



That's where the Screened Pentode starts its work



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. 1 We help ourselves by helping

you. When writing, whether your problem is big cr small, give every detail, and address your envelope to T.S.D., Ref. D.N.B.

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.





ROUN the

What of Television ?

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HERE 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 lately the degree of perfection to which wireless telephone reception 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 wall nick perfect but immedibecome well-nigh perfect, but immedi-

ately it was found possible to syn-chronize 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 WIRE-LESS 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 PRACTICAL WIRELESS has, since

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. 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 apparatus, we would say that they will find all the additional information and constructional details which they require contained in our regular feature, the "Television Supplement.

Secret Out

'OR 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 scoret until just recently, when it has become known in the office that Mr. Camm has been designing another new receiver for his

TWO FREE GIFTS NEXT WEEK!

(1) The PRACTICAL WIRELESS "1934 Wavelength Guide and Station Log "-A hang-up chart containing all of the important stations and their new wave-lengths, 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 modify 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 !

readers. Mr. Camm described his "Furv Four" in January, 1933, and this remark-ably efficient set was easily the most popular 'home-constructor set of the year. The latest 1934 receiver is even better than the 1933 one, so you can rest assured that it is something really good. Although very easy to make, it embodies all the latest developments and is sure to meet with the warm approval of every amateur who delights in set construction. The writer is forbidden from giving any further details at the moment, but the complete specification will shortly be available for publication. Look out for the set which will ensure perfect reception during 1934 !

Practical Mechanics for January THE January issue of NEWNES' PRACTICAL MECHANICS (6d, from all newsagents, MECHANICS (6d. from all newsagents, or 7¹/₂d. post free from George Newnes, Ltd., 8-11, Southampton St., Strand, W.C.2) contains many interesting articles on fascinating scientific and mechanical subjects. There are well illustrated articles on iects. There are well illustrated articles on
"Making Mains Transformers for all Purposes," "The Iris Diaphragm," "Astronomy," "Model Boats," "Making a Small Precision Lathe," "Home Cinematography," "Television Synchronizing Gear," "Piccard Gondola," "Experiments in Chemistry," "Microscopy," "Home Recording," "Practical Conjuring," "Lathe Work for Amateurs," "Model Railways," "Gramophone Upkeep, Overhaul and Repair," "Making an Ingenious Combination Lock," "Practical Hints and Tips," "Building Model Aeroplanes," "Making a Twin

Ingenious Combination Lock," "Prac-tical Hints and Tips," "Building Model Aeroplanes," "Making a Twin Solenoid Electric Motor," "The Polariscope," whilst special features deal with "New Tools, Gadgets, and Accessories," "Money Making Ideas," "Trade News," "Club Reports," "Free Patent Advice to Inventors," "Replies to Readers' Queries," "The Latest Novelties," "Notes, News and Views," etc., etc. This modern and practical monthly

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" announce 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 promfhent members of both "His Master's Voice" and Columbia staffs were present.

ENSURE YOUR FREE GIFTS BY **ORDERING NEXT WEEK'S ISSUE NOW !**

January 13th, 1934

ROUND the WORLD of WIRELESS (Continued)

Wireless for Diamond Mines

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N interesting example of the use of wireless in industry is the regular A communication service maintained by the Consolidated Diamond Mines of South-West Africa, Limited, between their station at Luderitzbucht (South-West Africa) and their mining camp at Oranjemund, 160 miles distant. Equipment capable of with a view to the broadcast of an operation on either telegraphy or telephony, tive programme for radio listeners.

as desired, was supplied by the Marconi Company some eighteen months ago, and has since been regularly used for the exchange of messages at fixed hours every morning and afternoon, on wavelengths of about 1,100 metres. 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. Theⁱtransmitters are the Marconi "U" type of 1¹/₄ kilowatts power, and derive their energy from paraffin engine generator sets. This type of transmitter comprises two rectifying valves and one oscillator in the telegraph unit, with a modulator and submodulating valve added for telephony. The wave range is from 600 to 3,000 metres.

Short Plays from Midland Regional

)N 22nd Midland January

ON January 22nd Midland Regional listeners will hear three short plays-Maurice Baring's *The Drawback; The Monkey's Paw*, by W. W. Jacobs, which has been given from London, and Gertrude Jennings' clever comedy of a lift, *Five Birds in a Cage*. Then, on the 27th, there is a pantomime bur-lesque, Snowdrop and the Seven Dwarfs (Hollywood Version), with music and lyrics by Ronald Hill. As the result of nearly two hundred auditions, Martyn Webster has found some new acting talent in the region, and some new players will be in the casts.

New "Points of View " Talks

THE first Scottish Regional discussion in the new "Points of View" series will take place on January 15th. This series will bring to the microphone, on some halfdozen occasions, distinguished Soots to discuss some of the great world problems of the present day. "Is Democracy of the present day. "Is Democracy Doomed "is first on an interesting list, and it will be debated by Mr. Tom Johnston, who was Parliamentary Under-Secretary for Scotland in 1929-31, and Lord Privy Seal in 1931, and Professor F. A. E. Crew, the distinguished biologist and author. It will be interesting to discover whether there is a typically Scottish view-point on great world problems.

Prague's Alternative Programmes

HE old Prague-Strasnice station, which was closed down when the new Liblice transmitter was brought into operation,



has been completely overhauled and brought up to date. It is now carrying out tests in the early morning hours on 249.2 metres with a view to the broadcast of an alterna-

RECORDING THE KING'S CHRISTMAS MESSAGE



By special permission of The King, an H.M.V. gramophone record of his Christmas Day speech was made in the "His Master's Voice" recording laboratories at St. John's Wood. The half-recorded wax blank, which is made chiefly of soap, can be seen, whilst one of the engineers adjusts the volume and the other examines the track of the King's voice under a magnifying glass. The width of the track of His Majesty's voice in the record is only three thousandths of an inch.

Opera House Relay IN future Radio Budapest will restrict its relays of performances from the Royal Hungarian Opera House to excerpts



Problem No. 69

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 gramo-phone 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 altera-tion in Volume was experienced for part of the travel, and then suddenly the volume fell way 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 oorrect solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, e-11, Southampton Street, Strand, London, W.C.2. Envelopes should be marked Problem No. 69 and posted to reach here not later the January 15th.

SOLUTION TO PROBLEM No. 68

consisting of one act, as it has been found that when this course is adopted the appetite of listeners is whetted and the opera house bookings proportionately increase as a consequence of the broadcast.

Neutral Broadcaster for Holland

CO far the two Dutch transmitters, D 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 associations. 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 !

HE National Broadcasting Company of America, when removing its belongings to the new headquarters at Radio City, was called upon to transfer 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, an embellishment which greatly enhances their value.

Radio in the Sahara Desert

THE French Authorities have decided to establish a comprehensive network of small wireless telephony and telegraphy stations in the Sahara desert with a view to linking erent military posts. The first

up the different military posts. three stations will be installed at Wahatel Faragia, Wahatel Karigia and on the Sinai promontory.

Will the Poste-Parisien Take Over Other Duties ?

A CCORDING to a report from Paris the Poste-Parisien station may 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 en-suring 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 grad-ually being replaced by clock carillons at the opening or end of the programmes.

Value of Super-Power Valve's Emission N 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.

PRACTICAL WIRELESS

N studying the problem of flight, designers.

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

functions in several respects in a manner similar to that of In a manner similar to that of the human eye. In perfecting the Iconoscope, as this new in-vention 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 cathoderay tube is somewhat analogous to the ordinary radio valve. It possesses a hot cathode, or filament, and an anode. Fig. 2 illustrates diagrammatically the

amplifier. Its particular value various elements comprising it. First of all there is the Fig. 1.—Showing how the scenes projected on to the mosaic are scanned, in television is that the amount 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, Arranged above are two pairs of plates, D, Arranged above are two pairs of plates, D, mounted at right angles to each other: these are known as the deflecting plates. The

D-D 0 0 Anode 5 Shield

Fig. 2.-Theoretical diagram of a cathode ray tube.



The Marvellous Invention of an American With the Iconoscope Objects Scientist. can be "Seen" in Their Entirety and Retained in an Electronic "Memory." By "LAMBDA"



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 flourescent 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 pipe

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 LIGHT

plates, whose func-tion 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 em-ployed 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. of an evacuated glass built. 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

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-

(Continued overleaf)



(Continued from previous page)

electric cell for only a fraction of a second and corresponds to the illumination of one picture element. Supposing we desire to obtain a scene composed of, say, 70,000 picture elements, the time of transmission of one element will be quite infinitesimal.

We have already seen that the current from a photo-electric cell is proportional to the amount of light falling upon it and also to the time during which it is acting on the cell, so that in this example the amount of light is very small indeed, and consequently the amount of amplification needed to obtain a satisfactory result would be very great.

Now the inventor of the Iconoscope reasoned that if a television system could be devised which would function in the same manner as the human cyc, comprehending the whole of the scene at once, all points of the picture would affect the photosensitive cells at the same time. If the picture contained 70,000 elements we should, theoretically, secure 70,000 times the amount of photo-electric output.

ELECTRON BEAM

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 only one of the many photo-electric 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 Pc 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 on 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 cathodc Pc emits electrons and consequently the condenser C becomes positively MOSIAC

SIGNAL PLATE

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



Having "seen" the whole of the picture it would of course still be necessary to sean it, so that it would also be essential to devise some method whereby the scene could be retained; some sort of electronic "nemory" would have to be arranged. This was the problem.

The Solution

In order to solve this problem a special form of cathode-ray tube was constructed in which a rectangular plate is used in place of the fluorescent screen (see cover illustration). This plate consists of a sheet of a very thin mica, mounted upon a sheet of metal known as the signal plate. Upon the other side of the mica sheet is sprayed a solution of light sensitive material which settles upon it in the form of globules. Each of these globules constitutes a separate photo-electric cell, the plate behind the mica sheet representing the anode which, of course, is common to all the cells.

The picture is projected upon the mosaic, which results in a continuous emission of electrons according to the distribution of the light in the picture. This device also acts as a number of small condensers, the mica sheet being the dielectric. The charges acquired by each element of the mosaic are released by the cathode-ray locam each time the picture is completely scanned. The impulses are amplified and used to modulate the intensity of the cathode-ray beam in the receiving tube, by which the condenser is charged also depends upon the intensity of the light.

Now when the electron beam strikes this particular element Pc C 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

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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 bent 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 on the neck of the tube. A complete television transmitter along these lines is illustrated on the cover.

The writer is indebted to Dr. V. Zworykin, for his courtesy in supplying the diagrams and photographs of the Iconoscope reproduced in this article.

THE ADVANTAGES OF R.C. COUPLING

R ESISTANCE-CAPACITY coupling between low-frequency stages has fallen very much into disfavour of

This is doubtless due to the excellent late. performance given by the modern transformer, which can generally show a straight response from 50-5,000 cycles at least. The comparatively large stage gain is also an important point in its favour. Offset against this is the undeniable fact that resistance-capacity coupling still has a much wider frequency response than the transformer. The low-stage gain is not a very formidable objection in these days of high amplification mains valves. Perhaps, however, the most important fact to be borne in mind is that R.C. coupling scores heavily in the reproduction of transients.

Let us examine these points individually. Providing a good transformer is parallel fed, there is probably little to choose between the two coupling methods as far as bass response goes. Look at the response curve of any transformer, however, and we shall see that above 5,000 cycles the curve falls rapidly. This is due to the inherent self-capacity of the windings; 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.

Now we come to transients. In passing, we may as well remark that the musician usually terms this "attack," which is selfexplanatory. Any sudden or staceato sound comes under this heading; handclapping, and pistol shots are good examples, as also are the explosive consonants in speech, e.g., "p" and "b." Most receivers fail dismally in handling transients when transformer coupling is employed. The reason for this is that all transformers tend to oppose any change in current; in point of fact they have electrical inertia. A sudden surge of current occasioned by a transient will meet with a sluggish response by the transformer; it will not "jump to it."

Furthermore, when the sound ceases the transformer is loth to leave go, as it were. Our original transient, therefore, emerges from the fray as a blurred and poor imitation of the original. No such effect is apparent with R.C. coupling. Reproduction has far more "attack." The rendering of the piano and stringed instruments, which are rich in transients, is far more pleasing and bife-like.

A few words with regard to details. Do not make the coupling condenser too large, and do not use too high a value of gridleak, otherwise trouble will arise with grid blocking. This phenomenon is caused by a heavy charge on the condenser being unable to leak away quickly enough. If, on the other hand, the leak is made too small, amplification will suffer; too small a grid condenser will tend to weaken the bass. A useful compromise between the bass. A useful compromise between the bass. A useful compromise between the a.5 meg. leak.

It must not be thought from the foregoing that a receiver using transformer coupling is incapable of good reproduction. Far from it. So much depends on the rest of the set, in particular, perhaps, the loudspeaker. After all, what is the use of striving for a receiver response up to 10,000 cycles when the speaker cuts off at 5,000 ?

MANY requests are received by the Advice Bureau of PRACTICAL WIRE-LESS 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 for individual 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 essen-

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.

"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.



Fig. 1.—The above circuit represents an excellent arrangement for a battery-operated 2 watt amplifier.

tials of the circuit to be used, as will be seen when reading the following paragraphs, but sufficient information will be given to permit of the average experimenter working out the final details for himself.

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 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 .25 megohm volume control potentio-meter. Choke-capacity coupling is em-ployed 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 milliamps. 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 .02 mfd. condenser across each half of the .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 pre-ferred, and it is better to employ speakers (Continued overleaf)



Fig. 2.—In this circuit indirectly-heated D.C. valves are employed, their heaters being wired in series.

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(Continued from previous page)

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 biassing 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 parallel-fed through a choke-capacity circuit. The two pentodes are each capable of delivering 2,300 milliwatts output when supplied with an anode voltage of 250, or of just under 2 watts when 200 volts is fed to

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-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



Fig. 3.—The circuit for a really powerful A.C. mains-operated amplifier. Indirectly heated values are employed in the first two stages with a pair of directly heated pentodes in the push-pull output stage.

Thus a total output of about the anodes. 31 watts (3,500 milliwatts) can be expected under normal working conditions. All the valves are of the type requiring 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 on sale. As regards the choke used for feeding the input push-pull trans-former, this need have an inductance of

of 200, and this is obtained by the insertion of suitable decoupling (and voltage-dropping) resistances in the high tension supply circuic. Rectification is by means of a fullwave valve rectifier which gives an output of 500 volts at 120 milliamps. There are three low tension windings on the mains transformer, of which one supplies 4 volts at 4 amps, for the filaments of the directlyheated output pentodes, another gives 4 volts at 2 amps. for the heaters of the first two valves, and the third supplies 7.5 volts at 2 amps. for the rectifier filament. Automatic grid bias is provided for all the valves by means of suitable resistances in the cathodit and H.T. negative leads, whilst an adequate degree of decoupling is provided to ensure stability under all conditions.

Suitable Components

The smoothing choke must be an exceptionally good component having an inductance of not less than 15 henries when carrying the maximum high tension current (120 milliamps.). All the smoothing and coupling condensers must be of a type having a rated working voltage of not less than 1,250, and it is wise to insert fuses in the positions indicated on the circuit diagram. It is scarcely necessary to detail all the components employed, since the values of all important ones are clearly marked on the drawing. Notice particu-

January 13th, 1934

larly the wattage ratings of the various resistances and bear in mind the fact that the values shown are minimum ones which there is no harm in exceeding. It would appear that the maximum output of this amplifier should be about 20 watts, since the two valves in push-pull have cach an andistorted output rating of 10 watts. Actually, however, the full output cannot be obtained, due to the fact that the total anode current consumption of the four valves under "maximum anode voltage" conditions is slightly over 160 milliamps. As the rectifier is of a type supplying only 120 milliamps, the full voltage will not be obtained under working conditions, with a result that none of the valves will be fully loaded. This is not really a disadvantage and makes for longer valve life whilst permitting the use of perfectly standard and easily-obtained components. To ob-tain a full 20-watts signal output it would be necessary to connect two rectifiers in! parallel or to use a rectifier of the mercuryvapour type; neither method is worth the expense entailed unless the full output is an essential feature.

In making A.C. amplifiers to give greater outputs, up to, say, 100 watts it becomes necessary to employ a pair of valves of the transmitting pattern in the output stage, 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" pattern 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 halfwave 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.

High Tension from a Low-tension Accumu-

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. As with 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, free from interference and of equal quality. Such an individual expects too much from one instrument. You cannot have it all ways. If you want multitudes of stations, you must be prepared for a fair amount of headphone work and a sacrifice of a certain amount of quality.

N a previous article I dealt at some length with instability of the kind which

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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 LF and HF since quite often the 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 leads near to 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



HT-Lead Windings

Fig. 2.—L.F. instability in portable sets can often be cured by screening the loud-speaker leads with metal braiding.

Fig. 3. - Different methods of preventing the passage of H.F. currents into the amplifier L.F. are shown here. New components and connections are indicated by heavy lines.



tuning coils, or to 25.000 Ohms the detector or S.G. 15 instability 1 FChal above referred to 1:1 are perhaps fairly Transi but they should always 2 MGa be looked for as a preliminary to the Farth further tests that might be applied H.T.to a set which is behaving unsatis-L.F.Chok 25.000 Ohms Detecting L.F. In-Sutout Transfi 2 Mfd. 2MG Earth

By BERNARD DUNN Numerous Simple Methods of Dealing With Distortion and Other Troubles Arising from Unstable L.F. Amplification are Here Described

Fig. 1.-These theoretical and pictorial diagrams show how the detector and consequent L.F. valves can most easily be decoupled. The decoupling com-ponents and wiring are shown by full lines, the remainder of the circuit The decoupling combeing in broken lines.

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 many different ways. It might be noticed that reproduction is simply distorted; perhaps it sounds "screechy" or highpitched ; there might be a constant whistle accompanying all repro-duction; 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 by 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., i: is a perfectly easy matter for the low frequency currents appearing in the anode circuit 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 (Continued overleaf)



815





Fig. 4.—When instability is due to fitting a new high-amplification value a volume control should be connected between the L.F. transformer and the grid of the value.

(Continued from previous page)

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 mfds. 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.

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 responsible for the trouble it is considerably better to tackle the problem 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, always 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 inappreciable and efficiency would not be impaired. The output valve in any fairly 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, the decoupling components and wires being shown in full lines, and the others by broken ones.

L.F. Feed-back

A prevalent source of L.F. instability in portable sets is feed-back between the frame aerial and loud-speaker leads. The two are bound to be placed fairly near together, so that the difficulty is not quite so easy of solution. One way of overcoming it is to screen the speaker leads by means of a length of the special metal braiding sold for the purpose. This is slipped over the wires, making sure that it does not make contact with them, and connected to H.T. negative (which corresponds to the normal earth connection of a "fixed" receiver) by means of a length of thin wire (See Fig. 2). Whilst on this subject, it should be mentioned

that the lengths of wire made up in the form of coil springs and intended for curtain runners are not suitable for screening purposes unless all the turns are soldered together. This is because the wire forms a small inductance coil, and thus, instead of preventing H.F. pick-up, it actually assists 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.

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 bypass 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 connected from each anode. The capacity of the condenser depends upon the severity of the trouble, but a value from .001 to .005 mfd. will nearly always prove suitable. It should be remembered that if the capacity is too high there will be some slight loss of the higher notes.

H.F. "Stoppers "

Although the method of by-passing H.F. currents which reach the power-valve is fairly effective, it is generally better to prevent them from passing into the L.F. amplifier at all. High-frequency currents should really be entirely dispensed with in the anode circuit of the detector valve, but they do sometimes find their way farther into the set. The H.F. choke should prevent their passage into the amplifier stages, but it cannot be fully effective unless a by-pass condenser is connected from the anode of the detector-valve to earth. This is a point which is too frequently overlooked, although it only calls for a fixed condenser wired as shown in Fig. 3. The condenser may have a value between .0001 and .001 mfd., but in every case the smallest value which gives the desired result should be employed, since the higher values by-pass a small percentage of the higher audio-frequencies as well and so tend to make reproduction rather lowpitched.

Another method of preventing H.F. currents from passing into the L.F. amplifier is to insert a "stopper" in series with the lead 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 H.F. choke. This method is of particular value in the case of short-wave receivers, although it is by no means uscless with normal broadcast 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 unbearably poor when a pentode is fitted in place of a previous small power



Fig. 5.— The amplification of an L.F. stage can easily be reduced by using the connections shown above and explained in the text.

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 tolerate this, in the idea that the pentode naturally does not produce such good quality, although it increases the output volume. The idea is entirely fallacious, and if the effect mentioned above is noticed when changing over to a pentode, it is a sure sign that instability has been introduced. In the majority of cases it can be removed merely by reversing the connections to the secondary terminals of the L.F. trans-former. Sometimes, a "stopper" is re-quired before the difficulty can be overcome, whilst in extreme cases it is practically essential to reduce the amount of amplification by replacing the L.F. trans-Before former by one of lower ratio. going to the expense of such a modification, however, it is a good plan to try the effect of fitting an L.F. volume control, as shown in Fig. 4, or of reducing the step-up effect at Fig. 5. In the latter method, two fixed resistances are connected between the secondary terminals of the transformer, and the grid of the output valve connected to the junction between them. In some instances the quality will be improved by shunting one of the resistances by a .01 mfd. fixed condenser.

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Illustration shows Models 342, 344 & 347. Model 341 has similar cabinet but with Loud Speaker adjustment in centre of fret.

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January 13th, 1934

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PRACTICAL WIRELESS

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 Charge 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 the mains switch is "over," but we do not know whether the "charging" secondary is functioning correctly or not; also should the pilot lamp circuit be broken we get an extra heavy load transferred to the charging secondary, and this may cause some damage if not under strict supervision. This serious disadvantage, I have found, may easily be overcome by the following



A combined fuse and pilot light.

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modification to the usual circuit; the fuse in the circuit is replaced by a 2-volt lamp rated at the required charging lamp rated at the required charging current (e.g., .25 amp.). A suitable adaptor (see diagram) is constructed to enable the circuit to be extended to a socket placed at the rear of the control panel. The .25 amp. lamp will, therefore, act as a combined fuse and pilot light, and, because it is in series with the charging circuit, we can adjust the transformer tapping and re-TAPPINGS



sistance setting to cause the pilot lamp to just glow, and, having set this, we know 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 alterna-tive to a thermal delay switch in certain cases of home-constructed all-mains 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 mechanically interlocked so that the A.C. supply must be switched on and the filaments begin to warm up before voltage is put on the plate of any of the valves. The switches are arranged as shown herewith, switch No. 1 being an ordinary panel mounting No. 1 being an ordinary panel mounting tumbler, fixed in the usual way, and used for switching the A.C. supply from the mains. Switch No. 2 is a plain push-pull switch mounted on the panel just above No. 1 as depicted. No. 2 switch, however, must be of the type in which the control shaft does not revolve. Also the distance shaft does not revolve. Also the distance between the switches should be as short as possible. When the switches are mounted

a piece of stout metal of the shape shown is fixed on the shaft of the snape shown is fixed on the shaft of the push-pull switch, and held securely by the screw cap or knob of the switch. It will be seen that switch No. 2 cannot be pulled on until switch No. 1 has first been put in the "on" position. Again, switch No. 1



An alternative to a thermal delay.

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 14in. by lin. Glue these twelve pieces to the cone, 4in. from the edge, at equal distances round its periphery, and in such a such that the side measuring 14in lies way that the side measuring 11in. 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, havingonce centred the cone, to obtain an equal tension on each piece of linen. т. Μ, ALLAN (Troon).



A method of mounting a straight floating cone.

READERS' WRINKLES (Continued from previous page)

A Novel Rotary Switch

HIS novel aerial-earthing switch, which is made from odds and ends, is of simple construction and has self-cleaning contacts. No measurements are included, as these will vary with the thickness of



A novel aerial-earthing switch.

window frame, etc. The switch rotor is part of a cotton reel, and the four spring contacts were obtained from two old electric lamp sockets, the springs forming excellent contact with the rotor and also providing an easy means of mounting and connecting leads. The holes in the sides of the box through which the leads are connected to the four brackets can be made weatherproof by wax from an old H.T. battery, whilst the lid keeps rain from the contacts. The The

whole can be painted to match the woodwork of the window. Only a quarter of a turn is necessary to switch on and off, hence two nails and a pointer operate inside the window as stops and indicating device respec-tively. The nail acting as "off" stop is positioned so that the gap between the long and short brass contact strips

comes between the two earth leads. The diagram shows the switch in the "on" position. The pressure of the spring contacts is adjusted by altering the distance of the brackets from the "contact-strips." --WM. A. SCANES (Bexley Heath).

Fitting a Scanning Disc to a Motor Shaft FOUND the following method of fitting a scanning disc to a motor shaft very satisfactory. An old tuning dial was drilled through the blank end, and the disc centre drilled to the size of motor shaft.



A method of mounting a scanning disc on a motor shaft.

The disc was then attached to the dial by four bolts, one at the centre of each spoke. If the tuning dial centre is too small for the in 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 dial centre is too large thin metal packings can be used, leaving a hole for the screw. The accompanying sketch clearly shows the arrangement.—JOHN FORMAN (Leicester).

T 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 bécause 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, 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 anode, terminal of the output 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



any convenient earthing point, such as a water or gas pipe. It will be seen that this idea is applicable to any type of speaker —moving-coil or balanced armature—and that the normal speaker is used as an efficient output choke for feeding the extra one.—O. (London).

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 at each ble. The tool shown in the ac each hole. The tool shown in the ac-companying sketch, which is self explana-tory, will definitely avoid one error and greatly simplify the whole process. Care should be taken to see that the distances A-B and C-D are equal, and that the moving parts are push fits. The spindle X should be the same diameter as the motor spindle, and the screws holding this and the rod Y should be screwed up tight to avoid any risk of movement. The rod Y should preferably be of square cross section to ensure that the punch is held vertical for each hole. The disc is divided into the requisite 30 sections and the position for hole No. 1 carefully marked. To en-sure of no radial error occurring, the boss to fit the motor shaft is next fitted to the disc, and the

spindle X allowed to turn in same. The punch is then lowered to just press on the disc and, after being set exactly square with any radial line, the grub screw is tightened up, thus ensuring that the side of each hole punched will be exactly parallel with the radius at any position. The



A device for punching holes in a scanning disc.

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 9" or 10" to allow for the slight downward movement of the punch when struck.—E. L. NIMMO (Wimbledon).

A Novel Panel Lighting Device

THE accompanying illustration on this page shows a panel illuminating device which has a very pleasing appear-ance. The cover for the bulb consists of an ebonite cap taken from a scent 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 compass type battery-tester 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 cbonite cap tightly, is glued to the panel round the bulb, and, after the cap has been screwed on, the fitment is com-

plete.-J. E. DAVEY (Selhurst). SLOT EBONITE RUBBER OR BATTERY TESTER A neat pane! lighting arrangement To

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821

FILTER

DEDE To begin with, it should be explained that the three prime functions of the valve in radio recep-

comparatively weak signals developed in In the aerial circuit (highfrequency amplificado f. the audio-frequency component (the "programme") from the

tion), (2) separation of the audio-frequency component (the "proradio-frequency component (the carrier) this process is known as "detection" and (3) the amplification of the audiofrequency 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, *v.a.* ve. The filament, or cathode, the anode, and the control grid perform their VARIABLE MU VALVE normal functions, but the fourth electrode, the screening grid, which is connected



mu valve-and an ordinary S.G. valve.

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 schsitive 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, there-



HOW TO CHOOSE AND USE THE

In this Series of Articles the Author Explains the Function of the Various Types of Valves Employed in Modern Receivers

CURRENT

ANODE

fore, 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 or-

dinary screen-grid valves to overloading

by strong signals has led to the introduction of a modified form known as the variablemu 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

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

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



Fig. 2.-Variable bias to a battery variablemu valve.

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 highfrequency stage.

The several types of battery variable-mu valves on the market can be divided roughly into "long-grid base" and "shortgrid 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 provious low-frequency valve, or "driver" needs a small negative



Fig. 3.—Method of auto-bias for mains S.G. valve.

bias. Valve makers have therefore sought to produce new variable-mu valves which can be controlled by a 9 volt, or even $4\frac{1}{2}$ 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 values of this type in the battery range give full control with a grid-bias variation of as little as 4½ volts, but generally speaking, a value 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-nu 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-

(Continued on page 824)

S HORT-WAVE work is really a class on its own, and for the best results special receivers should be designed 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 highfrequency pentode H.F. stages.

The Adaptor

Although it may be argued that in functioning in this way the converter "adapts" 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.

. Earth

Aerial

Fig. 1.—The simple circuit for a shortwave adaptor.

S.W. H.F.Choke

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 re-

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 of these arrangements. Taking the adaptor first, a reference to Fig. 1 will indicate a typical circuit for the unit, the connection to the receiver being made with the four-prong base shown, which may very easily be made from an old valve base if desired.

The circuit is almost self-explanatory. First of all we have a very small capacity series aerial condenser C_1 passing to the grid tuning circuit L_1 C_2 , the number of turns on L_1 depending on the wavelength

range it is desired to cover, while C_2 can have a maximum capacity of .00015 mfd. Leaky grid rectification is employed, the condenser and resistance values being about .0003 mfd. and 3 megohms respectively. In the anode circuit we find a short-wave highfrequency choke. As a rule, these can be made up very readily by the amateur himself by taking a length of wire one quarter of the average 'wavelength of the range to be covered and winding this as a single layer solenoidal coil. For example, if the average wavelength is in the ultra-short range, say 8 metres, then 2 metres of wire (about $6\frac{1}{2}$ ft.) wound on an inch former will do nicely.

Adjustment

The reaction circuit is quite normal with a capacity variation feed, the value of the condenser C_3 being of the order of .00025 mfd. Note that the moving vanes of both variable condensers are on the earth side. Both filament leads and the lead from the high-frequency choke pass to the filament and anode prongs of a four-pin valveholder plug, the grid pin being free, as mentioned earlier.

It is quite usual to find that when the adaptor is connected to the broadcast receiver, the regeneration or reaction is not very smooth. This reduces the sensitivity



Taking the adaptor Fig. 2 .- Another form of short-wave adaptor of somewhat novel character.



Fig. 3.—An interesting converter circuit showing in this case a mains-fed value. ADAPTORS OR CONVERTERS (Continued from previous page) | lin. former, are tuned by a condense of .0002 mfd. maximum capacity.

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. 2 will have an especial appeal. The aerial feed is effected through a small series condenser C_1 as before, but the tuned circuit $L_1 C_3$ is now located across the anode and grid of the valve. As before, the ratings of inductance and capacity are dependent upon the wavelength range the adaptor is expected to cover. For example, for ultra-short wave working C_3 would be .0001 mfd. capacity, and L_1 three or four turns of No. 12 s.w.g. spaced $\lim_{t \to \infty} 0$ for description of the grid leak R_1 and the grid condenser C_4 , these could be $\frac{1}{2}$ -megohm resistance and .0001 mfd. capacity respectively.

An ultra-short-wave high-frequency choke is located in the anode circuit, but notice that reaction is introduced via a differential condenser C_2 . This has its two fixed plates joined one at each end of the tuned coil L_1 , while the moving vanes connect to earth. To use the unit, just plug into the detector position of the broadcast receiver with the plug provided and follow out the operations detailed for Fig. 1, being careful to adjust the anode voltage of the adaptor valve.

A Converter

The points which have just been dealt with in no way exhaust the adaptor question, but enough has been said to indicate the broad outlines of the work and principles involved. It is necessary now to look into matters appertaining to converters. A unit of this character has already been built and will be published shortly in PRACTICAL WIRELESS, so at this juncture I shall content myself by dealing with an ultra-short-wave converter which differs somewhat from that already constructed. The circuit is shown in Fig. 3, and a comparison with Figs. 1 and 2 will indicate where lie the main differences.

First of all, the two separate coils L_2 and L_3 , consisting of say three turns on a lin. former, are tuned by a condenser C_1 of .0002 mfd. maximum capacity. The aerial is magnetically coupled to this circuit by coil L_1 , which can consist conveniently of a single turn of wire. The bottom end of this coil is, in the diagram, linked to earth by a dotted line, this being to indicate that it must be tried on site to see whether the earth connection to the coil L_1 is desirable or not. Condenser C_2 is variable and has a capacity of .00005 mfd., and located in the position shown makes the valve act as a combined oscillator and first detector—the main criterion of difference between an adaptor and a converter which has been pointed out earlier.

Other Points

The grid-leak R_1 and the grid condenser C_3 can have values of 3 megohms and .0001 mfd. respectively, while the bypass condenser C_4 can be made equal to C_3 , that is .0001 mfd. In the positive anode feed to the valve there is an ultra-shortwave high-frequency choke shunted by a .0001 mfd. fixed condenser C_5 , and after this we have a standard broadcast band H.F.C. This latter choke must be of the fieldless type, and the signals are fed through C_4 (.002 mfd.) to an output terminal which is connected to the aerial terminal of the broadcast receiver.

Note here that if the broadcast set has a series aerial condenser of the pre-set type this must be either short-circuited or turned to its maximum value, preferably the former. The second output terminal is joined to the earth terminal of the set, while H.T.+ and H.T.— link to the set's high-tension source or a separate one, whichever is more convenient. As to valve choice, a good general purpose mains type valve, such as the 41MHF, MH4, 354V or AC/HL is suitable, and the working of both the converter and set together follows the usual lines of superhet practice with the proviso that tuning is much more critical.

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HOW TO CHOOSE AND USE THE BEST VALVES.

(Continued from page 822)

ing a small resistance between the H.T. negative and the cathode. This has the effect of making the cathode slightly positive with respect to the grid, and amounts to the same thing as making the grid slightly negative. Fig. 3 shows the method of biasing a "straight" screen-grid valve in this way. The value of the resistance depends upon the amount of bias required and the anode current of the valve, and is always quoted by the maker. The capacity of the by-pass condenser is not critical, and may be from .1 to 1.0 mfds.

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



Fig. 4—Arrangement for variable bias and constant screen voltage for mains variable-mu values.

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 screened 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 for mains sets are available in most British makes, and both "straight" and "V.-M" types are available. 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.

HE question of choosing a circuit is not quite the simple one 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





Points on the Choice of Circuits for Various Requirements, Explained by P. J. WATTS

> 2 watts will prove adequate. This means that in a normally furnished room, say 10ft. square, a fully loaded 2-watt output will provide signals sufficiently powerful to be heard with comfort in every part of the room, and the faintest broadcast sound will not be lost. If, however, it is desired to radiate dance music sufficiently loud to or



Fig. 1.- A good 3-value mains circuit, the Mains Express Three.

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

with 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 is the volume calculation will be in the volume selection will be "How loud?" It may be stated that for normal room strength

enable dancing to be carried out and not have the music masked by the sound of talking, laughter, moving feet, etc., 5 watts will be found the very minimum, although my personal preference is for a 5-watts output stage, to which the signal fed is only of moderate volume, so that all risk of overloading is removed on even the loudest climax. This arrangement also permits of a very "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 1 watt, 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 ade-quate where a very small room is in use, 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 speaker is necessary in order to do justice to an output of 2 watts or more. The H.F. stages must be chosen according to the range which the receiver has to cover. In other words, if it is desired to hear the small powered Continental stations, or probably American medium-wave broadcast stations, then two 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 general all-round results it may be said that

the single variable-mu H.F. stage (or simple S.G. valve if the extra complica-tion of the control is not thought necessary) will prove adequate, whilst for consistent long-distance reception two H.F. stages should be employed.

(Continued overleaf)



Fig. 2.-Circuit Diagram of the Fury Four.



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.single H.F. stage with the added L.F. amplification. The superheterodyne circuit is shown in Fig. 4, which is the arrange-ment 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 on 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 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.

Fig. 4.-Theoretical circuit of the Premier Super.

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.

(Continued from previous page)

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 multielectrode 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.

THERE is no better method of reviewing the 1934 edition of the Broadcaster Radio and Gramophone Trade Annual which has just been published by the Broadcaster and Wireless Retailer, of 29, Bedford Street, Strand, W.C.2, than by suggesting, by mention of a few of its contents, the wide scope covered by this publication.

The constitution and the year's work of every one of the trade's important associations, including the R.M.A., the B.V.A., the R.W.F., the W.R.A., the Gramophone Dealers Association, the Component Manu-facturers Federation and the Cabinet Manufacturers Association, forms part of the publication.

The Service Section of the Annual (probably of greater interest to the retail reader of this reference work than any other of its valuable sections) has been extended.

No less than twelve pages are devoted to I

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.G., 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 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.



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 by the 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.

PRACTICAL WIRELESS

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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 in 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 not simply a standard transformer having a tapped

or the standard transformer 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

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 FR6-PM-22 Class B, and when putting your order you should be very clear about this reference. It

be very clear about this reference. It will be noted, of course, that in the list of components which was published

has the components which was provided and last week the reference was abbreviated and the figure 4 was quoted instead of 6. The wiring diagram on page 786 illustrated a Class B choke connected to the output valve, but with the speaker which is specified this will not be required. The terminals of valveholder V4, 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.2 plug is inserted in the 16-volt tapping on the grid bias battery. G.B.—1 is then plugged into the 3.5 volt socket temporarily, and the accumulator is joined to the L.T. spades. Connect the aerial lead to terminal A2, and switch on. Rotate the wave-change control so that the pointer is towards the right, when the coils are set for the normal wave-band, and upon rotating the tuning control to the approximate wavelength of your local station, this should be heard. Rotate the upper right-hand control until signal strength is very How to Trim this Fine New Receiver which Employs the Most Modern Coils and Valves

ADJUSTING AND OPERATING

weak, and then with a long screwdriver made from a strip of wood carefully adjust the trimming screws which are visible through the top of the ganged condenser. You will find that not only are the three screws interdependent, but then the screws interdependent,

ganged condenser. You will find that not only are the three screws interdependent, but that the actual setting of the tuning scale will also be modified when they are adjusted. You should, therefore, endeavour to obtain your local station with the pointer upon the correct wave-length figure on the scale, although if you find that the signal strength is not at its maximum on this point



Neat panel layout of the Nucleon Class B Four.

the indicating wire on the condenser scale may be slightly bent in order to give the correct indication. When once 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 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 obtain 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 to provide the best quality,

and this is best carried out on the local station, where the maximum signal strength is obtained. It will not be found unduly critical, but the maximum voltage without distortion should be employed.

It should be unnecessary to remove the screening cans from the tuning coils, as no adjustments are available on these particular parts. If for any reason the cans are removed, on 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.

LIST OF COMPONENTS FOR	THE NUCLEON CLASS B FOUR
One set Wearite Iron-Core Coils (Types B.P. 1,	One Type H.F.P.A. Screened H.F. Choke.
BP. 2 and T.G.). (Wright and Weaire.) One Polar Star Minor Three Gang Condenser	(Wearite.) One Midget Screened H.F. Choke. (Bulgin.)
with Horizontal Drive. (Wingrove and Rogers.)	One A.F.3 L.F. Transformer. (Ferranti.)
One Polar Pre-set Condenser (.0003 mfd.).	One Hypernik Class B Driver Transformer. (Lissen.)
(Wingrove and Rogers.)	One Metaplex Baseboard (14in. by 11in.). (Peto-
One 50,000 ohm Megite Potentiometer. (Graham Farish.)	Scott.) One Panel (14in. by 7in.). (Peto-Scott.)
One .00015 Differential Reaction Condenser.	One Terminal Strip (14in. by 11in.). (Peto-
(Graham Farish.) Three 4-pin valveholders and one 7-pin. (Graham	Scott.) One 7-way Battery Cord. (Belling and Lee.)
Farish.)	Five Type B Terminals (Aerial, Aerial, Earth,
One .03 mfd. Non-inductive condenser Three .1 mfd. Type 81 ditto	L.S.— and L.S.+). (Belling and Lee.) Two Coils Connecting Wire, Length of Screening
One .0002 mfd. Type 34 ditto	Braid, Screws, etc. (Peto-Scott.)
One .00015 mfd. Type 34 ditto T.C.C. One 1 mfd. Type 50 ditto	One 220 VSG valve One 210 DET valve
One 1 mfd. Type 50 ditto Two .01 mfd. Type 34 ditto	One P.215 valve Cossor
One 2 mfd. Type 50 ditto	One 240B valve
One 250,000 ohm 1 watt resistance Three 100,000 ohm. ditto	One 16-volt Lion Grid Bias Vinces
One 30,000 ohm. ditto Dubilier	One 2-volt 40 amp. Accumulator, (Lissen.)
One 10,000 ohm. ditto	One Rola FR6-PM-22 Class B Loud-speaker.
One 3-point On/Off Switch Type S.39. (Bulgin.)	(Rola.)



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.

2-VOLT BATTERY. Screened Grid and Variable Mu S.G. 10/6 H.F. and Detector 5/- Super Power 6/6 Clais "B" Output 10/6 Pentode 10/6 DAA R I Every ne	MAINS. Output Pentode - 12/6	
POST THIS COUPON TO US	Name	Pr.W.2
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	To IMPEX ELECTRICAL LT	ID., 47, Victoria St., Westminster, London, hone: VIC. 3914. Telegrams: Dariolect, Sowest, London.

Prospect

The Author of this Interesting Survey Looks Ahead, and Discusses Probable Developments During 1934. Will Television Arrive, and Will Receivers Take the Form He Suggests? By LAMBDA

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 triodes, H.F. 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



Fig. 1.—A set of the future ? Note the dial divided into channels.

AMP

MAGNE

them. But during the present year television will definitely arrive. Not perfect! Receivers were not by any means comparable with present-day apparatus ten years ago, but broad casting had arrived.

This year we shall see pictures with a p p ar a tus which will be compar a b le with those early wireless receivers. 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 quasioptical 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)

COIL CARRYING L.S. CURRENT Fig. 2.—An ingenious visible tuning device.

(Continued from previous page)

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 radiofrequency 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 tonecorrection 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 ? Stations in Europe are spaced 9 kc/s

apart, so that this method cannot be adopted. The alternative would be to allow each station a channel number. If our dials were then calibrated accordingly, what a simple matter it would be to refer to the channel number in the list of stations. Another advantage of this system would be the facility with which stations could be identified, for it would only be necessary to refer to the corre-sponding channel number in the list of stations to ascertain the name of the station being received. What an advantage this system would

be. Visual tuning indicators, in some shape Fig. 3.-The small Fig. 3.— The share cathode-ray tuning or form, will be un-device developed by versal in new receivers. Standard Telephones They will be very much in evidence at the nuch in evidence at the

of the almost universal application of automatic volume-control they will become essential.

ENER

year have displayed amazing ingenuity and resourcefulness in their ability to provide new types of valves. Will this rate of pro-gress be maintained in 1934? At the present moment there does not seem to be any very urgent need for new types of valves, but rather a standardization of the cxisting types. There is, of course, always room for improvement. No doubt the battery pentagrid valve will be produced in due course. Battery-set users will then be in the same position as the owner of a mains superhet receiver. In 1933 the battery set was well catered

for in the new types of valves produced, particularly output valves. However, the triple twin valve may be produced in this country this year. It would be welcomed by owners of mains receivers with only a limited anode voltage available. At present, to obtain an undistorted output of five watts or over, it is necessary to provide an anode voltage of at least 400 volts for the output valve. In some cases this may necessitate the re-designing of the mains portion of the

receiver. With the triple-twin valve this can be achieved, and an output of about four watts obtained with 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

we can be sure that stagnation will not set in. New components will be designed, and The valve manufacturers during the past | further advances made in all directions.

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, next radio exhibition at Olympia. In view

> "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.

HOW MANY

LISTENERS REALISE ?

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.



Sole Agents in I.F.S. : Kelly and Shiel, Ltd., 47. Fleet Street, Dublin.



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

TYPE PM 4A

Whiteley Electrical Radio Co. Ltd., Dept. D, Radio Works, Mansfield, Notts Sole Agents in Scotland : Radiovision Ltd., 233, St. Vincent Street, Glasgow, C.2.





Photo-cells in Commerce

DROBABLY every wireless enthusiast is PhotoADLY every wheless enthusiast is interested in photo-electric cells and their applications from a technical and scientific point of view, but probably few 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, 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. Immediately the ray of light is broken, due to a horse, dog or motor-car passing the line, the cell actuates the amplifier which, in turn, stops the watch 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 em-ployed. 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 Beckenham. It is by no means un-likely 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 stages of amplification by means of a single valve, have been made in the past and sold in fair numbers on the continent. Some of these valves have been reasonably efficient and have been used in the construction of compact receivers of the lowpower type, but the valves have only been capable of providing a comparatively small signal output. A new valve of the "multiple" type has now been developed in America which, in addition to providing two stages of low-frequency amplification, is able to deliver an output of some 5 watts. The valve is, in fact, intended principally for use in public-address amplifiers. It is

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 reliablé, 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 their original characteristics will cause noticeable distortion. I was thinking par-ticularly of coupling condensers used in R.C.C. coupling. A slight insulation leak-age will result in a positive charge leaking on 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 tapping 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. originally gave perfe If the receiver gradually gave perfectly good quality, but has since begun to distort, then a number of causes immediately suggest themselves. Apart 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 is, 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 to him what phase difference is. This is probably a question which is difficult to understand by many radio fans who are now using the electric mains as a driving force for their receivers. I quite appreciate it is difficult for the uninitiated to understand how, if there is only one voltage, there can be any

difference. If the voltage is alternating there may be a difference in the time when any selected value of voltage is reached, even though the voltage is the same, because alternating current is governed by a time factor, that of frequency per second. This time factor is usually stated on the house meters as so many cycles, such as 40, 50, 60 and so on. In some districts, such as parts of the Midlands and Cornwall, it is as low as 25 cycles per second. With direct current there is no alternation, and so no phase difference. When direct current is pulsating, an introduced alternating current is converted into changing values of direct current, and here phase enters also.

Revision of Wavelengths

THE unique Philips calibration system with the micrometer dial which is incorporated in Philips models 630A. and C., 634A. and C., and 636A., has a great advantage' with regard to the wavelengths shuffling, because the dial itself needs no change. All that is necessary to keep the system up to date after January 15th is a new calibration chart which they are supplying.

New charts will be ready for all Philips New charts will be ready for all Philips owners of any of the above-mentioned types free of charge. New charts for the 634A. and C., and 636A. are now ready. These will be sent upon receipt of the necessary particulars, which are—type number of set, registration number and number of the old chart. This consists of two forumes for instance 24 two figures, for instance 24.

New charts are also available for dealers for any of the above-mentioned types they may have in stock, and will be sent without delay upon receipt of the application form which is being sent to them.

Home-constructors' " Difficulties "

IT is becoming very obvious that many of the so-called difficulties 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. It is absolutely unnecessary to lock these up with 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 we have found that even thick connecting wire has been sheared practically right through, and the slightest touch results in the wire snapping off. The fingers 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, com-plete with instructions for assembling, component values and notes on operation.

Obtainable at all Booksellers, or by post 2/9 from Geo. Newnes, 2/6

January 13th, 1934



The I.C.S. Radio Courses cover every phase radio work, from the requirements of the 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.

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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.

We will be pleased to send you details of any or all of these subjects. Just fill in, and post the coupon, or write in any other way, stating which branch of Wireless interests you —the information you require will be forwarded at once.

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- WIRELESS ENGINEERING
- WIRELESS OPERATORS





All Sorts

All Sorts There is a very good comic record by Ike Freedman (the Scottish Hebrew Gentle-man). He sings (on *Regal MR*1095) King of Palestine and Romeo. They are both excellent tunes as well. If you dare risk one of those airs, which will probably result in your murder (by those who will catch it from you !) The Man on the Flying catch it from you :) The man on one right Trapeze (Decca F3682) will be most suitable. The thing is well sung by a good vocalist with the Jolly Rollickers. You have now been warned. The most interesting novely for a long time is the record of an Electronde 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 "musica oscillator" as Mr. Taubmann "plays " musical it. It sounds like a disembodied 'cellocello without any wood, that is. believe this is a discovery with big possibilities, if it isn't too difficult to mani-pulate. 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 (walz). A first-rate dance record of the "straight" sort. One of the really big hits of many months is the record of two high-lights from the "Gay Divorce." two high-lights from the Gay Divorce. They are played by Leo Rersman's Or-chestra 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, Maud (Columbia DB1205). 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 tiny Hand is Frozen and The Serenade from The Fair Maid of Perth (Columbia DX540). The first is very good indeed both from the vocal and histrionic view-point. Tauber has a perfectly enchanting song in I Greet You, My Beautiful Sorrento on Parlophone RO20228. 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 are on Columbia DB1204, sung by Harold Williams. East-hope Martin lovers, please note : these are in the tradition.

Now two records introducing well-known airs with vocal settings. The first is our

old friend Stephanie Gavotte, and Emmy Bettendorf sings the simple exquisitely—on Parlophone R1633. words Then Anona Winn does two on Columbia DB1203. Anona winn does two on common Dires. Czibulka is again chosen with *Hearts and Flowers* and the famous *Rendez Vous*. The words are ballad ish, of course, but by no means unsuitable. Both are nicely by no means unsuitable. Both sung to these very good tunes.

Josef Schmidt has two magnificently sung arias from La Tosca- E Lucevan le Stelle and Recondita Aimonia on Parlo-phone R1619. This singer is definitely from the top shelf. Few of us are proof against such songs as Mary (Kind, Kind, etc.), and Eileen Alannah. You will enjoy their singing by the Victorian Quartette on Regal-Zono MR1039. An uncommonly attractive bit of harmony, with orchestra.

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 DX537. As the chairman of a Columbia DX537. As the chairman of a company of decidedly shaky 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 IVe Can't Let you Broadcast That and 'Oles (Columbia DB1216). The poor B.B.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. B8003), proves that Claude Hulbert is not such a fool as he seems—as the other three of Those Four Chaps discover.

A musical novelty of very great merit is A Gypsy Sing-Song (Regal-Zono MR1048). 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 Tidworth Tattoo on H.M.V. C2593-4. Definitely better than the Aldershot one, and the massed band playing Sanctuary of the Heart is unforgettably striking. The other is one of the best the Grenadiers have ever done-Columbia DB1207. They play Unter den Linden and Phantom Brigade, both marches clear of the usual uninspired blare. Clean-cut bright tunes

-so splendidly played. Two very good "at the piano" artists, Two very good at the plano at uses, Fred and Leslie Douglas, sing exceedingly well Carry Me Back to Green Pastures and Fve Found The Right Girl (Sterno 1245).

Peter Dawson has done some of Stanford's songs of the sea. Quite the best is *Outward* Bound (H.M.V. B4482). I don't know a better performance of his. A very good chorus is with him.

834

PRACTICAL WIRELESS



BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

COLVERN TUNING UNITS

COLVERN TUNING UNITS THE provision of high-efficiency tuning coils, together with a ganged condenser having a wavelength-calibrated scale enables the home-con-structor to assemble a highly-efficient receiver with a mininum oftrouble. Messrs. Colvern have new turned their attentions to the production of a unit of this type, and that illustrated below employs the Ferrocart iron-core coils, together with combined switching. As may be seen, the coils are of the "G" pattern, which are slightly more compact than the original "F" type of Ferrocart 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-corporated in the coil bases, a radio-gramophone switch, and also a battery switch is mounted on the plate to be operated through the wave-change switch rod. The switch nearest the control knob is for radio-gramophone chauge-over, and is a clean-acting, substantial switch which will not be liable to give rise to troubles through faulty contacts. At the opposite end of the switch rod is a Q.M.B. type of switch designed to operate by a cam 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 receiver. The complete Colpak, 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 intervalve type, with reaction coil fitted to the hitter coil. In the superheterodyne pack, the com-bination consists of band-pass and oscillator coil which is suitable for use with a circuit employing a perturbed valves. The price for either type is 57s. 6d. (without dial).

MULLARD HIGH-EFFICIENCY PENTODE

MULLARD HIGH-EFFICIENCY PENTODE THE Mullard Pen.4VA is now generally released, and where the maximum output from a single stage is desired no listener should hesitate to obtain one of these valves for feeding the loud-speaker. As we have previously mentioned, this delivers nearly swatts undistorted output. In addition to this factor is will handle a larger signal than the Pen 4V, and thus, whilst giving the user the advantage of more volume, it at the same time reduces 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 250 volts anode and auxiliary grid voltages. The bias required at this figure is 22 volts and a 500-ohm resistor will befound correct if inserted in the cathode lead. The correct load impedance is 6,000 ohms, and the price is 18s. 6d.

NEW FERRANTI RECEIVERS

THE latest 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 Magna Con-solette; the Arcadia Console and the Arcadia Radio-

gram. The Lancastria Radiogram is built on very sound and modern lines, having a sloping baffle to assist in maintaining constant high quality at any volume level, aud is fitted with a high-grade electric motor and pick-up. The price is twenty-six guineas. The Arcadia models are superheterodync receivers designed as table models or radiograms, and also represent extremely efficient and up-to-date instru-ments. The list may be obtained by any reader upon application to Messrs. Ferranti, at Hollinwood, Lancashire.

THE FILTERMATIC OCTAVE TONE CONTROL

THE FILTERMATIC OCTAVE TONE CONTROL
 Some state of the server of the server

The neat Colpak manufactured by Colvern Ltd. Note the two switches.

NOVEL EXIDE INDICATOR

SEVERAL ingenious methods have been used in the past to enable the non-technical user to ascertain the condition of a low-tension accumulator. Thus we have had coloured balls which floated either singly or iu combination according to the condition of



This illustration shows the new indicating device for accumulator condition, developed by the well-known Exide people.

the acid. A single ball which floated on the surface, or sunk to the bottom with varying gravity, and so on. The Exide factory are now producing an ingenious device which removes all worry from the user's mind, and as may be seen in the illustration, one side of the accumulator is furnished with a full-size indicator bearing very clearly the words, "Full," "Half," and "Empty." A large hand is pivoted at the opposite side of this scale, and as the accumulator discharges the hand slowly travels across the scale. There is thus no possibility of any misunderstanding arising and the indication may be read even when the cell is standing inside a cabinet or other dim'y-lighted place.

UTILITY COMBINED CONTROL

A MOST ingenious combination control has been submitted for test by Messrs. Wilkins and Wright. It consists of a small bakelite dielectric reaction condenser and a potentiometer mounted on a common control spindle. As probably many experi-menters 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 potentiometer is, of course, used to vary the bias on a variable-mu H.F. valve and thus control volume, whilst the condenser is employed in the usual way for caction purposes. The idea underlying the combina-tion therefore, is that as the signal input is increased, reaction is increased. Obviously, the H.F. control montrol commences to operate and this is difficult to new Utility device the plates of the reaction condenser are of unusual shape and thus it is possible for the control to be turned through a fair movement (actually 180 deg.) before the plates of the condenser commences interleave and this will, in the majority of cases, enable the H.F. Input to be modified to the required degree before the reaction control commences to privation. The arrangement was tried out on three different receivers in which the separate controls had yery smooth control without any necessity for drasted to ontrol is 7s. 6d., with a reaction condenser of the interleave and the ordinary type as required. **EXSTICK'S RADIO BULLETIN**

EASTICK'S RADIO BULLETIN

EASTICK'S RADIO BULLETIN
The December, 1983, issue of this interesting little booklet is alled chiefly with lighter fare, including seasonal greetings from various radio manufacturers. Among the other contents are particulars of meetings, etc., of the W.E.A. during November and December; short-wave notes, and specifications of periodicals during December. Details of the new Edex Short-Wave Converters are also given. The Duplex model has been redesigned, in order that it may be used in conjunction with superhets. This model is now fitted with a universal plug-adaptor was used for A.C. mains sets, and spade terminals for been redesigned, in order that it may be used in conjunction with superhets. This model has now fitted with a universal plug-adaptor was used for A.C. mains sets, and spade terminals for been redesigned, in order that it may be used in conjunction with superhets, whereas in the old models the plug-adaptor was thery sets.
The Super model is a complete all mains (A.C.) Super-het. converter, employing a screen-grid pentoder H, f. stage preceding the oscillator valve. A special short-wave two-speced slow-motion dial is fitted, with illuminated escutcheon. This converter is built into a very attractive oak cabinet, with plug-intended from J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, Londow, E.C...

TRIOTRON VALVES

TRIOTRON VALVES THE popular Triotron valves need little introduc-tion to our readers, but to those who have not yet tried them in their receivers we would recommend a very useful booklet, the Triotron Valve Guide for 1934, which has recently been issued. In addition to giving complete information regarding each type of values in the very comprehensive range which is now variable, it also includes several popular types of circuits to enable you to obtain the best results from the valves. A technical appendix gives some useful information explaining in simple terms the working of auto-grid bias, decoupling, etc., and a selection of lats and tips on better reception. The Triotron Technical Service Department is always ready to assist in solving radio problems. All interested readers are advised to write for a copy of this useful booklet to Triotron Radio Co., Ltd., Triotron House, Blooms-bury Street, London, W.C.I.

836

MALIS POWER

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If you have not already a copy of the Heayberd 1934 Handbook, get it NOW. This book will be of great help to all interested in mains power for radio sets. Fifteen blueprints of Mains Units and Battery Chargers, Helpful hints and technical tire Chargers. Helpful hints and technical tips will also be found in the Handbook, as well as a full list of Heayberd components. Cut out this ad. and send NOW with 3d. in stamps for your copy.



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MAINS' POWER RADIO, Ltd., Romford, Essex.

PRACTICAL WIRELESS

January 13th, 1934

2 PT 8. 00



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

SIR,—With reference to my query re-garding 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 log a remark-able 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 to life" quality of reproduction make the set a perfect source of entertain-ment. Thank you for a fine set.—H. STENNING (Brighton).

"Simply A 1 "

SIR,—I have just received my Pocket Tool Kit, and may I add one more "Thank you" to those which have preceded minc. Every Wednesday I look forward to receiving my copy of PRACTICAL WIRELESS. I think it is the only paper, book, or encyclopædia that is of use to anyone with a wireless set, from a crystal upwards, and especially to home constructors. The Tool Kit is simply A l, and I hope to make fuller use of it very shortly as I am contemplating the construction of a new set. -C. B. HILL (Ringwood).

Two S.G. Short-wave Converter with Special

Low-Loss Features

SIR,—The accompanying circuit diagram is of a short-wave superheterodyne con-verter 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 sct, this gives efficient operation from 12 metres up to 80 metres entirely on the loud-speaker. On a 100-degree slowmotion dial fitted to the converter, oscilla-tions come in continuously from 6 to 100 degrees on the lower of the two short-wave bands, and from 0 to 91 degrees on the upper. I attribute this remarkable result to the

use of two screen-grids.

 Absence of dead spots and excessive damping due to use of antinodal coil.
 Connection of S.W. H.F. choke to reaction coil (terminal 7 of antinodal coil), rather than as ordinarily connected, i.e., to anode of valve.

4. Use of 5-megohm grid-leak, instead of the 2 megohms usually specified.

5. Lack of stray capacities owing to ease

with which short connections can be arranged in this combination.

A long study of English and American short-wave periodicals has failed to disclose to me any circuit which has used this combination of two screen-grids, and I think I can claim originality for this, plus the special use of the R.I. antinodal coil (which



Circuit diagram of S.G. Short-wave Converter.

(Continued on page 838)



-THAT receivers are obtainable in America which cover wavebands from 10 to 600 metres. The superhet principle is employed in these

The supernet principle is employed in these receivers. —THAT the new H.F. pentodes may be used very successfully for H.F. amplification on the short waves. —THAT more detailed television transmissions

-THAT more detailed television transmissions may take place in the early months of this year. -THAT a combined volume tone-control is essential for a quality receiver. -THAT a vertical rod of metal, or metal pipe, will be found in many cases more efficient than an orthodox outdoor aerial. -THAT the pipes of a central-heating system often prove more efficient as an aerial than an earth

earth

earth. —THAT an all-metal ventilator shaft will form an effective static screen for a lead-in. —THAT the metal chassis of a car is not all that can be desired as an "earth" owing to the insulation afforded by the rubber tyres. —THAT the ultra-short waves are being used for certain medical purposes as "cures."

NOTICE.

RADIO CLUBS

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

and should be received First following week's issue. UXBRIDGE RADIO CLUB The third meeting of the Uxbridge Branch of the Anglo-American Radio and Television Society was held at 11, Hawthorn Drive, Willowbank, Uxbridge, on December 21st. An enjoyable time was spent by all present, and records of America were once again played over—by request. A number of short-wave stations were tuned in upon the club receiver. A discussion upon one *versus* 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 adding 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 such was the case in a great number of instances. However, if the receiver was well designed the extra amplification ould be obtained vithout a large increase in unwanted noises. The club two-valve all-mains receiver was demonstrated and all agreed that it was extremely silent in operation. There is no charge for attendance to meetings of the Uxbridge Branch, and everyone is welcome. The club is not a technical one although technically minded listeners will find much to interest them. Tarliculars may be obtained from Mr. Leslie W. Orton, H, Haw-

club is not a technical one although technically minded listeners will find much to interest them. Particulars may be obtained from Mr. Leslie W. Orton, H, Haw-thorn Drive, Willowbank, Uxbridge. Radio Normandy broadcast a special message regarding this branch between 5 and 6 p.m. on Christmas day.

SLADE RADIO A talk on "Oscillators and their applications" was siven by Mr. F. J. Singleton at a meeting held recently. After a few words on testing and servicing modern radio receivers he went on to give a full description of the all-mains oscillator and the various uses to which it can be put. The Philco 16B all-wave model was then described by Mr. G. T. Peck. This has 11 valves, covers 10-600 metres without a break, and is provided with shadow tuning, tone compensation at all volumes, and twin class C output giving 11 watts undistorted. The demonstration showed that the receiver was remarkably selective and very powerful. Those interested are invited to write to the Hon. Sec. or details of the Soclety. Address, 110, Hillarics Road, Gravelly Hill, Birmingham.

INTERNATIONAL DX'ERS ALLIANCE

The special broadcast list of the I.D.A. is given below for the benefit of readers who are members of this organization.

Jan. 14 4-6 a.m. PAOASD, Amsterdam 3,770 79.57 m. Jan. 21 2-4 a.m. 3,543 84.67 Jan. 21 4-6 a.m. *CR71A, Mozambique, Africa

84.67 m. 4-6 a.m. PAOASD, Amsterdam 3,770

Jan. 27 6,060 Jan. 28 Jan

in. 28 4-6 a.m. 1907.00., 79.57 m. 10. 28 7.30-9 a.m. VE9CS, Vancouver, Canada 6,070 49.43 m. cb. 4 2-4 a.m. *CR7AA, Mozambique, Africa 3,543 84.67 m. Jan 6,070 Fcb. 4

Reports to stations and to I.D.A. *CR7AA, Box 183, Laurenco Marques. Mozambique, Africa. WABC is the *KEY* station of the Columbia System. Confirmed personally by Director of Public Events, etc. Particulars of membership can be obtained from the European representative, F. Wiseman, 90, Brighton Grove, Newcastle-on-Tyne, or R. A. Rawles, Publicity Dept., Blackwater Corner, Newport, I. of W.

ANGLO-AMERICAN RADIO AND TELEVISION

ANGLO-AMERICAN RADIO AND TELEVISION SCIETY Records of American stations were again heard at the fourth meeting of the Uxbridge Eranch, held at 1, Hawthorn Drive, Willowbank, Uxbridge, on tweek, were of CKAC, CKGW, WSB, WSM, WEAF, WAC, WTIC, WCAU, WHAS, KYW, KMOX, WKAC, etc. They were all loud and clear. A were interesting time was spent by all, and short waves were the topic of the evening. A number of SW, stations were tuned in upon the club receiver, or primeresting time was a spent by all, and short waves were the topic of the evening. A number of SW, stations were tuned in upon the club receiver, or primeresting time was a part the B.B.C. 7-metre (approx), transmitter and the Crystal Pilace trans-mitter regularly. He used a three turn (one inch immeter) coil for grid and the same for reaction. The receiver was his ordinary short-wave set. He is or barge for attendance to the Uxbridge Branch, or or joining the society. Everyone is welcome. Meetings are held each Wernesday. Full particulars from teslie W. Orton, "Kingsthorpe," Willowbank, Ux-bridge.

PRACTICAL WIRELESS



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YOU MUST GET OUE FREE NEW 1934 HANDBOOK. Full particulars of long and short Radio courses from £2. Uaique home-study methods and recommendations. Terms arranged. Radio TraIning Institute of Gr. Brit., 85, New Oxford Street, London.

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about be enclosed with applications for catalogues. No other correspondence whatsoerer should be enclosed.
 BROADCAST TALKS
 THE full B.B.C. programme of talks for the period January to March inclusive is given in a booklet just published, entitled "B.B.C. Talks, 1934." The scries that provides the most imposing list of speakers is at 8.30 p.m. on Tuesdays. It is designed as a summary of the group of talks which have been planned for the autumn and spring by the Central Council for Broadcast Adult Education, under the general title of "Taking Stock." Among the speakers in this scries will be: Mr. H.G. Wells, Mr. Winston Churchill, Mr. David Lloyd George, Mr. Ernest Bevin, Mr. Israel Sieff, Mr. Bernard Shav, Mr. Water Ellot, and Mr. Quintin Hogg. In this same "Taking Stock." group comes the "National Character" series at 7.30 p.m. on Mondays. Hitherto the subject has been approached mostly from within. In the spring listeners are to hear some views from abroad-from such men as Professor Moritz Bonn, Professor Fellx Frankfurter, and Dr. Karel Capek. Among the other well-known speakers who will also be heard during the senson are Professor John Hilton, Sir Oliver Lodge, Professor C. G. Sellgman, Mr. Vernon Bartlett, Mr. A. P. Herbert, Mr. James Agate, and Sir Walford Davies. The talks booklet may be obtained free on personal application to the B.B.C. Bookshop, Broadcasting House, Portland Place, London, W.I, or for one penny by post, from any B.B.C. offices.

LISSEN RECEIVERS

LISSEN RECEIVERS LISSEN RECEIVERS A VERY attractive range of receivers, including the famous "Skyseraper" series, is displayed in the latest folder issued by the Lissen people. Here are models to suit varying tastes and purses, and from which the most discriminating listener should have no difficulty in choosing a receiver to suit his require-ments. There is model 8005, a two-valve battery set with a "pentode" performance, and its price is only £3 19s. 6d., complete with batteries and valves. At the other end of the range there is model 8060, a fine six-valve all-mains superhet. Equipped with A.V.C., band-pass tuning, and an electro-dynamic loud-speaker, this high-class instrument is priced at £14 14s. Other models include A.C. and D.C. models with moving-coil speakers, and battery-operated portable and table sets, all housed in handsome cabinets of modern design, and at prices ranging from £4 4.s. to £12 12s. Full particulars of all the receivers are given in the folder, copies of which can be obtained on application to Lissen Limited, Lissenium Works, Worple Road, Isleworth, Middlesex.

REPLIES	то	BROADCAST
	QUE	RIES

ARDY (Newbury): (1) 7th harmonic of Port for the part of the provided that the provi

January 13th, 1934

January 13th, 1934 Place, Stirling, Scotland; (3) G5RD, A. R. Gardner, "Ashleigh," Abbots Langley, Watford, Herts; (5) G5NW, E. J. Allan, 8, Westfield Place, Dundee, Angus, Scotland; (7) G5KH, H. D. Cohen, 144, West Hill, Putney, S.W.15; (8) G5SA, D. Price Jones, Western Electric Co., Ltd., Bush House, Aldwych, W.C.2; (9) G6VK, A. E. Brooks, 19, Alexandra Road, Uplands, Bedminster, Bristol, Głos.; (10) G2UU, E. J. Pencey, "Collawood," 126, Pinner View, Harrow, Middlesex; (11) CTIFZ, Jose C. Correia da Silva, Elvas, Portugal, NiGHTARK (Peterborough): WIBI, Willard H. Northrop, 71, East Brown Street, West Haven, Conn.; W1ACK, F. P. Webber, Jnr., 602, Humphrey Street, Swampscott, Mass.; W1AWC, Rcuben R. Townroe, Church Street, Yalesville, Conn.; W2CIM, Richard Rauch, 180, Mortimer Avenue, Rutherford, New Jersey, U.S.A.; W2CIF, Henry J. Abrew, Balmville, Newburgh, New York, U.S.A.; W5AW, J. S. Tucker, 1911, S. Tyler Street, Amarillo, Texas; W3CL, K. Mengle, 723, Parkside Avenue, Bufalo, New York, U.S.A.; W9HOY, H. M. Flora, 10,815, Prairie Avenue, Chicago, Ill.; W2COJ, Laird, 1,000, Sanford Avenue, Irvington, New York, U.S.A.; W8CI, Wm, H. Marshail, Jnr., 2,712 North Avenue, Parma, Ohio; The last four call signs you give belong to Dutch amateur transmitters, but we regret we are unable to trace them in the latest ists. We advise you to write to : N.V.I.R., Post Box 400, Rotterdam, Holland, for further information.

THE CROYDON RADIO SOCIETY The last meeting of 1033 was spent in discussing members' radio problems at St. Peter's Hall, South Croydon. Mr. Nightingale presided. Many topics required elucidation, ranging from the design of smoothing circuits for mains units to acoustics in large halls. At the end of the meeting the chairmany termarked on the flourishing condition of the society, inasmuch as every member present had had something to add to the discussion. The New Year fixture cards are now ready, and the syllabus is a very full one up to April, when the session ends. One feature is of quality reproduction, and, of course, the President, Mr. H. R. Rivers-Moore, is giving another popular lecture. Dr. Hughes will also lecture on "Acousties in Radio." PRACTICAL WIRELESS readers are urged to the many good things the society has arranged for the many good things the society has arranged for the many good things, Maycourt, Campden Road, South Croydon. South Croydon.

PRACTICAL LETTERS (Continued from page 836)

the makers originally did not advise as suitable for superhet converters), and the suitable for superhet converters), and the method of joining S.W. choke through reaction coil to anode of S.G. I have received Sydney direct (confirmed) on loud-speaker with witnesses present. I had Schenectady at R.9 for one full hour on the occasion of the relay of Chicago arrival of General Balbo. All the G.S. stations, all the Germans, Russians, and the Italian and Portuguesc are alternative locals to me, with the volume control at locals to me, with the volume control at 50 per cent., and the summer atmospherics of the broadcast band never one evening stop me from getting a good alternative

programme—European or extra-European. The cost of the necessary components works out at two guineas.—H. W. AUBURN (Hampstead).



PRACTICAL WIRELESS

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ERIES and

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If a postal reply is desired, a stamped ad-dressed envelope must be enclosed. Every dressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

switch should be joined to the aerial, and then when the switch is open, the receiver will be in the normal condition, but when closed the resistance will be included across your aerial-earth circuit and it may then be adjusted to give you the volume required. When the receiver is then required for foreign or distant stations, the switch should be opened. The control will require no further adjustment after the preliminary setting has been made setting has been made.

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D	TA SHE	ET No. 69).		
Cut this out each week and paste it in a					
notebook.					
SERIES RESISTANCES TO CONVERT					
1 1			2.0		
Voltage	Resistance required for				
Range					
Required 1mARange 5mA Range 10 mA Range					
2 Volts	1,900	300	100		
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From the above table any intermediate values may be obtained.

WAVE-BAND IDENTIFICATION

WAYE-BAND IDENTIFICATION "I have finished the Orbit receiver and am more than delighted. It works in a most satisfactory way, and I wish to include it in a large radio-gram cabinet, but have one small grouse. The knob on the coils is not clearly marked with the wave-band, and I should like to fit some indication on the dial-light so that I can see (and others in the home also) when the set is turned to the long or the medium waves. Can you suggest any simple arrangement which will not cost a lot to fit up?" --Y. S. (Birmingham).

Constructor's H.T. Units

TESTING A FAULTY SET "I have rigged up a circuit of my own design, taken from various points I have seen in your book." When

-NQUIRIES by Our Technical Staff

tested out it was absolutely dumb. What is the easiest way to test through the circuit for the most likely fault. I have only got a voltmeter and no other testing instruments."— G. H. (Hatfield).

instruments."—A. H. (Hatfield). You do not state the type of circuit, but if you have a pair of headphones it should be a fairly simple matter to have these connected in the anode circuits of the detector and L.F. stages in turn. If any H.F. stages are fitted, they should be cut out, and the aerial taken direct to the tuned circuit feeding the detector stage. By joining the 'phones in this anode circuit you should hear something, and you can then include the H.F. stage (or stages, one at a time) until you fail to hear signals, when you will know that the fault has been localized in that part of the apparatus. If with all the fault arises in the L.F. side and can add these stage by stage. (The actual fault should not be difficult to locate once its position in the circuit is found, but a milliammeter will be found extremely useful. AUTOMATIC CALLING DEVICE

AUTOMATIC CALLING DEVICE "I wonder if it is asking too much to give me details of a scheme which will switch my set on when the tuning note is sent out. I should like to make up a device like this purely for a novelty, and I wondered if you had any ideas or knew of any scheme which makes this possible."—F. H. (Wylam-on-Tyne).

possible."—F. H. (Wylám-on-Tyne). Such a scheme is possible, but it is rather too complicated and expensive for you to build up. To operate on the tuning note only, you would have to fit a small receiver (continually switched on) with a low-frequency circuit adjusted so that the continued reception of a note having the frequency of the tuning note would cause a relay to come into operation and so switch on your receiver. If the constant-note circlit was not included, it might be possible for the set to be switched on by a powerful static or even a B.B.C. test transmission. It would be possible to fit a simpler device to operate when a carrier wave was received, and a more or less simple tuned circuit, with a powerful relay designed to operate from the carrier would switch on the set. The idea is not worth the trouble of fitting in our opinion.

In our opinion. SHORT-WAVE RECEIVERS "In view of the popularity of the short waves I should like to make up a set for the purpose of hearing what is doing down there. Do you advocate separate coils for small wave-bands, and to adopt the old plug-in idea, or is it possible to use switching without much loss? I am not so keen on long-distance work as to hear some sort of results for purely entertainment value."-K. W. (Exeter). The nume-in arrangement has much to be said for it,

value."-K. W. (Exeter). The plug-in arrangement has much to be said for it, especially if a large range of wavelengths is to be covered. On the other hand, switching will simplify operation, with slight losses, and as you do not want extreme long-distance work, this should prove no handicap. However, we think that for general short-wave experiment, the plug-in arrangement will prove most useful, as you can then find the band which offers and can then leave that particular coil in eircuit until you dosit eagain to carry out experiments. Further-more, the coils will be easier to make up and you will find the resultant circuit more straightforward.



Build your own H.T. Unit simply, safely, efficiently: exactly to suit your receiver's needs and adaptable to changed conditions. You can have no better guide than Ferranti. Leatlet No.

describes models for every purpose : from your dealer or send stamps to FERRANTI LTD. Dept. D . HOLLINWOOD, LANCS



SPECIAL NOTE.

REPLIES TO

SPECIAL NOTE. We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. Weregret that we cannot, for obvious reasons— (1) Supply circuit diagrams of complete multi-valve receivers. (2) Suggest alterations or modifications of receivers described in our contem-poraries.

poraries.

(3) Suggest alterations or modifications to

(3) Suggest alterations or modifications to commercial receivers.
 (4) Answer queries over the telephone.
 Please note also that all sketches and drawings which are sent to us should hear the name and address of the sender.

LOUD-SPEAKER POLARITY "I have a rather old type of reed loud-speaker and I wish to bring this into use again. I have cleaned it up and reassembled it, but find that during the cleaning process the positive and negative markings have become removed. 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. (Teignmouth).

receiver in the correct way."—Ř. L. S. (Teignmouth). 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 then carefully adjust the tension-ing screw until the reed files down on to the pole pieces. Now, slowly unscrew the adjustment until the reed comes away, and then reverse the connections to the receiver. If in the new position the reed files to the magnet then that is the correct way round for the speaker and the terminals should be suitably marked. If, however, in this second position, you find that the first method of connection was correct. **REDUCING THE LOCAL**

first method of connection was correct. **REDUCING THE LOCAL** "I have a commercial receiver which employs two variable-mu H.F. stages and delivers nearly three watts output. I find that even when the volume control is turned to its very minimum position (just before it cuts right out) the local station is much too loud. Is there any way in which I can reduce the strength of. this station? Generally, I find that it is good enough to undo the aerial lead, and then turn the valves full on, in which case the local comes through fair, but not quite loud enough. I do not, of course, want to interfere with the inside of the set."—W. S. C. (Glasgow). The einvolest method of reducing the sensitivity of

The simplest method of reducing the sensitivity of The simplest method of reducing the sensitivity of your receiver when the aerial is connected is to join a resistance across aerial and earth terminals. The actual value will depend upon the tuning arrangements, and generally a value up to about 150 ohms proves most suitable. You can probably find room at the back of the cabinet, for instance, to fit a variable resistance having a maximum value of, say, 400 ohms, and you should join the arm of this resistance to earth, and the end of the winding to one side of an ordinary short-circuiting (on/off) switch. The other side of the

PRACTICAL WIRELESS MISCELLANEOUS ADVERTISEMENTS

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