened. Major naval, and air, and news of the front and Empire news will be featured in this way and the underlying moral of these programmes will be that, although the road to victory has its ups and downs, the reverses will only serve to spur Britons on to still greater efforts which will end in the defeat of their enemies.
Aliens and Wireless Sets

I LEARNED from the Ministry of Home Security that all Germans living in this country, irrespective of age or grade, must immediately dispose of their radio receiving sets. It does not matter whether the German concerned has been in this country for half a century or more. It is illegal for him to own a wireless set. If any of my readers know of any German who owns a wireless set he should take immediate steps to inform him that it should be disposed of at once or, alternatively, the police should be informed. In this war we cannot afford to take risks, and I have no doubt that this new order will impose hardships on many Germans living in this country who are anxious to see Hitler defeated. But fifth-column activities in other countries have taught us a lesson. While the German troops have arrived, people who would never have been suspected of subversive action have guided the invaders, fed them and housed them. That must not happen here. There may be something in the suggestion that once a German always a German at heart. Do not be misled by the name of the hated Hitler. That may be part of the camouflage and the cunning, and is intended to disarm suspicion. It is the duty of every reader to raise any difficulty in the case of bona fide radio wholesalers or retailers, if the set is kept separate from the battery, and is securely wrapped up and sealed.

The military and the police ears are, I presume, exempt. Vans equipped with P.A. outfits are receiving cooperation. An amplifier is not wireless receiving apparatus. Moreover, it seems that portable receivers may be carried for short distances by hand without the police interfering.

With regard to Philco car radio they state that they are evolving a scheme which will shortly be circulated to dealers. Sets which use a vibrator unit can be operated by removing it and feeding alternating current of appropriate voltage to the primary winding of the vibrator transformer. I understand that Philco are about to introduce a transformer for the purpose. It must be noted that where an energised loudspeaker field is employed, further modifications are necessary.

Valve Standardisation

THE British Institute of Radio Engineers have formulated a policy which they have submitted to the Service Departments, the Ministry of Supply, and the Ministry of Labour. Their proposals are intended to help in the national emergency and are not made for controversial reasons. They think that if the proposals are adopted they would release from the radio industry skilled artisans, such as toolmakers, jig and tool designers, etc., as well as save valuable material including copper, iron, nickel, molybdenum, and glass. Also they would increase export trade, and simplify radio servicing.

Briefly, they propose a first step of a general adoption of the 6.3 volt 6.3A valves. This range of valves which, of course, includes a higher voltage range, is comprised by twenty types, as against the enormous number of other types. In some quarters this is thought to total nearly 1,000. They say that if receivers were designed on the use of these three types they would equal in performance any receiver at present available. They even suggest that there would be a greater all-round advantage, and at a lower cost to maintain over new consumer. For example, such features as automatic inter-station noise suppression, automatic volume control, post demodulator automatic volume level maintainer, would be obtained by the incorporation of the screened triode-heptode, the output tetrode, and a two system rectifier, be included without difficulty, thereby proving a sales advantage in the home and export field. Obviously, all receivers would have to be of the A.C./D.C. type, thus entirely eliminating the needs for mains transformers, and in the case of smaller sets eliminating the smoothing choke, thereby saving a considerable amount of high quality Swedish iron and copper.

The technical objection that certain specialised apparatus will still require specialised types of valve is undeniable, but does not materially affect the scheme, since, of the ten millions to twelve millions radio receiver valves absorbed by the radio receiver industry, well over 90 per cent. are used in sets in which the five specified types of valves could be satisfactorily used. The other 20 per cent. is made up of replacement valve business which, if the proposed scheme is put into effect, could easily be satisfied for the next 18 months to 2 years from the existing available stocks of diverse types. The specialised types of valve manufactured have always been less than 10 per cent. of the normal receiver valve business, and the adoption of the scheme put forward will undoubtedly expedite production of the specialised types which may still be required for the Defence Departments, the B.B.C., and the G.P.O.
HE history of music during the eighteenth century is really the story of "matters musical" rather than of music itself. Even more important than the invention of new harmonies and sounds was the discovery of new forms in which to write music; new instruments on which to play it; and new combinations of instruments for which to write it. The enormous progress in these departments of the art is what makes the century particularly illustrious; revolutions in harmony and kindred subjects were to follow in the next.

And their importance cannot be exaggerated. The sonata, which Bach, developed the first stages of "first movement," or modern sonata—binary form, which Haydn was shortly to perfect, and Beethoven, under still further transformations, to extend a hundred and fifty years later. Whilst Gluck infused it with lasting qualities by insisting on the equal importance of all its component parts, and choosing tragic and dramatic plots for his own examples, Mozart, a far greater genius, took it into the hands and with a series of incomparable masterpieces ensured immortality for himself and his works.

Haydn

Haydn’s development of sonata form opened up the vast world of the sonata, symphony, quartet, etc., without which music to-day would seem non-existent. Haydn’s own examples were to be greatly excelled by those of the divine Mozart, as his were, in turn, to be by those of the giant贝多芬. It is to Haydn’s first teacher of importance, that we owe the modern sonata. Without his experiments and discoveries it is doubtful what would have happened. Not only did the expansion of sonata form from the suites and overtures of Bach and Handel, ensure the eventual arrival of the symphony, but side by side went the great expansion of the orchestra— including the introduction of violins—to ensure that when it did arrive it would be the biggest and most comprehensive form that music was to evolve for itself; and the most satisfying. Beethoven’s master works set the seal on it for all time.

The Pianoforte

The invention of the "piano e forte" was a tremendous event which inspired the first of that gigantic series of compositions for the instrument, to which almost every composer of note has contributed ever since. Wagner and Elgar are lone exceptions. Only to-day does the fount of inspiration which the first hammer-actioned pianoforte set running, seem to be drying up. The modern virtuoso pianist is largely to blame. Unlike his predecessors he never finds time to devote to serious composition.

The PRACTICAL WIRELESS ENCYCLOPAEDIA

By F. J. Camm

Wireless Construction, Terms, and Definitions explained and illustrated in concise, clear language

From all Booksellers, or by post 8d. from George Routledge, Ltd., 60, Strand, London, W.C.2.
Voltage Measurements

An Explanation Regarding the Choice of a Voltmeter for Eliminator Output Measurements

I have been stated many times in these pages that it is essential to use the right type of meter when measuring such points as detector anode voltage, S.G., or, in other words, the output of a mains unit or eliminator. It still appears, however, that many beginners the difference between a low-resistance voltmeter and one of high resistance is a point of little consequence.

It should be clearly understood that a voltmeter, i.e., a milliammeter having a resistance in series with one of its leads, this resistance being usually enclosed in the meter casing. The function of the resistance is to cut down the current to the value permissible through the ammeter. When a voltage is applied across the output terminals of the ammeter-resistance combination (i.e., the meter terminals), a current will flow through the meter, causing a deflection of the needle. To avoid loss of time in calculation, the ammeter scale is marked in volts, so that while the current is still the actualizing force in the meter, the deflection is now registered in volts.

The value of the series resistance is governed by the current range of the meter, and the maximum voltage it is desired to measure. For reasons that will be explained later, this resistance must have a high value if accurate voltage measurements are to be obtained.

A milliammeter having a full-scale deflection of 2 mA. or less, may be converted into a reliable voltmeter; or, in other words, a voltmeter having a resistance of 500 ohms per volt, or more, will give sufficiently accurate voltage measurements for all ordinary wireless purposes.

Reason for Inaccuracy

A low-resistance meter is unsuitable for measuring eliminator voltages, because eliminators have a high internal resistance, due to the incorporation of smoothing chokes and dropping resistances. A low-resistance meter will naturally drain more current than a high-resistance instrument—Ohm's Law states that current is equal to voltage divided by resistance. This high current drain reacts on the source of voltage to be measured, thus causing an inaccurate indication on the meter.

Effect on D.C. Mains Unit

Let us take, for example, a simple 250 volts D.C. mains unit as shown in Fig. 1, having an output of 125 volts at 7,500 ohms. The voltage drop inside the eliminator will then be its internal resistance of 5,000 ohms multiplied by 1/40 amp., which amounts to 1000 volts. Therefore, when the eliminator is on load—that is, when the receiver is switched on.

As will be seen from the sketch, the total internal resistance of the eliminator is 5,000 ohms (500 ohms choke, plus 4,500 ohms dropping resistance). In order to obtain the specified output of 125 volts, the current consumption must be 1/40 amp. (25 mA.), and therefore the total circuit resistance must be 250 volts divided by 1/40 amp., which amounts to 10,000 ohms. We already have 5,000 ohms in the eliminator, therefore the external load (receiver to which eliminator is connected) must be 5,000 ohms. If a voltmeter having a resistance of 5,000 ohms is now connected across A and B, with the receiver switched on, the total load will be reduced to 2,500 ohms, because the meter resistance of 5,000 ohms will be in parallel with receiver resistance of 5,000 ohms. Therefore, the total resistance across the 250-volt mains will be 4,500 ohms (dropping resistance) plus 500 ohms (choke) plus 2,500 ohms (meter and receiver). This amounts to 7,500 ohms, and consequently the total current consumption will be increased to 1/30 amp. (250 volts divided by 7,500 ohms) and consequently the meter would not be the true output voltage. The foregoing calculations should also make it quite clear that the specified output voltages of an eliminator are only obtained when the eliminator is on load—that is, when the receiver is switched on.

Battery Receivers

In the case of the battery-operated receiver, a low-resistance meter will give sufficiently accurate measurement of the voltage of the H.T., L.T., and G.B. batteries, because the internal resistance of these is very low. If, however, it is desired to measure the H.T. voltage applied to the plate of a valve having a resistance in its anode circuit, for example, a detector valve preceding a parallel-fed transformer or R.C.C. unit, the low-resistance instrument again becomes unsuitable for the same reason as that given above in the case of the D.C. mains unit.

RADIO TRAINING MANUAL

Will all readers who have reserved copies of this book please claim them without further delay.
ELECTRONIC BREVITIES

Notes on Cathode-ray Tube Developments, and Photo-electric Cells

Removing a Danger

CATHODE-RAY tubes for certain purposes have to be created at extremely high voltages, a figure of 50,000 volts for the final anode not being uncommon. If by accident a short circuit should occur in the main H.T. supply, or should there be a flash-over, then the capacity which exists between the electron beam, and detecting coils and the anode, is capable of causing the coils to assume for a short period of time a potential of 50,000 volts which is negative to earth. This is, therefore, a source of danger to any engineers who may be working with the tube, and in addition, damage may be caused to equipment or components associated with this part of the apparatus. Various schemes have been devised to overcome or reduce this risk, and in one of the most up-to-date, inductive windings are connected in series between the main H.T. terminals, and those sections of the equipment associated with it. A flash-over or short-circuit will then be instrumental in producing a very large voltage drop across those windings, and this will have the effect of reducing very materially the momentary potential which is assumed by the detecting equipment.

A Triple Use

THE electronic multiplier continues to be developed for a variety of specific purposes, but in America details have been made available of this device which in the form proposed is said to be generally, suitable as a generator of oscillations, amplifier, or detector. The most important feature seems to be dependent upon the shaping and disposition of the secondary emitting electrodes, and for this multiplier they are constructed in the form of two or more conical rings. The walls of these rings are made to diverge in the direction of the final collecting electrode which is generally the high-potential anode, and to converge towards the cathode with which is associated a grid, also conical shaped. This grid has an open mesh, and is raised to a high positive potential with reference to the cathode. When the operating potentials have been applied and regulated to their correct values, the primary electrons released from the cathode surface are drawn outwards in a radial direction, and so strike against the inner wall of the initial conical ring secondary-emitting electrode. The primary electrons with the secondaries released by the impact are now attracted by the high voltage of the open mesh, and pass through the interstices at great speed to impact on the opposite inner wall of the second ring electrode. A further electron multiplication takes place, and this process continues until finally the amplified electron stream is drawn through an aperture at the top of the conical assembly to be collected by the final anode. Although the process of working is described, no details appear to be available to show exactly how the device works, and it is likely that any one of the three purposes mentioned at the beginning of the paragraph.

Enlarging by Projection

ACCENTRATED effort seems to be taking place abroad in order to perfect schemes, which can be regarded as quite satisfactory, for enlarging television pictures to a size comparable with that normally seen in an average up-to-date room. There is little doubt that this work will have many repercussions on any subsequent developments which take place in this country in the eagerly awaited post-war period. A large percentage of the present schemes incline towards the principle of replacing the fluorescent screen of the cathode-ray tube with a special form of surface which reacts to the modulated electron beam in such a way that each elemental area changes its degree of transparency or opacity in direct proportionality. The idea will be made clear by reference to the accompanying simple diagram where the light from an arc lamp is concentrated by means of a back reflector on to this special surface, while a projection lens directs the emerging beam towards a remote screen so that the final picture is enlarged by many diameters. In one of the most up-to-date of these methods the surface which acts as a light-controlled relay—shown in the diagram for simplicity as a series of apertures to correspond to elemental areas—is built up by depositing a very large number of tiny light particles over a rippled sheet of glass. This sheet is positioned close to the screen of the electronic relay so that as a direct result of the electrostatic charge of the electron beam impact the tiny particles orientate edgewise to the lamp beam instead of remaining broad-side. The actual degree of rotation will depend on the strength of the electrostatic influence which in turn has a direct relationship to the television picture modulation. Another advantage of this relay scheme is that there is a storage effect, for each element of picture remains bright or dark as the case may be for the whole period of a picture scan, and in consequence the overall brightness of the final enlarged picture is much greater than one where at any one instant only a single elemental area is operative.

Colour Response

ALTHOUGH photo-electric cells for different purposes have found their way into every form of modern industry, there is one particular feature that still needs careful observation, namely, the colour response. The perfect photo-electric cell for general purposes would be one which had a colour response exactly simulating the human eye, but so far the efforts of the inventors have failed to produce a cathode material which falls within this category. Some cells are colour sensitive at the red and infra-red end of the spectrum, while others work best in the ultra-violet light. As an indication of the extent of these variations reference can be made to the accompanying graphs where the percentage of maximum response of one or two representative photo-electric materials used for cells has been plotted against the wavelength of radiation in Angstrom units (A.U.). At 50 per cent. it will be seen that the eye covers the approximate range of 5,000 to 6,000. The same diagram shows how caesium oxide and caesium on silver oxide have really good sensitivity outside the visible spectrum at the infra-red end, while potassium has its best performance for different purposes have found their way into every form of modern industry, there is one particular feature that still needs careful observation, namely, the colour response. The perfect photo-electric cell for general purposes would be one which had a colour response exactly simulating the human eye, but so far the efforts of the inventors have failed to produce a cathode material which falls within this category. Some cells are colour sensitive at the red and infra-red end of the spectrum, while others work best in the ultra-violet light. As an indication of the extent of these variations reference can be made to the accompanying graphs where the percentage of maximum response of one or two representative photo-electric materials used for cells has been plotted against the wavelength of radiation in Angstrom units (A.U.). At 50 per cent. it will be seen that the eye covers the approximate range of 5,000 to 6,000. The same diagram shows how caesium oxide and caesium on silver oxide have really good sensitivity outside the visible spectrum at the infra-red end, while potassium has its best performance in the ultra-violet region.
Output
Smoothed

Unsmoothed

C2

Input

Fig. 1.—Smoothing circuit as used in mains units and receivers.

Choke-capacity L.F. Coupling

A similar application for a low-frequency choke is as a coupling between two audio-frequency valves. The connections are shown in Fig. 3, and are identical with the speaker winding is entirely responsible for the audio-frequency portion of the speaker current, while the alternating current component and also an alternating current component corresponding to audio-frequency power which will ultimately operate the loudspeaker. It is, of course, possible to pass the whole anode current through the speaker winding, and in many cases the loudspeaker will operate quite satisfactorily, provided its impedance is correctly matched to that of the output valve. But then the direct current portion of the anode current will pass through the winding as well as the alternating current component, and will have the effect of heating it up. This may not be of importance in the case of a small output valve, but the mean anode current of many large output valves is fairly heavy—say a matter of 30 milliamperes or more, and may be greater than the speech coil can carry continuously without overheating or even the risk of burning out.

One way of avoiding this is to employ a choke-capacity output filter, as shown in Fig. 2. A choke having a suitable inductance value is connected in the anode circuit of the output valve between the anode and H.T. positive terminal. The choke has a comparatively low resistance to the direct current portion of the anode current, but the audio frequency portion is choked back and taken as d.c. through the condenser C to the loudspeaker, and thence to the H.T. terminal. An additional advantage of this system is that, as the speech winding is entirely isolated by the condenser C from the high-tension voltage, there is no risk of shock or disarrangement of the loudspeaker or extension leads are accidentallyearthed.

Selection

We must now consider what points affect the selection of a low-frequency choke. Obviously, the first consideration must be to see that the choke has the correct impedance—the figure specified by the designer of the set. Next, it is important to ascertain that the rated inductance is obtained when the choke is carrying the full load current of the circuit. This is, of course, a matter of design. The inductance of the choke depends upon the number of turns, the size of the coil, and the size of the core, and the current carried. If the core is not of sufficient section, the iron may become magnetically saturated at, or even before, full load. If the steady, direct current component is sufficient to saturate the core, the alternating current component will not be able to produce the alterations in magnetic strength required, and the effective inductance will drop. The correct specification for a low-frequency choke, therefore, is that it shall be of a given inductance at a given current. All good makes of choke are rated in this way by the manufacturers.

The Resistance of the Choke is the next point to receive attention, especially in the case of smoothing chokes. If such a choke has a somewhat high resistance, a fairly big voltage drop will develop across it, and this voltage drop will be high when the current passing is high, and less when the current passing is reduced.

(Continued on next page)
CHOOSING A CHOKE
(Continued from previous page)

Three effects will follow: first, the drop in voltage due to the choke's resistance will reduce the anode voltage available for the various valves; second, the voltage regulation of the supply unit will be poor; and third, the receiver will be more prone to low frequency oscillation, hum, and motorboating because the resistance of the smoothing choke will be common to the anode circuits of all the valves.

Matching

If the choke is intended for use in a choke-capacity output filter, it may be necessary to obtain a tapped choke for impedance matching. Every listener knows that the impedance of the load in the anode circuits of an output valve must bear a certain relation to the valve impedance, and the best value of load impedance is usually quoted by valve manufacturers for each type of output valve. If the impedance of your output valve is not that of the correct value to form the optimum load for your output valve, you must adjust matters by employing either an output transformer of appropriate ratio, or a tapped choke. A tapped choke may be considered as a kind of transformer (the transformer is the technical name), in which the whole or a part of the choke winding acts as the transformer primary, while a part of the whole of the winding functions as the secondary. Tapped chokes giving a variety of different ratios can be obtained, as well as centre-tapped chokes for push-pull, quiescent push-pull, and Class B circuits.

Concerning the mechanical design of low-frequency chokes there is really not much to be said. The purchaser will naturally see that the general finish is good, and will attend to such matters as convenient and accessible fixing lug or feet, and solid terminals or soldering tags. Insulation is an important matter, particularly in smoothing and output chokes, and must be designed to withstand the full voltage to which the component is likely to be subjected.

It is sometimes necessary, especially in the case of chokes which are to be incorp-

orated in the receiver proper, to shield the component magnetically, in order to prevent stray magnetic fields from the choke inducing hum in other parts of the circuit. Shrouded chokes are enclosed in a metal case, and are connected to earth by the terminal provided. Shrouding is not so important in smoothing chokes embodied in supply units installed some little distance from the receiver proper.

chemical cleaners for switchers, etc., and these should be used when the receiver is sufficiently dirty to warrant their use. Normally, of course, an ordinary rag and a little elbow grease should be sufficient.

Contacts Wanted

PLYMOUTH: Member 6597, 90, Albert Road, Devonport.

Newcastle-on-Tyne: Member 6609, 43, Hume Street, Newcastle-on-Tyne 3, Northumberland. (Incidentally, we recommend our "Wireless Transmission for Amateurs" for the purpose mentioned by you.)

Wakefield: Member 6573, 131, Manygates Lane, Sandal, Wakefield. This member is anxious to contact anybody who listens to 100,000 metres, or anybody who has heard OK3ZN on 20 metres, during April.

Plymouth: Member 6295, "Lewyn," 643, Kenton Lane, Harrow Weald, Middlesex.

Dunfermline: Member 6583, 12, Park Crescent, Dunfermline.

Walthamstow: Member 6736, 18, Borwick Avenue, Walthamstow, E.17.

Change of Wavelength

MEMBERS who are interested in American reception should note that WPIT, Pittsburgh, Pennsylvania, has changed the wavelength on which it carries programmes, particularly in Bing Crosby's latest recordings. On Brunswick 02973 he sings "I'm Too Romantic" and "The Moon and the Willow," whilst on Brunswick 02974 "Sweet Potato Pie," all of which are from the film. The last tune is coupled with "Between 18th and 9th on Chestnut Street," which he sings with Connie Boswell.

NEW RECORDS

An interesting album issued by Brunswick this month contains a set of records for tap dancers. These new accompaniment records—the music is in the Russ Morgan manner—have been made so that they can be used for every possible tap routine—Brunswick 02914/7. Russ Morgan and his Orchestra, "Two Hot Hits of the moment on Brunswick 02959—"Woodpecker" and "In an Old Dutch Garden," whilst Ella Fitzgerald and her Orchestra have made "Baby, What else can I do" and "Lindy Hopper's Delight" on Brunswick 02951.

Tunes from his latest film "The Road to Singapore" figure prominently in Bing Crosby's latest recordings. On Brunswick 02973 he sings "I'm Too Romantic" and "The Moon and the Willow," and on Brunswick 02974 "Sweet Potato Pie," all of which are from the film. The last tune is coupled with "Between 18th and 9th on Chestnut Street," which he sings with Connie Boswell.
A "Switch-in" H.F. Unit
Details of a Simple Fixed-tuned H.F. Amplifier which can be Brought Into Action Quickly when Required

By FRANK PRESTON

NOW that the majority of listeners use only the B.B.C. "Home" or "Forces" programme, the simplest type of receiver is generally sufficient to provide good reception. A receiver of the 0-2 type, for example, will give very satisfactory results in most parts of the country. This is a particularly important point when a battery set is in use, for battery current can be saved.

As everyone has found out, however, there are times when reception suddenly falls off, the programme becoming very weak or even inaudible until the volume control is tuned up. And when that is done background noises are sometimes troublesome or reproduction is too weak for comfortable listening. A high-frequency amplifier provides the best and simplest means of overcoming this difficulty, but since the amplifier is required only on certain occasions—and then it is usually for only a very short time—it is an advantage to be able to switch it out of circuit.

Alternative System

There are various methods of arranging the switching in an H.F. receiver, but some of them are not conducive to efficiency. In fact, it is an axiom that switches should be avoided wherever possible in H.F. circuits. One method is to transfer the aerial lead-in from its usual terminal to the anode terminal of the H.T. battery, which is because the choke is connected between the anode and the H.T. battery, which is not in the interests of national security, as has been announced on various occasions.

Simple H.F-Amplifier Unit

Details have often been given in these pages of H.F. amplifier units, but for the purpose under consideration a simpler form of unit is often to be preferred. As the receiver is used almost exclusively for the reception of the two B.B.C. programmes it is possible to use a fixed-tuned amplifier, in which the tuning circuit consists only of a medium-wave coil and a preset condenser.

Fig. 1 shows the type of circuit which may be used conveniently. As may be seen, there is a coil with a preset condenser in parallel, and this is connected in the grid circuit of an H.F. pentode. A change-over switch is fitted, by means of which the aerial lead may be connected either to the top end of the pre-tuned circuit or to the aerial terminal of the Det.-L.F. set. In addition to this there is a two-pole on-off switch; this is used to break the filament circuit of the H.F. pentode and also to disconnect the anode coupling condenser from the aerial terminal of the receiver when the unit is not required. To bring the unit into action it is necessary to operate the aerial switch so that the aerial is connected to the top of the pre-tuned circuit and also to close the two-pole switch. This completes the filament circuit and also connects the anode circuit to the input tuning circuit of the Det.-L.F. receiver.

By following this arrangement it will be seen that the H.F. choke is isolated from the detector tuning circuit when the amplifier is not in use. Although two separate switches are shown it would be a simple matter to gang them or to use a three-pole change-over switch. This should, for preference, be of the anti-capacity type, since some Q.M.B. switches are not altogether satisfactory for use in tuning and H.F. circuits.

Both Programmes

Only a single preset condenser is shown in Fig. 1, and this would be adjusted to bring the circuit into tune for either of the two B.B.C. transmissions—probably the
Practical Details

No matter which of the switching methods is adopted, the H.F. unit can be made in very simple form, using a small baseboard to carry the valveholder, coil and H.F. choke, and a small panel to carry the switches and, if desired, the preset condensers. The whole could well be fitted into a compact box to stand alongside the receiver. Terminals, on a terminal mount, should be used for the aerial and earth leads, but all other connections may conveniently be made with direct flexible leads running to the H.T. battery and the set.

The aerial and earth leads could be transferred from the receiver to the amplifier unit, and the b.c. lead would be connected to the aerial terminal on the set. H.T. and B.T. should be fitted with wender plugs and connected to 75- or 150-volt points on the H.T. battery, or to other sockets which provide the most suitable voltages. It is most convenient to connect the combined b.c. - L.T. - lead and the L.T.+ lead to the corresponding points on a valveholder in the receiver, but they may be taken directly to the batteries if the amplifier is switched off each time the receiver switch is turned to the off position.

The principle of the main switching does not differ from that shown in Fig. 1, but is to be preferred when a fairly long lead must be used between the aerial lead and a two-pole switch; it may also be found better to screen the aerial lead running between two separate switches.

Circuit-diagram of a parallel tuned circuit as described in the text.

The circuit diagram shows the grid G of valve T connected to the upper or unearthed side of the resonant circuit LC, while the plate P is connected to radio-frequency energy to the lower, or earthed, end of the resonant circuit; it will be understood that the grid and plate electrodes may be reversed in position.

While the proposal has been described with reference to the first tuned circuit in a wireless receiver, it will be understood that it may be applied to any tuned circuit whether it be used in a receiver or in a transmitter in connection with an oscillator, frequency changer or detector, or merely as a wave-meter. The arrangement described has been developed by the laboratories of the Radio Corporation of America.

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**Automatic Reduction of Static Interference**

A Brief Description of a New Use for "Westectors"

By W. A. FLINT

Most readers will be familiar with the use of "Westectors" for detection, A.V.C. and battery economy, but they may not know that they may be used as automatic "silencers" in communication receivers and the like, where static and automobile interference must be reduced to a minimum.

If such rectifiers are worked below the bottom bend of their characteristic curves (see Fig. 1) by keeping the normal audio voltage impressed on the rectifiers low enough to prevent the operating point of voltage impressed on the rectifiers low enough to prevent the operating point of the characteristic curve to the straight portion, and are connected back to back to give a non-linear characteristic in both directions, all audio voltages above this level will move the operating point up to back to give a non-linear characteristic and be reduced to a minimum.

Such circuits will considerably reduce the level of noise peaks and bring it to a level of about 15 milliwatts, which corresponds to comfortable headphone strength. These rectifiers will absorb any excess voltage such as that caused by static, which might otherwise cause loud "clicks" in the phones. When using this circuit, however, it is essential to isolate the phones from the H.T. supply by transformer or choke-capacity coupling. Otherwise, there will be a voltage drop across the headphone coils, which will serve to bias the rectifiers, and cause them to operate on the wrong part of their characteristic curve.

Another simple noise silencer circuit is shown in Fig. 5, where two "H" type rectifiers are connected across the centre-tap of a choke and the "earth" line of the receiver. The choke is connected in the normal combined resistance and choke-capacity coupling circuit, and the size of the "H" type rectifiers used depends upon the maximum audio-frequency signal voltage which is developed across the centre tap of the choke, and the "earth" line. For a maximum audio voltage of 2, type H.10 rectifiers should be used, for 4 volts the H.20, 8 volts the H.30, 16 volts the H.40, and 10 volts the H.50.

Such circuits as those outlined above may require minor adjustment to suit prevailing local conditions, but where static interference is experienced, their use will definitely prove of benefit in reducing such interference to a minimum.

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**THE FLYING REFERENCE BOOK**

by F. J. CAMM

A Complete Guide to All Types of Aircraft, which is especially useful at all Branches of Flying.


Price 5s. from all bookstores, or 5s. 6d. by post from C. Arthur Pearson, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.
in order to prevent uncomfortable listening. I tried a scheme once where I used two separate aerials, pointing in different directions and that also gave some freedom from fading, but introduced a difficulty due to an unbalancing of the input with the result that an effect very similar to fading was actually introduced. This was proved by using another set at the same time and whereas this gave fading at times, which was connected on the other set with the two aerials, there were times when a constant signal was received on the "comparative" receiver, but the signal from the two aerials actually faded. I should like to hear of the results experienced by other experimenters who have experimented with anti-fading devices. G. TREDGE (Winchester).

**Problem No. 405**

A BROWN had a A.C. mains receiver which worked well for some time, but suddenly developed a fault of the following nature: When adjusted for normal volume the results were almost as good as when the set was first installed, but as soon as the volume was reduced somewhat more was required. What caused the trouble? Three books will be awarded for the three correct solutions quoted. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newsens, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Each entry must be marked Problem No. 405 in the top-left-hand corner and must be posted to reach this office not later than the first post on Monday, July 22nd.

**Solution to Problem No. 404**

When Kent introduced his output circuit employing the oscillator he overlooked the fact that the L.F. choke would have a much lower resistance than 50,000 ohms, and, accordingly, the use of the latter component, in view of the high anode current of an output valve, resulted in the loss of substantial H.T. voltage and the valve accordingly failed to deliver the original output. The following three readers successfully solved Problem No. 403, and books have accordingly been forwarded to them:

D. Hay, Argyle House, 12, High Avenue, W.9.
C. A. Low, 10, Whitley Road, Stockport.
D. Ahlton, G. Ward, County San., Haresfield, Middx.

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**HUM REDUCTION**

MAINS hum in the output of a wireless receiver or low frequency amplifier is usually attributed to imperfect smoothing of the rectified alternating current supply, but it may be present if the lead-in conductors of indirectly-heated valves. The hum currents in such a case may be due to the capacity between the input and output of the grid and heater. Again, the heater itself may act as a grid to vary the current flowing from the anode to the cathode and thus produce hum. The alternatives which I think to be described have been found effective in reducing hum produced by the causes mentioned.

Referring to Fig. 1, an octal valve base is shown, and the electrodes to which the pins are connected are indicated. The shell or metal envelope of the discharge device, which is connected to the terminal 4, is commonly connected through external connections to the heater terminal 3, and to earth because of the greater convenience of wiring adjacent terminals together. The opposite heater terminal 7, it will be observed, is adjacent to the control grid terminal 6. The capacity between these two terminals, or more particularly between the lead-in conductors extending from these terminals up through the envelope, which capacity is indicated by dotted lines 9 in the figure, is sufficient to induce into the grid circuit objectionable hum which is produced by the current flow in the circuit. In fact, this voltage after amplification by two or three amplification stages may amount to as much as 10 volts, and is thus decidedly objectionable. This voltage may be very substantially reduced by tapping the heater terminal 7 through the external connections, this terminal being the one nearer to the control grid. The metallising terminal 4 is then connected to the terminal 7, and terminal 3 is, of course, not earthed. This change in circuit configuration has been found effective in reducing the hum voltage produced by the capacity, and is easily done by merely connecting the terminal 3 to earth. The same is true of the cathode as well, although some care is necessary as the grid is at a high potential.

Fig. 2 shows a valve circuit in more complete detail. The valve 10 has a mains unit which supplies approx. 250 v. at 80 mA, and I should make the parts of this as high as possible; for instance, I have used a unit which supplies approx. 250 v. at 80 mA, and 4 v. at 4 amps, which I should use. I think parallel trans. coupled for the L.F. stage should be employed. R. GUILLAME (Weybridge).
With the connections shown it will be observed that due to the cathode heating current supplied by transformer 12, the potential of the heater varies cyclically with respect to the potential of the cathode. This heater has the effect of a grid within the discharge device in that when its potential varies in the positive direction, the current in the anode circuit increases, and when it varies in the negative direction, the anode current decreases.

In order to eliminate the hum resulting from these variations, a voltage is supplied between the control grid and the cathode, which tends to oppose these variations in anode current. It has been found convenient to supply this voltage across the cathode bias resistor 11, and this is effected by the shunt combination of resistance 22 and condenser 23, the latter being connected between the cathode of the discharge device and the terminal 3 of the heater. It has been found that by properly proportioning this resistance and condenser relative to the resistance 11 and condenser 21, a voltage may be produced across resistance 11 tending to make the grid sufficiently negative with respect to the cathode during the half cycles of the heating current, when the anode current tends to increase just to overcome these variations. To effect this, it is merely necessary that the voltage supplied to the cathode through resistance 22 be in phase with the voltage supplied to the heater, and it may easily be shown that this condition obtains when the time constant of resistance 22 and condenser 23 is equal to the time constant of resistor 11 and condenser 21. By the use of this connection, including resistance 22 and condenser 23, the hum voltage may be reduced to substantially less than half that which is produced when these elements are omitted from the circuit.

Of course, the tendency of the anode current to increase, due to variation in the heating current, is opposed to a slight extent by the potential produced on resistance 11 by the passage of this anode current. That is, an increase in anode current produces a larger potential on resistance 11 which, in turn, drives the grid more negative and tends to maintain the anode current constant. This effect, however, is far too small to be of importance in the elimination of hum, and for effective elimination of hum it is necessary to supply a greater voltage across resistance 11 as is done by resistance 22 and condenser 23.

Fig. 3 shows a modification of the arrangement in which the heating current is supplied from a transformer 12 as in Fig. 2. The secondary winding of this transformer, however, has an intermediate point which is connected to the terminal 7 of the heater, the terminal at one end of the secondary winding being connected to the opposite terminal 3 of the heater, and the other terminal of the secondary winding being connected through grid coupling resistor 14 to the control grid of the discharge device. In this way it will be seen that when the heater is driven positive with respect to ground, thereby tending to cause the anode current to increase, the grid is simultaneously driven negative with respect to the cathode, thereby tending to oppose the increase in anode current, and thus prevent the production of hum. This system was developed in the Laboratories of the G.E. Company of America.
Mains Components

I have been given an indirectly-heated A.G.C. valve and as I have not had one of these before I am a bit puzzled about the circuit. Who can you tell me what are the connections to it, please? Another problem is, if an H.T. battery is used for H.T. and a mains transformer for L.T., is the negative end of the H.T. only connected to earth? — L. N. H. (Fellham).

The centre tap of an indirectly-heated A.C. valve is the cathode connection. The heater (or filament) is also a means of heating the valve, and to obtain the emission and thus the main point of connection is the cathode. It may be regarded as the essential filament pin in an ordinary bulb. Therefore, the simple detector stage the cathode would be joined direct to the earth line and the grid lead would be joined direct to the cathode. In an L.F. stage the bias required is obtained automatically by inserting a resistance between cathode and earth, the value being chosen according to the normal anode current and the voltage required. A by-pass condenser is shunted across the resistance. When the two sources of supply mentioned in your second query, the centre tap of the heater winding for L.T. must be joined direct to earth. If there is no centre tap you must connect a low resistance across the winding, and earth the centre tap you must connect a low resistance across the winding, and earth the centre tap of that. Special small adjustable components are available for this purpose and are known as ‘hum-dingers’.

Faulty Components

I have built two or three sets recently and they have all failed to work properly. I have corrected the faults of these parts I used and should be glad if you would send me a blueprint to enable me to build a good set with these parts, as I do not want to go on trying out troubles. — L. J. H. (Leyton).

We assume that you have built circuits of standard design and have not treated the parts in any arrangement. As most circuits to-day have been standardised it is not worth while our recommending another circuit as it would be more likely to do the same job as good work. The critical component is the critical component. If you look back through many of our past issues you will see that we have often put the coils underneath the lamps and condenser are always on top of the chassis, and the result is that the lamps seem connected in a special way. — T. N. (Winchester).

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I have a well-known make of P.A. amplifier delivering 10 watts. This has been used for some time for dance work but there is not much doing now and I should like to use the amplifier for radio work. I believe it is possible to add a form of tuner to this and should like details as to the best way of doing this. Have you any designs you could offer? — P. E. (Keighley).

Yes, you could build either a simple H.F. detector unit for local-station reception, or a powerful superhet unit for general work. In the former you have to include a detector stage and this would provide the output for feeding your amplifier in the same way as a microphone or pick-up. We have described one or two H.F. units in the past, and for general work we would recommend a superhet unit comprising of frequency changer, I.F. and 2nd detector, with A.V.C.

Pilot Lamps

I am constructing a receiver from a 'commercial' diagram and there is one little point I should like clarified. You will note from the extract I send that there are four small circles marked 'pilots.' I assume, are dial lights, but I do not wish to use four and wonder if there would be any readjustment to the circuit needed as the lamps seem connected in a special way. — T. N. (Winchester).

The dial lights, or pilot lamps, are normally used for a multi-waveband dial, each being switched for the waveband in use. There is therefore only one trip in circuits, and in the circuit in question an ordinary 6-volt bulb may be used. The lamp is joined in parallel with each of the single valveholders, and the only thing to do in the circuit in question is to ignore all the switch wiring to the lamps. Do not use a 4-volt filament as the ordinary, or an A.C. and a 6-volt filament will therefore be more suitable and give longer life.

Low-loss Insulation

I have noted that some modern parts are mounted on boards which look like glass and I have been told that this gives higher efficiency. I have an old well-known make glass dish on hand and wonder if I could cut this up and use it for insulation purposes? Would it be suitable, and if so, what is the best method of drilling it? — G. A. C. (Oswey).

The material in question is only needed if you desire to improve the improvement from its use on broadcast-boards being offset by losses in other parts of the circuit. For 5 metres and below the material offers advantages, but you would not doubt find that the material you have would be difficult to work and, furthermore, insufficient; flat sections would be difficult to get out. Good quality paxolin or the special ceramic insulation would be almost as good, unless you were to make highly efficient transformers. This set and then special precautions would have to be taken with all other parts of the set.

**REPLIES IN BRIEF**

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

M. J. M. B. (Shiffrbury). Write to the Columbia Company and to F. L. Masters, Forest Way, Pound Hill, Croydon, Sussex.

M. F. (Southwark). Get into touch with the makers. There may be a faulty component, probably one that has been broken, etc.

L. T. R. (Oswey). The original component is a standard carbon button, but it may be substituted by the Bulin capacitor, type E.F.10.

M. G. (Newport). We are looking into the matter, but we cannot find any details as to the point raised. Write to F. L. Masters, St. John's, Belfast. You must use a driver stage in the circuit in question. Do not try to modify the detector stage in the circuit in question.

J. L. L. (S. E. I.). We have no details of the set in question, but we think it is not advisable to try to modify it on the lines you suggest.

E. H. (CasaRaven). We have no details of the set and therefore cannot advise on the point raised.

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

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9426, 9427, 9428.—Fox, P. X.—Coil winding machines. May 29th.

9290.—Kreischer, George D.—Lock-on wireless set. May 27th.


9124.—Page, R.—Wireless aerial systems. May 29th.

9244.—Page, R.—Wireless antenna systems. May 29th.

9128.—Philo Radio and Television Corporation.—Loop antenna circuits. May 23rd.


9160.—Slater, G.—Automatic grano-phones. May 24th.

Specifications Published.


52490.—Thorton, A. A. (Philo Radio and Television Corporation.).—Noise-limiting circuits for carrier-wave communication systems. May 27th.


Printed copies of the full Published Specifications only, may be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

Notes from the Test Bench

Magic-eye Tuner

We have heard recently one or two cases where listeners have broken a valve or the connection to it. In each case the valve in question was the magic-eye tuner fitted to some commercial receivers by means of a horizontal fitting which leaves the end of the valve projecting slightly through a round escutcheon on the panel. Normally this should be quite satisfactory, but apparently careless cleaning has been responsible for pushing the valve in or something has fallen against the front of the set and the valve has received a severe blow. This type of trouble may be overcome in a simple manner, and in fact the following idea is also applicable to home-made receivers where this type of indicator is required. The valve is mounted in the ordinary way on the chassis, preferably towards the front. A small mirror is then mounted at an angle of 45 deg., above the valve and a hole is cut in the panel and provided with a slightly projecting screen so that the reflection of the valve to pin, the mirror may easily be seen. An additional refinement is to mount a small magnifying lens between the valve and mirror so that a larger image may be obtained.

Marking Valveholders

At one time it was customary for some set makers to label the valveholder on the receiver with the type of valve to be used. This is a good idea for the home constructor also, as it is possible in many modern sets where a single bias circuit is used, to get at the present time, stock which will give immediate delivery. Push-pull quads, fitted with a telephone or portable telephone, Etunings by making special use of the E.T. phone. Portable Exchanges in wood case, difficult at the present time, stock which will give immediate delivery. Push-pull quads, fitted with a telephone or portable telephone, Etunings by making special use of the E.T. phone. Portable Exchanges in wood case, difficult at the present time, stock which will give immediate delivery. Push-pull quads, fitted with a telephone or portable telephone, Etunings by making special use of the E.T. phone. Portable Exchanges in wood case, difficult at the present time, stock which will give immediate delivery. Push-pull quads, fitted with a telephone or portable telephone, Etunings by making special use of the E.T. phone. Portable Exchanges in wood case, difficult at the present time, stock which will give immediate delivery. Push-pull quads, fitted with a telephone or portable telephone, Etunings by making special use of the E.T. phone. Portable Exchanges in wood case, difficult at the present time, stock which will give immediate delivery.
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