TWO FREE GIFTS NEXT WEEK!

Practical Wireless

THE MODERN ELECTRIC EYE

THE WORLD’S HANDIEST AERIAL

SELF ADHESIVE
BEST PICK-UP
NEATEST

A revolutionary idea in Aerials. Just unroll the tape and press it up in position around the room or up to the attic—and it sticks. One pull and it’s down and leaves no mark. No danger from lightning, reduces static interference and increases selectivity. Ideal for artistic homes. Excellent pick-up for flats. Obtainable everywhere. British Pix Co., Ltd., London, S.E.1.

PIX INVISIBLE AERIAL 2' - DOUBLE LENGTH 3/6
That’s where the Screened Pentode starts its work

No longer does the signal have to pass right through to the output stage to reach the Pentode valve. Because here is a valve designed to bring Pentode Power into the aerial stage—to modernise radio design into Pentode-Detector-Pentode circuits. It is a great step! Remember how Mullards first introduced Pentode Power into the output stage of receivers! And then realise that here at last comes Pentode Power in the early stages—realise that this valve brings old A.C. receivers up-to-date. Ask your dealer about this new Screened Pentode. It is another Mullard Master Valve—*which speaks volumes.*

**V P 4**

**S P 4**

**PRICE 17/6**

Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You’re under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. D.N.B.

What of Television?

THERE are distinct signs that television is at last coming into its own, and the public is realising that, although present-day television transmissions are not perfect, they are at least capable of providing excellent entertainment. Until lately the degree of perfection to which wireless telephony has attained has been offered as an excuse for the statement that radio is rapidly approaching finality. Such a statement is obviously far from the truth, since no sound can be really "complete" without the associated "vision." It is a very short time since moving-pictures were considered to have become well-nigh perfect, but immediately it was found possible to synchronise sound and music with the pictures, ideas underwent a rapid change. To-day "silent" films would be scoffed at, and in precisely the same way it is safe to predict that "vision-less" radio will very soon be a thing of the past.

The change-over to televised wireless transmissions as common sources of entertainment will probably come "in a night," and it behoves every interested amateur to make himself acquainted with the principles of television at the earliest possible opportunity. It is very largely with this idea in mind that we commenced to present to readers of Practical Wireless a short time ago our "Television Supplement," the popularity of which has already become very apparent to us. Practical Wireless has, since its inception, gained a wonderful reputation for presenting a vast number of facts and a maximum amount of information in concise and interesting form, and readers may rest assured that the self-same principles will apply to the many articles on television which will be given.

Perhaps there are some readers who consider television beyond their comprehension, or who think that the necessary apparatus is either complicated or costly. To any such persons we would suggest that they carefully peruse some of the television articles, after which we are convinced that their views will completely be modified. To other readers who have already assimilated the fundamentals, or who have commenced to experiment with television, we would say that they will find all the additional information and constructive details which they require contained in our regular feature, the "Television Supplement."

A Secret Out

For some time the Editor of Practical Wireless has been hard at work on what motor car manufacturers delight to refer to as a "hush-hush" task. The nature of this has been kept secret until just recently, when it has become known in the office that Mr. Camm has been designing another new receiver for his production.

TWO FREE GIFTS NEXT WEEK!

(1) The Practical Wireless "1934 Wavelength Guide and Station Log." A up-and-down chart containing a list of the important stations and their new wavelengths, as laid down under the Lucerne Plan.

(2) A valuable booklet entitled "Making Your SET SELECTIVE." The problem of selectivity has become acute, and this specially-prepared booklet will show you how to improve your receiver to cope with modern broadcasting conditions.

F. J. CAMM'S 1934 FURY SUPER.

Next week's issue will also contain details of Mr. F. J. Camm's 1934 Fury Super. Every reader will be interested in his latest receiver, and readers who built the "Fury Four" (described in January and February last year) will be enabled for a few shillings to bring their receivers entirely up to date. The demand for the next issue, in spite of a greatly increased printing order, will be colossal! Reserve your copy now!

Practical Mechanic's for January


This modern and practical monthly magazine is lavishly illustrated and has an attractive new three-colour cover each month. Get a copy to-day.

Mr. W. O. Twells

It is with deepest regret that "His Master's Voice" announces the death of a valued member of their Advertising Department; Mr. W. O. Twells. He died on December 16th at the age of forty-five years; after a week's illness, culminating in double pneumonia.

Mr. Twells joined "His Master's Voice" in May last, after having been in charge of the radio section of Columbia advertising for four years. He was previously with Celebritone, Ltd. He leaves a widow and two young children. The funeral took place on Tuesday, December 19th, at which prominent members of both "His Master's Voice" and Columbia staffs were present.

ENSURE YOUR FREE GIFTS BY ORDERING NEXT WEEK'S ISSUE NOW!
Neutral Broadcaster for Holland

So far, the two Dutch transmitters, Hilversum and Huizen, have been run by a number of political and religious bodies, who in the course of their programmes have introduced a considerable amount of propaganda for their respective causes. In view of the friction existing between these various programme organizers an attempt is to be made to establish a high-power station with a view to a regular service of strictly neutral broadcasts.

Some Music Case

The National Broadcasting Company of America, when removing its belongings to the new headquarters at Radio City, was called upon to dispose of the largest collection of music in the world. It consists of more than 500,000 scores valued at well over half a million dollars. In many instances they bear the actual signature of the composer, and the value of these works is greatly enhanced by their value.

Radio in the Sahara Desert

THE French Authorities have decided to establish a comprehensive network of small wireless telephone and telegraph stations in the Sahara desert, with a view to linking up the different military posts. The first three stations will be installed at Wahatel Faragia, Wahatel Karigia and on the Sinai promontory.

Will the Poste-Parisien Take Over Other Duties?

ACCORDING to a report from Paris the Poste-Parisien might suspend its entertainment broadcasts in the near future, as there is a possibility of the transmitter being taken over by the French Admiralty. It would be used for ensuring communications between the capital, the naval seaports, and warships at sea.

Verbal or Gong Time Signals

CONTRARY to the custom adopted in this country by which the exact time is automatically supplied by the Greenwich Observatory, many continental stations still broadcast at odd hours, and take their signals from an electric clock in the studio. In Germany, except at fixed periods of the day, the listener is verbally told the time when the announcer strikes a gong and informs his hearers the number of minutes or seconds past the hour. A similar method has been the custom in most French studios, but it is gradually being replaced by clock carillons at the opening and end of each programme.

Value of Super-Power Valve's Emission

IN 1,000-hours a good two-volt battery super-power valve would emit electrons the total weight of which would be of the order of 300 times the weight of the complete filament.

Radio for Diamond Mines

AN interesting example of the use of wireless in industry is the regular communication service maintained by the Consolidated Diamond Mines of South-West Africa, Limited, between their station at Luderitzbucht (South-West Africa) and their Consolidated Diamond Mines of South-West Africa, Limited, at Grootfontein, 150 miles distant. Despite the severity of the atmospheric disturbances prevalent in South-West Africa, the service is very reliable. An interesting feature of the Luderitzbucht station is that its site being on solid granite with sand pockets, the use of counterpoise is required instead of the usual buried earths. The installations at both stations are identical.

The transmitters are the Marconi Company's U type of 1 kilowatts power, and derive their energy from paraffin engine generator sets.

By special permission of The King, an H.M.V. gramophone record of his voice, “The Drawback,” has been made and distributed in the R.C.C.

The bias resistance which was joined in the cathode circuit of the output valve was substituted by a potentiometer for the grid leak in the R.C.C. stage. He found, however, that as the control was adjusted, very little alteration in volume was experienced for part of the travel, and then suddenly the volume fell away rapidly, so that it was very difficult to obtain smooth control of the volume. He had the potentiometer tested, and it was found to be quite in order. What was wrong?

Three books will be awarded for the first three correct solutions offered. Address your attempts to The Editor, PRACTICAL WIRELESS, 6-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 69 and posted to him not later than January 15th.

SOLUTION TO PROBLEM No. 69

Jackson made up a battery-receiver in which an R.C.C. stage was incorporated. He found that both on local stations and gramophone the output valve was overloaded, so he substituted a potentiometer for the grid leak in the R.C.C. stage. He found, however, that as the control was adjusted, very little alteration in volume was experienced for part of the travel, and then suddenly the volume fell away rapidly, so that it was very difficult to obtain smooth control of the volume. He had the potentiometer tested, and it was found to be quite in order. What was wrong?

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SOLUTION TO PROBLEM No. 68

The bias resistance which was joined in the cathode lead of the H.F. valve in Jenkinson's receiver was taken, thus isolating the cathode lead of the valve. The problem was solved.

The following three readers succeeded in correctly solving Problem No. 67, and books have, therefore, been forwarded to them:


Radio Programme for Diamond Mines

AN interesting example of the use of wireless in industry is the regular communication service maintained by the Consolidated Diamond Mines of South-West Africa, Limited, between their station at Luderitzbucht (South-West Africa) and their Consolidated Diamond Mines of South-West Africa, Limited, at Grootfontein, 150 miles distant. Despite the severity of the atmospheric disturbances prevalent in South-West Africa, the service is very reliable. An interesting feature of the Luderitzbucht station is that its site being on solid granite with sand pockets, the use of counterpoise is required instead of the usual buried earths. The installations at both stations are identical.

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THE ICONOSCOPE

In studying the problem of flight, designers have taken as their pattern or model the bird, and so we have arrived at the present state of perfection in the art of flying. So it is with television. The eye and its operation have been the object of considerable attention by scientists who have been endeavouring to reproduce by artificial means what Nature provides.

Now Dr. Zworykin of America, who is well known for his researches into the problems of television, has produced by electrical means an "Electric Eye," which functions in several respects in a manner similar to that of the human eye. In perfecting the Iconoscope, as this new invention is called, the cathode-ray tube and the photo-electric cell have been utilized. Both have already been employed in television, and it seems only natural that further developments should be associated with them.

The Cathode-ray Tube

Fundamentally the cathode-ray tube is somewhat analogous to the ordinary radio valve. It possesses a hot cathode, or filament, and an anode. Fig. 2 illustrates diagrammatically the various elements comprising it. First of all there is the cathode C, which is surrounded by a circular shield S. Mounted above it is the circular anode or "gun" as it is called. Arranged above are two pairs of plates, D, mounted at right angles to each other; these are known as the deflecting plates. The glass tube is filled with a quantity of inert gas, such as argon. A positive potential of from 300 to 3,000 volts is applied to the anode, which has a small hole in the centre. Electrons are attracted to the anode and race through the hole at high speed, impinging upon the fluorescent screen at the end of the tube. On striking the fluorescent screen a luminous greenish glow appears. In order to focus the stream of electrons into a beam the shield is given a negative bias and the inert gas also assists in focusing. They are therefore emitted from the cathode in a stream similar to the stream of water which emerges from the nozzle of a fireman's hose.

After leaving the anode they pass through the two pairs of deflecting plates. It is a unique property of this electron stream that it can be diverted or bent, by placing a bar magnet close to the tube, when they will be attracted towards it. This stream can also be bent by electrical means. A positive potential is applied to each pair of deflecting plates, whose function is to alter the direction of flow of the electron stream, one pair of plates causing it to adopt a vertical movement and the other plates causing it to move horizontally. This is how we reproduce, by electrical means, the principle of scanning as employed with the Nipkow Disc or Mirror Drum in the mechanical television systems.

The Photo-electric Cell

Here again we have a device which operates fundamentally on the same principles as that of the radio valve and the cathode-ray tube; that is, an emission of electrons from a cathode is attracted to the anode, this being at a positive potential with respect to the cathode. The great difference lies in the method adopted to attract the electrons from the cathode to the anode. In the photo-electric cell the cathode usually consists of a coating of nickel or silver sprayed on the inside of an evacuated glass bulb. This sprayed surface is then coated with a light-sensitive metal. The anode may be a small disc of nickel, or may take the form of a small sheet of wire gauze.

Now when light is allowed to fall upon the light-sensitive cathode electrons are emitted; they are attracted to the anode and an electric current flows. This current, as can well be imagined, is extremely small, and is therefore amplified by means of a suitable valve amplifier. Its particular value in television is that the amount of current flowing varies with the intensity of the light which is focused upon it; therefore the fluctuations in light intensity can be converted into a fluctuating electric current which is directly proportional to the light value. Having considered these two devices we are now able to appreciate the importance of the Iconoscope and the remarkable advance which has been made towards the perfection of television.

The Problem

With existing television systems all scenes to be televised have to be scanned, line by line, and the picture rebuilt at the receiving end, dependence being placed upon the persistence of vision of the human eye to perfect the illusion. The scene is therefore composed of a number of elements; consequently the light falls on the photo-electric cell in a manner similar to that of the stream of water which emerges from the nozzle of a fireman's hose.

(Continued overleaf)
(Continued from previous page)

In which the picture is reproduced upon a fluorescent screen.

An Elementary Example

To appreciate how this system functions we will consider the circuit of Fig. 3, which shows the essential elements in the mosaic-photo-electric cell consisting of the mosaic of photo-sensitive cells which constitute the mosaic. This single cell is represented by P, and C represents its capacitance to a plate—the signal plate—common to all the elements. The complete electrical circuit is quite straightforward and can be followed from the cathode P, to C, then through the resistance R to the negative terminal of the high-tension battery, the anode Pa being connected to the positive terminal. You will notice the straight parallel lines representing the light source being projected upon to the photo-electric cell. In actual practice this would, of course, be the reflected light from the scene to be televised. Immediately the light falls upon this cell the cathode Pa emits electrons and consequently the condenser C becomes positively charged by the action of the light. As the number of electrons emitted by the cathode depends upon the intensity of light, so the amount by which the condenser is charged also depends upon the intensity of the light.

Now when the electron beam strikes this particular element Pe it receives electrons from the beam and consequently becomes discharged. For the reasons already given it will be apparent that the discharge current is proportional to the amount of light falling upon the cell. This discharge current is now converted into a signal voltage across the resistance R which is connected to a suitable valve amplifier.

The Iconoscope

We now arrive at the complete circuit of the Iconoscope and this is shown in Fig. 4. The photograph (Fig. 1) should be examined in conjunction with the theoretical diagram. Here we are dealing with the complete unit and the figure shown focused on the mosaic is ready to be scanned.

When discussing cathode-ray tubes it was mentioned that the beam could be deflected by magnetic or electrical means. In the Iconoscope, this deflection of the beam is carried out magnetically by means of two pairs of coils so arranged that they slip behind the mosaic. This phenomenon is caused by the action of electric magnets, or what are also called the explosive consonants in speech, e.g., “P” and “b.” Most receivers fail dismally in handling transients when tuned with transformer coupling where the coupling components is negligible, and providing correct coupling values are chosen, an even response up to at least 10,000 cycles may be assured.

Now we come to transients. In passing, we may as well remark that the musician usually terms this “attack”, which is self-explanatory. Any sudden or staccato sound comes under this heading; hand-clapping, and pistol-shots, for instance, as also are the explosive consonants as shown in speech, e.g., “P” and “b.” Most receivers fail dismally in handling transients when tuned with transformer coupling where the coupling components is negligible, and providing correct coupling values are chosen, an even response up to at least 10,000 cycles may be assured.

Furthermore, when the sound ceases the transformer is left to leave go, as it were. One original transient, however, cannot be removed from the fray as a blurred and poor imitation of the original. No such effect is apparent with R.C. coupling the self-capacity of the components is negligible, and providing correct coupling values are chosen, an even response up to at least 10,000 cycles may be assured.

A few words with regard to details. Do not make the coupling condenser too large, and do not use too high a value of grid condenser. A heavy charge on the condenser will not make the coupling condenser too large, and do not use too high a value of grid condenser. A heavy charge on the condenser will not make the coupling condenser too large, and do not use too high a value of grid condenser. A heavy charge on the condenser will not make the coupling condenser too large, and do not use too high a value of grid condenser. A heavy charge on the condenser will not make the coupling condenser too large, and do not use too high a value of grid condenser.
MANY requests are received by the Advice Bureau of PRACTICAL WIRELESS for designs and circuits in respect to amplifiers for public address and demonstration purposes. It is obviously outside the scope of that Department to supply complete designs and requirements, and it is thought that a few notes on the subject might be helpful.

The notes will be of a general nature, since it would be quite impossible to give a single design that would be suitable for all requirements. There are many points to consider in deciding upon the basic essentials.

Power Supply and Signal Output

The very first item which must be considered is that of the power supply which is to be used. If A.C. mains are available any desired amount of signal output can be obtained with little difficulty; with D.C. mains the output is more limited, whilst when the only available power is that to be derived from batteries it is impossible to obtain a greater output than 5 watts unless economy can entirely be ignored. When dry batteries (as opposed to accumulators) have to be employed for high tension supply the greatest economical output is restricted to about 2 watts.

Having settled the power-supply question, that of the signal output required must be taken into consideration. No very definite ruling can be given, but it will generally be found that an output of at least 1 watt should be allowed for every 6,000 cubic feet of space when the speakers are placed indoors, or to cover a circle of some 15ft. radius when the speakers are out-of-doors. These figures must, naturally, be modified according to the general out-of-doors. These figures must, naturally, be modified according to the general situation in which they are operated.

“noises” which occur at the same time as the speakers are in use, and also according to the acoustic properties of the room, or situation in which they are operated.

In this Practical Article the Author Gives Some Useful Information in Regard to the Choice of Circuits for Power and Public Address Amplifiers.

By FRANK PRESTON.

By way of example, let us suppose that an amplifier is required to enable gramophone records or wireless programmes to be comfortably heard in a small hall measuring 50ft. by 25ft. by 10ft. high. The volume of such a room is 12,500 cubic feet, and therefore a signal output of just over 2 watts is about the minimum required. This could be supplied by a battery-operated receiver having a good Class B valve in the output stage, and if three or four speakers were available, so that the sound could be more uniformly distributed, the output would probably be adequate.

A Battery-Operated Amplifier

A circuit for a suitable amplifier is given in Fig. 1, where it can be seen that two valves precede the Class B one. It might be possible fully to load the Class B with only a single (driver) stage, but it is always found better to operate valves at somewhat less than their maximum capacity when quality of reproduction is an essential feature. The first valve is of the L.F. type, having an anode impedance of about 10,000 ohms, and the input to this (from the detector valve of a receiver, pick-up or microphone transformer) is supplied through a 20 megohm volume control potentiometer. Choke-capacity coupling is employed between the first and second valve, whilst ample decoupling is provided in the first anode circuit. The second valve, which acts as a driver, is of the small power type, having an impedance of about 4,000 ohms and a mutual conductance of some 2.5 milliamperes per volt. It feeds into a driver transformer of 1:1 ratio, which has a resistance-capacity tone control in parallel with its primary winding. There is also a 0.02 mfd. condenser across each half of the secondary to prevent the possibility of “Class B rattle,” and undue high-note response. The output valve feeds into a centre-tapped Class B choke to which the speakers are connected. When only two speakers are employed it will generally be found best to wire them in parallel, but when several are to be connected up a series-parallel arrangement is to be preferred, and it is better to employ speakers
of the type now sold for "extension" purposes, having transformers with tapped primaries and a switching device for choosing the most suitable ratio under working conditions. In the particular circuit illustrated, grid bias is obtained from batteries, but there is no reason why automatic biasing should not be employed if desired.

On D.C. Mains

When D.C. mains are to be used for supplying the necessary power, the best circuit arrangement is probably that shown in Fig. 2. Indirectly-heated D.C. valves are used, and there are three in all; the first is of the high-amplification power valve type having an impedance of about 2,500 ohms, a mutual conductance of 4.5 milliamps. per volt and an undistorted output of some 600 milliwatts. This feeds into a pair of indirectly-heated D.C. pentodes connected in push-pull through a 5:1 input transformer which is paralleled through a choke-capacity circuit. The two pentodes are each capable of delivering 2,500 milliamps. output when supplied with an anode voltage of 250, or of just under 2 watts when 200 volts is fed to the anodes. Thus a total output of about 3J watts (3,500 milliwatts) can be expected under normal working conditions. All the ratings of the valves when working at 250 volts and a heater current of .1 amp. at 35 volts, and the heaters are wired in series, a tapped ballast resistance of 1,450 ohms being included in circuit to cut down the mains voltage to the required figure of 105. Automatic bias is provided for every valve, and the values of resistances shown are correct for most valves of the types referred to. Smoothing is by means of a 500-ohm choke and electrolytic condensers. The total H.T. current will be between 60 and 70 milliamps., and the smoothing choke must therefore be capable of handling this. Rather more than 50 milliamps. will be passed through the centre-tapped output choke, which component should have an overall inductance of about 50 henries when carrying the maximum current. So far as is known, there is no standard component on the market which complies with these requirements, although there are several firms who will make one to special order. The difficulty can easily be overcome, however, by employing two smaller chokes connected in series, and there are many examples of this type of component. As regards the choke used for feeding the input push-pull transformer, this need have an inductance of no more than 15-20 henries at 15 milliamps., and so no difficulty occurs in this respect.

A.C. Operation

When A.C. mains are being used any signal output up to some 15 watts can be obtained without great difficulty and without the need for a special H.T. generator. In fact, an amplifier of that nature can be made by using standard components throughout. The general arrangement of a simple circuit, which is extremely efficient, is shown in Fig. 3, from which it can be seen that four valves are employed altogether. The first is an ordinary indirectly-heated A.C. valve of the L.F. or small power type, and is resistance-capacity coupled to the second valve, a large power valve having a maximum undistorted output of about two watts. This valve is choke-capacity coupled to the input push-pull transformer which feeds into a matched pair of directly-heated super-high power pentodes. The latter should be of a type having an undistorted output of 10 watts, a mutual conductance of 4 milliamps. per volt and a maximum anode-voltage rating of 500. The suppressor grids require a maximum voltage of 200 volts. When working on D.C. the rectifier merely acts as a "passenger" in the circuit arrangement in Fig. 3 is generally applicable to any type of amplifier regardless of its signal output.

High Tension from a Low-tension Accumulator

WILL the author of the article entitled "High Tension from a Low-tension Accumulator," appearing in our issue dated December 23rd, 1933, please send his full name and address so that payment can be made?

Television—Be Prepared!

I HOPE all readers are mentally preparing themselves for the advent of television by carefully studying the frequent articles we publish on that subject. Television is inevitable, and radio cannot be considered complete until it arrives. At the radio telephony, the home constructor will undoubtedly be the first to enjoy real television.

The Search for the Ideal

A FRIEND of mine who has purchased quite a number of receivers is still searching for his ideal. I tried to elicit from him what that ideal was, and found that he wanted to receive almost every British and European station at equal strength, and makes for longer valve life and a high efficiency of the supplimentary components. To obtain a full 20-watts signal output it would be necessary to connect two rectifiers in series. If the rectifier is of a type supplying only about 30 milliamps. at 200 volts, when specially large rectifiers are called for. Nevertheless, the circuit arrangement given at Fig. 3 is generally applicable to any type of amplifier regardless of its signal output.

A "Universal" Amplifier

It is frequently desirable to have an amplifier of the "universal" type, which can be operated from either A.C. or D.C. at will and in such a case the circuit of Fig. 3 is applicable provided that a half-wave metal rectifier (or two such rectifiers joined in parallel) is inserted at the point marked "X." The rectifier should give an output of no less than 80 milliamps at 200 volts. When working on D.C. the rectifier merely acts as a "passenger" since it does no useful work, but when the amplifier is connected to A.C. mains it fulfils its normal function.

PRACTICAL WIRELESS
In a previous article I dealt at some length with instability of the kind which is often present in high-frequency amplifying stages, and now it is proposed to consider the low-frequency portion of the receiver. It is somewhat difficult to draw a distinct line between the two kinds of instability which have been referred to as L.F. and H.F., since quite often the two are inter-dependent to such an extent that, for example, high-frequency currents are the cause of low-frequency instability and vice versa. In order to make this point more readily appreciated, it might be mentioned that in some receivers L.F. instability of a violent nature can easily be produced merely by running the loud-speaker wires near the aerial-earth leads, or even to the terminals to which the latter are connected. In the same way, the proximity of speaker and pick-up leads can often be the cause of serious instability, whilst in a console type of receiver the same kind of trouble might be introduced by running the loud-speaker wires close to the tuning coils, or to the detector or S.G. valve.

The causes of L.F. instability above referred to are perhaps fairly obvious ones, but they should always be looked for as a preliminary to the further tests that might be applied to a set which is behaving unsatisfactorily.

Detecting L.F. Instability

Before going any further into the subject it might be best to decide just what we mean by L.F. instability, and also how it can be detected. As a matter of fact, this is often the most difficult part of our task, since the fault can manifest itself in so very many different ways. It might be noticed that reproduction is simply distorted; perhaps it sounds "scratchy" or high-pitched; there might be a constant whistle accompanying all reproduction, a whistle or "groan" might be noticed on notes of certain frequencies or on loud passages; the noise which has been given the name of "motor-boating," due to its similarity to the sound made by the exhaust of a motor boat, might make good reception impossible. Instability can make itself known in other ways, too, but one of the symptoms referred to is in most cases noticeable.

Next we should consider what is the prime cause of the trouble, so that we may be in a better position to localize the fault and to say exactly which component or connection is responsible for it. Broadly speaking, L.F. instability, like H.F. instability, is due to a feed-back or uncontrollable oscillation effect. But instead of the feed-back being one of high-frequency currents, it is low-frequency ones which are concerned, and because of this it invariably gives rise to effects which can be detected by the ear.

High Resistance H.T. Supplies

A very common source of the trouble is the high-tension supply. If this is of high resistance and the anodes of the detector and low-frequency valves are connected directly to H.T. positive, through the usual coupling components but without the insertion of decoupling resistances, etc., it is a perfectly easy matter for the low-frequency currents appearing in the anode-circuits of one valve to pass back to the anode of a previous valve, thus producing a definite and obvious feed-back or reaction effect. If the high-tension supply were of low resistance those currents would pass...
through it to earth and cause no trouble whatever. High-tension batteries, when in good condition, have a comparatively low internal resistance to L.F. currents and therefore do not tend to produce instability. But when the battery runs down, its internal resistance increases, and there is a definite opposition to the easy flow of signal current through it. The very old, though obvious, idea of connecting a large capacity (2 mfd. upwards) condenser across the positive and negative high-tension terminals is a good one, since the condenser provides an easy by-pass to the L.F. currents.

When an eliminator is employed instability is liable to be much more pronounced, due to the fact that it has, of necessity, a much higher resistance. This resistance is introduced by the chokes and resistances which are essential for smoothing purposes. Even with an eliminator, however, it is often quite sufficient to connect a 2 mfd. condenser between the output terminals in order to reduce its L.F. resistance to a reasonably low figure.

Decoupling the L.F. Stages

In every case where the H.T. supply is reasonable, it is easy to reduce the trouble by decoupling the detector valve, at least. This is done by inserting a fixed resistance of some 25,000 ohms between the coupling component (resistance, choke, or transformer primary) and high-tension positive, and joining a 2 mfd. fixed condenser between the "set" side of the resistance and earth. The method just mentioned is very well known, but does not, by itself, give the desired effect, especially when two or more low-frequency stages are included in the set. It is then a good plan to decouple the first L.F. valve also, and this could be done by following the same method, but that would not prove very satisfactory, because the resistance would so cut down the anode voltage that the valve could not operate under efficient conditions. But if a small L.F. choke were used in place of the resistance the voltage-drop would be appreciable and efficiency would not be impaired. The output valve in any fair modern set is adequately decoupled by means of the output transformer fitted to the loud-speaker, but where a speaker of the older balanced-armature type is still in use, the last valve can be decoupled satisfactorily by interposing a 1:1 transformer between the set and the speaker. All the methods of decoupling which have just been described are illustrated collectively in Fig. 1. A further method of preventing H.F. currents from passing into the L.F. amplifier is to insert a "stopper" in series with the leads from the transformer or R.C.C. unit to the grid of the first L.F. valve. The "stopper" may be either a fixed, non-inductive resistance of between 50,000 and 100,000 ohms, or a second small choke. This method is of particular value in the case of short-wave receivers, although it is by no means useless with normal broadcast receivers, especially portables. Connections for the "stopper" are given in Fig. 3.

New Valves

It was mentioned in the previous article on H.F. instability that the trouble could be due to the fact that new and more efficient valves had been used to replace older ones with which the set worked quite satisfactorily. The very same thing applies in respect to L.F. instability, and it is very often found that reproduction becomes almost unbearable poor when a pentode is fitted in place of a previous small power valve, for instance. Pentodes do give a certain amount of emphasis to the higher notes, but they should not cause reproduction to become distorted to the extent that it is accompanied by a constant "whine." Many amateurs make use of this apparent simple and inexpensive method of screening, with unsatisfactory results.

H.F. By-pass

With some portables it is not enough simply to screen the speaker leads, because there is a certain amount of H.F. current leakage into the last valve. In that case, a cure can generally be effected by connecting a small by-pass condenser between the anode terminal and H.T. negative; when a Class B output stage is employed, the condenser should be joined between the two anodes, or alternatively, a condenser may be fitted in series with each anode. The capacity of the condenser depends upon the severity of the trouble, but a value from 0.01 to 0.005 mfd. will nearly always prove effective. It should be remembered that if the capacity is too high there will be some slight loss of the higher notes. The two are bound to be placed fairly together. This is because the wire forms a small inductance coil, and thus, instead of preventing H.F. currents from passing in that direction, the point is mentioned because it has come to our notice that a number of readers have made use of this apparently simple and inexpensive method of screening, with unsatisfactory results.
Pick your own Programmes

Wouldn't you like a Receiver which would bring you a whole host of programmes from which to choose your entertainment—station after station—free from interference—at generous volume—with a rich, true-to-life tone? For a remarkably small outlay you can own such a Set—the Cossor Melody Maker. This remarkable Receiver incorporates every worth-while radio development. Its performance is outstanding—equal to many highly priced Sets. Yet it is so simple that you can assemble it at home—even if you know nothing about Wireless—send the coupon for a Constructional Chart.

Illustration shows Models 342, 344 & 347. Model 343, Model 344 similar cabinet but with Loud Speaker adjustment in centre of front.

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Balanced Armature Loud Speaker
Complete Kit of Parts including Cossor Valves—Variable-Mu Screened Grid, Detector, and Pentode Valves. Fully wired-up, Double-Gang Variable Grid Condenser, all-metal chassis, and all the parts. Hardwood cabinet 21 3/4" x 13 1/4" x 10 3/4" space for batteries and accumulator. Supplied with Cossor Variable-Mu Screened Grid, Detector, and Pentode Valves. Fully screened coils, Double-Gang Condenser, all-metal chassis, and all the parts. Handsome cabinet 8 1/4" x 13 1/4" x 10" space for batteries and accumulator. Balanced Armature Speaker; provision for Gramophone Pick-up Plug and Jack, Wave-length range 200/500 and 1000/2,000 metres. Price £6.7.6

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Complete Kit of Parts similar to Model 341 described above, except that it is supplied with Permanent Magnet Moving Coil Loud Speaker. Price £7.2.6

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Complete Kit of Parts as Model 341, described above, but with four Cossor Valves—Class "B" Output Stage and Permanent Magnet Moving Coil Speaker.

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Complete Kit of Parts, similar to Model 341, described above, but with four Cossor A.C. Mains Valves (incl. Rectifier Power Unit) and Mains Energised Moving Coil Loud Speaker. For A.C. Mains only 200/250 volts (adjustable) 40/100 cycles.

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WHO ARE YOUR BROADCASTING FAVOURITES? Read all about them in THE RADIO MAGAZINE.

Special Articles about HENRY HALL, GRACIE FIELD, VERNON BARTLETT, CHRIS- TOPHER STONE, TOMMY HANDLEY, and other Radio stars.

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BRINGS HUMAN INTEREST TO THE PROGRAMMES
Rapid Accumulator Testing

In many sets the accumulator is often put inside or in a cupboard, out of the way. This keeps it out of sight, but unfortunately, it is not very convenient for testing purposes. If the set is fitted with a moulded escutcheon held in place with two or more nuts and bolts, two of these can be wired to the filament circuit. The voltmeter can then be applied to the heads of the screws, which are, of course, on the front of the panel, and the correct voltage ascertained in a very short time. This method has the advantage that no reading can be taken unless the set is switched on.—P. W. (Windsor).

Combined Fuse and Pilot Light for Small L.T. Trickle-Charging Unit

The majority of low-tension charging sets are designed with a separate 4-volt secondary pilot lamp winding; this, however, besides being a rather heavy additional load upon a small set, does not give a true indication. It tells us that we are charging at the required rate, i.e., approximately 25 amp.—C. McLeod (Liverpool).

Substitute for a Thermal Delay Switch

The following device is a useful alternative to a thermal delay switch in certain cases of home-constructed all-main sets, where the owner does not mind an extra control. Two separate switches are used, one for switching the A.C. supply from the mains, and the other for switching the rectifier. The switches are interlocked so that the A.C. supply cannot be put off until No. 2 has first been pushed off. Switch No. 2 can, with advantage, be in the secondary circuit of the transformer which is feeding the rectifier. —P. D. Richards (Norwich).

Mounting a Floating Cone

When adopting the floating cone arrangement, where the cone is attached to a baffle by means of a linen ring, it is often difficult to centre the cone accurately, and at the same time obtain an even tension all round the linen. A better method is as follows: Cut a strip of linen into twelve pieces, each measuring 1 lin. by 1 lin. Glue these twelve pieces to the cone, 1 lin. from the edge, at equal distances round its periphery, and in such a way that the sides measuring 1 lin. lies along the cone, as shown in the sketch. The free ends of the linen flaps are then glued to the baffle, and it is an easy matter, having once centred the cone, to obtain an equal tension on each piece of linen.—T. A. T. A. W. (Troon).

An alternative to a thermal delay.
A Novel Rotary Switch

This novel aerial-earthling switch, which is made from odd and ends, is of some interest as these will vary with the thickness of the brackets from the "contact-strips." Only, a neat panel light ing device.

Fitting a Scanning Disc to a Motor Shaft

I found the following method of fitting a scanning disc to a motor shaft very satisfactory. A novel aerial-earthling switch.

The disc was then attached to the disc by four bolts, one at the centre of each spoke. If the tuning dial centre is too small for the motor shaft, it can be drilled out, care being taken to keep the drill straight. If the disc centre is too large, thin metal packings can be used, leaving a hole for the screw. The accompanying sketch clearly shows the arrangement.—Yours Forman (Leicester).

Connecting An Extra Loud-speaker

It is often required to connect an additional loud-speaker to the set for use in another room, and although this can be done by wiring it in parallel with the existing one, the method is not ideal because it often introduces distortion besides making it necessary to employ a long length of twin flex. The capacity of the flex might be so high as to cause a serious drop in volume and at the same time cutting off the high-note response. The difficulty can be overcome very simply as shown in the accompanying sketch; the normal speaker is left exactly as before, a lead being taken from the negative L.S. terminal on the set (the one joined to the centre terminal of the valve), to one side of a 2-mfd. fixed condenser. A single lead is then taken from the other side of the 2-mfd. condenser to one terminal on the extra speaker, whilst the second terminal on that speaker is connected to the normal speaker. The capacity of the flex introduces only a small drop in volume and at the same time is not likely to cause a serious drop in the high note response. The difficulty can be overcome very simply as shown in the accompanying sketch; the normal speaker is left exactly as before, a lead being taken from the negative L.S. terminal on the set (the one joined to the centre terminal of the valve), to one side of a 2-mfd. fixed condenser. A single lead is then taken from the other side of the 2-mfd. condenser to one terminal on the extra speaker, whilst the second terminal on that speaker is connected to the normal speaker.

Television Disc Punch Holder

However, careful one may be in marking out a television scanning disc, it is very easy to make quite an appreciable error in lining up the punch on the disc. The spindle X allowed to turn in stance. The punch is then lowered for just pressing on the disc and, after being set exactly square with any radial line, the grab screw is tightened up, thus ensuring that the side of each hole punched will be exactly parallel with the radius at any position. The punch holder is then pushed along the rod to the position for hole No. 1, the thumb screw tightened up, and the hole punched. The thumbscrew loosened again, the holder pushed slightly towards the centre until the outside edge of the punch falls exactly over the inside edge of the hole; just made, the screw tightened again and the punch is in the correct position for the next hole, the process being repeated for each hole.

No dimensions are given, as these will naturally vary with individual requirements, but if the rod Y is made from 3/16" square section brass there will be sufficient whip on a length of 8" or 10" to allow for the slight downward movement of the punch when struck.—E. L. Nimm (Wimbledon).

A device for punching holes in a scanning disc.

A Novel Panel Lighting Device

The accompanying illustration on this page shows a panel illuminating device which has a very pleasing appearance. The cover for the bulletin consists of an ebonite cap taken from a sènette bottle. The slot is formed by making two saw cuts near the top of the cap and prizing out the unwanted strip, leaving an edge which can be filed smooth. For the bulb holder, a gun-metal type batten strip suits the purpose admirably. The legs are cut down to an inch in length, one being bent to the same level as the other, and a hole large enough to take a small screw is drilled in the end of each. A hole slightly greater in diameter than the body of the tester is bored in the front panel of the set just above the tuning dial. Through this the tester is placed, and two screws, with connecting wires clamped beneath, are utilized to hold it in position. A cork, or preferably a rubber ring, that fits into the ebonite cap tightly, is glued to the panel round the bulb, and, after the cap has been screwed on, the fitting is complete.—J. E. Davey (Selhurst).

A neat panel lighting arrangement.
For the new wave-lengths.

SLOT AERIAL FILTER

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A crowded Ether... Stations a hair's-breadth apart... overlapping increasingly difficult to avoid. SLOT solves the problem! SLOT is a mighty atom—smaller than a matchbox, but wonderfully efficient. SLOT separates those Stations, makes Selectivity needle-keen, reduces interference without reducing volume. SLOT adapts your set to the new wavelengths. Fit SLOT to your lead-in, it takes but a moment and improves reception for good.

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to begin with, it should be explained that the three prime functions of the valve in radio reception are (1) amplification of the comparatively weak signals developed in the aerial circuit (high-frequency amplification), (2) separation of the audio-frequency component (the 'programme') from the radio-frequency component (the carrier)—this process is known as 'detection' and (3) the amplification of the audio-frequency signal so that it may operate a loud-speaker (low frequency amplification).

High-frequency Amplification

In modern receivers this function is always performed by some variant of the screen-grid valve. The ordinary screen-grid valve, which is available in both battery and mains types, is a tetrode, i.e., a four-electrode valve. The filament, or cathode, the anode, and the control grid perform their normal functions, but the fourth electrode, the screening grid, which is connected to an H.T. positive voltage of about half the anode voltage, acts as an electrostatic screen to prevent feed-back within the valve from anode to grid, which would otherwise occur and cause instability and howling.

The relative efficiency of screen-grid valves of various types can be gauged roughly from the value of their mutual conductance, this being a sort of "factor of goodness" published by the valve maker. For battery-operated types the conductance may range from about 1.0 to about 1.5, while in mains types the figure ranges up to 3.5, or even more.

For the average receiver, having only one high-frequency stage the more sensitive valves, i.e., those having a high mutual conductance, are preferable. If, however, two high-frequency stages are employed, it may be difficult to control two high gain stages, and valves of lower mutual conductance are often recommended.

H.F. Overloading and Distortion

Another point to bear in mind is that normal screen-grid valves are designed to handle without distortion only comparatively weak input signals.

The distortion point, that is to say, the value of grid voltage at which grid current commences to flow, varies with valves of different makes. Some valves, therefore, require a small amount of negative grid bias, while others work better without bias. Care should be taken, therefore, to read the instruction sheet issued by the valve-maker, and to carry out his recommendations in this regard.

The liability of ordinary screen-grid valves to overloading by strong signals has led to the introduction of a modified form known as the variable-mu screen-grid valve. It differs from the ordinary screen-grid valve in that, due to the special design of the grid, the grid base of the valve is greatly extended. The form of the characteristic curve of a variable-mu valve, compared with that of an ordinary screen-grid valve, is shown in Fig. 1.

Variable-Mu Valves

The value of the variable-mu valve is that, by applying a very small grid bias, or no bias at all, the valve is in a condition of maximum sensitivity, and will give full and undistorted amplification of small signals; but by applying an increasing amount of grid bias, the mutual conductance of the valve is decreased so that the effective amplification is less. At the same time, when operating at low sensitivity, the valve will handle quite powerful inputs without distortion. Thus, for weak signals, which are not likely to overload the valve, full amplification can be used while for strong signals, which would overload an ordinary screen-grid valve, and which usually do not need much amplification, more grid bias may be applied, thus cutting down the amplification, but at the same time avoiding distortion.

In the case of battery-variable-mu valves, bias is best applied by a potentiometer R of say 20,000 to 50,000 ohms connected across a grid-bias battery which may also supply grid bias to the low-frequency valves of the set. This arrangement is shown in Fig. 2, where the slider is connected back to the grid circuit of the high-frequency stage.

The several types of battery variable-mu valves on the market can be divided roughly into "long-grid base" and "short-grid base" types. The former requires a grid-bias range of about 15 or more volts for full gain control, but the short grid-base type uses a much smaller maximum grid-bias voltage. The short grid-base valve owes its development in part to the popularity of Class "B" output, regarding which some details will be given in a subsequent article. In Class "B" no bias is usually required for the output stage, although the previous low-frequency valve, or "driver" needs a small negative bias. Valve makers have therefore sought to produce new variable-mu valves which can be controlled by a 9 volt, or even 4 volt grid-bias battery.

"A.V.C."

Another development which has had a great influence on the design of the latest variable-mu valves is "automatic volume control," a device in which the adjustable bias to the variable-mu stages is applied automatically by the increase or decrease of strength of the incoming signal. One of the difficulties in applying automatic volume control is to obtain a large controlling bias voltage, and, although there are methods of amplifying the control voltage, a short grid-base variable valve is very desirable for most simple circuits employing A.V.C.

Some of the most recent valves of this type in the battery range give full control with a grid-bias variation of as little as 4 volts, but generally speaking, a valve of this type should be so designed that its mutual conductance is reduced to about 1.0 per cent. of the maximum by applying from 7 to 9 volts negative bias.

Mains operated variable-mu valves usually have a much longer grid base, of the order of 40 volts, but in most types, by reducing the screen voltage, the grid base can be decreased by about half, although this advantage is only obtained at some small sacrifice of maximum sensitivity.

Bias Application

Practically all mains screen-grid valves, of both ordinary and variable-mu types, required a small permanent negative bias, and this is best applied by includ-
SHORT-WAVE work is really a class on its own, and for the best results special receivers should be in use, incorporating all the features and avoiding all the pitfalls associated with this class of reception. For financial reasons this course is not always possible and, in consequence, recourse must be made to ways and means for adapting or converting the existing home radio set, so that it can tune down to the wavelengths desired, that is from about 15 to 80 metres for the short waves and from 5 to 8 metres for the ultra-short waves.

The Converter

Unfortunately, a great deal of confusion seems to exist as to the respective merits of an adaptor and a converter, as well as the distinction between their respective functions. The two terms are often interchanged, whereas each carries out its own particular work in a separate and distinct fashion, and it is therefore advisable right at the outset to clarify matters. The term converter should only be applied to those devices which actually convert one frequency into another. That is to say, the superheterodyne principle is involved, the converter being used often as the combined first detector and oscillator which, when coupled to the ordinary radio receiver, changes the short or ultra-short waves into long or medium waves, so that they can be handled in an efficient and normal manner by the receiver.

In effect, the broadcast receiver under these circumstances functions as the intermediate frequency amplifier and detector of the superheterodyne. For the best results, therefore, this intermediate frequency amplifier should give a fair measure of amplification, and, in consequence, one of the requirements when using a converter is to employ it in conjunction with a set having one or more screened-grid or high-frequency pentode H.F. stages.

The Adaptor

Although it may be argued that in functioning in this way the converter "wastes" the broadcast band receiver so that it can receive short waves, it is preferable to look upon the adaptor as working in a different way. An adaptor in its simplest form consists of a short-wave detector unit designed to be sensitive to short wavelengths, no change of frequency taking place while it functions. It works in conjunction only on the audio or low-frequency side of the broadcast receiver, and ignores the radio-frequency stages, whereas the converter requires them.

In this Article the Author Describes the Relative Merits of Both Types of Apparatus

By H. J. BARTON CHAPPLE,
Wh.Sc., B.Sc. [Hons.], A.M.I.E.E.

Owing to the fact that in some broadcast receivers the high-frequency side is inefficient, and the consequent amplification of a relative low order, one can obtain equal results with an adaptor or converter, and the final choice as to which is used by the individual, therefore, depends upon the merits and nature of the broadcast set, for the cost of each unit is of about the same order of magnitude.

In practice, the method employed for using an adaptor is to remove the detector valve from the set and use it in the unit, coupling the unit to the set by a plug fitting into the vacant valve-holder socket. No external or extra high-tension or low-tension supplies are required, for the unit uses those of the normal set, and as the grid terminal of the set's detector valve-holder is not used, the tuning arrangements are isolated and replaced with those of the adaptor.

Some Circuits

Let us now deal with some practical suggestions for using one or other of the arrangements.

Taking the adaptor (Continued overleaf)
ADAPTORS OR CONVERTERS

(Continued from previous page)

unless rectified, and the best way to smooth out the reaction control is to adjust very carefully the anode voltages applied to the 'adaptor valve. Another method is to try various values of grid-leak, but, as a general rule, the anode voltage adjustment will suffice.

Another Adaptor

For those readers desirous of trying something a little different from the normal or ordinary arrangement, the circuit shown in Fig. 1 will have an especial appeal. The aerial feed is effected through a small condenser C1, which must be of the pre-set type, and is always quoted by the maker. The capacity of the by-pass condenser is not critical, and may be from 1.1 to 1.0 mfd.

In the case of a variable-mu mains valve, the variable bias should also be applied automatically by a variable resistance in series with the small permanent bias resistance. The connections for this arrangement are shown in Fig. 4, where R4 is the permanent bias resistance and R3 the variable control bias resistance. Here again appropriate values must be taken from the valve-maker's catalogue or instruction sheet.

Screened H.F. Pentodes

A word must now be said concerning the most recent type of H.F. amplifier, namely the screened pentode, which in many cases is supplanting the screen-grid tetrode entirely. These valves are similar in design to screen tetrodes, but have a third grid situated between the screen and the anode and connected to the cathode as in an output pentode. The effect of this earthed grid is to render the valve capable of operation satisfactorily under conditions involving large anode voltage swings, and at the same time to greatly increase the amplification factor of the valve. In general it may be said that in any standard circuit a screened pentode will give a higher degree of amplification than an ordinary screen-grid valve, although owing to the bigger internal impedance of the high-frequency pentode, it shows to maximum advantage only when used in conjunction with well-designed coils.

Screened pentodes are connected in exactly the same way as ordinary screen-grid valves, and no alteration to the circuit is necessary when substituting them for existing tetrodes.

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By F. J. CAMM;

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HOW TO CHOOSE AND USE THE BEST VALVES.

(Continued from page 822)

 Fig. 3.—An interesting converter circuit showing in this case a mains-fed valve.

A word must now be said concerning the most recent type of H.F. amplifier, namely the screened pentode, which in many cases is supplanting the screen-grid tetrode entirely. These valves are similar in design to screen tetrodes, but have a third grid situated between the screen and the anode and connected to the cathode as in an output pentode. The effect of this earthed grid is to render the valve capable of operation satisfactorily under conditions involving large anode voltage swings, and at the same time to greatly increase the amplification factor of the valve. In general it may be said that in any standard circuit a screened pentode will give a higher degree of amplification than an ordinary screen-grid valve, although owing to the bigger internal impedance of the high-frequency pentode, it shows to maximum advantage only when used in conjunction with well-designed coils.

Screened pentodes are connected in exactly the same way as ordinary screen-grid valves, and no alteration to the circuit is necessary when substituting them for existing tetrodes.
THE question of choosing a circuit is not quite the same as which it might at first appear. For instance, how many H.F. stages should be employed for good long-distance results? How many L.F. stages for really high-quality loud-speaker results? Is A.V.C. to be incorporated? Shall the circuit be mains- or battery-operated? These are probably only a few of the points which arise in the minds of the listener who desires to construct for himself a new receiver, and the following notes will enable the choice to be narrowed down to such limits that the final selection should be made without any difficulty whatsoever.

Locals or Foreign?

First of all, it is necessary to have a detector valve, no matter what type of circuit is built. It is, of course, possible to use a crystal detector, or one of the metal-oxide rectifiers, but these may be dealt with later under the heading of refinements. The detector valve alone will not operate a loud-speaker, although the signals may be sufficiently powerful to furnish quite good headphone strength. Thus we come to the first point in our selection—one valve is required for detection, and if only headphone signals are required no further valves will require to be added after this stage, whilst if a loud-speaker is to be operated some successive amplification will have to be included. The degree of such amplification will depend both on the amount of amplification which precedes the detector valve, and upon the volume which is required from the speaker. For instance, if the detector valve is joined direct to the aerial input (with reaction included) the signals from a local station will be sufficiently loud to furnish quite good loud-speaker volume with only one L.F. stage. Similarly, two L.F. stages will probably bring in a fair number of distant stations at moderate volume. The final point in the volume selection will be "How loud?" It may be stated that for normal room strength of overloading is removed on the loudest climax. This arrangement also permits of a "full" tone being obtained without any of the customary harshness which occasionally arises when a 2-watt stage is worked "full out."

Class B or Pentode

For the battery user, Class B will be necessary to obtain this volume of sound, and this, in turn, necessitates a driver valve. Thus, for Class B working we have found that three valves are essential. A pentode valve will deliver an output of the order of 3 watts, so that for cases where this volume will suffice a pentode may be used and this will enable the driver stage to be dispensed with. The small power valve will prove adequate where a very small room is in use, or where the ordinary small loud-speaker is employed, as it must be appreciated that a moving-coil type of speaker is necessary in order to do justice to an output of 2 watts or more. The H.F. stages will be the minimum which can safely be employed. If these are of the variable-mu type it will be possible to fit a volume control to reduce the signal passed on to the detector when receiving stations nearer at home. One H.F. stage, feeding a detector valve which has a good reaction control, will, however, prove capable of splendid range, and if a variable-mu valve is used in this case no other form of volume control should be necessary. Thus, for all-round results it may be said that the single variable-mu H.F. stage (or simple S.G. valve if the extra complication of the control is not thought necessary) will prove adequate, whilst for consistent long-distance reception two H.F. stages should be employed.

(Point continued overleaf)
PRACTICAL WIRELESS

January 13th, 1934

The Superheterodyne

On the other side of the picture we have the superheterodyne circuit which will have a range sufficient to enable practically every worth-while European station to be received anywhere in England, and, provided the circuit can be accurately adjusted, this will prove one of the most useful of circuits.

Modifying the Detector Stage

The detector valve may be replaced by a cold valve, in which case the amplification normally obtained in this stage will be lost. It would be possible, of course, to use the detector valve, in the case of a replacement, as a subsequent L.F. stage, but where the cold valve is being used on economy grounds this cannot be done. No reaction can be employed with this type of detector, and therefore some further loss of volume is obtained. On the other hand, a diode valve, or a diode portion of a multi-electrode valve may be employed, in which case automatic volume control may be incorporated for keeping constant the strength of signals received in the H.F. stages. Reaction is, however, still precluded. A reaction circuit properly handled, will prove in many cases equal to a good H.F. stage, so that it is not always advisable to dispense with this unless it is found possible to use two H.F. stages, when the use of reaction becomes almost unnecessary.

Mains Receivers

Practically all of the above considerations apply alike to mains or battery-operated receivers, with the exception that the output from the pentode which is operated from the mains may reach the order of 3 watts. Summing up the above points, therefore, it may be stated that an S.O., detector, and pentode circuit will provide a number of stations with a good output, capable of feeding a moving-coil loud-speaker, and this arrangement may be said to be one of the best all-round receivers. Fig. 1 is the circuit of our Mains Express Three which incorporates this arrangement, and it is also obtainable in battery form under the title of the Long Range Express Three.

Where longer range is required two H.F. stages should be employed, and the Fury Four, shown in Fig. 2, is typical of this type of circuit. For the larger output afforded by the class B arrangement the Beta Class B Four shown in Fig. 3 employs a simple H.F. stage with the added L.F. amplification. The superheterodyne circuit is shown in Fig. 4, which is the arrangement employed in The Premier Super.

Tuning Coils

The choice of the tuning circuit, that is, whether band-pass, iron-core, etc., is to be used, will depend upon the amount which is to be expended on the receiver as well as upon the proximity of the nearest station. For instance, at five miles from a main B.B.C. station it would be found impossible to use a simple H.F. stage without losing a large number of distant stations working on wavelengths fairly close to the local. The band-pass circuit would restrict the local to a few degrees and thus enable a number of other stations to be heard. With two H.F. stages, however, the selectivity should be adequate for all normal requirements, although the use of a band-pass input circuit, or a band-pass coupling stage between the first and second valves, would increase selectivity. For the same reason, the iron-cored coupling coils give an increase in selectivity, and thus the choice of this part of the circuit will depend upon local conditions. The above notes should enable the choice of a receiver to be narrowed down to very small limits, and no difficulty should now be experienced by any reader in ascertaining just what particular type of set will best meet his particular requirements.

BOOK RECEIVED

The Broadcaster Annual, 1934.

Tabular information upon the supply voltages applying to nearly five thousand districts in the United Kingdom, while to make this type of information even more valuable some five pages are devoted to an examination of the relative markets for mains and battery receivers. The Broadcaster Annual Directory this year occupies over eighty pages, divided into four sections. Every important manufacturer, together with his address, telephone number, the addresses of his branches, is listed in section one. Similarly every important wholesaler is dealt with in section two.

Section three consists of an alphabetical list of trade names, and finally there is the Products Supplied section occupying nearly half the total space devoted to the Broadcaster Directory.

In addition the Annual gives figures for twelve months for the exports and imports of radio apparatus, data governing postal regulations, how to register a company, information upon factory acts and shop regulations, upon the procedure to be adopted in taking out a patent, registering a design or trademark, the latest form of licence issued by the British Licensing Pool and the R.A. and by Philips-Mullard group.

It gives monthly licence figures for every county of the British Isles, a directory of important new radio companies formed during the year, and a chart giving the characteristics of practically every valve on the market.

It is published at 5s., with a special privilege price of 2s. 6d. to Broadcaster subscribers.
Peto-Scott are pioneers in Radio and Television. Our service to the British public was introduced in 1915, and during fourteen years of solid Service and Satisfaction we have established a reputation for fair dealing that defies competition. Customers all over the globe come to us regularly for all their radio requirements—sets, kits of all descriptions, Part Kits, Miscellaneous Components, Speakers, Eliminators, and Accessories. Purchases can be made for cash, C.O.D., or on Easy Payments. We DEAK WITH YOU DIRECT. Peto-Scott's Easy Way Money, in Standard Set with Accessories. All sets, kits, parts, and accessories can be paid for by Cash or C.O.D. or Easy Payments. We take all major credit cards.

**SHORT-WAVE KIT**

**DISCOVER S.G. THREE**

The first S.G. Three Complete Kit of Standard Accessories.

**NEW ATLAS C.A. 25**

For Mains, Clone-B and Q.P.P.

**STAGE. POWER CONVERTER.**

Balance in 11 monthly payments of 8/6.

Balance in 11 monthly payments of 8/6.

**BARGAIN KIT**

GUARDIAN 0 0 P 4 VALVE RECEIVER, includes Peto-Scott Microphonic Receiver, 11ma.

**NEW W.B. P.M. 6A MICROLODE PERMA-**

Balance in 11 monthly payments of 8/6.

Balance in 11 monthly payments of 8/6.

Cash or C.O.D. Milk Subscription, 1/3 a year.

Send for "How to Build 4 SHORT-WAVE SETS," 2s.

Send for FREE BLUE PRINT of the MATCHED KIT "A".

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BEFORE giving instructions regarding the trimming of this powerful little receiver it is necessary to draw attention to the loud-speaker which is used with the apparatus, and also to the method by which it is joined to the receiver. The speaker itself is fitted with a special input transformer, which, unlike the usual type of Class B transformer is of a standard type, having a tapped primary which will "match" any type of valve. The characteristics required for ideal reproduction with a Class B valve have been very fully examined by the makers of the speaker, and an ingenious form of winding is employed in the transformer in order to get the best from this particular method of amplification, and it is therefore essential that the correct model is ordered. It should be noted that this is the FBN-PM-2/B Class B, and when putting your order you should be very clear about this reference. It will be noted, of course, that in the list of components which was published last week the reference was abbreviated and the figure 4 was quoted instead of 6. The wiring diagram on page 786 indicates a Class B choke connected to the output valve, but with the speaker which is specified this will not be required. The terminals of the successful B4, therefore, which are at present joined to the two terminals on the choke, marked "P," must be connected to the two terminals marked L.S., whilst the lead going to the choke terminal marked H.T. must be joined to the terminal on the speaker, which is similarly identified. In this way the very highest quality will be obtained and the output choke will not be required.

**Trimming**

Having joined the speaker as above mentioned, the battery plugs should be connected to the appropriate tapping points, the high-tension plugs being inserted in the positive and negative ends of the battery, whilst the G.B.S. plug is inserted in the 10-volt tapping on the grid bias battery. G.B.1 is then plugged into the 3.5 volt socket temporarily, and the bias battery. G.B.-1 may then be adjusted to provide the best quality, and this is best carried out on the local station, where the maximum signal strength is obtained. It will best results when the aerial is joined direct to the coil from terminal A2, but no matter which connection you employ, the trimming will have to be carried out for that particular connection and then not touched again. When receiving the powerful local station the upper right-hand control will be set to provide ample undistorted volume, and in many cases this will be at practically its zero position. For a weak or long-distance station, the control will have to be turned to its maximum position, and it may also be necessary to introduce some reaction through the medium of the upper left-hand control. A compromise between signal strength and selectivity may be obtained by reducing volume slightly on the right-hand control, and then using the reaction control to bring up the volume to the required level. The G.B.-1 plug may be adjusted or removed, no account should the coils themselves be touched as it is possible to upset the ganging or even to damage these components by unnecessary handling.

**The Aerial Condenser**

The aerial lead should then be transferred to terminal A1 and a search made for weak distant stations in order that you may more accurately gauge your particular local conditions. Carry out the trimming adjustment also with this aerial connection and see if it is necessary to use this condenser in your locality. Your aerial characteristics may be such that you may not get results when the aerial is joined direct to the coil from terminal A2, but no matter which connection you employ, the trimming will have to be carried out for that particular connection and then not touched again.

**How to Trim this Fine New Receiver which Employs the Most Modern Coils and Valves**

The indicating wire on the condenser scale may be slightly bent in order to give the correct indications. When the correct setting has been obtained it should be possible to select any station within range by simply turning the indicator to the correct wave-length.

The **Neat panel layout of the Nucleon Class B Four.**

In this way the very highest quality will be obtained and the output choke will not be required. The correct wave-length and selectivity may be obtained by reducing volume slightly on the right-hand control, and then using the reaction control to bring up the volume to the required level.

<table>
<thead>
<tr>
<th>LIST OF COMPONENTS FOR THE NUCLEON CLASS B FOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One set Weiszite Iron-Core Coils (Types B.P. 1, B.P. 2 and T.G.).</strong> (Wright and Weir.)</td>
</tr>
<tr>
<td><strong>One Polar Star Minor Three Gang Condenser (N.P.L.S.).</strong> (Graham Farish.)</td>
</tr>
<tr>
<td><strong>One 110 volts Lion Battery.</strong> (Bulgin.)</td>
</tr>
<tr>
<td><strong>Three 100,000 ohm. dials.</strong> Dubilier</td>
</tr>
<tr>
<td><strong>One 30,000 ohm. dials.</strong> Dubilier</td>
</tr>
<tr>
<td><strong>One 10,000 ohm. dials.</strong> Dubilier</td>
</tr>
<tr>
<td><strong>One 1 megohm dials.</strong> Dubilier</td>
</tr>
<tr>
<td><strong>One 3-pointer On/OFF Switch Type S.39.</strong> (Bulgin.)</td>
</tr>
<tr>
<td><strong>One Type H.F.P.A. Screened H.F. Choke.</strong> (Lissen.)</td>
</tr>
<tr>
<td><strong>One 120-volt Lion Battery</strong></td>
</tr>
<tr>
<td><strong>One 160-volt Lion Grid Bias.</strong> (Vinces)</td>
</tr>
<tr>
<td><strong>One 120-volt Lion Battery.</strong> (Bulgin.)</td>
</tr>
<tr>
<td><strong>One Terminal Strip (14in. by 1in.).</strong> (Peto-Scott.)</td>
</tr>
<tr>
<td><strong>One Panel (14in. by 7in.).</strong> (Peto-Scott.)</td>
</tr>
<tr>
<td><strong>One Type H.F.P.A. Screened H.F. Choke.</strong> (Bulgin.)</td>
</tr>
<tr>
<td><strong>One 240B valve.</strong> (Lissen.)</td>
</tr>
<tr>
<td><strong>One 200B valve.</strong> (Belling and Lee.)</td>
</tr>
<tr>
<td><strong>One Midget Screened H.F. Choke.</strong> (Bulgin.)</td>
</tr>
<tr>
<td><strong>One 240B valve.</strong> (Lissen.)</td>
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<td><strong>One 160-volt Lion Grid Bias.</strong> (Vinces)</td>
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</tr>
</tbody>
</table>
Now, more than ever before, range is of first importance to listeners. Wavelengths are changing; you will be unaccustomed to the new tuning, and only if your set will pick up distant difficult foreigners with ease and precision will you avoid irritation and disappointment.

The new Dario Valves will give your set the best chance. Their range is something new to wireless reception. They will pick out each station from the next as if no other existed, and, with it, their accuracy is perfect. Sturdy, too, like all Dario Valves in the past, these new models mean a big economy. Study the list of prices and types below and write to-day on the coupon attached for our new complete list of types, prices and specifications.

DARIO VALVES
Every new type and improvement.

POST THIS COUPON TO US
We will be pleased to send you our new list of types and specifications of the latest DARIO Valves. You will be astonished both by the completeness of the range and the very low prices.

Name
Address

To IMPEX ELECTRICAL LTD., 47, Victoria St., Westminster, London, S.W.1.
WHAT progress has been accomplished in 1933? What developments? What achievements? New valves! New coils! New circuits! All tending to improve reception; all helping to provide greater selectivity, greater sensitivity, and better quality.

Look at the new valves provided for us in 1933. Class B, double diode tubes, H.E. pentodes, and the pentagrid or heptode. These are not all.

Tuning circuits have been revolutionized by the introduction of Ferrocart and other iron-cored coils. Automatic volume-control is the order of the day even for battery receivers employing only one high-frequency stage. The pace has been set, and are we, in 1934, to see this rate of progress maintained?

Are we to witness anything startling or revolutionary in components or circuit design?

Now for 1934

Not being gifted with second sight, I do not propose to suggest that anything remarkable will occur in this remarkable age. Nothing surprises us, and we radio enthusiasts would probably only raise our eyebrows if it were announced that communication had been established with one of the planets. What would interest us would be that legislation had been introduced for the protection of wireless listeners against that very annoying form of interference—man-made static. Let us hope that during the present year this form of interference will definitely be laid by the heel, either by the prevention at the source of the interference or by the introduction of some means of preventing it, in every instance where it causes interference with reception. Considerable progress has been made, so let us hope that we shall soon see the end of this very troublesome form of interference.

Quality of Reproduction

There is going to be a demand for real quality reception this year. Whilst the complete set with self-contained loudspeaker will still be popular, those seeking real quality will favour the receiver which does not include a loud-speaker, the selection of the latter being left to their own individual choice. Perhaps the wish in this instance is father to the thought—but I do like my loud-speaker separate from the receiving set itself. A large baffle board about two feet square is my choice; real quality can then be obtained, providing, of course, that the set and loud-speaker are capable of faithful reproduction. A large baffle provides a better balance between high-and low-note response.

Television

There has been television, and rumours of television. We have grown accustomed to reception.

At the present time two television systems appear to be emerging from the results of the years of research into the problems associated with the development of television. There is the mechanical and the electrical system. The former employing the revolving mirror drum and some form of light modulating device, and the latter some form of cathode-ray tube. Both systems have their advantages and disadvantages. At the present time the mechanical system appears to be favoured by the majority. Further developments of both these systems will undoubtedly take place, and practical tests will then prove which is likely to be the superior method.

The combined vision and sound receiver will eventually become popular, and be available at reasonable prices.

Ultra-short Waves

A considerable amount of research work has been conducted on the transmission and reception of wavelengths below 7 metres—the quasi-optical waves—Experiments are being conducted on wavelengths as low as 9 centimetres.

These quasi-optical waves travel only in straight lines, their range being essentially limited by the curvature of the earth. They can be efficiently projected in narrow beams, are not affected by atmospheric noise, and only require very low power. For television they appear particularly suitable, as they

(Continued overleaf)
can easily be modulated by frequencies of several hundred kilocycles. Already experiments in television transmissions on these wavelengths are being conducted, and there is no doubt that there are great possibilities for the future of television on these extremely short-wave lengths. Owing to the wide frequency channels available, 120-line scanning will be practicable, thus providing greater picture definition, which is a great step towards making television of real entertainment value. Maybe that this year we shall witness great advances in this direction.

The superhet receiver has come to stay. It is rapidly superseding the tuned radio-frequency circuit. It is certainly more selective, and it cannot now be accused of being responsible for poor quality of reproduction.

Tone-correction devices can be applied very successfully to a superhet receiver, as only one frequency, the intermediate frequency, is being dealt with. Consequently, the amount of attenuation of the higher frequencies can be calculated, and tone-correction circuits easily designed. In all probability three-valve superhets will become available. PRACTICAL WIRELESS foresaw the four-valve superhet with A.V.C. as far back as May 27th, 1933, when the hexode valve was described. This is now an accomplished fact, made possible by the use of the hexode or pentagrid frequency changer.

Considerable improvements are being made in tuning dials; they are now easier to read, and the horizontal type of dial is rapidly coming into favour. Shall we also see a further development, and have our dials engraved with frequency channels instead of wave-lengths or frequencies?

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Fig. 3.—The small cathode-ray tuning device developed by Standard Telephones.

Stations in Europe are spaced 9 Ws or over, it is necessary to provide an anode voltage of about 250 volts. This valve would therefore be an advantage in small mains sets with limited anode voltage. The triple-twin valve is somewhat analogous to the Class B valve for battery sets.

This is my forecast for 1934. You see, there is still plenty of scope and room for improvement. Time will tell whether these predictions are correct. In any case, we can be sure that stagnation will not set in. New components will be designed, and further advances made in all directions.

"I wonder how many listeners realise (as I did when trying out the 'Microlode' pointer) how much volume is wasted when the speaker is not correctly matched to the output valve." writes a user.

Only when a speaker is accurately matched to the set can the full benefits of the unique Mansfield magnetic system be heard to full advantage. Crisp attack, brilliant top notes, clean bass and astounding freedom from resonances due to the greater flux density. Even balance of tone and better volume due to "Microlode" matching.

W.B. Microlode speakers have received first or sole specification for nearly every important constructor set since their introduction. Hear one on your set to-day: you will be amazed at the difference. Write for the folder.

17 Ratios for power or pentode and 4 for Class B. Perfect matching gives improved balance. The "Mansfield" magnet gives greater sensitivity.

W.B. Microlode speakers have received first or sole specification for nearly every important constructor set since their introduction. Hear one on your set to-day; you will be amazed at the difference. Write for the folder.

Resolved to have the best ?

"MICROLODE" Model P.M. 4A 42/-

"MICROLODE" Model P.M. 6-32/6

Whiteley Electrical Radio Co. Ltd., Dept. D, Radio Works, Mansfield, Notts

Sole Agents in Scotland: Radiovision Ltd., 279, St. Vincent Street, Glasgow, C.2.
The NUCLEON CLASS B FOUR is built around Reg. Trade Mark WEARITE NUCLEON IRON CORE COILS

The very heart of this most modern receiver is its coils—Weartite Nucleon Coils. Their amazing characteristics, giving such a high degree of selectivity—permitting the valves to make the most of the initial signals, has prompted the very design of this set. Your coils must be WEARITE NUCLEON.

NUCLEON IRON CORE COILS

The January 13th, 1934

NUCLEON CLASS B FOUR is built around Reg. Trade Mark WEARITE NUCLEON IRON CORE COILS

The very heart of this most modern receiver is its coils—Weartite Nucleon Coils. Their amazing characteristics, giving such a high degree of selectivity—permitting the valves to make the most of the initial signals, has prompted the very design of this set. Your coils must be WEARITE NUCLEON.

COUPON To Messrs. Wright & Weaire Ltd., 740 High Road, Tottenham, London, N.17.
Please send me a copy of your new booklet, No. GN2, giving full details of your components, together with technical data, and also Full-size Blue Print with constructional details for building the "WEARITE TEAMSTER." I enclose 3d. in stamps to cover cost and postage.

NAME ............................................................
ADDRESS .....................................................

Please write in block letters

WHAT SET IS YOURS?

FOR EVERY SET ON THE MARKET THERE IS A SUPER-LIFE GROSVENOR BATTERY

For instance...

PYLE
There is a Super Life Grosvenor for every Pyle set.

PYLE P.B.1 Ask for Grosvenor DBA 170 (15v.) 17/6
PYLE P.F. Ask for Grosvenor SR 200 (100v. 44v.) 17/6
PYLE P.M. Ask for Grosvenor DBA 200 (15v.) 17/6

MICHAEL Duplex 4 Ask for Grosvenor DBA 300 (15v.) 17/6

MICHAEL Class B S. Ask for Grosvenor SR 400 (84v.) 17/6

Mercury-protected cells make it The Longest-Lived Battery in the World

GROSVENOR ELECTRIC BATTERIES LTD., 2-3, White Street, E.C.2.
Works: Watford, Herts.
Telephone: METropolitan 6088 (2 lines)
Photo-cells in Commerce

PROBABLY every wireless enthusiast is interested in photo-electric cells and their applications from a technical and scientific point of view, but probably few will realise to what extent these light-sensitive devices are employed commercially. It will, therefore, perhaps surprise many readers to learn that a number of dog, horse and motor-race courses employ what are called ray-timing devices. In these cases a ray of light (generally ultra-violet or infra-red, but sometimes visible light, which is invisible to the naked eye) is directed across the finishing line on to a photo-electric cell connected to an amplifier and stop-watch. If the ray of light is broken, due to a horse, dog or motor-car passing the line, the cell actuates the amplifier and so gives an exact record of the time of finishing. At the starting end of the track a similar arrangement is also employed for starting the stop-watch.

Another use for photo-cells is that of counting the number of finished objects passing along an endless belt in factories. Where mass production methods are employed, in that case the cell "feeds" into an amplifier in the output circuit of which is included an electric counter. Any mistake in counting the number of articles passing along the belt is thus impossible, and the counting process is perfectly simple and rapid. At least one firm of biscuit makers in this country employ photo-cell counters, whilst in America the system is employed in many engineering shops and in flour mills.

Photo-cells are also extremely useful in connection with street lamps, for they can be arranged to switch on the lights immediately the normal daylight falls below some pre-determined intensity. As a matter of fact, photo-cells are used for this purpose (only experimentally at present, it is admitted) in Liverpool, Hull, York, Erith and Beckenheim. It is by no means unlikely that still wider and permanent use will be made of this system of automatic illumination in the future.

A High-output Multiple Valve

MULTIPLE valves, in which a single filament is used in conjunction with two or more grids and anodes to provide two or more stages of amplification by means of a single valve, have been in the past and sold in fair numbers on the continent. These were generally of the indirectly-heated type and is distinctly unusual in that the output load for the first set of electrodes is connected in the cathode, instead of in the anode, lead. An advantage of this system is that, by correctly choosing the output component, it can be used to provide the necessary bias without the use of the normal bias resistance.

Leaking Condensers

MODERN condensers and resistances are usually very reliable, and remain constant in value for long periods. But even so it does not do to overlook the possibility of a slight change in value or reduction in efficiency after constant use, and in some instances only a slight divergence from their original characteristics will cause noticeable distortion. I was thinking particularly of coupling condensers used in R.C.C. coupling. A slight insulation leakage will result in a positive charge leaking off to the grid of the following valve. If the value of the associated grid leak is rather high this charge will accumulate, and so neutralize the grid bias which is applied through the grid leak. In other words, the valve will be under-biased, although apparently the correct bias is applied. A milliammeter connected in the plate circuit of the valve will show a higher reading than it should do. This is, of course, an indication of under-biasing, so that if on checking up the value of the bias taping or resistance the voltage is found to be correct, then strong suspicion rests on the coupling condenser.

Distortion and Ageing Components

A POINT which it is always useful to know when attempting to diagnose the cause of distortion is whether the distortion has always been present or whether it has gradually developed. The receivers which we receive in for servicing are of the indirectly-heated type, and from the obvious ones, such as worn-out batteries and old valves, there are others, such as the accumulation of dust and damp, the partial breaking down of resistances and condensers, etc.

Dust, of course, a great enemy of good quality, since it is usually hygroscopic in nature, and by attracting moisture from the air, forms a thin, conducting medium over the surface of the various components in the receiver. In this way many terminals become connected together by what amounts to a high resistance.

Phase Difference

ONE of my correspondents asks me to explain the phase differences which are encountered by the home-constructor are actually of his own making. The majority of the receivers which are received by us for examination owing to their failure to come up to the guaranteed standard are full of small points which go a long way to prevent good results. One of the most common faults lies in the method of tightening nuts. Great care should be taken when tightening up a spanner, or to use a screw-driver on those which have slotted heads. Where the connecting screw passes through bakelite or similar material, the action of using a spanner on the nut does not always result in increased tightness, but rotates the actual screw when the locking faces are firmly in contact, and further rotation unscrews the screw or bolt beneath the bakelite surface. In many components this results in the internal connecting wire or lug coming loose and noises, or even complete disconnection results. In other cases we have found that even thick connecting wire has been sheared practically right through, and the slightest touch results in the nuts moving. In all such cases the manufacturers are sufficient to enable a really good connection to be made, and "finger tightness" should be the rule with all connections.

50 Tested Wireless Circuits

By F. J. CAMM (Editor of "Practical Wireless")

This handbook contains every modern circuit, complete with instructions for assembling, component values and notes on operation. Available at all booksellers, or can be purchased from the author, 8-11, Southampton Street, Strand, London, W.C. 2.
ANNOUNCEMENT

The I.C.S. Radio Courses cover every phase of radio work, from the requirements of the youth who wishes to make wireless engineering his career to the man who wants to construct and maintain a broadcasting set for his home. The Radio industry is progressing with amazing rapidity. Only by knowing thoroughly the basic principles can pace be kept with it. Our instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the industry.

OUR COURSES

Included in the I.C.S. range are Courses dealing with the Installing of radio sets and, in particular, with their Servicing, which today intimately concerns every wireless dealer and his employees. The Operating Course is vital to mastery of operating and transmitting. There is also a Course for the Wireless Salesman. This, in addition to inculcating the art of salesmanship, provides that knowledge which enables the salesman to hold his own with the most technical of his customers.

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Name

Address

Janurary 13th, 1934

RECENTS

REVIEWS OF THE LATEST RECORDS

ON THE WAX

By T. Onearm

All Sorts

There is a very good comic record by Ike Freedman (the Scottish Hebrew Gentleman). He sings (on Regal M10148) King of Palestine and Romey. They are both excellent tunes as well. If you dare risk one of those airs, which will probably result in your neighbours thinking you who will catch it from you) The Man on the Flying Trapeze (Decca F3682) will most suit the thing. Messrs - is sung by a good vocalist with the Jollies and you have now been warned. The most interesting novelty for a long time is the record of an Electrodome performance of Le Cygne and Schubert's Serenade by Martin Taubmann (H.M.V. B8020). Every radio lover should get this record: it is not only extremely interesting from a technical standpoint, but it is very delightful to listen to this "musical oscillator as Mr. Taubmann " plays". It sounds like a disembodied cello- a 'cello without any wood, that is. I believe this is a discovery with big possibilities, if it isn't too difficult to manipulate. I shall certainly try it.

For Dancing

If you have never heard Chalmers Wood and his Scottish Dance Orchestra, do so at once. Try Scotch Broth (foxtrot) and Scottish Memories (waltz). A first-rate dance record of the "straight" sort. One of the really big hits of many months is the record of the Two High-lighters, "Any Day Divorce". They are played by Leo Rersman's Orchestra and are Night and Day and I've Got You On My Mind (H.M.V. B6398). Fred Astaire sings both vocals, which gives the record an enormous cachet.

Songs of all Kinds

Beloved Ben Davies," the announcement of his new record begins, and nobody will disagree. At seventy-six, this veteran sings Tom Bowling and Come Into The Garden, Maid (Columbia DB1204). I wish we could have had "Tom" on both sides, so as to have a new side when the other was worn out! It is clear that "Maud" is a strain on him, but it is delightful to hear him again. Now Heddle Nash, one of our best English tenors of to-day. He sings your very Hand in Frolic and The Serenade from The Fair Maid of Perth (Columbia DX340). The first is very pleasant both from the vocal and harmonious viewpoint. Tauber has a perfectly enchanting song in I Greet You, My Beautiful Berenice and Schubert's Serenade (H.M.V. R6022). You will travel far before you hear a lovelier melody. Two songs of the rural school-When the Harvest's In and The Merry-Go-Round (Columbia DB1204), sung by Harold Williams. Eastboats Martin lovers, please note: these are in the tradition of the old friend Stephanie Cavovetti, and Emmy Bettendorf sings the simple words exquisitely—on Parlophone R1033. Then Anona Winn does two on Columbia DB1303. Cozulka is again chosen with Hearts and Flowers and the famous Rendez Vous.

High Spirits

There are many laughs abroad from the latest records, and one of the best of those quiet, subtle monologues I have ever heard is John Tilley's Company Promoter on Columbia DX597. As the chairman of a company of decidedly shabby character he addresses the shareholders. In his address are some gems of highly polished humour, every one of which is too good to quote. A great record! Then Norman Long, breezy and cockney as ever, gives us We Can't Let you Broadway (Columbia DB116). The poor B.R.C. stop quite a number of hefty blows in the first, and the second is the philosophy of the gent with the road-drill. Taking Possession (H.M.V. B6003), proves that Claude Hubert is not such a fool as he seems, and the other is Songs of the Grenadiers: Too Many Gipsies.

A musical novelty of very great merit is A Gypsy Sing-Song (Regal Zono M10148). Sidor Barman's Gypsy musicians give real support to the title, and those who yearn for the gypsies to sing to them (as the song demands) will get all they want here. There are two band performances which must not be missed. The first is the musical staging of the Twidworth Tattoo on H.M.V. C2559-4. Definitely better than the Aldershot one, and the second is the musical staging of the Grenadiers. Two Gnomes have ever done—Columbia DB1207. They play Under the Garden Flag and The Brigada, both matches clear of the usual uninspired blare. Clean-cut bright tunes again here.

Two very good "at the piano" artists, Fred and Leslie Douglas, sing exceedingly well Carry Me Back to Green Pastures and I've Found The Right Girl (Sterno 1249). Peter Dawson has done some of Stanford's songs of the sea. Quite the best is Outward Bound (H.M.V. B636). It gives a much better performance of his. A very good chorus is with him.
BY THE PRACTICAL WIRELESS TECHNICAL STAFF.


calibrated scale enables the home-con-actor to assemble a highly-efficient receiver with a minimum of trouble. Messrs. Colvern have now turned their attentions to the production of a unit of this type, and that illustrated below employs the Ferroncourt iron-core coils, together with combined switching. As may be seen, the coils are of the 'G'-pattern, which are larger than the original 'Y'-type of Ferrocoat coil. The coils, together with the screened condenser, are mounted on an aluminium base-plate, and, in addition to the coil wave-change switch in-clude a battery switch, a radio-frequency switch, and also a battery switch is mounted on the plate to be operated through the wave-change switch on the rod.

This switch nearest the control knob is for radio-frequency cancellation, and is a clean-cut, Shuttlecock switch which will not be liable to troubles through faulty contacts. At the opposite end of the switch is a G.M.B. type of switch designed to operate by a main action on the end of the rod. This may be used for breaking the low-tension circuit, and, if required, the switch may be supplied in the high-voltage type suitable for switching off a mains receiver. The complete Colvern, as it is called, may be obtained for simple receivers, or superheterodynes. In the former case the coils provided are of the band-pass and inter-valve type, with reaction coil fitted to the latter coil. In the superheterodyne pack, the combi

ination consists of band-pass and oscillator coil which is suitable for use with a circuit employing a separate oscillator valve, or one of the newer superheated or heptode valves. The price for either type is 32/- ed. (without dial).

mullard high-efficiency pentode

The Mullard Pen.4VA is now generally released, and while the maximum output from a single stage is desired no listener should hesitate to obtain one of these valves for testing the loud-speaker. As we have previously mentioned, this delivers nearly 8 watts unfaulted output. In addition to this factor it will handle a larger signal than the Pen 4V, and thus, while giving full advantage of modern design, it sacrifices at the same time the possibility of distortion due to overloading. It is an A.C. valve having a 4 volt 1.5 amp heater, and taking up to 300 volts ac and auxiliary grid voltages. The bias required at this figure is 30 volts and a 200-ohm resistor will be found correct if inserted in the cathode lead. The correct load impedance is 6,000 ohms, and the price is 18s. 6d. (including tax). The correct condenser for feeding the loud-speaker.

ULTRA-VIOLET RECEivers

The list received from Messrs. Ferranti gives complete details of the whole range of Ferranti receivers and extension loud-speakers. Four new models have only just been introduced, namely, the Lancastria Radiogram ; the Arcadia Conssole ; the Arcadia Console and the Arcadia Radiogram. The Lancastria Radiogram is built on very sound and modern lines, having a sloping top to assist in maintaining constant high quality at any volume level, and is fitted with a high-grade electric motor and pick-up. The price is twenty-six guineas. The Arcadia models are superhetodryne receivers designed as table models or radiograms, and also represented extremely efficient and up-to-date instruments. The list may be obtained by any reader upon application to Messrs. Ferranti, at Holthwood, Lancashire.

The Filtralmer Octave Tone Control

Something new in tone controls has been announced by the Mullard Company. As we have already pointed out, the problem of obtaining a tone control without volume and pitch alteration has been difficult to solve. As the Mullard new control was designed to meet this requirement, we are assured the Arcadia Console and the Arcadia Radio-gram. The Lancastria Radiogram is built on very sound and modern lines, having a sloping top to assist in maintaining constant high quality at any volume level, and is fitted with a high-grade electric motor and pick-up. The price is twenty-six guineas. The Arcadia models are superhetodryne receivers designed as table models or radiograms, and also represented extremely efficient and up-to-date instruments. The list may be obtained by any reader upon application to Messrs. Ferranti, at Holthwood, Lancashire.

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Utility combined control

A MOST ingenious combination has been announced by the Mullard Company for an extension loud-speaker. A small bakelite diode reaction condenser and a potentiometer mounted on a common control spindle. As probably many experimenters have found when endeavouring to combine two devices of this nature, it is exceedingly difficult to make the two controls operate at the correct moment. The reaction is, of course, controlled by a condenser on a variable-m.v. H.F. valve and thus control volume, while the potentiometer serves for reaction purposes. The idion underlying the combination, therefore, is that as the signal input is increased, reaction is increased. Obviously, the H.F. control must be connected to a certain extent with the reaction control commences to operate and this difficult to accomplish with the standard pick-up of the loud-speakers. For this new Utility device the plates of the reaction condenser are made of unusual shape and are not in use for the control to be turned through a fair movement (actually 190 degrees), so that the pick-up does not have to interfere with this, and in the majority of cases, enable the H.F. input to be modified to the required degree before the reaction control commences to function. The arrangement was tested out on three different receivers in which the separate controls had previously been fitted, and it was found to provide a very smooth control without any necessity for drastic voltage, or circuit alterations. The price of this control is 7s. 6d., with a reaction condenser of the differential or the ordinary type as required.

Eastick's Radio Bulletin

THE December, 1933, issue of this interesting little booklet is filled chiefly with lighter fare, including seasonal greetings from various radio manufacturers. Among the other contents are particulars of meetings, etc., of the W.R.A. during November and December; short-wave notes, and specifications of components for various sets described in recent periodicals during December. Details of the new short-wave sets are contained in the December issue of the Radio Journal, and in the December, 1933, issue of the Radio 

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

F. J. C.'s Latest: Excellent Results

Sm.—With reference to my query regarding your latest set, I have carried out your instructions for locating the fault, and find that the trouble was caused by two loose connections on coil F.10, the terminal screws being loose and making bad contact. After correcting this I find that the receiver is all you claim it to be—and more. The selectivity permits of all the separation necessary in this district, and the sensitivity enabled me to list a remarkable number of stations. In a locality such as Brighton, where fading after dark is troublesome, even on the nearest Regional and National (London), the A.F.C. control is especially appreciated. The absence of fading and really "true life " quality of reproduction make the set a perfect source of entertainment. Thank you for a fine set.—H. STENNING (Brighton).

"Simply A 1"

Stk.—I have just received my Pocket Tool Kit and I am one more "Thank you" to those which have preceded mine. Every Wednesday I look forward to receiving my copy of Practical Wireless. I think it is the only paper, book, or encyclopedia that is of use to anyone with a set as well as to those which have preceded mine. After correcting this I find the trouble was caused by the terminal screws being loose and making bad contact. I hope to make fuller use of it very shortly as I am contemplating the construction of a new set.

G. HILL (Ringwood).

Two S.G. Short-wave Converters with Special Low-Loss Features

Sir,—The accompanying circuit diagram is of a short-wave superheterodyne converter which utilizes two screened-grid valves (metallized), one as oscillator, the other as detector. Combined with the R.I. antinodal short-wave coil, and used in conjunction with a five-valve (2-v-2) mains broadcast set, this gives efficient operation from 12 metres up to 80 metres entirely in this combination. I attribute this remarkable result to the special use of the R.I. antinodal coil (which I can claim originality for this, plus the use of two screen-grids, and I think is of a short-wave superheterodyne converter which utilizes two screened-grid valves (metallized), one as oscillator, the other as detector. Combined with the R.I. antinodal short-wave coil, and used in conjunction with a five-valve (2-v-2) mains broadcast set, this gives efficient operation from 12 metres up to 80 metres entirely in this combination. I attribute this remarkable result to the special use of the R.I. antinodal coil (which I can claim originality for this, plus the use of two screen-grids, and I think is especially appreciated. The absence of fading and really "true life " quality of reproduction make the set a perfect source of entertainment. Thank you for a fine set.—H. STENNING (Brighton).

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UKRISIDE RADIO CLUB

The third meeting of the Uxbridge Branch of the Anglo-American Radio and Television Society was held at 11, Hawthorn Drive, Willowbrook, Uxbridge, on December 18th. An enjoyable time was spent by all present, and records of America were once again played over, by request. A number of wave-stations were tuned in upon the club receiver. A discussion upon one, two, or multi-valve receivers for short-wave work was the topic of the evening. A Ruislip member contended that the increase in unwanted noises which was caused by the addition of an amplifier to a single-valve receiver was such as to render the tuning in of faint stations an extremely difficult procedure. Mr. Leslie W. Orton agreed that this was the case in a great number of instances. However, if the receiver was well designed the extra amplification was worth having, because, in suppressing side and similar noises by placing a .015 mf. condenser across the secondary of the transformer, the extra amplification could be obtained without a large increase in unwanted noises. The club two-valve all-main receiver was demonstrated and all agreed that it was extremely useful in operation.

There is no charge for attendance to meetings of the Uxbridge Branch, and everyone is welcome. Meetings take place every third Thursday of each month, at 7.30 p.m. on Christmas Day.

SLADE RADIO

Mr. A. P. Slade, in a talk on "Oscillators and their applications," gave a new life to the club with a talk on the art of tuning in all types of stations. The Sladeophone offered a new and practical method of obtaining radio entertainment. It was the only apparatus which could catch all wave-stations and which could be purchased within the means of all classes of radio listeners.
Use... SIFAM METERS for ALL RADIO TESTS!

The name Sifam stands—as it has always stood—for workmanship and accuracy. D.C. meters are fitted in black bakelite casings and A.C. meters in metal cases. All movements are carefully balanced and fitted with knife edge pointers. Accuracy guaranteed.

Send for illustrated leaflet, giving all information.

SIFAM ELECTRICAL INSTRUMENT COMPANY, LIMITED, York Works, Browning Street, LONDON, S.E.17.

Invisible Aerials


You must get our free new 1934 handbook:

Full particulars of long and short wave courses from £2. Unique home-study methods and recommendations.

PRACTICAL WIRELESS

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

The coupon on this page may be used to every query.

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries service is intended only to give help and advice on difficulties arising from the construction or operation of apparatus described in our pages, or on general wireless matters. We cannot undertake to supply diagrams in full, or to solve underlying difficulties.

1. Simply circuit diagrams of complete apparatus are normally given.

2. Suggest alterations or modifications of methods described in our contemporary series.

3. Suggest alterations or modifications to commercial receivers.

4. Answer queries over the telephone. (In case of doubt always send in a query, as some queries are referred to our Technical Staff.)

LOUD-SPEAKER POLARITY

I have a rather old type of reed loud-speaker and wish to bring this up again. I have cleaned it up and reassembled it, but find that during the cleaning process the positive and negative markings have become reversed. I should like to know, therefore, if there is any simple way of finding out which is positive and which is negative in order that I may connect this to my receiver in the correct way. —R. L. S. [Templement]

There is no necessity to know which is positive or which is negative so long as you connect the windings to your receiver in the right sense. Of course, if a filter-output circuit is used it will not matter which way round the speaker is connected. However, if it is joined direct in the anode circuit you should connect it to the terminals and the correctly set-up tone-

wave function will turn the reed flat down on the pole pieces.

It is much better to follow carefully the instructions before the reed is attached to the pole pieces, then the first trial, what was correct.

REDUCING THE LOCAL

I have a commercial receiver which employs two variables, which I do not have. Can you advise on how I can reduce the output without interfering with the positive or negative feed? It would be used in the diode feed.

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