A.C., UNIVERSAL & D.C. 3-Valve Superhets. Exclusive!

Practical Wireless

3D.

AND AMATEUR TELEVISION

EDITED BY F. J. CAMM.

Published every Wednesday by GEORGE NEWNES LTD.
Vol. 5.—No. 112.
November 10th, 1934.
Registered at the G.P.O. as a Newspaper.

INSTANTANEOUS SUCCESS

OPERATING THE £5 SUPERHET FROM A.C. AND D.C.

EDITOR :
Vol. V. No. 112 || F. J. CAMM || Nov. 10th, 1934.
Technical Staff :
W. J. Delaney,
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.,
Frank Preston, F.R.A.

ROUND *the* WORLD *of* WIRELESS

The £5 Three-valve Superhet—Good News for Mains Users

Users of D.C. and A.C. mains and owners of eliminators will be delighted to learn that Mr. F. J. Camm's £5 Superhet Three will be produced in special versions to meet their special needs. There will be a D.C. version, an A.C. version, a model employing Universal valves, and, additionally, its operation by means of eliminators will also be dealt with. For identifying purposes only it will be necessary to retain the designation title. It will be appreciated, of course, that these mains versions will give rise to variation in prices of the components. The designer will, of course, produce these mains versions as cheaply as is compatible with efficiency.

Index and Binding Cases for Vol. 4 Now Ready

Those readers who bind their copies of "Practical Wireless" will be pleased to learn that indexes for Volume 4 are now ready and can be supplied for 4d. post free, and that binding cases (including index) can be supplied for 2s. 9d. post free, from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.

Our Companion Journals

Readers of "Practical Wireless" should make a point of placing regular orders for our companion journals, the *Practical Motorist*, 3d. every Wednesday; *Practical Television*, 6d. monthly; and *Practical Mechanics*, 6d. monthly. For *only 6d.* per month you can learn all there is to know about the latest developments in this newest of sciences from *Practical Television*, whilst *Practical Mechanics* deals with every field of mechanical and scientific thought. The *Practical Motorist* is *the* paper for the owner-driver.

The Television Committee

IT has been announced officially that the Television Committee have now made good progress in sifting the evidence presented to it. Before formulating any definite proposals, however, they have deemed it advisable to visit America and Germany in two separate parties in order to become acquainted with the television progress made in these two countries. A return to this country is not expected until towards the end of November, so the report will inevitably be delayed, and it seems unlikely that anything will be heard until 1935.

IMPORTANT EDITORIAL NOTICE

Will those Readers who have been collecting the Gift Tokens for their Presentation Volume of NEWNES

TELEVISION AND SHORT-WAVE HANDBOOK

please note that the last GIFT TOKEN, No. 9

*(provided they started collecting from the first announcement of this offer, see below *)*

appears on the back cover of the next issue of

"PRACTICAL WIRELESS"

Will readers who are qualifying for this wonderful Presentation Volume affix the last Gift Token to their Subscription Voucher directly next week's PRACTICAL WIRELESS is published and forward the completed Voucher in accordance with the instructions thereon, IMMEDIATELY.

PLEASE DON'T DELAY

There will be an enormous number of volumes to despatch, and it will take some little time to get them all out. All applications will be treated in strict rotation. If you do not receive your volume within 15 days of the despatch of your application—notify by postcard, giving date application was made.

NOTE.—Carefully read instructions on your Subscription Voucher and make sure it is properly filled in before forwarding.

** This will not be your last Gift Token if you did not start collecting until after the first announcement—in which case you continue to collect until you have the necessary nine Gift Tokens attached to your Subscriotion Voucher.*

If you have lost any of your Gift Tokens you may send threepence in stamps in lieu of each and if by chance you have mislaid the Subscription Voucher, you can still obtain your volume by sending nine Gift Tokens and a remittance of 2s. 6d. with your name and address written plainly on a sheet of paper.

Complete and send in your Subscription Voucher immediately you have affixed the last Gift Token to

PRACTICAL WIRELESS
Presentation Department, T.S.H.,
14, SOUTHAMPTON STREET,
STRAND, LONDON, W.C.2.

Any query regarding this offer must be accompanied by a stamped addressed envelope for reply.

"The Microphone at Large"

THE third of this series will be heard from Tewkesbury Abbey on November 16th. The programme is arranged by Walter Pitchford, who was the narrator in the Midland Cathedral series last year, and Owen Reed; it will include change-ringing by the Diocesan Guild of Ringers, and music from both the organs. The bells are a peal of twelve, completed this year by Taylors, of Loughborough, as a memorial to the Reverend Charles Davies, a native of Tewkesbury, who is regarded as the father of modern change-ringing. The larger organ was originally built for the Inventions Exhibition of 1885, and was given to the Abbey as a Victoria Jubilee Memorial in 1887. Milton, the poet, played the smaller organ (a Harris of 1637) when it was at Hampton Court. Tewkesbury Abbey, dedicated in 1123, is famous for its Norman work.

Sibelius Concert

ON November 15th, the City of Birmingham Orchestra is giving a Sibelius Concert which includes the Symphony in A minor, and the violin concerto—with Arthur Catterall. Leslie Heward will conduct this concert, which will be relayed from the Birmingham Town Hall. A talk on Finland will occupy the interval.

Brigade of Guards Bands at the Cenotaph

BROADCAST of the Armistice Day ceremony at the Cenotaph, London, on November 11th, will start at 10.30 a.m., when the Brigade of Guards will play the following: "Heart of Oak"; "The Minstrel Boy"; "Land of my Fathers"; "Isle of Beauty"; "David of the White Rock"; "Land of the Leal"; "Skye Boat Song" (pipes); "Oft in the Stilly Night"; "When I am laid in Earth" (Purcell); "Solemn Lament" (Walford Davies); "Flowers of the Forest" (pipes), and "Funeral March" (Chopin).

ROUND the WORLD of WIRELESS (Continued)

The Royal Wedding

THE B.B.C. have received permission to broadcast the wedding of His Royal Highness the Duke of Kent and the Princess Marina at Westminster Abbey in the presence of Their Majesties the King and Queen, on November 29. The service will be relayed in its entirety. The scenes outside the Abbey will be described by Howard Marshall before and after the ceremony. The service and the commentaries will be broadcast from all B.B.C. transmitters, including the Empire station at Daventry.

The B.B.C. Orchestra at Manchester

DURING the coming winter the B.B.C. Symphony Orchestra, with its conductor, Dr. Adrian Boult, is visiting four provincial cities. The first visit will be to Manchester, where the orchestra will give a concert in the Free Trade Hall on Wednesday, December 5th, at 7.30 p.m. The orchestra will have the full complement of 119 players, with Arthur Catterall as leader, and the programme has been laid out so as to take the fullest advantage of that large body of players. Pieces have been chosen which cannot well be presented in accordance with their composers' wishes unless a big team is engaged in their performance.

The programme begins with Wagner's Prelude to "The Mastersingers," and Strauss' Tone Poem, "Ein Heldenleben," comes next, in which Arthur Catterall takes the solo violin part.

In the second part of the programme are John Ireland's Symphonic Rhapsody, "Mai-Dun," one of the strongest and most vivid pieces of our time; and Paul Hindemith's "Philharmonic Concerto," a theme and variations which take their name from their dedication to Wilhelm Furtwangler and the Berlin Philharmonic Orchestra. The programme concludes with the "Bolero" of Ravel, which has so quickly found a place for itself among the most popular orchestral music of to-day.

Light Entertainment from Scottish Regional

AN hour's mirth and melody by members of the Glasgow Press will be broadcast on November 10th. Taking part will be representatives of all the Glasgow daily and evening newspapers. The programme is described as "Glasgow Press Gang."

"The Show Goes Over"

THIS show, which will be broadcast on the National wavelength, November 29th, and on the Regional wavelength, November 30th, will afford listeners an opportunity

INTERESTING and TOPICAL PARAGRAPHS

of a peep behind the microphone during the production of a musical comedy by a broadcasting company which specializes in sponsored programmes. The director of the show meets with many trials and tribulations in handling a theatrical star, who is very temperamental, and a bunch of "yes" men. No matter what the difficulties, the show must go over! Book and lyrics of "The Show Goes Over," are by Max Kester on a scenario by Laurence Gilliam, the music is by Austen Croom-Johnson and Brian Michie will produce.

"Invitation to the Waltz"

THIS new production by the authors of "Good Night Vienna," will be broadcast in the London Regional programme on November 14th, and the National programme on November 15th. The book and lyrics are by Holt Marvell, and the music is by George Posford. This is the first occasion for three years that the latter has composed for the microphone. During that time he has been busy on films and stage work. "Invitation to the Waltz" is an imaginary explanation why Weber wrote the world-famous piece of this title. The story takes place in Venice and in Germany during the time of Napoleon. Weber is featured as one of the characters.

RADIO IN THE KITCHEN.

The owner of this H.M.V. refrigerator has had a loud-speaker finished in cellulose to match the porcelain exterior of the refrigerator.

The "Red Aces"

ON November 12th, a new dance band will broadcast from the Midland Regional. It is a versatile ten-piece combination, directed by Eddie Carney—Tony's "Red Aces." The manager of a Birmingham dance hall formed it from bands he has organized in various parts of the country. Most of the players are masters of more than one instrument, and with the band is the boy soprano, Stanley Rawlings, who, at fourteen years of age, can sing in three languages and play twelve instruments.

An Interesting School Concert

THE concert by the Dean Close School at Cheltenham, the school's fourth broadcast, will be relayed to Midland Regional listeners on November 17th. Its remarkable musical progress is largely due to the work and the enthusiasm of Heller Nicholls, the composer, who is the Director of Music.

Concert from Midland Regional

ON November 17th, an important concert, chiefly of light music, will be given from the Midland Regional. Stanford Robinson, conductor of the B.B.C. Theatre Orchestra, goes to Birmingham as guest conductor of the B.B.C. Midland Orchestra, and the vocalist is Winifred Lawson, of D'Oyly Carte fame. The programme will include Debussy's "Clair de Lune," orchestrated by Mouton, and the song "One Fine Day" from "Madame Butterfly."

SOLVE THIS!

PROBLEM No. 112.

Jackson had a small two-valve A.C. mains receiver, which he had constructed, and which gave fair results. As volume was not all that could be desired, he decided to add a further valve. This took the form of an L.F. stage between the detector and output valve, but then completed volume was less than with the original two-valver. No part of the original receiver had been altered, except so far as concerned the breaking of the anode circuit of the detector to include the primary of the extra transformer. The heater terminals of the extra valve were wired in parallel with the existing ones, and the correct value of H.T. was applied to the valve. No mistakes had been made in the wiring. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 112, and must be posted to reach here not later than the first post Monday, November 12th, 1934.

Solution to Problem No. 111.

Jarvis had overlooked the fact that the wave-change switch was joined between the tapping on the coil and earth, and therefore on medium waves the bias condenser was short-circuited, thus preventing the correct application of the bias for volume control purposes. The switch should have been joined between the lower end of the coil and the tap when he made the alteration.

The following three readers successfully solved Problem No. 110, and books have therefore been forwarded to them: Mr. W. C. A. Smyth, 70, Martinez Avenue, Bloomfield, Belfast. Mr. H. Salmon, 44, Casella Road, S.E.14. Mr. H. B. Page, Merlo, Burnside, Rutherglen.

CHANGING TO SUPERHET

The Simplest Methods of converting a "Straight" Receiver into a Modern Superheterodyne are Described and Illustrated on This Page

THE many advantages which are peculiar to the superheterodyne circuit are being more extensively realized than ever before. There is no doubt that the modern superhet. completely solves the years-old problem of selectivity, but it is not yet universally appreciated that a superheterodyne receiver may be as simple and inexpensive to construct as a receiver of the "straight" type. This fact will doubtless be emphasized in the minds of thousands of constructors by the advent of the "£5 Superhet. Three," and this remarkable receiver will certainly make a large percentage of PRACTICAL WIRELESS readers "superhet.-minded."

Although many hundreds of readers are sure to build the new set, there will be others who are not prepared to make a completely new receiver at the present time. One reason for this may be that the set at present in use is comparatively new, or that it functions so well that the owner is loath to dismantle it in order to make a new one. Difficulties of this kind can best be overcome by retaining the set in its present state and adding to it a unit which will convert it into a modern superheterodyne. Provided that the receiver is of sound design and now functions satisfactorily there is no reason why the addition should not produce still more gratifying results. One can hardly expect the conversion to prove so efficient as a completely new design, but it will be useful in demonstrating the remarkable capabilities of a really up-to-date superhet. Moreover, all the new parts required for the superhet. unit can later be used in the construction of a new and self-contained receiver.

Most readers are aware that any superheterodyne must incorporate, in some form or other, the following stages: first detector, oscillator, intermediate-frequency amplifier, second detector, and low-frequency amplifier. An ordinary three-valve set with high-frequency amplification (S.G., H.F., pentode, or V.M.) contains the elements of all except the first two stages, so it can be seen that if these are added a superheterodyne circuit can easily be built up. After slight modification the present high-frequency valve will act as I.F. amplifier, whilst the detector and L.F. valve will continue to perform their normal functions.

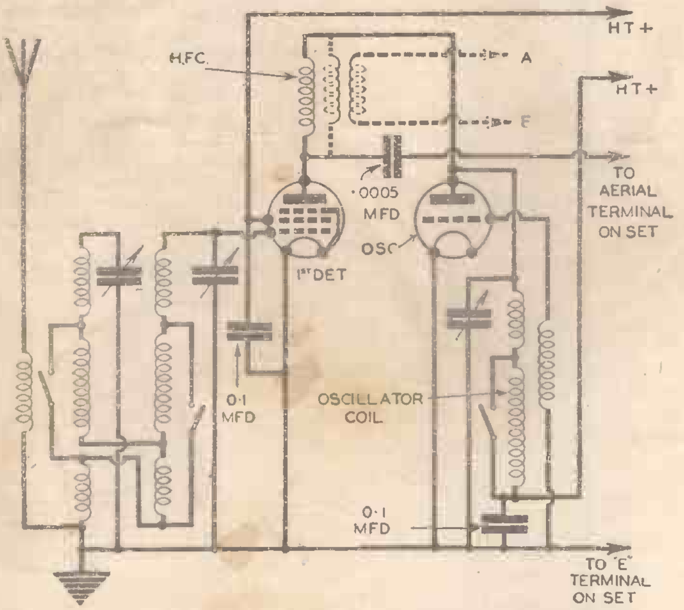


Fig. 1.—The circuit of a simple superhet unit intended for working at an intermediate frequency of 150 kilocycles.

The Frequency-changing Unit

The only functions to be carried out by the additional superhet. unit are those of first detector and oscillator, and it is possible to employ either two separate valves or one multi-electrode valve of the pentagrid, heptode, octode, or triode-pentode type for the purpose. The constructor who has one or two valves on hand will no doubt prefer to employ separate valves, but if there are no spare valves available it will be better to buy one of the modern dual-purpose type. A first-detector oscillator circuit employing two battery valves is given in Fig. 1, from which it can be seen that the arrangement is very simple and straightforward. Note that a band-pass filter, of the inductively-coupled type, is used in the aerial-input circuit and feeds into a screened pentode (this might be replaced by a plain S.G. valve). The band-pass circuit is a practical essential with almost any superhet. for the avoidance of second-channel and other forms of interference. A good high-inductance H.F. choke is connected in the anode circuit of the first detector, and anode-circuit mixing of the oscillator frequencies is employed. The oscillator valve is an ordinary triode—type L. or H.L.—and is connected to a standard oscillator coil.

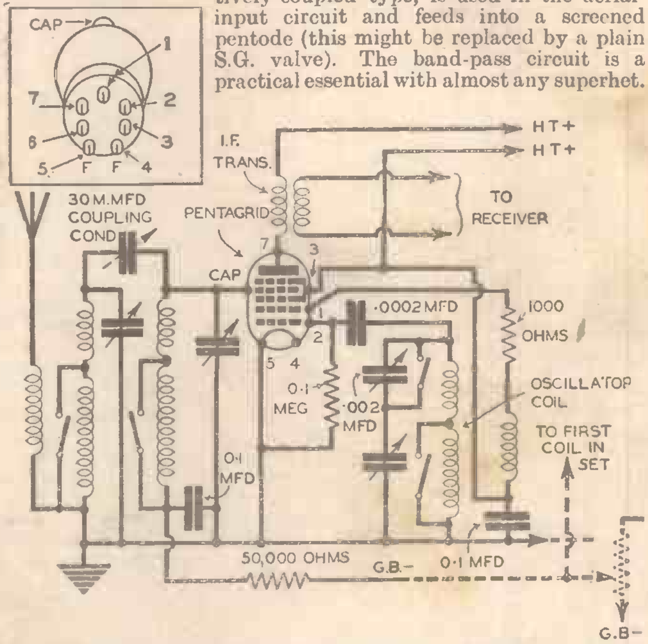


Fig. 2.—The general circuit for a superhet unit employing a pentagrid frequency-changer. If desired, the I.F. transformer shown may be replaced by a choke-condenser combination. Inset shows the connections (underside) to the pentagrid 7-pin valveholder.

Coupling the Unit

Tuned-grid coupling is used between the first detector and the H.F. valve in the receiver, so that the set must be tuned

(Continued overleaf)

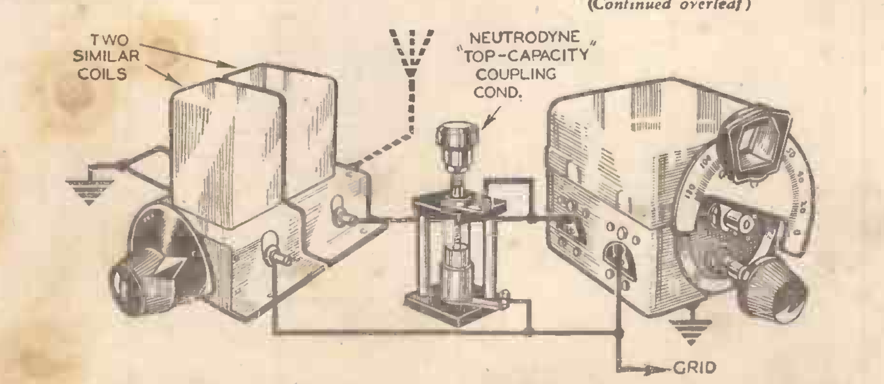


Fig. 3.—Showing how two ordinary and similar coils can be used in a band-pass circuit by employing a neutrodyne condenser to provide "top-capacity" coupling.

(*Continued from previous page*)

to the wavelength corresponding to the intermediate frequency provided by the superhet. unit. It is customary to use oscillator coils and condensers which give an I.F. of 110 kilocycles. This, however, is equivalent to a wavelength of about 2,700 metres, which is higher than the average receiver is designed to tune. For this reason it is better to choose oscillator components which give an I.F. of not less than 150 kilocycles (2,000 metres) so that the receiver can be tuned to the correct wavelength. Once the receiver has been tuned to the intermediate frequency it need not be altered again; for this reason it is quite permissible to remove the normal tuning condenser (which might then be used in the superhet. unit) and replace it by the appropriate number of .001-mfd. pre-sets.

When the receiver is not fitted with a band-pass input circuit it is much better to substitute H.F. transformer coupling for the tuned-grid circuit previously mentioned. In that case the anode circuit of the first detector becomes as shown by broken lines in Fig. 1, the transformer shown being a special 150-kilocycle I.F. unit. This replaces both the H.F. choke and the coil and condenser used to tune the grid circuit of the H.F. valve in the receiver.

For Mains Operation

The circuit given in Fig. 1 can readily be modified for use with a mains set, provided that the power unit of the set is capable of supplying the additional current (both H.T. and L.T.) required by the unit. High tension will rarely present any difficulty, but in many cases there will be no "spare" L.T. current available, in which case it will be necessary to employ a separate 4-volt, 2-amp. transformer for feeding the heaters of the valves in the unit. The primary winding of this is simply connected in parallel with that of the existing mains transformer.

Using a Pentagrid

A circuit arrangement including a battery pentagrid valve is given in Fig. 2; apart from the valve itself this is almost identical with Fig. 1. Provision is made for applying A.V.C. or variable grid bias, however, but when neither of these is required the lower end of the second band-pass coil may be connected straight to the earth line. Should the present receiver be provided with A.V.C. or variable-mu control the lead marked G.B. should be joined to the supply lead, as shown in broken lines. An octode or heptode valve could be used in a circuit of the kind shown in Fig. 2, by making the detail wiring alterations required by the particular valve.

A mains frequency-changing valve could be used in the circuit under discussion, with the provisos dealt with in connection with the Fig. 1 circuit. Alternatively, a triode-pentode frequency-changer may be used, but otherwise the general arrangement would not differ very widely from those in Figs. 1 and 2. In fact, the triode-pentode can be considered almost identical with two separate valves.

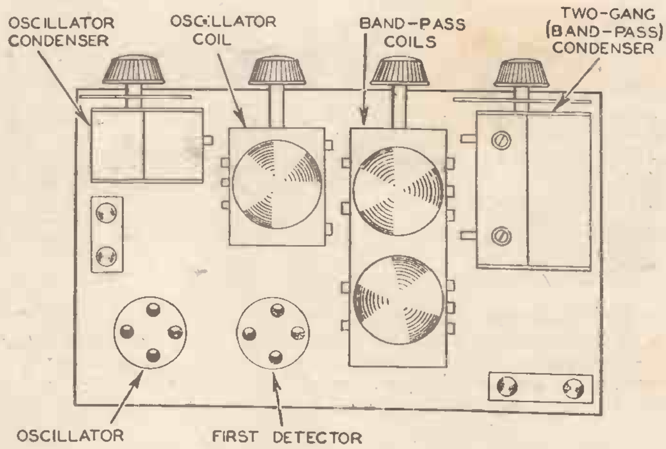


Fig. 4.—A good arrangement of components in a superhet unit in which separate valves are used for first detector and oscillator and separate coil and condensers. The layout could be simplified if a multi-electrode valve were used in conjunction with a special coil assembly.

The practical constructional details will be almost the same, regardless of which of the three types of circuit is employed. If a suitable pair of band-pass coils is already in the set, this can be used in the input circuit to the superhet. unit whilst the same two-gang tuning condenser can be employed. A new oscillator coil will, of course, be required, and this can best be tuned by means of a separate .0005-mfd. variable condenser, provided that two tuning controls are not objected to. When band-pass coils are not on hand the coil at present used in the aerial circuit of the set can be employed in conjunction with another similar one, and, with a "top-capacity" coupling condenser connected as shown in Fig. 3, the coupling condenser requires to have a very small capacity, and a neutralising condenser having a maximum of about 30 micro-microfarads will prove most convenient.

Single-knob Tuning

When single-knob tuning is desired it will generally be best to obtain a complete three-coil assembly, as well as a three-gang superhet. condenser. As there are few such assemblies available which are designed to give an intermediate frequency of other than 110 kilocycles, however, it will be necessary in most cases to replace the aerial tuning circuit, and also the inter-valve circuit by two 110-kilocycle I.F. transformers. Such a major alteration as this, however, will entail almost as much work—and expense—as dismantling and re-building the complete set.

The arrangement of the parts is not very critical, but a layout something like that shown in Fig. 4 will prove most satisfactory. It should be observed that the tuning condensers are chosen so that their terminals are on the side adjacent to the coil terminals, and that all the parts are so placed that the connecting wires are as short and direct as possible. The output terminals should also be positioned so that the wires required to connect them to the existing set are very short and direct. It is obviously not possible in the space available to give complete wiring diagrams for the various circuits suggested, but as the connections are very few in number these should not be required. In order to avoid possibility of confusion, however, the connections to the multi-electrode valves mentioned are given as insets to the circuit diagrams.

A Romance in "Ekcos"

THERE are two men who call for my particular admiration in the radio world, for they have not been spoiled by their success. They are Mr. E. K. Cole and Mr. W. S. Verrells, of E. K. Cole and Co., Ltd., the makers of the famous Ekco receivers. When first I came in contact with them they knew very little about the technical side of radio, but they realized the great bugbear to wireless was the troublesome high-tension battery. They sought to devise some means of utilizing the electric mains as a source of supply. They were so successful in this direction that the foundation was laid for the huge factory which is now one of the monuments of Southend-on-Sea, and enriches the town by many thousands of pounds every week. Daily some new addition is made to this colossal factory. In the past it has been necessary to import from abroad a considerable amount of semi-raw material to complete component parts, but this has been gradually overcome, until to-day it is possible to make everything at home. When I was in the factory a few days ago, I was very intrigued with the manner and simplicity with which the bakelite cabinets are made. A scoop of powder is sifted into a container, which then disappears from sight into a huge 1,000-ton press, to emerge immediately as a beautiful cabinet—and so it is from one end of the factory to the other. Miracles are being performed by machinery and clever mechanics which arouse the enthusiasm of the most lazy engineer. Such are the strides accomplished by these two men that in a matter of seven or eight years their business has grown from a shanty to an enormous factory covering nearly 200,000 sq. ft. This progress could only be made by giving a customer a square deal and a receiver *par excellence*.—C. D. K.

HERE AND THERE

Concert by Bristol Artists

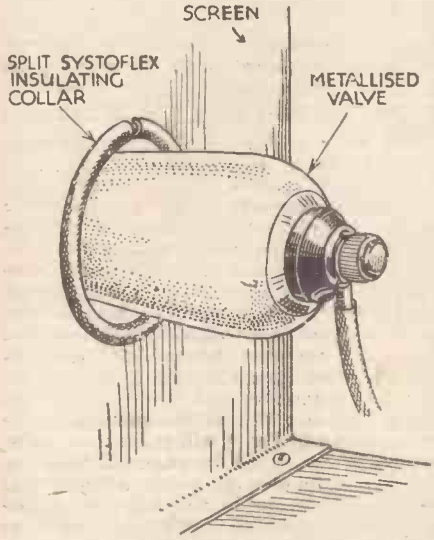
WEST REGIONAL listeners will hear a concert by Bristol artists on November 12th. Margaret Harris and Edgar Glasspool will give two groups of duets on two pianos, and Eveline Willcox (soprano) will sing a group of songs. Eveline Willcox was a soloist for the Bach Choir in Toronto this year; she has also sung at recitals and musicales in Paris. Edgar Glasspool, who has been playing the piano since he was six, found himself very much in the same position as a connoisseur at auction sales who always finds the same dangerous rival bidding against him. When he found that Margaret Harris was always his rival in competitive festivals he asked her to join forces instead, and now they play duets.

READERS' WRINKLES

THE HALF-GUINEA PAGE

A Use for Systoflex

NOW that metal-covered valves are being extensively used, I devised the simple method (shown in the accompanying sketch) for preventing the



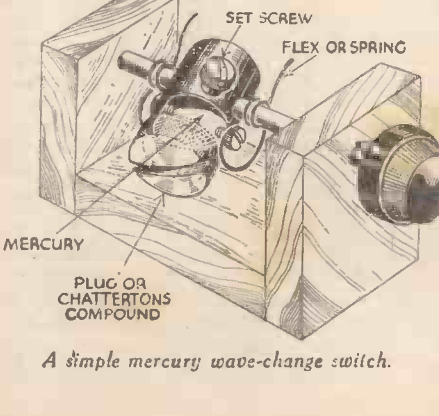
Using a piece of systoflex for protecting a metallised valve where it passes through a screen.

metal covering coming into contact with any metal screen or base-boards which the valve may have to pass through.

A piece of sleeving is split and put round the edge of the hole, thus effectively insulating the valve.—HUGH HUGHES (Liverpool).

A Mercury Wave-change Switch

ONE of the most troublesome parts in a receiver is the wave-change switch, which is often noisy and unreliable. I solved the problem by making for my own use the simple mercury switch shown in the accompanying sketch. A piece of ebonite rod is bored to a depth of ¾in. to form a cup, and through the sides two holes are bored and tapped to take two screws. The cup is then half filled with



A simple mercury wave-change switch.

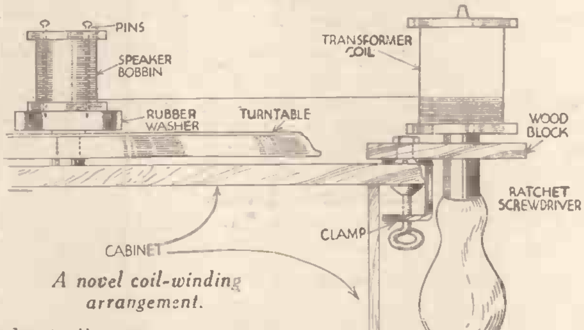
THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

mercury and the opening closed with a screwed cap, or some Chatterton's compound. A hole is drilled through the other end of the ebonite so that it can be slipped on a spindle. Connection to the two screws is made with short pieces of flex. On half-turning the spindle the ends of the two screws are submerged in mercury and so form a perfect contact. Any number of these switches could, of course, be fixed on the same spindle.—D. STUART (Bankhead).

A Novel Coil-winding Arrangement

THE handy coil-winding device shown in the accompanying sketch can be made as follows. First, cut a piece of wood

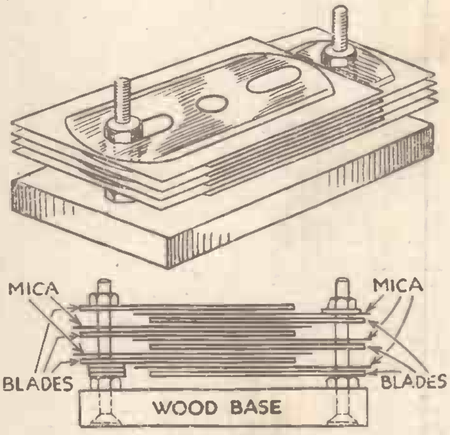


A novel coil-winding arrangement.

about 4in. square, screw a clamp on one end, and drill a hole in the wood to take the stem of a ratchet screwdriver. Push the screwdriver through the hole and clamp to the side of a gramophone cabinet. Next fit a rubber washer on the turn table spindle, and fix the coil to be rewound. This is done by pushing two pins through the hole in the coil, and into the rubber washer. When this is done, put an old transformer coil, or bobbin of wire, on the blade of the screwdriver as shown in the sketch, and wind the motor. To wind the coil simply start the motor.—W. KENNEDY (London, S.E.).

A Razor-blade Condenser

HERE is a novel use for used razor blades. Procure a piece of wood roughly 3in. by 1in., and screw a long terminal in each end 1½in. apart. Cut a number of pieces of mica, or similar insulating material, to a size slightly larger than the blades. Slip a blade over one terminal by the end hole, then a piece of mica, and repeat the operation on the opposite terminal so that the blades are interleaved with sheets of mica between.

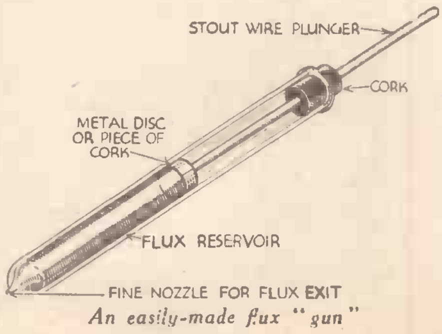


A novel razor-blade condenser.

Different capacities can be obtained by experimenting with the number of blades, and the finished condenser can be slipped into a match-box with terminals projecting through the top.—R. H. GEEVES (Luton).

An Easily-made Flux "Gun"

THE accompanying sketch shows a simple device which proved to be a very economical and easy method of applying flux when soldering. The barrel of the "gun" consists of a piece of glass tubing, such as a syringe, with a nozzle at one end. The case of a propelling pencil would also answer the purpose. The end of the tube is plugged with a cork having a central hole which is an easy fit for the plunger rod. A slight pressure on the plunger enables a small amount of flux to be deposited on any desired spot where soldering is to be done. The sketch shows the arrangement quite clearly.—J. GUY (Poplar).



An easily-made flux "gun"

FACING THE VALVE REPLACEMENT PROBLEM

The Use of Modern Type Valves in Lieu of Those which Have Done Yeoman Service in the Past is a Problem which All Readers Have to Face. This Article Explains How Best to Meet the Situation.

SOONER or later every listener realizes that the time has come when he must replace his valves, and the choice of new ones is not always a simple one. If the receiver is of fairly modern design it is, as a rule, just a matter of purchasing new types of valves identical with or equivalent to the original kit. There are many cases, however, where the selection of suitable replacements presents something of a problem.

The Best Plan

In the case of a very old set, for example, such as the once popular detector and two L.F. combination, the nearest modern equivalent of the original types may be quite unsuitable because they are actually too efficient for use in the old circuit. As a result, oscillation, howling and all sorts of similar troubles will be experienced. The new detector is quite likely to give trouble in this respect due to the much greater sensitivity of the modern valve. Of course, the best plan with such an old receiver is to scrap it and build a more up-to-date instrument, but if this is not practicable for any particular reason it may be possible to modify the receiver, bringing it sufficiently up to date for use with the nearest modern equivalent of the original valve.

When proceeding with the adaptation of a really old set, a new detector valve will often be made to work in a stable manner by reducing the high-tension voltage to this stage. In the old days it was quite usual to employ anode voltages of 50 to 75, cr even more in the detector stage. It is worth while trying the effect of using 40 volts or perhaps a little less, and this often produces the desired result of a restoration to stability.

Reducing the Number of Stages

When using a new and highly efficient output valve, trouble may be experienced with distortion due to overloading in this stage. The explanation is that owing to the greater sensitivity of modern valves they need not be designed to handle such big input signals. As a result, when used in place of an output valve of old design the newer types are overloaded and considerable distortion ensues. If the valve in question is of the "power" type it will be fairly safe to substitute a super-power valve which is considerably less sensitive than the power type. Another alternative is to reduce two low-frequency stages to one and use a power pentode, this type of valve being able to give its full output when fed direct from the detector valve.

Modern valves of greater sensitivity are more likely than their forerunners to develop low-frequency instability, particularly of the form known as "motor-boating," which is usually the result of a high resistance common to the anode circuits of several valves, such as the resistance caused by a faulty cell or cells in the H.T. battery. The effect can be avoided by adequately decoupling all high-tension circuits except, of course, the anode circuit of the output valve.

Such patching up of a really old set for use with new valves is, however, at best, a temporary measure, and it can be taken that, in general, sets of the old det. and two L.F. type will in a very short time become as rare as the dodo, since they can have neither the range nor the selectivity necessary for satisfactory reception under modern broadcasting conditions. It is best, therefore, if it can possibly be managed, to re-design and rebuild the set completely, using modern parts and, of course, up-to-date valves.

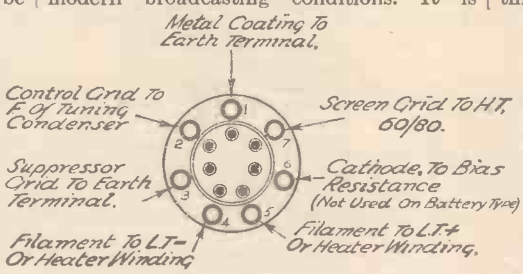


Fig. 1.—Indicating the valveholder terminal connection of a 7-pin H.F. pentode.

More Modern Sets

The question now arises of choosing replacement valves for a somewhat more modern type of set, say, the popular screened grid, detector and pentode combination which, in one form or another, has been the standard set for the average listener and constructor during the past four or five years. In most cases quite satisfactory results will be obtained if the new valves are of the same types or the nearest modern equivalents of the types used in the original receiver.

There is one direction in which an improvement can be made at once in the certain knowledge that it will be effective. That is the substitution of high-frequency pentodes in place of screen-grid valves in the high-frequency stages. The change-over usually calls for no alteration whatsoever in the circuit—the connections to a high-frequency pentode being identical with those for a screen-grid valve. One point, however, must be kept in mind, namely, that in the case of most makes of battery H.F. pentodes the valves are fitted with a seven-pin base and not the more familiar four-pin or five-pin base. A.C. mains valves in the H.F. pentode class are, however, available in either seven-pin or five-pin form.

It will be of service to point out here the contact arrangement of the seven-pin base as applied to H.F. pentodes. Looking at the valveholder and turning it so that the two pins which come closest together are at the bottom, and commencing with the single pin at the opposite side of the holder from the two pins just mentioned, the top pin, which we will call No. 1, is connected to the metallized coating. Working round the holder in an anti-clockwise direction, pin No. 2 on the left of pin No. 1 is connected to the control grid; the next pin, No. 3, is the suppressor-grid connection; the next two pins, 4 and 5, are the filament or heater connections. Pin No. 6 is unconnected in the battery types, but is the cathode connection in indirectly heated mains valves, while pin No. 7, on the right of pin No. 1, is the auxiliary grid connection. The top cap is, of course, the anode connection, as in the case of a screen-grid valve.

The illustration Fig. 1, should make this quite clear.

Another Form of Detector

Another improvement which can be made in a receiver employing a high-frequency stage, whether a screen-grid or screened pentode valve be used, is to modify the circuit so that a variable-mu valve may be employed. The circuit for this type of valve has been reproduced many times in PRACTICAL WIRELESS, and the alteration will present no difficulty.

In place of an ordinary triode detector a high-frequency pentode can be used, and this is a particularly useful idea for a receiver employing only one high-frequency stage and where, therefore, the added gain of a highly sensitive screened pentode detector will be welcome. Moreover, the larger gain obtainable with this type of valve may make it possible for the listener to dispense with reaction, thus simplifying the operation of the set, eliminating at least one cause of distortion, and making it possible to gang the tuned circuits much more accurately with a very satisfying effect on both sensitivity and selectivity.

It is recommended that the leaky-grid system of detection be employed, and that resistance capacity coupling be used following the H.F. pentode detector. The theoretical circuit is shown in Fig. 2, the approximate anode and auxiliary grid voltages being 100/150 and 50 respectively.

Better Output

Concerning the low-frequency side of a battery set of the type we have been

(Continued on page 305)

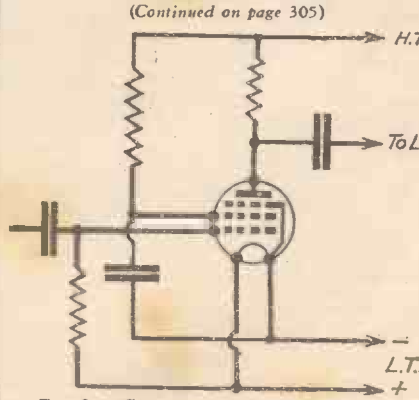


Fig. 2.—Circuit connections for a typical H.F. pentode detector circuit.

IMPROVING A.V.C. ACTION

A Brief Explanation of the Principles of A.V.C., and a Description of Two Suggested Circuits to Give a More Useful Range of Control Than is Usually Provided

THE term "Automatic Volume Control" or, to use the well-known abbreviation, A.V.C., is familiar to all interested in radio. The purpose of A.V.C. is to keep, the output from the detector stage, and therefore the output volume, also, at a reasonably constant level.

Two considerable advantages are conferred by the provision of A.V.C. One is that when a station is tuned in, the output volume is automatically set to a predetermined level, and the other is that variations due to fading are minimised. Naturally an A.V.C. system does not enable exceptionally weak signals to be received, but simply serves to reduce the receiver's overall amplification as is necessary.

Various A.V.C. Systems

There are various ways of obtaining the A.V.C. effect, but the most usual is by means of a diode rectifier associated with the normal detector stage. This diode may form part of a double-diode-triode valve, or it can be separate as, for example, when a Westector is used for this purpose. The H.F. voltage applied to this diode circuit by the carrier is rectified, and fed through suitable filters as a negative grid bias to the grids of one or more pre-detector amplifying valves. For example, in the circuit shown in Fig. 1, the heptode V1, and the variable-mu S.G. valve V2, are controlled by the A.V.C. bias voltage.

It will be obvious to the reader that the diode rectifier will normally develop a small A.V.C. bias on even a very weak carrier. This is not desirable, as the sensitivity of the receiver would be reduced, and for this reason it is usual to delay the action of the A.V.C. diode so that it does not operate below a certain carrier voltage. This modified arrangement is termed "delayed" A.V.C. and is the form commonly adopted.

The delay effect is obtained by applying a negative bias to the anode of the A.V.C. diode. In Fig. 1 it will be seen that the A.V.C. diode anode (D1) is connected through its 1-megohm load resistance to the negative end of the V3 cathode bias resistance. The A.V.C. diode anode is therefore negative with relation to its cathode. In the case of a battery valve bias voltages are adjusted with relation to the negative side of the filament.

When the peak carrier voltage across the 1-megohm load resistance is less than the D.C. delay voltage across V3 bias resistance, the A.V.C. diode does not rectify, and as no A.V.C. bias voltage is developed, V1 and V2 will operate at full efficiency.

When the peak carrier voltage exceeds the D.C. delay voltage the A.V.C. diode will rectify and develop an A.V.C. bias voltage, this voltage increasing as the carrier strength increases. As the A.V.C. bias voltage controls the amplification given by V1 and V2, an increase of A.V.C. bias will tend to reduce the amplification, and also the carrier voltage applied to the A.V.C. diode and the signal diode.

Obviously, if the A.V.C. system has a sufficiently wide range of control, a constant peak carrier voltage will be applied to the signal diode D2 which feeds the L.F. amplifier, and this peak carrier voltage will be equal to the D1 diode delay voltage. When the carrier voltage is insufficient to operate the A.V.C. system the receiver operates at full efficiency.

Principle of Control

It should be mentioned that the principle of controlling a diode rectifier by applying a bias voltage should be noted as it is of primary importance in the use of diode rectifiers in general. For not only can the action of a diode be delayed, that is to say, made inoperative on weak signals, by applying a negative bias, but by the use of positive bias the diode action can be accelerated and made sensitive to very weak signals.

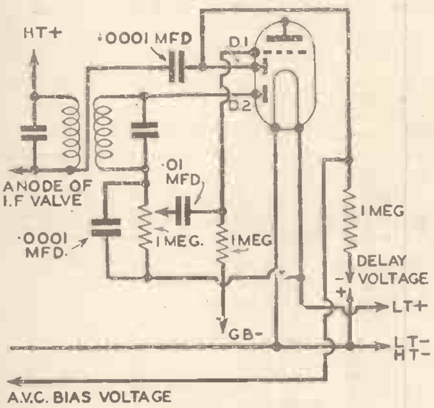


Fig. 2.—A delayed automatic-volume-control circuit.

A positive bias equal to the filament voltage is applied to the signal diode D2, shown in Fig. 2, by returning the 1-megohm load resistance to L.T.—. This increases the sensitivity of the diode, and of the receiver as a whole, to very weak signals. Fig. 2 also shows the method of applying a delay voltage to the A.V.C. diode in a battery receiver. The effect of biasing a diode is the same as that of varying the grid potential of a leaky-grid detector, and can be applied to a Westector as well as a valve-type diode.

It will be clear that the L.F. amplifier of an A.V.C.-controlled receiver should be designed so that when the peak input to the

(Continued overleaf)

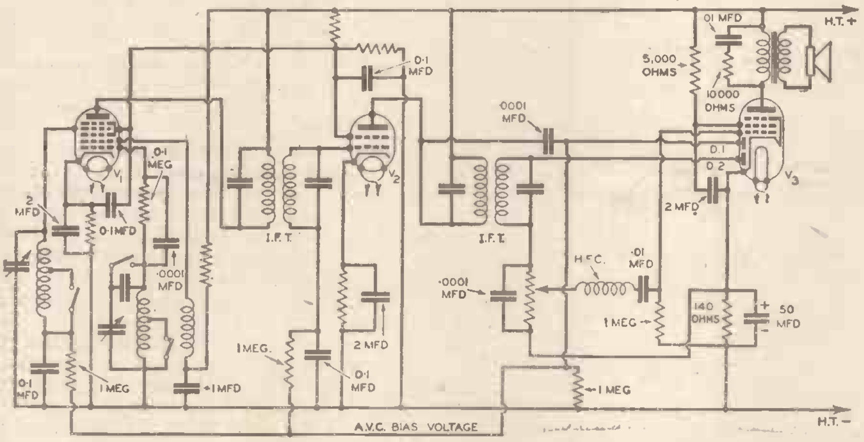


Fig. 1.—A three-valve A.C. superhet giving about three watts output with a very good A.V.C. system.

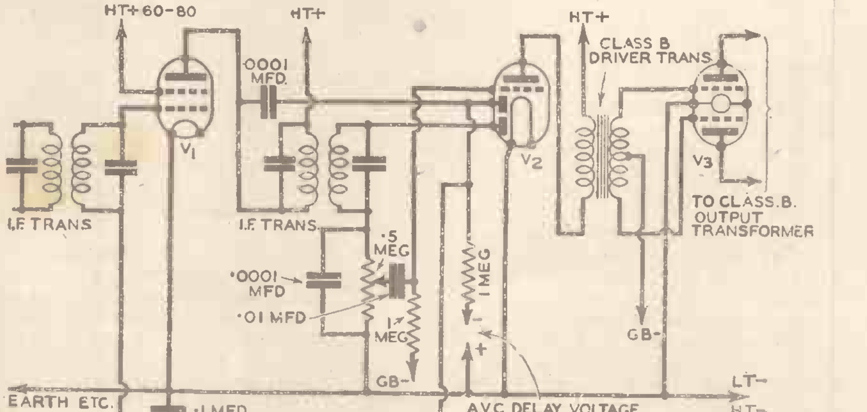


Fig. 3.—In this circuit the triode section of the double-diode-triode is used as driver for the class B stage, so giving several advantages.

(*Continued from previous page*)

L.F. from the detector is equal to the A.V.C. delay voltage, the full output desired is obtained without the L.F. volume control being reduced appreciably. The A.V.C. system will then hold all stations received at the maximum undistorted output, or less. As previously explained, this is the desired effect.

Many receivers incorporating A.V.C. have not fulfilled this requirement, with the result that the A.V.C. action has only been obtained with the L.F. control reduced considerably. As in most cases of this type, only very strong stations are receivable with the L.F. volume control reduced appreciably, so that the A.V.C. action has occurred when it is least required.

Double-diode and Pentode

The combination of a double-diode with a high-efficiency output pentode as one multi-valve makes a three-valve A.C. superhet with a very good A.V.C. characteristic possible. A receiver of this type is shown in Fig. 1, and the pentode section only requires an input of two or three volts to give some three watts output.

Unfortunately, no valve of this type is at present available for the battery user, but a similar circuit could be employed using a steep slope pentode and two Westectors as the diodes. When Class B output is desired on the grounds of economy the circuit shown in Fig. 3 could be adopted. The first detector and oscillator are not shown, but a heptode could be employed with advantage.

The triode section of the double-diode-triode is used as the Class B driver in this circuit. It is usual to use a small-power valve as driver for a Class B stage, but providing the smaller type of Class B valve is used with the correct ratio driver transformer the circuit shown should give 1 to 1¼ watts output.

To obtain higher sensitivity than a four-valve superhet of this type would give, a signal-frequency H.F. stage could be employed with advantage. This stage could be controlled by the A.V.C., and this would improve the A.V.C. characteristic, although two controlled valves in a superhet give a sufficient range of control for general use.

Both the suggested circuits operate with a high input to the signal diode, which ensures linear rectification, and, consequently, very good quality apart from the improved A.V.C. action.

HUM-BUCKING and HUM-DINGING

Some Devices for Overcoming the Introduction of Hum by a Modification in the Construction of the Moving-coil Loud-speaker

By W. J. DELANEY

UNDOUBTEDLY the greatest trouble which the builder of an A.C. mains receiver has to contend with is hum. This seems to be almost ineradicable, and there are dozens of places in the circuit where hum is introduced. The correct type of A.C. valve operates quite satisfactorily with raw A.C. as its heater supply, and the only part of this circuit which can cause hum is an inaccurate centre-tap to the heater winding. If the mains transformer is made by a reliable firm there should be no difficulty here, but the actual receiver might unbalance the centre-tap and thus cause trouble. The use of an artificial tap will remove anxiety from this, and a small potentiometer having a resistance of about 30 ohms is well known for this purpose. In its commercial form it is known as a hum-dinger or nodalizer. Even when this is employed and all inductances, etc., are screened, hum sometimes persists, and although the smoothing may seem adequate, owing to the use of a loud-speaker field winding for a choke it may seem impossible to remove the last trace of hum. The field winding of a mains-energised loud-speaker is obtainable with various resistances, suitable for use with supplies from 6 volts up to 250 volts. The smaller variety is intended for excitation from a 6-volt accumulator, but it is possible to use a mains circuit consisting of a mains transformer and a metal rectifier. The higher ranges are intended for D.C. supplies, and it is a common practice to connect them in the eliminator section of a mains receiver, relying upon their high inductance to provide adequate smoothing for the receiver, and utilising the total anode current of the receiver for the excitation current. Unfortunately, although the current in each case is rectified, it will still bear a slight ripple and it is this which gives rise to hum.

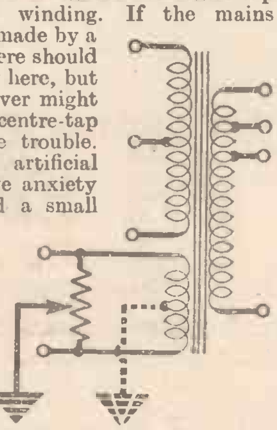


Fig. 1.—Hum may be prevented by connecting the earth lead to a potentiometer across the heater winding.

Low-voltage Speakers

Where a speaker of the low-voltage type is in use and operated from a mains supply, hum may be completely eliminated by using a high-value electrolytic condenser. The complete circuit is shown in Fig. 2, and the condenser should have a value of 2,000 mfds. This condenser will effectively remove the slight ripple which passes the rectifying circuit, and the complete arrangement should prove quite efficient and silent in use.

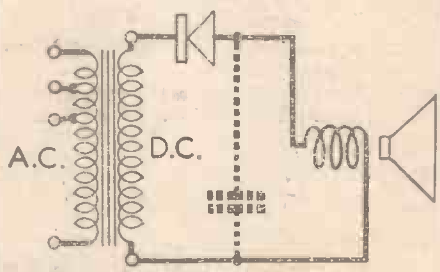


Fig. 2.—A large capacity fixed condenser across the low-voltage field winding.

With the high-resistance windings, this device does not lend itself owing to the fact that when used for smoothing the H.T. supply to a receiver we are dealing with high voltages, and a high-voltage electrolytic condenser is an expensive item. There is, however, a much simpler method in use, and this consists of a small coil in the speaker, wound and connected in a certain manner. The hum is introduced by induction from the field winding into the speech coil, and therefore it seems quite logical to balance out the hum by introducing a similar hum, or varying current, in an opposite direction. To do this, it is only necessary to wind a coil to couple out of phase with the speech coil, and to connect this in series with the speech coil. The exact number of turns, the distance from the speech coil, and the tightness of coupling with the field winding will vary according to the particular design of the loud-speaker, and therefore exact details cannot be given. For test purposes, a small coil having the same number of turns as the speech coil, and wound directly over the field winding, may be used, and to avoid an alteration in the impedance of the speech coil, care will have to be exercised in the choice of the wire gauge.

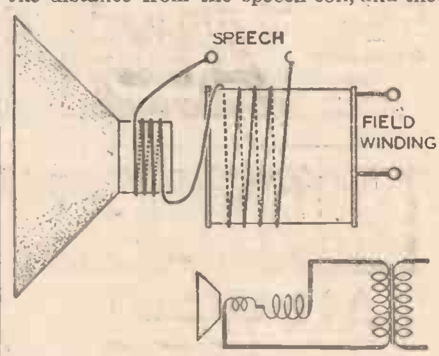


Fig. 3.—A hum-bucking coil used with a mains-energised speaker.

It should be mentioned that modern speakers of repute are fitted with this hum-bucking coil, but there are many older types still in use where the addition of this coil will affect an improvement in reception.

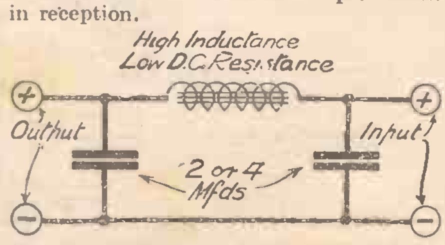


Fig. 4.—The normal A.C. mains smoothing circuit for use on D.C. or universal receivers.

UNUSUAL LOUD-SPEAKER ARRANGEMENTS

A Number of Interesting Suggestions in Connection with the Mounting and Disposition of the Speaker are Here Made. By FRANK PRESTON

DESPITE the fact that it has, within the last few years, become the recognised practice to arrange a loud-speaker as a moving-coil unit placed behind a grille or opening covered with silk or similar material, it is by no means certain that this is the best system. Various attempts have been made to render a wireless receiver less like a piece of laboratory equipment and more in keeping with home furnishings, but the same amount of attention has not been paid to the speaker. There does not appear to be any particular reason for this, and it is time some change was made.

An important step in connection with the method of mounting the speaker unit was made in the "All-Pentode Three" recently described in these pages. In the case of that popular receiver the speaker was mounted underneath the lid, as shown in Fig. 1. A circular hole was made in the lower portion of the lid, but this was covered by a second board placed over it and supported on four small pillars. It will be seen that with this arrangement the sound from the speaker cone is directed on to the upper portion of the lid which acts as an efficient baffle, or sounding board. The consequence is that the sound is "diffused" and more uniformly distributed over the room. In addition to this, however, the speaker is completely disguised.

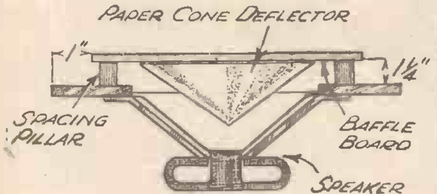


Fig. 1.—The ingenious speaker arrangement used in the "All-Pentode" Three, and which is described in the accompanying text.

There may be many readers who would like to experiment with this arrangement themselves, and they will find the dimensions given in Fig. 1 helpful. There is one point that should be mentioned, which is that it is generally advantageous to fit a small "deflector" cone to the underside of the baffle. This cone may be of the type previously made for use in conjunction with a moving-iron or reed speaker movement, and it is wise to try a few different cones of varying degrees of stiffness. The cone can also be tried fitted in one of two ways: rigidly attached to the baffle, or mounted with a strip of spongy rubber between its rim and the sounding board.

Those readers who have a speaker movement, or even a telephone earpiece, of the reed pattern will find that a very interesting speaker can be made, as shown in Fig. 2. It will be seen that the movement is mounted on a wooden batten fixed across the framework of thin-panelled door, whilst the projecting reed is so arranged that it just touches the panelling. An improvised loud-speaker of this type will often be found to produce excellent results, especially when

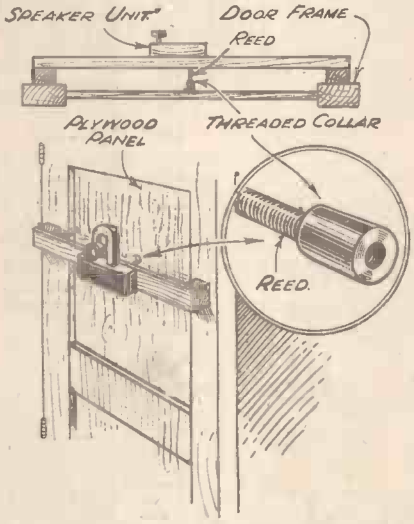


Fig. 2.—A type of speaker which often functions admirably, and can be made from an old moving-iron or reed-type unit.

used in conjunction with a receiver which is normally inclined to give somewhat high-pitched reproduction. It is necessary to experiment a little to find the optimum pressure which the end of the reed should exert on the panel, since if the pressure is too great the unit will be made insensitive; on the other hand, if the pressure is too light the "speaker" will rattle on loud passages. This difficulty is best overcome by fitting a small threaded collar, or even a long nut, to the screwed end of the reed and adjusting this until the best position is found. After that, a spot of solder can be applied to fix the collar rigidly in place.

If a loud-speaker of this type is being made experimentally it is a good plan to try different kinds and thicknesses of wood for the panel, although this is not possible when the door of a cupboard or cabinet is being employed. It is also well to try the effect of fretting the panel, and of mounting it loosely in the frame by placing thin strips of rubber between it and the beading which is used to hold it in position.

Returning to the orthodox type of moving-coil loud-speaker unit which has recently been brought to such a high degree of perfection, mention should be made of different methods of

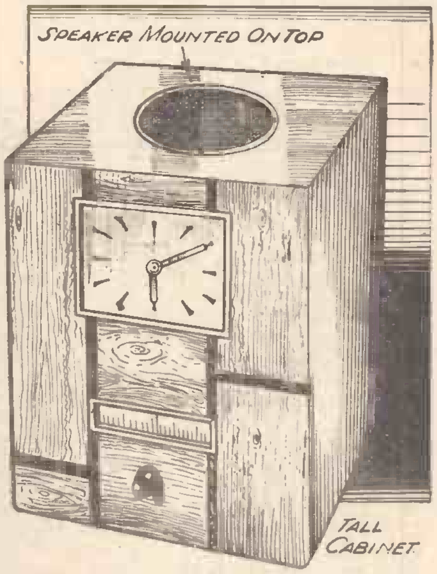


Fig. 4.—Excellent reproduction can often be obtained by mounting the speaker in the top of a tall cabinet, etc., so that it faces upwards.

positioning the unit. It is generally known that when the speaker is mounted in a cabinet of the console type it should either be on the same level as the ear (when listening) or should be placed on a sloping baffle, as in Fig. 3. The latter arrangement is often to be preferred, and is particularly valuable when dual speakers are used and one of these must, of necessity, be placed low down. A little refinement that often proves popular in an arrangement of this kind is the provision of a lamp for floodlighting the speaker gauze. Such a light can easily be provided, as shown in Fig. 3, by making a rectangular hole over the speaker opening and fitting a small flash-lamp bulb-holder over it. The hole should be covered with a strip of coloured non-inflammable celluloid, whilst the lamp-holder can be wired in parallel with the normal dial light. When the latter is not fitted the terminals of the holder should simply be connected to the two filament,

(Continued on page 301)

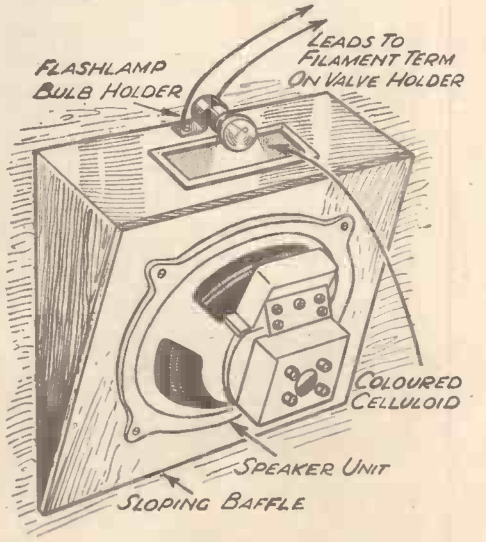


Fig. 3.—This drawing shows a small refinement which might well be fitted to a speaker mounted on a sloping baffle—it takes the form of a lamp for floodlighting the speaker opening.

SIMPLE AIDS TO GANGING

Setting the Trimming Adjustments of a Ganged Tuned Receiver is Considerably Simplified by Suitably Connecting a Milliammeter

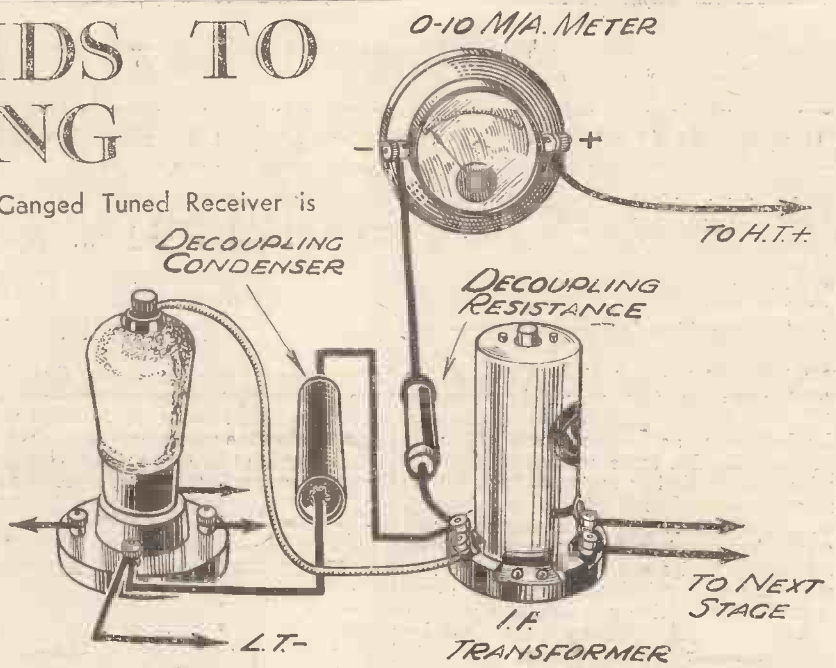


Fig. 1.—This shows a milliammeter connected in the anode circuit of an A.V. controlled I.F. valve of a superhet to serve as a tuning indicator for both ganging and normal tuning purposes.

CORRECT adjustment of the trimming condensers of any receiver with ganged tuning is essential if the best results are to be obtained. This process should present no difficulty if the designer's instructions are followed.

The trimming adjustments can conveniently be made while receiving any constant transmission of moderate strength, but if a modulated H.F. oscillator is available the procedure is facilitated. This is because slight differences in strength of the constant L.F. note provided by an oscillator are more easily noted than small changes in intensity of speech or music.

Adjusting the Set

When adjusting a set in conjunction with a modulated H.F. oscillator a visual indicator of resonance will enable very accurate settings to be made. Any of the various output meters now available may be used, but if an instrument of this type is not at hand it is usually possible to arrange a milliammeter in some part of the receiver to serve as an indicator.

For example, if the receiver is provided with automatic volume control some form of tuning indicator is usually fitted. If this should not be so, a milliammeter can be inserted in the H.T. supply lead to any one of the A.V.C. controlled valves. An 0—10 milliammeter is usually suitable for this purpose, and the connections for a typical arrangement are shown in Fig. 1. The trimmers are adjusted in the correct sequence until the tuning indicator change is as great as possible or, in the case of a milliammeter, until the reading reaches its lowest point.

If the receiver is not equipped with A.V.C. it will usually have a leaky-grid or anode bend detector. With a superhet this reference applies to the second detector. The anode current of either of these types of detectors changes when a signal is applied, the current decreasing with a leaky-grid detector but increasing with an anode bend rectifier. By adjusting the trimmers until the greatest possible change in current is obtained, accurate results are assured.

With battery-operated receivers a 0—5 milliammeter will serve for a leaky grid detector, and a 0—1 milliammeter is satisfactory for the anode bend type. With mains valves these values will usually be suitable except when the detector is a "power" grid, in which instance a meter reading up to 10 milliamps will be adequate in most cases. As the change of current is relatively small it is desirable that the meter range be such that the detector anode current gives approximately half scale when a signal is tuned in. A meter with several ranges is ideal for this purpose. Fig. 2 shows the meter suitably inserted in a battery leaky-grid detector stage.

Battery-operated Receivers

With battery receivers having Class B, Q.P.P., or an output valve controlled by an H.T. economiser, the output stage anode current varies in sympathy with the applied signal. A meter can be connected in the H.T. lead to the output stage, and the trimmers set to give the greatest obtainable increase in anode current.

Should it not be convenient to connect a meter in the detector stage of a battery-operated receiver having a normal power or pentode output valve, this may be converted into an anode-bend rectifier by increasing the negative grid bias. A milliammeter connected in the anode circuit of the output valve would then show an increase as the signal input becomes greater. The negative grid bias should be increased between 50 and 100 per cent. while checking in this way.

Whatever arrangement is adopted the meter should always be connected at the low potential end of the anode circuit. That is to say, the meter should not be inserted between the anode terminal and the component normally connected to the anode. This arrangement, in the case of a detector or H.F. valve, usually causes instability and may cause serious errors in ganging. It is preferable to place the meter in series with the lead connecting the particular stage to the H.T. positive wiring. The diagrams show the meter connected as suggested in typical circuits.

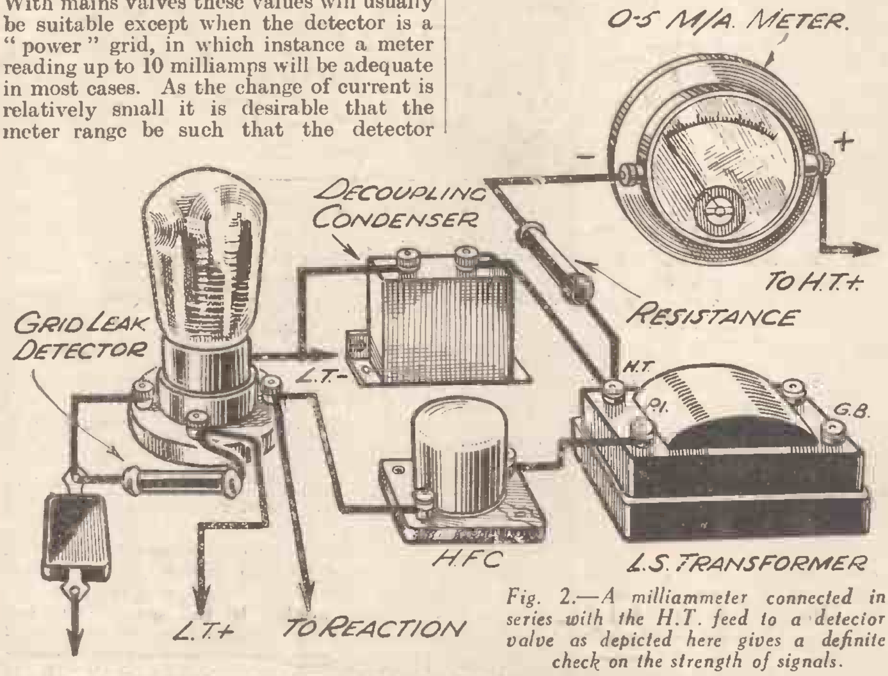


Fig. 2.—A milliammeter connected in series with the H.T. feed to a detector valve as depicted here gives a definite check on the strength of signals.

REVIEWS OF LATEST RECEIVERS

THE HYVOLTSTAR UNIVERSAL SUPER SEVEN

THIS particular receiver is probably one of the most advanced models which is on the market to-day, and it would appear from an examination of the circuit incorporated that there is no feature or principle which has been omitted. To briefly go over the circuit we find the following: Seven valves incorporating a nine-stage superheterodyne principle. The first valve functions as a pre-signal H.F. amplifier and is coupled to a pentagrid frequency changer. A double-tuned I.F. transformer couples the output of this stage to a variable-mu pentode acting as an intermediate-frequency amplifier, and this in turn is coupled to the following stage by a second double-tuned I.F. transformer. For second detection a Westector is employed, one of the new WX. types being used in this position. A second similar component is included in this part of the circuit to provide A.V.C., and this is arranged to operate with a delay voltage as well as an amplifier, thus providing fully delayed and amplified A.V.C. This stage is followed by an L.F. stage and is fed into a push-pull output stage incorporating two pentodes. Finally, a double-rectifier is employed, one half supplying rectified current for the push-pull stage, and the other half supplying the first stages as well as providing current for the field winding of the energised loud-speaker. In addition to all of the above features, all valves are of the Universal mains-voltage type, thus avoiding the use of a mains transformer, and rendering the receiver suitable for use on A.C. or D.C. supplies without alteration. The specification is still further enhanced by the inclusion of a visual-tuning indicator, and the tuning range covered extends from 13 to 2,000 metres. This is without a doubt a most ambitious circuit.

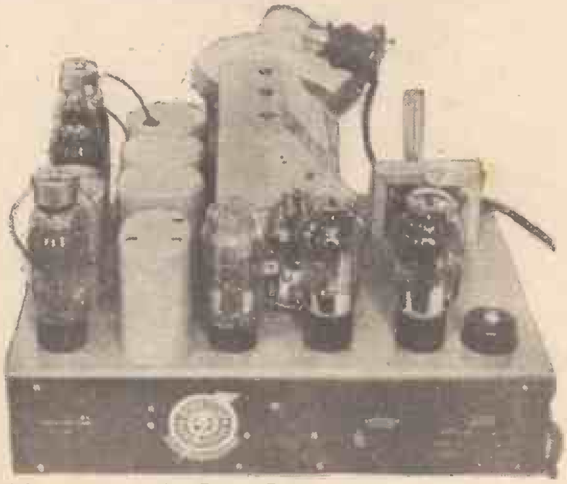
The Hyvoltstar Super Seven in its attractive table cabinet.

The Layout

As may be seen from the illustrations on this page, the receiver has six controls, although the operation is not rendered difficult as might at first be supposed. The extreme right-hand control changes from radio to gramophone reproduction, pick-up sockets being provided on the chassis for the permanent inclusion of this component. The next control regulates the wave-range, and has four separate positions. On its lowest setting the wave-range is from 13 to 27 metres, and the scale for this range is printed at the top of the large scale and is in brown print. The next position on the switch is the short-wave range, and the appropriate scale is situated immediately below the previous one, is printed in green, and covers a range of 26 to 53 metres. The next position is the medium wave-band, extending from 200 to 550 metres, and this is printed immediately beneath the former scale in black, whilst the final setting is for long waves, from 800 to 2,000 metres, and this scale is in red. A 15-watt lamp, operated from the main supply, illuminates this scale, and this provides a ready method of ascertaining the range which is in use, and as the scale is calibrated in metres and is so perfectly illuminated there is no hesitation in obtaining an accurate setting at any time. The next control is a combined on-off switch and volume control, a clockwise rotation of the knob switching the set on and then building up volume to the maximum. Immediately above this is the main tuning knob, controlling the ganged condenser with the small short-wave condenser mounted on the same spindle. Next is a tone control, providing a variation in range from maximum high-note to maximum low-note. Finally, a control is fitted to enable the visual-tuning indicator to be adjusted to provide the required range of brilliancy on all stations, and, obviously, once this has been set, it may be ignored.

Results

As might be expected the receiver is tremendously powerful. Practically all the European stations are receivable, and the only limiting factor is the signal-to-noise ratio. Thus, dozens of stations may be tuned in, but owing to the noises which accompany the carrier a few do not have entertainment value. It is interesting to adjust the neon indicator so that it does not go completely out between stations, and then to rotate the tuning control with the volume control set to the silent point. In this condition it is possible to tune through the broadcast band and the indicator remains at its highest setting throughout practically the whole scale length, the indication being, of course, that there is a station at every part of the scale. Naturally, owing o the signal-noise ratio above-mentioned, quite a large number of these cannot be listened to and, therefore, the indicator is adjusted so that it goes completely out in between stations, and then, by setting the volume control to the silent point, it is possible to rotate the tuning control, and when the light rises to a maximum the volume control may be turned up to provide the requisite signal strength. This avoids all the between-station noises, and the limit set by the indicator control ensures that only worth-while stations will be heard. The output stage provides 7,000 milliwatts. The chassis, with valves, is obtainable separately for those who wish to build their own receiver or radiogram, and it costs 22 guineas. Complete in the cabinet, as shown on this page, the price is 26 guineas, and it is also obtainable as a complete self-contained radiogramophone for 40 guineas.



The chassis of the Super Seven, showing the short-wave condenser ganged to the main condenser.

USING ELIMINATORS FOR F. J. CAMM'S £5 SUPERHET THREE

An Account of the Performance of This Receiver with Various Types of A.C. and D.C. Mains Units and Some Details of Further Models

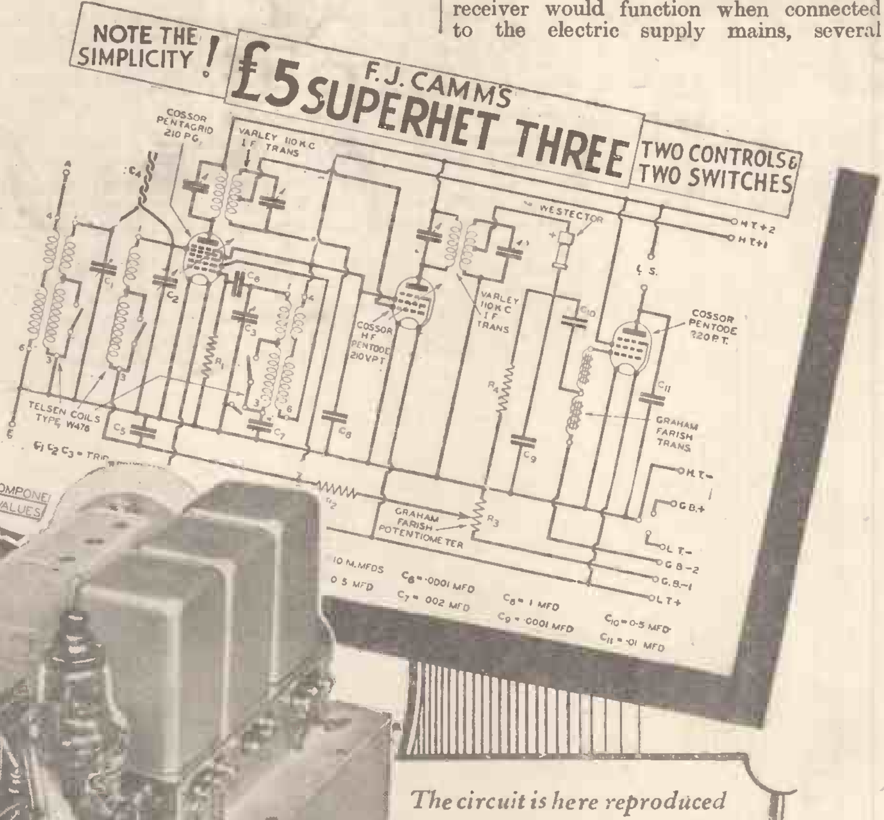
OUR post-bag gives a very good indication of the interest which is aroused by an article or design published in our pages, and we certainly expected to receive numerous letters when we published details of Mr. Camm's £5 Superhet Three battery receiver. We had no idea, however, of the tremendous interest which this receiver would arouse, and the enthusiasm which the public is evincing for this particular model far exceeds any previous design which we have published. We have literally been snowed under with requests for demonstrations; suggestions for modification to meet some individual needs; queries concerning mains models, etc.

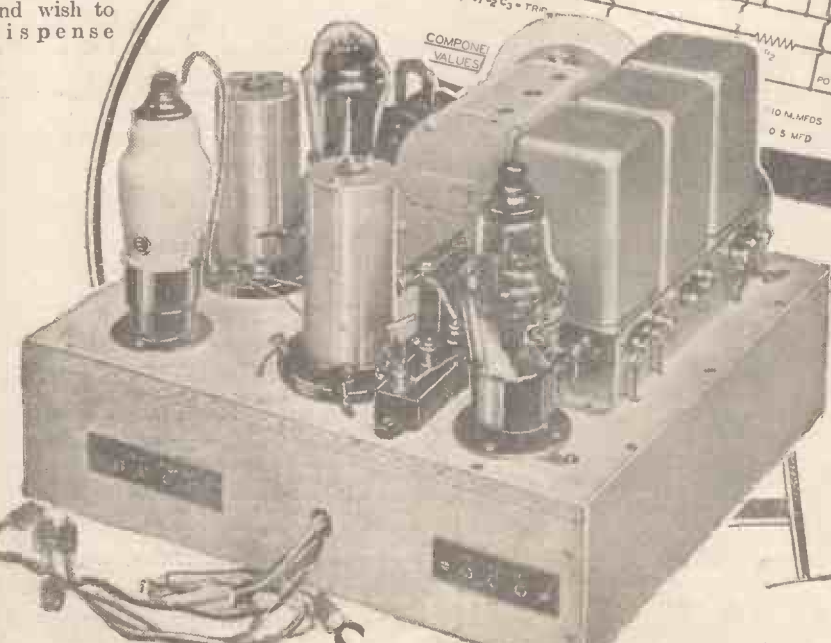
Modifying the Design

Many readers prefer a Class B output stage, and wish to know whether the change to this type of output would be likely to introduce instability or mar the performance of the receiver. A specimen was modified for this purpose, and certainly gave high-class results, but it must be appreciated that an extra valve is required for this conversion, and thus the upkeep costs will be greater, as well as calling for some modification of the chassis. We do not propose to give details concerning this change, as we do not consider it worth while. Those who do not object to the extra valve, and who prefer the Class B circuit are quite at liberty to make the change if they so desire. Many readers have the electric supply mains in the home, and wish to dispense with the H.T. battery and, in many cases, also with the L.T. battery. We have carried out a number of experiments with this receiver, using home-made mains units, commercial mains units, and with modifications of the original design to employ special mains valves. All of the experiments have been highly successful.

A.C. Mains Units

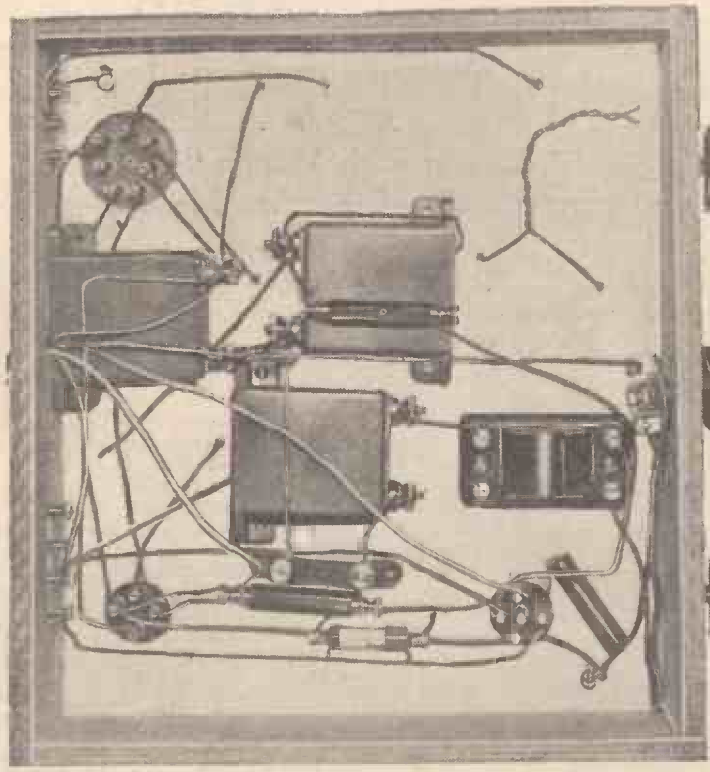
An examination of the original circuit diagram will show that the decoupling which is included is very meagre, and, indeed, some criticism has been levelled at the design from this point of view. When originally constructed, the receiver employed every device conceivable in the interests of stability and perfection of performance. Then, when the circuit was in thorough working order and was giving the performance which was desired, the circuit was gradually stripped. First this component was dispensed with, then another. All the time, the aim of the designer was to reduce the receiver to the bare essentials consistent with high-class performance, and no endeavour was spared to bring down the price whilst still maintaining the high standard which was set with the receiver in its original condition. Thus, if a small change in wiring produced a slight fall in volume or selectivity, the wiring was replaced. In this way the circuit was slowly stripped, and a condition was arrived at where any further modification produced inferior results. In that state the £5 Superhet Three was presented to our readers, and thus full confidence is placed in its performance. To ascertain how the receiver would function when connected to the electric supply mains, several





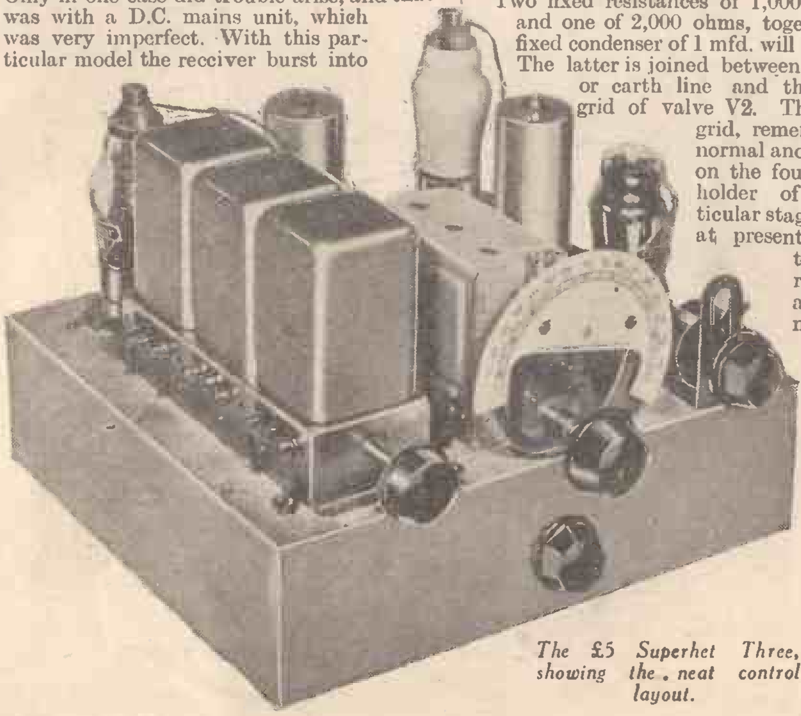
The circuit is here reproduced in order that readers may see the points involved in this article. The photograph of the set is also included for reference.

OPERATING THE £5 SUPE
MAINS UNITS AND FU



This illustration shows the underside of chassis, from which it will be seen that there is ample room for decoupling components when an inefficient mains unit is employed.

commercial mains units were obtained, as well as some simple home-made units in which the design was not all that could be desired. When these units were connected in place of the H.T. battery the circuit proved not only perfectly stable in every respect, but gave the same ideal performance as was obtained with the dry batteries. Only in one case did trouble arise, and that was with a D.C. mains unit, which was very imperfect. With this particular model the receiver burst into oscillation as soon as it was switched on. It was thought desirable, however, to experiment with the receiver, and to ascertain whether this could be modified slightly so as to enable it to function without making any alteration to the mains unit, as it is fully realized that there must be many units at present in use which are far from ideal, and therefore we wished to be in a position to state definitely that the receiver would function on any type of unit. Finally, it was found that the inclusion of three fixed resistances and one fixed condenser completely cured the instability, and enabled the receiver to function as before.



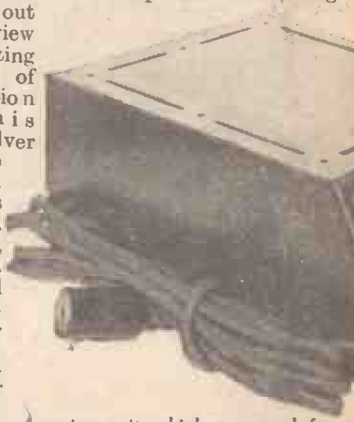
The £5 Superhet Three, showing the neat control layout.

The Decoupling Circuits

For those readers who find that the particular unit which they are employing gives rise to this trouble the following are the modifications which are necessary. Two fixed resistances of 1,000 ohms each and one of 2,000 ohms, together with a fixed condenser of 1 mfd. will be required. The latter is joined between the chassis or earth line and the screening grid of valve V2. The screening grid, remember, is the normal anode terminal on the four-pin valveholder of this particular stage. The wire at present joined to that pin is removed, and is connected to one end of the 2,000 ohms resistance, whilst the other end of the resistance is joined to the valve pin. Now remove the H.T.1 lead from condenser C8. Connect the lead to one end of one of the 1,000 ohm resistances, and join the other end to the terminal on C8, from which the lead was taken. Finally, disconnect the lead from terminal 6 on the oscillator coil, and connect the lead to one end of the remaining 1,000 ohm resistance, joining the other end of the resistance to terminal 6. This then disposes of those queries relating to the operation of the receiver from small mains units, and those who have such apparatus or wish to purchase it may go ahead in the full knowledge that the performance will be as satisfactory as with the original battery model.

An A.C. Model

Among the numerous queries have been many regarding the design of a three-valve on these lines, but intended entirely for mains operation, and to these readers we would point out that experiments are being carried out with a view to perfecting a design of modification of this three-valver for use on A.C. mains or D.C. mains, and in a universal form suitable for use on either type of mains without alteration. Obviously, it will be necessary to make certain modifications in the circuit design to suit the higher efficiency of the valves, and also the particular requirements of mains valves so far as biasing, etc., are concerned, but in the main the principal circuit features will be retained. For those who have already commenced building the receiver, or who only require that the



A mains unit which was used for te... res...

COMPONENTS FOR TH

- One set 3-gang superhet coils, type W476 (Telsen).
- One 3-gang superhet Midget variable condenser, type 2124 B, and disc drive (J. B.).
- Two "Practical Wireless" I.F. transformers (110 kc/s) (Varley).
- One .002 mfd. Formodenser (Formo).
- One 50,000 ohm potentiometer (Graham Farish).
- One 1 mfd. fixed condenser (Graham Farish).
- Two .5 mfd. fixed condensers (Graham Farish).
- One .01 mfd. tubular condenser (Graham Farish).
- Two .0001 mfd. fixed condensers, type 34 (T.C.C.).
- Three ohmite resistances, 150,000, 100,000, 30,000 (Graham Farish).
- One Max. L.F. transformer (Graham Farish).
- One potentiometer bracket (Peto-Scott).
- One 3-point on-off switch (Graham Farish).

RHET THREE FROM A.C. AND D.C. URTHER NOTES ON OPERATION

Another mains unit which proved highly successful in operating the £5 Superhet Three.

high tension shall be supplied from the mains, we shall describe next week a small mains unit which may be built at low cost especially for the operation of the receiver. It is hum-free, stable, and simple to construct, and takes the place of the high-tension battery only.

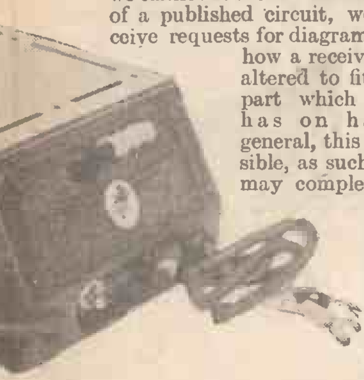
Our Demonstrations

Certain querists have raised the point of distance, and are anxious to know whether we are prepared to demonstrate the receiver in remote parts of the country.

We would emphasize that we shall make every endeavour to demonstrate the receiver in such parts of the country that every reader will have an opportunity of hearing it. A reader from Glasgow, for instance, wished to know whether Scotland would participate in the demonstrations, and should sufficient requests be received from that part of the British Isles you may rest assured that we shall bring the receiver there for you to hear.

Altering the Receiver

In spite of repeated protests by us that we cannot authorize the modification of a published circuit, we still receive requests for diagrams showing how a receiver may be altered to fit in some part which a reader has on hand. In general, this is impossible, as such a change may completely spoil the performance of a receiver, or prevent it from functioning. An exception is in the employment of a speaker to which a Class B output stage is fitted. One such request was received from a reader in Birmingham. Obviously, with a unit of this description no alteration is required to the receiver, other than the use of a standard triode in place of the present output pentode. The adaptor, if one is fitted to the Class B speaker, is then plugged into the last valveholder, with the triode inserted into the adaptor, and the extra stage is automatically added, and the receiver should perform in a normal manner. The grid bias will, of course, have to be modified to suit the triode, which becomes the driver stage.



...st purposes and which gave splendid ...ults.

H.T. Consumption

A number of requests have also been received regarding the H.T. consumption. In the original model, when operated from a 120-volt H.T. battery, the total current consumption is 11 mA. The maximum undistorted output of the pentode valve, when fully loaded and with correct voltage applied, is 1,000 milliwatts. These figures are both subject to modification, and the current consumption, for instance, may be considerably modified by altering the value of the applied bias. If reference is made to the first issue regarding this receiver, it will be seen that the applied bias is given as 9 volts. It was further stated that by increasing the bias to 12 volts the anode current could be further reduced, but, naturally, the input will have to be modified. When only 9 volts bias is applied the total anode current rises to 17 or 18 milliamps. Consequently, when it is desired to obtain the maximum of which the pentode is capable, and where the applied signal is sufficient to load the valve, the makers' figures should be adhered to, when the undistorted output will be in the neighbourhood of 750 to 1,000 milliwatts.

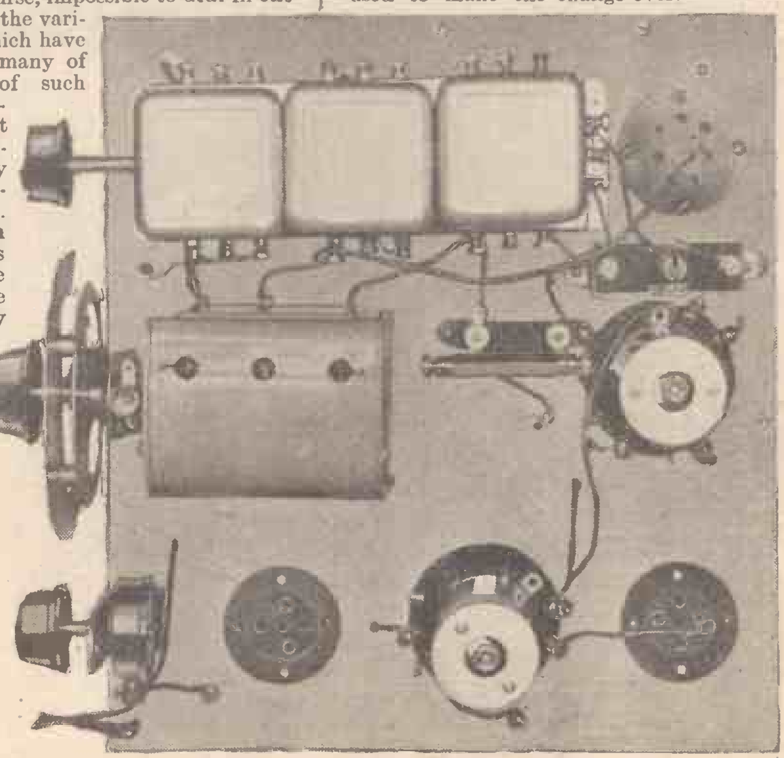
Other Requests

It is, of course, impossible to deal in one issue with all the various points which have been raised, many of which are of such slight importance that they are applicable only to the individual querist. The main points, that is to say, those which have been raised by a number of readers, are dealt with above, and it will be seen that we are making every endeavour to cope with the needs of every reader. To do this, of course, a very extensive programme has had to be prepared, and Mr. Camm is sparing no effort to ensure that no reader will be dissatisfied, either with the arrangements made especially for him, or with the receiver in the form in which he builds it.

The L.S. terminal strip is fitted with pick-up sockets, and several requests have been received concerning the use of this receiver for gramophone record reproduction. Unfortunately, it is not a simple matter to couple the pick-up to the Westector, or that part of the circuit, and therefore it is necessary to arrange to include this in the grid circuit of the pentode valve. The pick-up is, of course, joined between the grid and the grid-bias plug, which means that the wiring may be left in place permanently, or a simple single-pole change-over switch may be used to make the change-over.

...HE £5 SUPERHET THREE

One 7-pin sub-baseboard valveholder, terminal type (Clix).
One 5-pin sub-baseboard valveholder, terminal type (Clix).
One 4-pin sub-baseboard valveholder, terminal type (Clix).
One Westector, type W6 (Westinghouse).
Three wander plugs (H.T.+1, H.T.+2, H.T.—) (Belling Lee).
Two spade terminals (L.T.+, L.T.—) (Belling Lee).
Three G.B. plugs (G.B. +, G.B.—1, G.B.—2) (Belling Lee).
Two terminals strips (A.-E. and L.-S.) (Clix).
One Metaplex chassis, 11in. by 10in. with 2½in. runners (Peto-Scott).
Three valves, 210PG, 210VPT, 220PT (Cossor).
One Stentorian Standard P.M. loud-speaker (W.B.).
One 120-volt H.T. battery (Drydex).
One G.B. 16½-volt battery (Drydex).
One L.T. 2-volt accumulator (Exide).
Kits or separate parts are supplied by Peto-Scott, Ltd.



This plan view shows the neat and simple appearance of the upper side of the chassis.

One of Many Testimonials which have been Received by Us:

Clapham, S.W.4.
28th October, 1934

Dear Mr. Camm —

You will recollect my calling to see you to hear a demonstration of your £5 Superhet Three, a favour for which I would express my very sincere thanks. I was pleasantly astonished at its remarkable performance.

You will, I am sure, be very pleased and gratified to hear that I have built the set, and that I am extremely pleased with it. At the moment of writing it is playing in this room, and it is, to my mind, the ideal set of all superhet designs for the battery user (I have no mains).

I have built one superhet set before, viz., a four-valve superhet designed by a well-known firm, but I *never* got it to work properly: therefore you will appreciate that, after constructing and wiring up, and switching on, I naturally expected, at least, considerable trouble before I got it to go. As a matter of fact, when I switched on, I turned the dial from end to end, and not one station came in. I quite imagined I had failed, in spite of careful checking of the wiring. I discovered I was on long waves, and then immediately tried medium waves. Here again careful searching did not seem to bring in anything until at last the London Regional came through full and clear, without any trimming of any kind. I found the trouble was simply due to the hair-breadth tuning—a most valuable feature—and, after getting used to it, and ganging up—which, by the way, only took about 5 minutes—station after station came through at good round volume and quality, and entirely free from interference. What a difference from my old "professional" superhet! With this one always had whistles and interference.

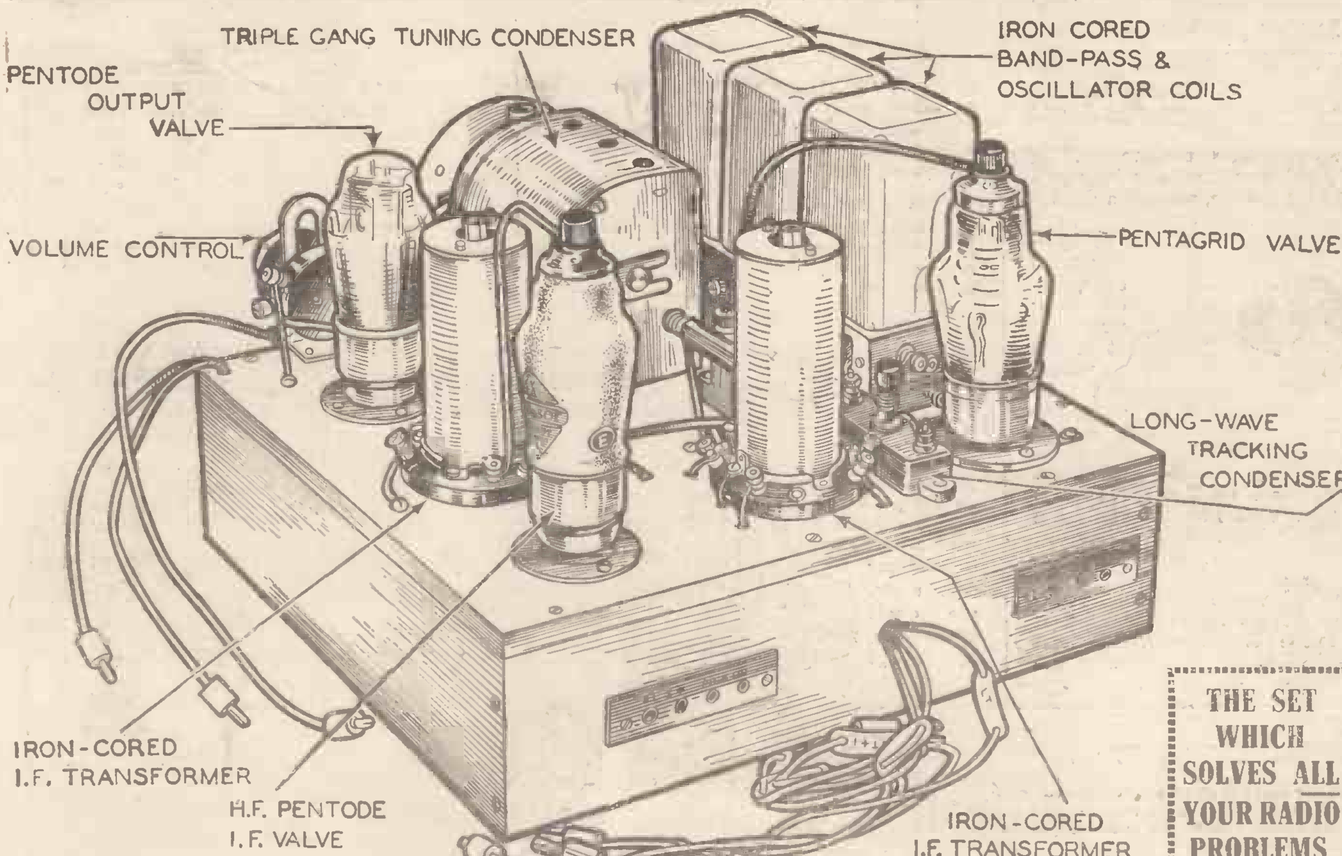
I tried long waves again, and then I remembered the .002 variable pre-set tracking condenser. Setting the condenser to about 1,500 metres, and just rotating the knob of the pre-set, in came Droitwich at full volume.

I may say I have fitted a full-vision scale (with vertical drive) to this set, and this, calibrated in wavelengths, is remarkably exact.

I must offer you my sincere congratulations on the success of your magnificent set. Your patient two years' research is thus amply rewarded, it being just the very set I have been looking for, and yours is the first set I have seen so ingeniously designed, and I have no doubt it will be built in thousands, as it deserves to be. In any case, I will strongly recommend it.

I have, I may say, never read "Practical Wireless" before the present number. I was introduced to it merely by the fact that I saw it hanging outside a shop, and the advertisement relating to the set was so conspicuously displayed on the cover, and seemed to be so precisely what I required, that I at once bought it, and, after quickly perusing the circuit details, at once set out to collect the parts. Henceforth I shall be a regular reader, having placed a standing order with my local newsagent, and shall follow your articles and developments of this set with very keen interest. Your paper is truly named "Practical."

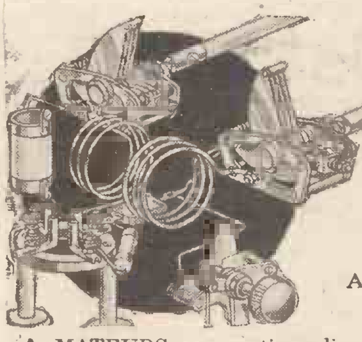
Yours very sincerely,
ALBERT E. HOLDAWAY.



THE SET WHICH SOLVES ALL YOUR RADIO PROBLEMS

GOOD NEWS FOR MAINS USERS

In order that every reader may take advantage of this remarkable circuit development, we shall produce it for A.C. and D.C. operation. In addition we shall produce a model employing Universal valves.



Short Wave Section

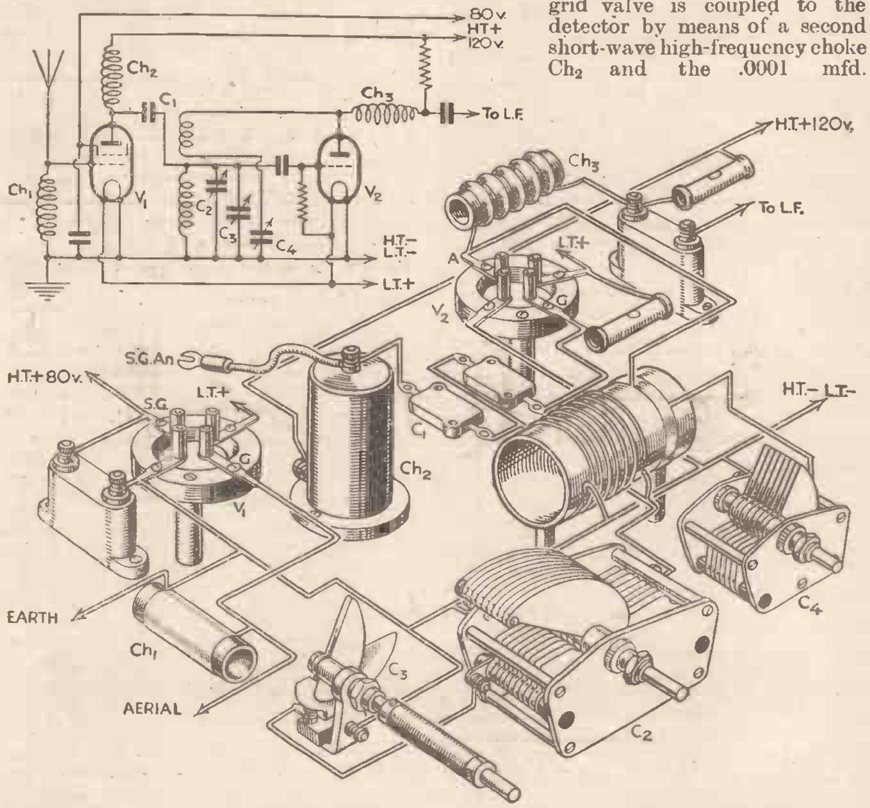
EASIER SHORT-WAVE WORK

An Article Explaining Two Methods for Simplifyin Tuning. By K. E. BRIAN JAY.

AMATEURS are sometimes discouraged from attempting short-wave work by stories of the extreme delicacy required in operating a short-wave receiver owing to the very sharp tuning. This is a pity because such ideas are rather exaggerations. At the same time it must be admitted that tuning is sharper than on the usual wavelengths, and therefore any device that simplifies it is well worth consideration. There are two arrangements that are to be recommended to the beginner for this purpose, which make operation considerably easier although at first sight they appear to be complications. They are the untuned H.F. stage and band-spread tuning. The circuit of a receiver embodying both devices is given in the accompanying illustration.

The Untuned Stage

This is simply a screen-grid high-frequency amplifier whose grid circuit, instead of being tuned by the usual coil and condenser, consists only of a short-wave high-frequency choke Ch_1, which acts as an aperiodic grid coil; that is it responds more or less equally to all wavelengths in the tuning range. A manufactured choke may be used, but a satisfactory one can be made at home by winding about sixty to eighty turns of 36 SWG DSC wire on a half-inch diameter ebonite or glass rod or tube. The screen-grid valve is coupled to the detector by means of a second short-wave high-frequency choke Ch_2 and the .0001 mfd. mica condenser C_1. If manufactured chokes are used for Ch_1 and Ch_2 they should be of different makes or have widely differing characteristics; if this precaution is not taken the amplifier will probably be unstable and oscillate uncontrollably. It is sometimes found that a universal type choke is best at Ch_2. The effect of this stage is to isolate the detector from the aerial circuit: this is an advantage because the aerial often gives rise to unstable operation of a reacting detector, by causing signals to swing when it is blown about in a high wind, and especially by producing "blind spots," that is, places in the tuning range at which the receiver refuses to oscillate owing to the loading effect of the aerial at its natural wavelength or its harmonics. The H.F. valve also produces a little increase in the overall amplification of the receiver, but this is so small as to be unimportant compared with the benefit of more stable detector operation, a benefit that is obtained without any complication of the tuning controls.



A typical two-valve short-wave circuit using an untuned H.F. stage and band-spread tuning.

Band-spread System

The band-spread arrangement consists merely of a small variable condenser C_3 connected across the main tuning condenser C_2 of the detector circuit. In the usual way, when C_2 is the only condenser it has a capacity of about .00015 mfd., and this is rather large for comfortable tuning on short waves; at the same time the use of a smaller condenser limits the range of wavelengths that can be covered, and makes it necessary to use several coils, which is somewhat inconvenient. The short-wave broadcasting stations are grouped in bands of wavelengths at various points throughout the spectrum, roughly at 49, 31, 25, 19 and 17 metres, in which bands they are fairly close together, and so with a large condenser at C_2 we may find that it covers three of these bands on one coil and that the stations in the bands only occupy a couple of degrees on the tuning dial. Now if we connect a smaller condenser C_3 of about .000035 mfd. or so in parallel with C_2 we can tune C_2 to the required waveband, and then tune in the individual stations using C_3 only, on whose dial they will be much more widely spaced than on C_2.

The Condenser

C_3 now becomes the main tuning control, and is called the band-spread condenser, while C_2 is the band-selecting or band-setting condenser. C_2 may be the ordinary condenser as specified for the coil concerned, and C_3 one of the special midget short-wave variable condensers that are made for the purpose. The method of operation is to set C_3 to the middle of its capacity, and adjust C_2 so as to bring in a station in the centre of the required band, for example, Zeesen DJA on 31.38 metres in the centre of the 31-metre band. Other stations within the band, Daventry GSB, Schenectady W2XAF, etc., are then tuned in with no more trouble than on the ordinary medium-wave broadcast band. Not the least advantage of the system is that the usual 12 : 1 ratio dial gives quite sufficient reduction for the purpose. The receiver is calibrated with the band-spread condenser at the middle of its range by noting the readings of the band-setting condenser C_2 for different wavelengths; slight mis-adjustment of C_3 may upset the calibration by a degree or two, but it will not be at all serious and in practice is not noticed. Of course if a wavemeter is available it may be used for the calibration.

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

HOW THE SUPERHET WORKS—2.

This week the intermediate frequency is dealt with and the proverbial superhet selectivity explained. Practical details of the "mixer" circuits are also discussed.

SO far you will notice the superhet does not differ in any way from the straight set, but from the grid of the first detector onwards the working is quite different. With a straight set the oscillations in the aerial coil are either boosted up by one or two stages of H.F. amplification before reaching the detector, or else—as in the simpler sets—they are fed directly to the detector valve. They are then rectified, that is, the speech frequencies are separated from the high frequencies, and, finally, the speech frequencies are passed through an L.F. amplifier stage or direct to the output stage and the loud-speaker. With the superhet the current in the aerial circuit is mixed with another alternating current before it is passed through the usual amplifying and rectifying processes. This second current is produced by the *oscillator valve* V_2, and by means of a tuning condenser it is made to alternate at a slightly different speed from the input current. The mixing of these two currents, each vibrating or alternating at different frequencies, results in their vibrating in unison at one moment, and the next moment vibrating against one another. It is like two people walking along together, the one taking slightly longer steps than the other. At one moment they may be walking in step, but gradually they get out of step until one is putting his right foot forward while the other is stepping out with the left. As they continue, however, the cycle is repeated and they find themselves once more in step. The periods during which their steps coincide occur at intervals of time equal to the difference in the number of steps they take per minute. In the same way the period when the vibration of the two currents coincide occurs at regular intervals dependent on the difference between their respective frequencies. Naturally, when the two frequencies are "in step" they produce an extra powerful alternation in the current, and when they are "out of step" they tend to neutralize one another, and so reduce the magnitude of the oscillations.

This regular rise and fall in the value of the current, due to the different speeds at which the two component currents vibrate, is called the *intermediate frequency*. The practical details of the production of the intermediate frequency, and how it is amplified, etc., will now be fully explained.

We have seen that up to the grid of the first valve the superhet is no different from a straight set. The waves received by the aerial set up electric currents in the aerial-tuning coil in the same way as in any other type of receiver. Incidentally, a favourite arrangement is to use a band-pass filter as shown in Fig. 6 (November 3rd issue), but although this has certain advantages it is not absolutely essential, and a single, sharply-tuned coil will do quite well. However, from the first valve onwards the principle of the superhet is, as already mentioned, quite distinct. Instead of detecting and amplifying the signal current in the ordinary way it is first of all mixed with another current (produced by the receiver itself) and so creates a third current or pulsation known as the *intermediate frequency*.

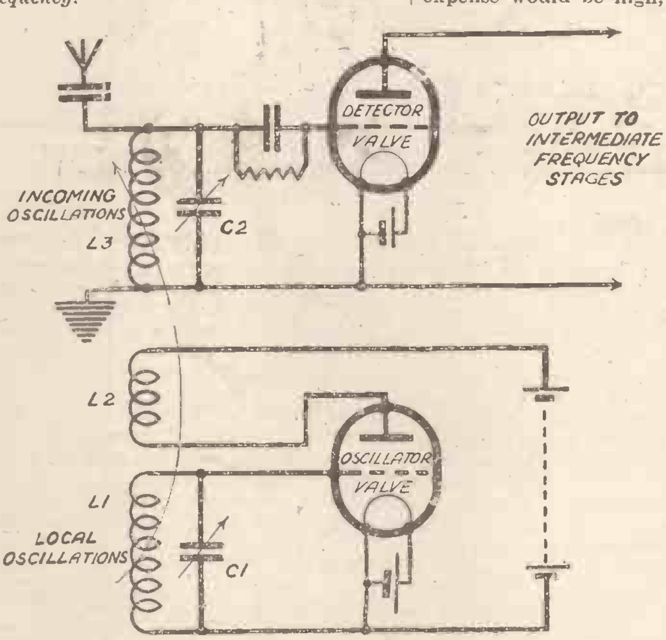


Fig. 7.—A simple frequency changer. A local alternating current is produced by the oscillator valve and "mixed" with the incoming oscillation by the coupling of the coils L1, L2, and L3, thus producing the intermediate frequency.

Many Tuned Circuits

To obtain selectivity a large number of tuned circuits is essential. With a straight set this means that every time we wish to select a station we have to tune each of these circuits; in other words, we have to adjust a number of variable condensers. This is not particularly difficult if there are only, say, two condensers. In this case by designing the coils exactly alike and matching the condensers very carefully, it is possible to operate them from one spindle, knowing that when one is correctly tuned to a station that the other will be also. Any slight difference which may occur between the two settings, due, for instance, to stray capacities in the wiring, can be adjusted by the usual small "trimmer" condensers. However, a receiver which employs only two tuned circuits is rarely selective enough to meet present-day conditions. One with three tuned circuits is better, and thanks to the precision of modern components it is quite possible to gang the three condensers and obtain accurate tuning of all three circuits. But if three tuned circuits are not sufficiently selective then the employment of still more coils and condensers becomes necessary. It is now that the situation becomes acute, for not only is the manufacture of a multi-gang condenser expensive, but correct matching becomes problematical. Naturally, the more tuned circuits there are the sharper is the tuning, and for that very reason the matching becomes increasingly critical. For instance, a slight error which would make practically no difference in a two-circuit tuner may be sufficient to lose a station completely in a very sharply-tuned multi-circuit tuner.

Of course, it does not mean to say that it is *impossible* to design a straight set with, say, five or six matched coils tuned by a ganged condenser, but the initial expense would be high, the ganged condenser would of necessity be rather cumbersome, and what is, perhaps, more important, it would be difficult to ensure that it would retain its original accuracy after continual use. If the superhet circuit had never been invented no doubt we should see the production of straight sets with more than the conventional two or three tuned circuits, but, as it is, the superhet takes their place. *With this receiver it is possible to have a large number of tuned circuits with only a three-gang condenser!*

The Reason for Superhet Selectivity

There are several reasons for the superior selectivity of the superhet, but the most obvious is undoubtedly the one just mentioned, namely, that with the superhet it is possible to have many tuned circuits the tuning of which is *fixed*! The typical superhet circuit, shown in Fig. 6, provides a good example. Here, only the aerial and oscillator coils need variable condensers to tune them, the setting of the intermediate coils being the same whatever the wavelength of the station being received. Let us see how this is brought about.

It is all to do with the *intermediate frequency*—the idea behind the superhet being to mix the high-frequency current due to the incoming signals with another high-frequency current generated by the receiver itself. The frequency of the second current is arranged to be slightly different from that due to the incoming waves, and, as already explained, the resulting mixed current will rise and fall accordingly as the two currents pulsate in step or out of step with one another. It is this rising and falling which is known as the intermediate frequency.

Now, it will be readily understood that the speed of the rising and falling depends on the difference between the frequencies of the two currents. Thus, if the two currents pulsate at a speed or frequency only slightly different from each other, then the pulsations will coincide only after comparatively long intervals, whereas if the frequencies of the two currents differ considerably the resulting rising and falling will occur at short intervals. In the superhet it is arranged that this rising and falling (the intermediate frequency) will always take place at the same speed. In other words, the intermediate frequency is always the same.

That is why the tuning coils and condensers in the intermediate-frequency part of the circuit have fixed tuning. Whatever the wavelength or frequency of the incoming signals happens to be they are converted into the one fixed intermediate frequency by the time they reach this part of the circuit, and, therefore, the coils only need tuning to this frequency. Once the signals have been converted into the intermediate frequency they can be passed through any number of fixed tuned circuits and amplified by as many valves as required, thus giving extreme selectivity and enormous amplification without adding to the number of controls. In practice, however, the use of more than two to six tuned circuits and one or two valves is rarely necessary.

The large number of tuned circuits gives a high degree of selectivity, but there are other advantages to be obtained from the conversion, for it is much easier to design efficient circuits when dealing with low frequencies than when dealing with high frequencies. The intermediate frequency of a superhet is usually the comparatively low one of 110 kilocycles, and at that frequency coils and other components are relatively more efficient. Stray capacities between wires, self capacity in the tuning coils, copper losses, eddy currents, and insulation leakages, etc., have a less serious effect than at high frequencies. There is a third important reason for the superior selectivity of the superhet. It is connected with the fact that the percentage separation between one station and another becomes greater at the intermediate frequency than at signal frequencies, but we must leave the discussion of this until later as it is rather difficult to understand at this stage.

How the Mixing is Carried Out

Now let us return to the practical side of the superhet circuit and see how the H.F. current, due to the incoming waves, is mixed with the locally generated current to provide the intermediate frequency. This is the most important part of the whole circuit. In the typical circuit under discussion the mixer is composed of two valves—one known as the *oscillator* (V2) and one as the *first detector* (V1). The oscillator valve and its attendant coils act like a one-valve set in which the reaction is turned " full on," thus causing the valve to oscillate continuously

This, however, does not mean that it is producing the howls and whistles which are popularly understood to constitute " oscillating." A valve which is oscillating does not produce howls unless the oscillations clash with, or " heterodyne," those from an outside source, such as a broadcasting station. This is clearly demonstrated when you turn the reaction knob of a lively receiver too far. Although it may be oscillating violently, howls and squeaks are only produced when you tune the set to the same, or nearly the same, wavelength as a broadcasting station. You then hear a chirp as you swing the tuning control past the station. Do not think that because the superhet contains a valve which is oscillating continuously that it is prone to produce more howls than a straight set—far from it! It simply means that the oscillator valve produces a high-frequency alternating current which flows backwards and forwards in its associated coils. This current is then fed to the first detector valve, and mixes with the H.F. currents due to the incoming waves. There are quite half a dozen different ways of mixing the two currents, but it is not necessary to give details of them all here.

The method shown in Fig. 7 is one of the easiest to understand. It is called a *grid injector* system, because the local oscillations are mixed with the incoming oscillations by injecting them into the grid circuit of the detector valve. It will be observed that the oscillator valve has a grid coil L1, which is tuned by means of the condenser C1, also a reaction coil L2, which is placed sufficiently close to L1 to start the valve oscillating. These two coils are then coupled to the aerial or grid coil L3 of the receiver. The fact that these three coils are all coupled together is indicated by the arrow passing through them. To operate the receiver the tuning condenser C2 is rotated until L3 C2 is tuned to the required station. This sets up an electric current in the aerial coil of the frequency of the incoming waves. The oscillator coil is then tuned by the condenser C1 to a frequency slightly different from the oscillations in L3. These oscillations mix with the incoming oscillations by reason of the coils all being coupled together, and thus produce the intermediate frequency.

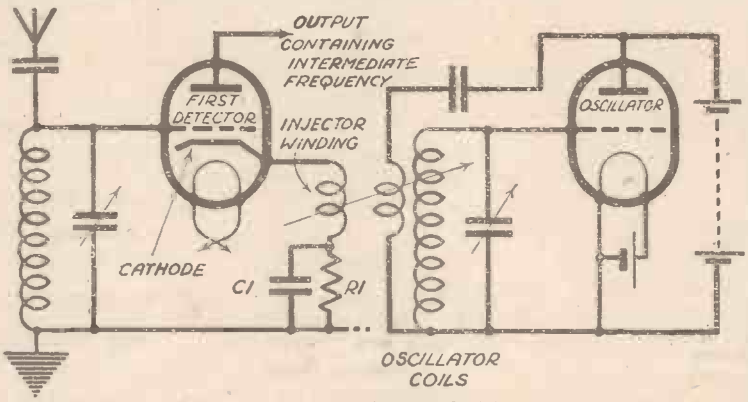


Fig. 8.—The " cathode injector " method of frequency changing.

Now suppose we choose an intermediate frequency of the usual 110 kilocycles (1,000 cycles per second), and that the frequency of the incoming oscillations is 1,000 kilocycles. We should then have to tune the oscillator to produce a current alternating at a frequency of either 1,110 kilocycles or 890 kilocycles. Either would do equally well, since the frequency of the intermediate current is equal to the difference between that of the input frequency and the oscillator frequency. Thus 1,101 kilocycles and 890 kilocycles would both give a difference of 110 kilocycles. This means that there are two positions of the oscillator tuning condenser which will enable the station to be heard. It is the usual practice, however, to tune the oscillator to the higher frequency, and by ganging the oscillator condenser with the tuning condenser C2 it can be made to track round, so that the oscillator circuit always tunes 110 kilocycles *above* the frequency of the aerial circuit. Thus, if the set were tuned to a station operating on 1,000 kilocycles, then the oscillator condenser would be automatically set to 1,110 kilocycles, while if the set were tuned to a station broadcasting on 1,500 kilocycles the oscillator would tune to 1,610 kilocycles; at 2,000 kilocycles the oscillator would tune to 2,110 kilocycles, and so on.

One Knob Tuning

Of course, it is not possible to use the ordinary type of ganged condenser—the type in which each section is identical—for this purpose, because the oscillator does not require to be tuned to the same frequency as the aerial coil. It must tune 110 kilocycles above it at all settings of the dial. A special superhet type ganged condenser must therefore be used. In this, the section tuning the oscillator has specially shaped vanes. The capacity of this section is smaller than the aerial tuning section, so that it tunes the oscillator coil 110 kilocycles above the frequency of the aerial coil at any setting. Of course, the lower the setting of a tuning condenser the higher the frequency to which the circuit tunes, hence the reason why the oscillator section has a smaller capacity than the aerial section.

NOTES ON SECONDARY EMISSION

How Distortion is Avoided

A SECONDARY emission effect is a purely static phenomenon, so that it takes place under D.C. conditions. In a screen-grid valve the screen does actually screen the plate to a large extent so that the plate voltage does not very greatly affect the emission. For a fixed-grid voltage E_g and screen voltage E_{sg} we can say that the cathode emission is I_c. Assuming the grid to be negative, there is no grid current, therefore $I_c = I_a\ I_{sg}$.

Curves of a typical value are shown in Fig. 1. S.G. voltage 90, control grid at —1.5 volts. If the S.G. and anode currents are added they are almost constant. When

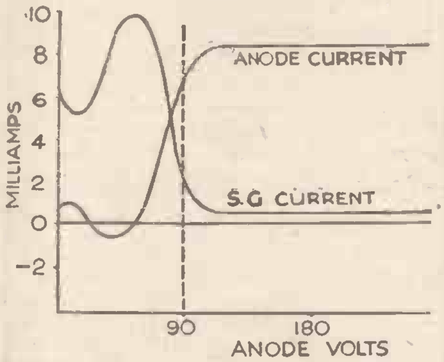


Fig. 1.—Typical curves for an S.G. valve

the anode voltage is below that of the screen grid a large amount of secondary emission takes place, and the anode current becomes negative! This strange effect, negative resistance, is because under some conditions an increase of anode voltage causes a greater anode current, but the electrons hitting the anode have gained much energy, and each may knock two or three out of the anode, these going to the screen grid.

Although the anode voltage may be but 20, the electrons may have a velocity equivalent to 50 to 60 volts if the screen is at 90. The effect is due to the mechanical inertia of the electrons, which is again a result of their finite mass, which although very small cannot be entirely neglected. If their mass were negligible they would follow the lines of force accurately and secondary emission would not occur.

In a pentode a grid is placed between the anode and the screen grid. This is tied, usually inside the valve, to the cathode. If now the electrons are knocked from the anode and the screen grid is more positive than the anode, there is no anode-to-screen-grid current, for there is no accelerating field, the suppressor grid causing a stopping field. Thus the electrons cannot escape from the anode. If the anode of a pentode becomes disconnected there may be a potential, negative, of course, of hundreds or even thousands of volts on it. This causes many breakdowns from a pentode while it is working. A break at X in the diagram might cause much damage to the valve and other components.

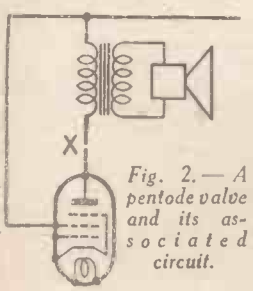


Fig. 2.—A pentode valve and its associated circuit.

SUPPLEMENT TO "PRACTICAL WIRELESS"

AMATEUR TELEVISION

A DUAL PURPOSE SCANNING DISC

(concluded from November 3rd issue)

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

FOR most practical purposes the hole size can be taken as .028in. and this gives a total picture width of .84in. The single turn spiral of 30 holes will have positions marked as in Fig. 4, but punching operations should not start until the second spiral of 30 holes has been marked off.

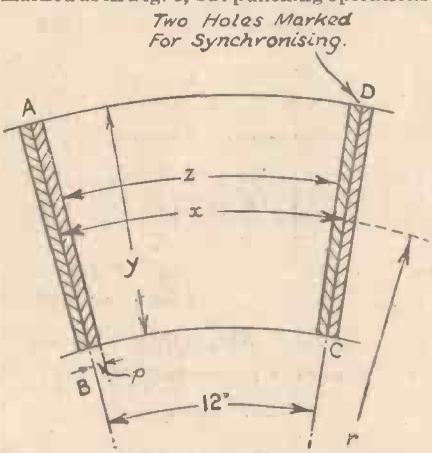


Fig. 6.—Details for marking out a disc to receive the German transmission.

Suiting Continental Transmissions

For the German transmissions of 30-line pictures the scanning is horizontal, starting at the top left-hand corner and finishing in the bottom right-hand corner. Disc rotation is clockwise, and the spiral linking the holes is therefore in an anti-clockwise direction towards the centre as indicated in Fig. 5. In order to furnish the required synchronising signal and include it in the picture transmission, one hole is marked off at each end of the slightly wedge-shaped picture area. The whole scheme of things is made clear by a reference to Fig. 6.

The length of the picture is taken as the circumferential distance measured on the circle of *mean* radius r, that is midway between the arcs AD and BC. But since the picture ratio is given as four horizontal to three vertical we have the first expression $\frac{4}{3}=\frac{z}{y}$ where z is the width and y the height. In order to allow for the hole masked off at each end the true circumferential width is the distance z plus two hole sizes. Questions of disc size settle the length of the mean radius r, and so the hole size is calculated quite readily.

Marking the Second Spiral

Now in the 20in. disc we are dealing with the inside edge of the last hole is 8.66in. from the disc centre, so a satisfactory length for the mean radius is 7¼in. Hole size then becomes $\frac{2\pi \times 7.5}{1260}$, which is .0374in. Taking the figure to the nearest thousandth as before—*i.e.*, .037in., this gives an actual picture height of 1.11in., and an actual picture width (allowing for masking) of 1.48in. It is worth noting that although the actual mean disc radius for the German picture is much less than that for the B.B.C. standard, the hole size is over 30 per cent. greater, and the resultant picture therefore appears much brighter.

The same radial lines of 12 degrees angular separation can be used for marking off the hole positions, and so as to adequately clear the first spiral markings it is suggested that the first hole be started diametrically opposite the first marked hole position, and the distance of the outside edge of the first hole from the disc centre is 7.5+(15×.037), that is 8.055in. The second hole is stepped in a distance of .037in. towards the centre, working round the spiral in an anti-clockwise direction. The third hole is a further .037in. inwards, and so on round for the 30 holes. The two sets of hole markings will be as shown in Fig. 7, and the next step is actually punching the holes.

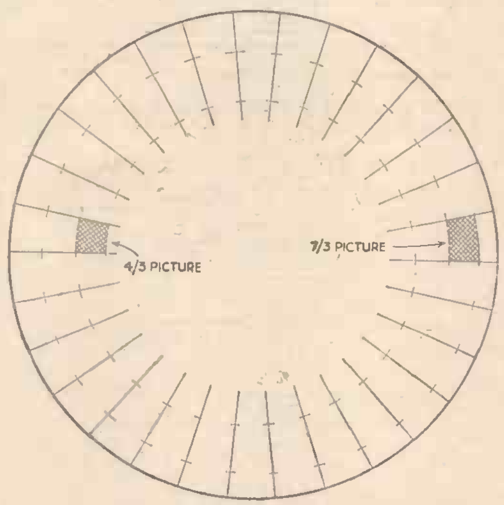


Fig. 7.—The disc marked out with an outer clockwise spiral of holes and an inner with a clockwise spiral of holes.

Making the Holes

Two square section punches of .028in. and .037in. size must be obtained. These can be made up by the reader if extreme care is taken, using silver-steel rod, and adequately tempering a 1in. length, which can be accommodated in a brass holder as shown in Fig. 8. Using the smaller punch for the outside spiral, place the punch so that the outside edge coincides with the mark on the radius and a second edge lies along this radius. Place a hard wood block underneath, and with a single hammer-blow drive the punch through the thin aluminium disc.

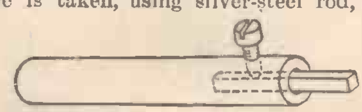


Fig. 8.—Fixing the small square punch in a brass holder.

When the first spiral of 30 holes is done, repeat the process for the inner spiral, using the larger punch but locating it for each hole position as in the previous case.

The disc can be used solid, but it is better to lighten it by cutting away sectors so that there are eight spokes and a rim as shown in Fig. 9. These spokes can then be used for stroboscopic speed observation as has been shown in previous articles. The rim of the disc which faces the observer must then be sprayed with a dead-black paint, taking great care not to fill up the punched holes. Finally, add a brass or aluminium boss.

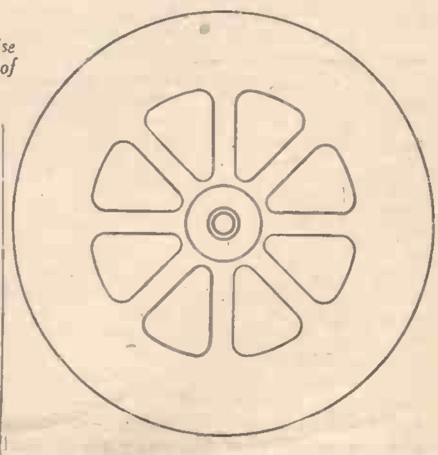


Fig. 9.—Lightening the disc by cutting away sectors to give eight spokes.

Using the Disc

For driving the disc a universal motor should be used, and as the direction of rotation has to be altered for observing the horizontally scanned images, it is necessary to bring the brush connections out to a double-pole double-throw switch, as indicated in Fig. 10. In the same diagram the switching arrangements are shown for feeding the television signals to one neon lamp or the other. The lamp on the right will show the B.B.C. images, while the lamp at the top gives the Continental images.

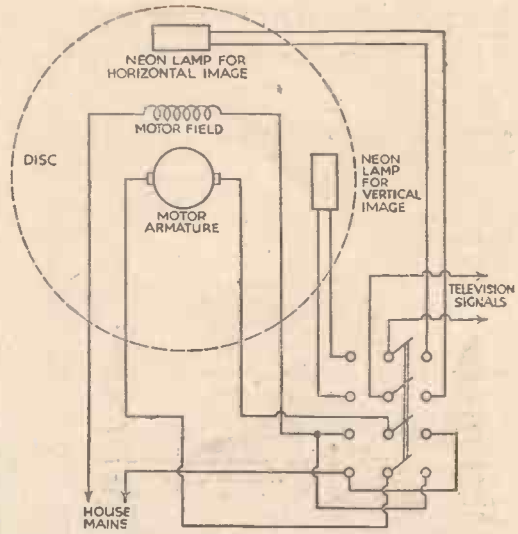


Fig. 10.—The simple switching arrangement for changing motor direction and neon lamp connections.

UNUSUAL LOUD-SPEAKER ARRANGEMENTS (*Continued from page 287*)

or heater, terminals on one of the valve-holders.

A method of mounting a loud-speaker unit which is seldom employed, despite the excellent results which it often gives, is shown diagrammatically in Fig. 4. It will be seen that the unit is in the top of a grandfather clock or other tall piece of furniture, and faces upwards. Where the wireless cabinet is very high the speaker can be mounted in the top of that; otherwise it will be better to fit the unit into a box or rough framework that can be stood on top of any convenient piece of furniture. The framework referred to may take the form of a rectangular piece of five-ply wood with a hole in its centre mounted on two 5in. bearers of ¾in. wood, the whole being covered with silk gauze or even muslin to keep out dust. A solid box is not suitable because it is liable to introduce too many resonances. Where it is permissible to cut the top of the cabinet itself it is, naturally, better to fit the speaker on the inside.

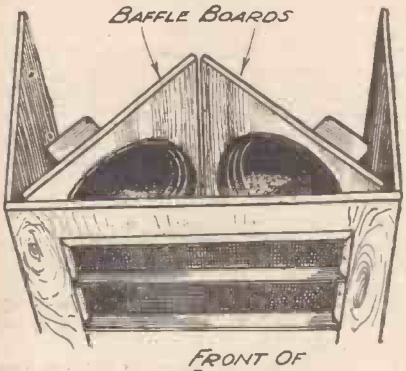


Fig. 5.—It is frequently worth while to arrange a pair of speakers on baffle boards set at an angle to each other, as shown here.

Several receiver manufacturers have devised a variety of methods of mounting their (double, in most cases) speakers with a view to getting better "balance" in reproduction, to "focusing" the sound, and to diffuse it. An arrangement which has not, so far as I am aware, been used in any commercial set is one I experimented with several years ago, and which is illustrated in Fig. 5. Here, two speaker units are mounted in the conventional manner on inclined baffles situated at an angle to each other. If one speaker gives emphasis to the higher frequencies, and the other to the lower, it is found that excellent "balance" can be secured. It might appear that an undue "focusing" effect would be obtained, so that volume would be much greater at one spot than at all others, but this need not be the case. A certain amount of initial experiment is at first necessary to find the optimum angle for the baffle boards, and this varies according to the speakers chosen.

Although it appears to be quite wrong in theory, I have often found that extremely good reproduction could be secured by mounting the speaker in the *back* of the receiver cabinet, more particularly when it was of the console type. To obtain best results with this arrangement it is generally necessary that the set should be placed in a corner, so that the walls act as fairly effective sound reflectors.

By JACE

The New B.B.C. Studio at Maida Vale

OWING to the prospect of having to relinquish No. 10 Studio, due to the rebuilding of Waterloo Bridge, the B.B.C. found it necessary to find another large studio to replace it, and in February of last year the old Skating Rink in Delaware Road, Maida Vale, was acquired. This has now been transformed into a studio, and is the largest which the Corporation now possesses. It occupies a site rather more than twice the size of the site of Broadcasting House.

The building is mainly of one storey, but at one end there are two storeys, and this part has been used for offices, waiting-rooms, etc. The large studio has been built within the original building. It is 110ft. long, 72ft. wide, and 32ft. high to the centre of the curved ceiling. In addition, though the studio will not be licensed for public performances, there is a balcony with seats for an audience of 112 people. The studio is designed to accommodate an orchestra of 120 players and a chorus of up to 200 singers.

NEW B.B.C. STUDIO

The Maida Vale Skating Rink, which the B.B.C. have now converted into a modern studio.

The internal acoustic treatment and decoration of the studio has been carried out in building board and plaster, while large concrete baffles have been fitted over the air ducts through which the used air is extracted from the studio. Running parallel with the studio on the Delaware Road side of the building is a range of rooms built and equipped for sound recording. Beneath these are band-instrument rooms, stores, etc.

Electrical power is supplied by the Metropolitan Electric Supply Company's mains. A sub-station has been installed in the building. The input to this is taken from the company's high-tension feeder at a pressure of 6,600 volts. This is transformed to provide two supplies to the building, one being 400 volts 3-phase 50 c.p.s., and the other 230 volts single-phase 50 c.p.s.

There is a separate battery room adjacent to the control room, which supplies current for the control room amplifiers, switching relays, etc. These batteries are charged by a set of motor generators in an adjoining room. There are four separate supplies:—

Cathode heating, 6 volts 800/1,200 ampere hours.

Anode supply, 250 volts 20/30 ampere hours.

Microphone polarizing, 21 volts 100/300 ampere hours.

Relay operation, etc., 24 volts 200/300 ampere hours.

Both the batteries and motor-generator sets are duplicated as at Broadcasting House.

The studio is equipped with ten microphone points, which are connected to five separate circuits, there being two points in parallel on each circuit. This allows flexibility in the placing of microphones about the studio, while provision is made for any type of microphone to be used. The microphone circuits terminate on a 6-way fade unit in the adjoining listening-room, which is also equipped with a gramophone desk for the reproduction of effects and a loud-speaker for checking purposes.

The control room equipment consists of four control positions and one switching position and, in addition, two rows of racks which carry the amplifiers, switching relays, line termination equipment, and power-discharge switching. An additional control position is provided in an acoustically-treated room fitted with a loud-speaker so that programmes can be controlled by a member of the balance and control section.

Apart from certain modifications, the detail design of the apparatus installed at Maida Vale is similar to that in Broadcasting House. The illustration on this page shows the new studio as it appears from the outside.

RADIO CLUBS AND SOCIETIES

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.

SLADE RADIO

THE thirteenth of the society's "Junk Sales" took place at a meeting held recently. A very large quantity of surplus apparatus was brought in, but the disposal was satisfactorily carried out, and, as usual, some of the lots provided considerable amusement. Details of the society and advance programme will be forwarded on application. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

There was a lecture on "Commercial Photo-electric cell applications," by Mr. W. G. Stockton, of the General Electric Co., Ltd., at the last meeting of this society. After describing the theory very briefly he went on to give details of a large number of the applications. These included timing (horse-racing), counting papers, etc., paper control at printing works, counting tyres, smoke detection, counting steel tubes, automatic lighting traffic lights in Birmingham, control of town lighting, tea mixing, control of steam, rail, car, and electric signs, burglar alarms, escalator control, and various uses on underground railways. A series of excellent slides were exhibited during the lecture.

THE CROYDON RADIO SOCIETY

THE Croydon Radio Society's gramophone pick-up night took place on Tuesday, October 23rd, at St. Peter's Hall, Ledbury Road, South Croydon. The technical adviser used the amplifying stages of his famous quality receiver, and by switching, any two pick-ups could be compared at a time. Among the many instruments brought by members was Dr. Meredyth-Jones's B.T.H. Minor, which was noted as having a better top response than another member's B.T.H. There was a good performance given by a Harlie, belonging to Mr. Quaddy, a new member. A resonance lurking in its top frequencies proved its undoing. However, it was not until Mr. Menage produced his Piezo electric pick-up that outstanding reproduction was heard. In fact, in most ways it was voted as being better than the others in most respects. Its bass was magnificent, and response was remarkably even over all frequencies up to a very reasonably high figure. Its weight on the record was only 1½ozs., and its output was unusually large. Frequency test records were tried, as well as the Society's own musical test records, and reproduction was very even and pure.—Hon. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

THE thirteenth meeting of the above chapter was held at the British Legion, Long Street, Middleton, near Manchester, on October 16th, at 8 p.m. The meeting was preceded at 7.30 by morse instructions. Arrangements for a programme of lectures and demonstrations for the coming season were discussed, and it was decided that the annual meeting of the chapter be held on December 4th. All members are asked to attend. The usual business of the meeting was followed by a demonstration by Mr. R. Lawton of his short-wave receiver with which he has heard over 320 broadcast and commercial short-wave stations and hundreds of amateurs throughout the world. He displayed a great number of verifications, which included that of the reception of the station KFZ (Admiral Byrd's Expedition at the South Pole) and KNRA, the schooner *Seth Parker*, which is on a world cruise. The next meeting will be held on November 20th, commencing at 8 p.m. Morse instruction will be given at 7.30 p.m. at all future meetings.—R. Lawton, Secretary, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

A VERY interesting demonstration of a National A.C. Short-wave 5 was given at the meeting of the London Chapter on Friday, October 26th. The receiver comprised screen-grid variable-mu H.F. stage, screen-grid detector, followed by one L.F. stage, and final output stage in push-pull. The power side of the receiver was a separate unit. Many of the regular short-wave stations were heard at full strength on the loud-speaker. Everything is done at our meetings to help short-wave listeners, and everyone interested is invited to attend. Morse instruction is given from 7.30 to 8.15 p.m.; 8.20 p.m., refreshments; 8.30 p.m., weekly short-wave review, followed by lecture and demonstration. Short-wave reception is demonstrated at every meeting. The chapter meets at the R.A.C.S. Hall, Cavendish Grove, Wandsworth Road, S.W.8, and is near Vauxhall Station.—A. E. Bear, secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

INDEX & BINDING CASES
FOR VOLUME 4 ARE NOW READY.
Indexes 4d. each post free; Binding Cases (including index) 2/9 post free.

Ferranti Loud-speaker Cabinet

MANY constructors already possess an extra loud-speaker for use as an additional listening point, but find that the construction of a suitable cabinet is not such an easy matter. Not only does the design require to be fairly correct, but the finish will have to warrant the inclusion of the speaker in any room, and it is not a simple matter to obtain that high-class finish generally seen on a factory-produced article. Messrs. Ferranti have introduced the cabinet shown below, and it is obtainable in walnut and Macassar ebony, with a square black bakelite grille. Its dimensions are 11¼in. high by 15¾in. wide by 7½in. deep, and it costs 32s. 6d. No doubt many constructors could accommodate a small receiver in such a cabinet in addition to the speaker, and it will prove a very useful addition. The popular Ferranti speaker, type M5, can be supplied for fitting into this cabinet at 30s.

A speaker cabinet which will be found very useful. A Ferranti product.

Graham Farish Accessories

AN item to merit attention is the "Gard" lightning arrestor, priced at 2s., which price includes a £200 insurance against damage caused by lightning. The new model is slightly different in design from the previous one, for it has been improved. The arrestor is automatic in its action and need only be connected between the aerial and earth leads to ensure immunity from lightning; actually, it consists of a small spark gap of extremely low capacity built into the bakelite container. The new model is provided with a hood so that it can be fixed outside the house without the contacts being short-circuited by rain water.

Another useful item is the "Slot" selectivity device, which is a special form of variable condenser for connection in series with the aerial lead-in. It can be attached either to the set or at any other convenient point between the lead-in and the aerial terminal, and the sharpness of tuning can readily be varied by movement of a small projecting lever. The "Slot" is priced at 2s.

New Heayberd Lines

MESSRS. HEAYBERD inform us that they have recently introduced some interesting new chargers and a special safety hand lamp. The latter consists of the normal protected lamp with carrying handle and suspending hook, but it is fed from a double-wound transformer contained in a neat metal box designed to hang on the wall near to a lighting or power point. The voltage from the mains is thereby reduced to 12 volts, and thus there is little risk of receiving a dangerous shock should a short-circuit develop. It is especially recommended for use in damp places or where machinery is in action. The price is 39s. complete.

The chargers comprise type A and type B. The former includes an impregnated mains transformer, metal rectifier, and ballast resistance. The panel is fitted with mains input plug and socket, and intermediate tappings with shrouded terminals are fitted. The metal case is of perforated sheet metal for adequate cooling, and provided with rubber feet. Type B includes a polarised ammeter and a variable slide resistance in addition to the parts included in type A. The prices range from £4 10s. to £7 19s. 6d. Two portable models are available at £5 17s. 6d and £6 15s., the former delivering an output of 12 volts at 5 amps, and the latter 60 volts at 2 amps.

Ferranti Condenser Colour Code

THE fixed condensers supplied by Messrs. Ferranti are colour-coded, in the same manner as resistances, and for the benefit of dealers, service men, etc., we give below the code which Messrs. Ferranti have adopted.

COLOUR	CAPACITY μF
BROWN	·002 1500V TEST
BLUE	·004
GREEN	·01
YELLOW	·02
WHITE	·03
RED (1 BAND)	·05
RED (2 BANDS)	·05 1000V TEST
BLACK	·06

The condenser colour code which is used by Messrs. Ferranti.

PRACTICAL LETTERS FROM READERS

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).

Strong Points of View

SIR,—I noticed in your issue for October 13th a letter from a reader asking for a short-wave receiver. As I have had the same urge I can sympathize with him. If Americans can produce all-wave receivers, import them, pay duty, and undersell the cheapest broadcast receiver sold in this country, there must be something radically wrong with British brains and/or British manufacturers.

I became a free trader through spending some years abroad, and I now buy American receivers, altering them to suit my idea of quality, or constructing from American circuits.

I have no sympathy with battery users unless they live miles from a good system or supply, and still less for those with mains in their homes and 2-volt accumulators in their receivers. It is about time the battery short-wave fetish was debunked for short-wave broadcast use.—A. HILDRED (Clapham).

The All-Pentode Three

SIR,—*Congratulations* on this splendid set, and now may we have an *all mains* pentode three, please ?—A. G. BROMMAGE (Hampstead).

[*What do other readers think of the idea of a Mains Pentode 3 ?*—ED.]

"An Economy Set"

SIR,—Many thanks for my prize won in your recent Favourite Circuits Competition. There is no need for me to say anything about the W.B. speaker, because *you* know how excellent they are. May I take this opportunity of again suggesting that you describe a set designed to use components which are advertised in the small advertisements in PRACTICAL WIRELESS. You could call it an economy set, and the advertised goods are *guaranteed* by the sellers.—R. E. SKETCHLEY (Northampton).

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

Ultra Short-wave Work

SIR,—As an interested reader of PRACTICAL WIRELESS I should like to make a few remarks on 56 megacycle work. A contributor in the October 24th issue seems to imply that the band is full of signals and one has only to build a 5-metre receiver to hear plenty of stations, both local and DX. As you know, this is hardly the case, and the realization of this point is apt to damp the enthusiasm of your readers who may have had their appetite whetted sufficiently to build a 56 m/c receiving set. I absolutely agree that experimental work in connection with 56 m/c transmission is intensely interesting, and I myself have had great pleasure in working on this band, but the point I wish to stress is that the short-wave listener must not expect to get results on a 5-metre receiver such as he may be accustomed to get on the lower frequency bands, but, on the other hand, any time and labour he expends will probably produce results of real scientific value. The knowledge of wave propagation of wavelengths over 10 metres, however, has been studied by research workers for many years, and is now at a point where it is possible to predict with a good deal of certainty how a signal of any wavelength will be received at any given part of the world, at any given time of day, and at any given season of the year, but the question of wave propagation of 5-metre signals has been left largely to the amateur. As I see it, the question to be solved is: "to what extent do 5-metre signals obey the law of light propagation ?" Many text-books refer to these waves as "quasi-optical," but this definition has had to be so modified during the last year or so as to make it meaningless. I do not know what is the greatest distance a 5-metre signal has been received at, but distances up to 200 miles or so have been reported during tests both in this country and in America, so there is ample proof that the waves that were once believed to travel in straight lines do definitely bend to some extent with the earth's surface.

If any of your readers get down to real experimental work on 5 metres I am sure they will get as much pleasure from it as they do when working on the lower frequency bands.

In conclusion, I should like to say that I shall be very pleased to co-operate with anyone within reasonable distance from my station, by providing test transmissions. The power used at present is only about 2 watts, but this will be increased shortly to 10 watts, so a comparatively large area should be covered.—H. MILES (Radio G2NK), Bromley, Kent.

CUT THIS OUT EACH WEEK

Do you know

—THAT the total capacity of condensers in series is equal to the reciprocal of the sum of the reciprocals.
—THAT the total resistance of resistances in series is equal to the sum of the resistances.
—THAT for use with most microphones a transformer with a ratio of about 100 to 1 is necessary.
—THAT iron should not be used for screening H.F. circuits.
—THAT an H.F. choke can with advantage be included in the usual gramophone pick-up leads to prevent instability.
—THAT enclosing the glass bulb of a valve in cotton wool or similar material prevents microphonic noises.
—THAT tilting the loudspeaker often enables better reproduction to be obtained.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

FACING THE VALVE REPLACEMENT PROBLEM (Continued from page 282)

discussing, valve renewal time will serve as a good opportunity to change over to Class "B" output or to quiescent push-pull, in the latter case using one of the new double pentodes specially designed for this purpose. Considerably enhanced output, while keeping the high-tension consumption within very modest bounds, will be the result of this modification.

In the case of a mains receiver little alteration will be possible in the low-frequency portion of the set, the choice lying between triode or pentode output using valve types which have not substantially changed for some time.

The question of re-valving a superheterodyne receiver needs special care. The detailed design of the frequency changer portion of such a receiver is intimately bound up with the characteristics of the valves employed, and no departure from the original arrangement is usually possible, at any rate in the case of a commercially-manufactured set. A home-built superhet, however, is perhaps a rather different proposition, and one built over a year ago might with advantage be modernized to use one of the latest types of frequency changer. These, of course, fall into two main classes—the triode-pentode comprising triode oscillator and pentode mixer with exterior coupling, and the other class, represented by the heptode and the octode, in which the coupling between oscillator and mixer is electronic. Recent articles in PRACTICAL WIRELESS have given full details of these valves, and of the circuit arrangements required for their practical application.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on Cover iii must be attached to every query.

If a postal reply is desired, a stamped addressed 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.

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. We regret that we cannot, for obvious reasons—

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

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

Advantages of the Superhet

I have a 2 H.F. det.-pen. receiver working from a mains eliminator with accumulators for L.T. I have three separate tuning condensers as the coils are not matched. Will you please tell me the advantages of the superhet? I am quite pleased with my receiver, but I feel that I should like one a little more powerful. How will volume compare with my present set? Also, would it be possible to tune with three different tuning condensers? I do not mind how difficult tuning is."—R. H. (Aylesbury).

A superhet would be more powerful than your present set if it was properly designed, but you cannot get louder signals than your present output valve gives when fully loaded, and, therefore, the locals would still be the same volume. It is to be presumed, however, that the superhet would have a greater range. The various features of this circuit will be explained in the series commenced in last week's issue under the Beginner's Supplement. Separate condensers could certainly be used, and, in fact, are essential unless matched coils and condensers are used.

Values of Decoupling Resistance

"Could you please tell me what value of decoupling resistance is required to drop 80 volts when the current passing through it is 10 milliamperes?"—F. T. H. (Thornton Heath).

The value of a resistance is ascertained by dividing the required voltage by the current expressed in amps. Thus 10 milliamps is .01 amps., and the value of the resistance in question would be $\frac{80}{.01}=$ 8,000 ohms. Another method of ascertaining the value is to divide the voltage by the milliamps and multiply the answer by 1,000, thus: $\frac{80}{10}\times 1{,}000=8{,}000$ ohms.

Overheating

"I have an H.T. eliminator which has been in use for two years. I have had satisfactory service from it all the time, but yesterday I detected a strong smell of burning coming from it, and I found that the mains transformer had got very hot. None of the other components of the eliminator or set was more than warm, and I still get excellent reception. The transformer gets hot in about five minutes. Can you tell me the cause of the trouble and the remedy?"—W. A. T. (Swansea).

The heating is almost certainly due to an overload, but there are many different causes which might be found for this. The insulation of the transformer windings may have broken down; a component in the receiver or eliminator may have broken, or a short-circuit may have developed. This may be traced by measuring the total current of the receiver, by including a milliammeter in the common negative lead and checking up with the valves in use, together with any potential dividers across the supply. It would probably be advisable to send the mains transformer to the manufacturers in order that they may ascertain whether or not it has been damaged.

Crystal Set Wanted

"I am desirous of building a crystal set, and should be pleased if you would supply me with some instructions. Probably you have a book giving full instructions, and I should be glad to know if this is so."—D. J. W. (Chichester).

You will find a circuit of a wireless receiver in "50 Tested Wireless Circuits," obtainable from this office for 2/10 by post.

A Field Winding Problem

"I have been using a 3-valve home-made set with a field-energised loud-speaker, having no field resistance marked on it. I have now bought a new speaker with a field of 2,500 ohms and have joined this in series with a smoothing choke in my mains unit. I am wondering whether I am passing too much current through the field, as I do not understand Ohm's Law, and do not want to damage the speaker."—H. S. (Skegby).

You should have no fear of overloading the winding with your present equipment. The only point to worry you is whether the resistance of the field is so high that it limits the voltage applied to your valves. Unless your eliminator delivers 300 volts or so, you will find that you are not fully loading your valves as the voltage drop through the 2,500 ohms field will make a considerable difference to the H.T.

Using a Mains Pack

"I have a little point I should like explained. I have a commercial A.C. receiver and should like to use the mains portion for supplying other battery sets. Is this possible, please?"—W. H. P. (Degany, N.W.).

We presume you wish to use the mains section, but not the receiver portion. This should be possible, although you will have to be careful regarding the cutting out of various voltage dropping resistances, etc. If you examine the mains section you will find a smoothing choke, and this point is the positive lead, and you should take the lead for your other set from the receiver side of this choke. You could break the lead here and fit two terminals to insulated sockets on the chassis and bridge these when using the mains set, but take a lead from the live one for the extra sets.

A Resistor Query

"I have two centre-tapped resistors, one is marked .04 and the other .015 on each side of the centre tap. I shall be grateful if you could tell me their values."—N. W. (Forest Hall).

The marking is probably in megohms, and thus .04 is equal to 40,000 ohms and .015 is 15,000 ohms. There is a possibility, however, that the components are double condensers, as it is not usual to mark resistances with a decimal value in the manner stated.

THE QUERIES COUPON APPEARS ON COVER iii

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

ANNOUNCE a City Branch at 165 and 165a, Fleet St., E.C. (next door to Anderton's Hotel), for the convenience of callers; post orders and callers to High St., Clapham.

OFFER the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under 5/- cannot be sent C.O.D. PLEASE SEND FOR ILLUSTRATED CATALOGUE POST FREE.

STUPENDOUS Purchase of Set Manufacturers' Stock. All electric 3 Valve (S.G. Det. Pen.) Set in Walnut Cabinet with moving-coil speaker 200-250 volt 40-60 cycles. Chassis built. 200-2,000 metres with 4 valves, £4/19/6.

ALL Electric 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts, undistorted output, complete with 5 valves, and Magnavox Super "66" Speaker, £12/10/0.

TYPE 4480, 9in. diameter, permanent magnet Handles 4 watts, 7 ohms speech coil, 13/6. Multi-ratio transformer, 4/6 extra.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World Famous Continental Valve Manufacturer; all the following standard mains types, fully guaranteed, 4/6 each, H.L., L., Power, High, Medium. Low magnification, Screen Grid 250v., 60 m.a. rectifier. Directly heated Pentodes, 1 watt, 3 watt and 4 watt A.C. outputs.

THE following Type, 5/6 each; 350v. and 500v., 120 milliamp full wave rectifiers, 2½ watt indirectly heated pentode.

THE following American Types at 4/6; 250, 227, 112, 171, 210, 245, 26, 47, 24, 35, 58, 55, 37, 281, 80 and the following types, 6/6 each: 42, 77, 78, 25Z5, 36, 38, 83, 39. 44, 53, 6B7, 2A5, 2A6, 2A7, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier. Condensers, resistances and diagram, 120v., 20 m.a., 20/-; trickle charger, 8/- extra; 150v., 30 milliamps, with 4v., 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250 v., 60 milliamps with 4v., 3-5 amps. C.T., L.T., 30/-; 300 v. 60 m.a., with 4 volts, 3-5 amps., 37/6; 200v. 50 m.a., with 4 v. 3-5 amps. L.T., 27/6. D.C. Eliminator Kits, 120v., 20 m.a., 8/6; 150v., 30 m.a., 10/6.

PREMIER chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps, 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a., for voltage doubling, 8/6; 4v. 3-4a., C.T. L.T. 2/- extra; with Westinghouse rectifier giving 200 v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v. 60 m.a. and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a., C.T., L.T. and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T. 10 Transformer, 200v. 100 m.a. rectified with 4v. 3-5a., and 4v. 1-2a., C.T., L.T. and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.) with screened primary, 10/-.

PREMIER Mains Transformers, output 350-0-350v. 120 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.) with screened primary, 10/-.

PREMIER Auto Transformers, 100-110/200-250v. or vice versa, 100-watt, 10/-.

WESTERN ELECTRIC Mains Transformers, 300-0-300v. 65 m.a., 4v. 1-2a., 4v. 2-3a., 6/6; 500-0-500v., 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a., C.T., 4v. 1a. C.T., 19/6.

SPECIAL Offer of Mains Transformers, manufactured by Phillips, input 100-200v. or 200-250v. output 180-0-180 volts 40 ma., 4v. 1 amp., 4v. 3 amps., 4/6.

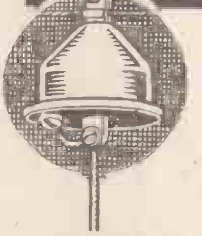
PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v., A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6. 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. only) Electric Gramophone Motors. 100-250v.; 30/- complete.

COLLARO Gramo. Unit consisting of A.C. motor 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-.

(Continued at top of column three.)

STOP THAT INTERFERENCE!



Why endure all those noises caused by electric trains, trams, vacuum cleaners, electric signs, etc.—when a Radioformer static filter will give an immediate cure. Get one now—it is easily fitted to your aerial and set. Supplied for Long or Medium waves. Aerial and Set Transformer and 50 ft. shielded down lead 17/6. When ordering use the coupon.

Set Transformer	6/6
Aerial Transformer	6/6
Shielded Cable 50ft.	4/6
Shielded Cable 100ft.	8/-

The BRITISH MADE

RADIOFORMER

RADIOFORMER LTD., YORK WORKS, BROWNING STREET, S.E.17.

COUPON

Messrs. Radioformer Ltd., York Works, Browning St., S.E.17.

Please send one Long / Medium Radioformer kit for which I enclose P.O. for......or illustrated descriptive leaflet.

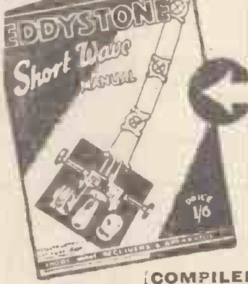
Name ....

Address ....

Please send me a Radioformer kit, including 50ft. down lead.

GW

1935 EDDYSTONE SHORT WAVE MANUAL



Fully illustrated with constructional details for building Battery and Mains S.W. Receivers: 6v. S.W. Superhet with A.V.C. All Wave Wavemeter, 5-meter Receiver. Simple 5-meter Transmeter. Crossfeeder Aerial System. Battery and Mains S.W. Converters. Amateur Bands Receiver. 100 watt Transmitter Eliminators, etc.

COMPILED BY THE LEADING SHORT WAVE SPECIALISTS

PRICE 1/6

Obtainable from your RADIO DEALER, W. H. SMITH, or in case of difficulty, direct from STRATTON & CO., LTD. (Dept. 25), Broomsgrove Street, Birmingham.

London Service Dept.:—Webb's, 14, Soho Street, W.1.

CUT H.T. BILLS IN HALF

Recharges itself overnight.

Any voltage supplied.

Not only does the Standard Wet H.T. Battery last years and save pounds on dry H.T., it greatly improves performance. **"It has made my set equal to any mains for selectivity and volume, easily the best battery I have** had at double the cost, no fading at all," writes Mr. Veats, B'ham. Solve your H.T. problem once and for all:—install a Standard. Replenish at long intervals—that's all. 120v. 12,500 m.a., 22 carr. paid. All Standard H.T. spares supplied. Write:

WET H.T. BATTERY CO. (Pr.) 95, Dean St., Oxford St., W.1. *Note new address.* Gerrard 6121.

(Continued from foot of column one.)

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

CENTRALAB Potentiometers, 50,000, 100,000 ½ meg. any value, 2/-. 200 ohms. wire wound, 1/-.

EDISON Bell Double Spring Gramophone Motors, complete with turn-table and all fittings, a really sound job, 15/-.

WIRE Wound Potentiometers 1,000, 2,500, 50,000, 90,000, 150,000, 200,000, 500,000, any value, 2/- each; 1,000 ohms wire-wound semi-variable resistances, carry 150 m.a., 2/-.

POLAR Star, manufacturers' model, 3-gang condensers, fully screened, with trimmers, 7/6; unscreened, 5/-.

BRITISH Radiophone 110 kc/s Intermediates, 3/-. Cosmocord Pick-ups, with arm and volume control, 12/-.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Utility Bakelite 2-gang 0.0005 screened with uniknob trimmer, 3/6; Polar Bakelite condensers, 0.00035, 0.0003, 0.0005, 1/-.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C.154, 2,500 ohms, 12/6; D.C. 152 magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or Pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 16/6.

RELIABLE Canned Coils with Circuit accurately matched, dual range iron-cored, 3/6.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 4/6.

T.C.C. Electrolytic Condensers, 8 mf. 440v. working, 3/-; 15 mf. 50v. working, 1/-; 6 mf. 50v. working and 2 mf. 100v. working, 6d.; 8+4 mf., 450v. working, 4/-.

T.C.C. Condensers, 250v. working, 1 mf., 1/3; 2 mf., 1/9; 4 mf., 3/-; 4 mf., 450v. working, 4/-; 4 mf., 750v. working, 6/-.

BRITISH Insulated Cables Condensers 50 mf. 50v. 2/9; 8 mf. 550v. Peak Working. 3/6.

10,000, 12,000, 15,000 ohm, wire-wound Potentiometers with mains switch 1/6.

GRAMPIAN Permanent-Magnet Moving Coil, 9in. Diameter, handles 4 Watts, Universal Transformer, 18/6. Energised 2,500 ohms, handles 5 Watts, 21/-.

WESTERN ELECTRIC Condensers, 250v. working, 1 mf., 6d., 2 mf., 1/-, 4 mf., 2/-. 400v. working, 1 mf., 1/-; 2 mf., 1/6.

H.M.V. Condensers, 400v. working; 4+2+1+1+1 +1+0.5, 3/9; Phillips 300v., 6+4+2+1+1, 4/6.

DUBILIER Condensers, 8 or 4 mfd. dry electrolytic 450v. working, 3/-; 4+4+2+0.1, 3/6.

VARLEY Constant square Peak Coils, band-pass type BP7, brand new in maker's cartons with instructions and diagrams, 2/4.

VARLEY H.F. Intervalve Coils BP8 band-pass complete with instructions in original cartons, 2/6.

SCREENED H.F. Chokes by One of the Largest Manufacturers in the Country, 1/6.

PREMIER British-made Meters, moving iron flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 m.a., 0-1, 0-5 amps., all at 6/-.

A LARGE Selection of Pedestal, table and radiogram cabinets, by best manufacturers, at a fraction of original cost, for callers.

THE Following Lines 6d. each or 5/- per dozen.—Chassis valveholders, 5-, 6-, or 7-pin, screened screen grid leads, any value 1-watt wire end resistances wire end condensers, 0.0001 to 0.1 Bulgin 3 amp. main switches. Cyldon capacitors, double trimmers.

UTILITY 3-gang Condensers, completely screened, with trimmers, ball-bearing, 6/9; with complete slow-motion dial, 7/11.

BRITISH Radiophone, 2-gang, screened, with trimmers and complete slow-motion dial, 5/6.

PREMIER SUPPLY STORES

20-22, High St., Clapham, S.W.4. Telephone: Macaulay 2188. Nearest Station, Clapham North Underground.

10/6 Only!!—Brand New Manufacturers Surplus Moving Coil Speakers, by one of the best-known British makers; energised, 2,500 or 6,500 ohms field, power or pentode transformer, 8in. cone; 10/6 each.

12/6 Only!!—As above, but 10in. cone; 12/6 each.

15/6 Only!!—Permanent magnet with power or pentode transformer, 8in. cone; 15/6 each.

17/6 Only!!—As above, but with 10in. cone; 17/6 each.

CABINET for Any of Above, 2/9 each only; secure one of these amazing bargains now; cash with order or c.o.d.—Hulbert, 6, Conduit St., W.1.

HIGHEST possible allowance made on used wireless goods in exchange for new sets, components, or Peto-Scott kits. All latest receivers supplied on easiest of terms.—R. Wigfield, Furlong Road, Goldthorpe, Yorks.

WANTED, good modern wireless parts, sets, eliminators, meters, valves, speakers, etc. Spot cash waiting. Exchanges. Send or bring. We pay more than any other dealer. Open 9-8.—University Radio, 142, Drummond St., Euston, N.W.1.

SOUTHERN RADIO'S WIRELESS BARGAINS.

RECEIVERS.—G.E.C. Osram Four-valve (Actual) Sets. Complete with four Osram valves, permanent magnet moving-coil speaker. Magnificent pedestal cabinet. Ready to use on all voltages. A.C. all Osram proprietary components in original sealed cartons, £6/15/- (list £15/15/-). An exceptional bargain.

CROMWELL 3-valve Battery Sets, complete with three Cossor valves, Permanent magnet moving-coil speaker in magnificent walnut console cabinet. Brand new, in original sealed cartons, £3/12/6 (list £8). Same model as above Class B, £3/17/6.

BOTOLPH Lightweight Portables, complete with 5 valves, Exide batteries and accumulators, £2/19/6 (list £8/8/-); a real suitcase portable.

KITS.—A few left only of the original Scott-Taggart S.T.400 Kits, complete with all specified proprietary components. In sealed cartons, £2/19/6 (list £4/17/6).

COILS.—Igranic Super-het Set of Four (1 osc., 2 I.F. with Pigtails, 1 L.F. Plain), 12/6 (list 50/-). Lissen Superhet three coil Kit. Screened Ganged on Base with switch. Type L.N. 5181, 9/6. Same description for Band Pass or any straight circuit. Type L.N. 5162, 7/-.

VARLEY Constant Square Peak Coils B.P. 5, complete with all accessories in sealed cartons, 2/3.

LEWCOS B.P.F./R., T.B.F./C, O.S.C./126 (Extensor), T.O. S/R, all at 3/6 each. A full range of Edison Bell plug-in coils, two-pin, at 9d. each.

PICK-UPS.—Marconi Model K. 25 (1935 issue), 22/6 (list 32/6); Six only Rothermel Piezo Electric Pick-ups, 35/-; Four only B.T.H. Senior Pick-ups, 32/6.

CONDENSERS.—Lotus, 3-gang, 12/6; 2-gang, 8/6; Single Dyblock, 4/6. All capacity 0.0005. Fully screened with trimmers, complete with dials, knobs and escutcheons. Special bargain line. Plessy four-gang condensers, superhet type. Fully screened with trimmers (less dials), any standard dial will fit, 10/6 (list 45/-).

DUBILIER Block Condensers, 4mfd. (2 x 1 x 1) 1,000-volt, 2/9; 4.5 mfd. (2.25 x 2.25), 3/-; T.C.C. (0.1 x 0.01), 1/3 each.

SPEAKERS.—Rothermel Permanent Magnet Moving-Coil Universal Transformer, 16/- (7in. cone); Blue Spot Permanent Magnet Speakers Universal Transformer, for Power, Super Power, Pentode and Class B, 23/-; Blue Spot 66R Units, brand new and boxed, 10/6 (list 35/-), complete mounted on Blue Spot Chassis, 16/6 (list 45/-).

MISCELLANEOUS.—Westinghouse Metal Rectifiers, H.T. 6, 7, 8, 9/3. Morse Tapping Keys, with flash signal and buzzer, complete with battery and bulb, 2/-.

LISSEN General Purpose Output Chokes, 20/28 henries, 18/60 m.a., L.N. 5301, 6/- each.

LEWCOS Superhet, dual wave frame aerials, 9/-.

THOUSANDS of other bargains. Callers are assured of a tremendous saving in all branches of wireless needs by visiting any of our shops. All 1935 receivers can be supplied on the most favourable hire-purchase terms.

ALL goods guaranteed and sent post paid.

BRANCHES at 46, Lisle Street, W.C.2; 16, Leicester Street, W.; 271/275, High Road, Willesden Green, N.W.10. All Mail Orders to 323, Euston Road, N.W.1.

SOUTHERN RADIO, 323, Euston Road, London, N.W.1. (near Warren St. Tube). 'Phone: Museum 6324.

THE following unused Set Manufacturers' Surplus; all goods guaranteed perfect; immediate delivery.

COLVERDYNE'S (Ferrocart) 7/6; Dubilier or Erie resistors, 1 watt type, 7d., 2 watt type, 1/2, Marconi K19 pick-ups, 22/6. Radiophone IF transformers, 110KC or 117.5KC, 6/6.

WESTINGHOUSE rectifiers, HT8, 9/6, HT9, HT10, LT4, LT5, 11/-. Regentone transformers for HT8 or HT9 with 4v-4a LT winding, 7/6.

MAINS transformers, 350-0-350v., 60 ma., 4v-4a, 4v-2a, 12/6. Eliminators, outputs, 150v. 25ma., S.G. and detector. A.C. type and Westinghouse rectifier, 25/-. D.C. type, 12/6. Collaro gramophone motors, 100-250 v. A.C., 34/-.

DUBILIER dry electrolytic condensers, 8mf. or 4mf. 500v. working 50v. 50 mf., 3/6.

ROTOROHM volume controls, with switch, 2/6. BTH pick-up tone arms, 3/-.

ALL types of brand new American valves in stock, first class makes, guaranteed. 247, 235, 551, 89, 18, 19, 46, 59, 6A7, 15, 42, 41, 38, 39, 78, 75, 57, 58, 24, 44, 36, 43, 12/-. UX171A, UX199, UX280, UX245, UX226, UY227, 8/-. UX250, UX281, UX210, 18/-.

BTH-RK speakers, 6v. field, suitable for P.A. work, 27/6. A.C. type with field rectifier, £2/7/6.

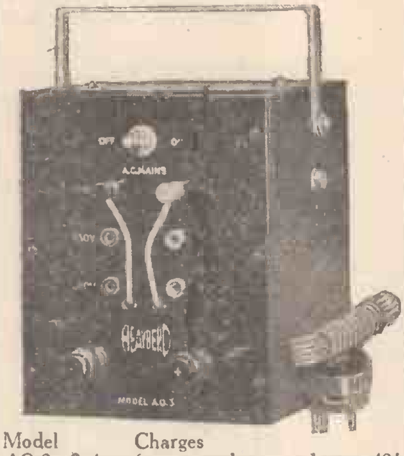
MAGNAVOX speakers, complete with hum-bucking coils, output transformers, etc., 152 (9in. cone), 22/6. 154 (7in. cone), 15/9. Rola F6 (7in. cone), 17/6, with all 2,500 or 6,500 ohm fields. Magnavox PM254, 18/-. Magnavox, PM252 (9in. cone), 22/6. Carriage paid, cash with order or C.O.D.

WARD, 2nd floor, 45, Farringdon Street, London, E.C.4. Telephone: Holborn, 9703.

WIRELESS Experimenters Surplus. Transformers, Chokes, Speakers, Large Rectifier, etc. List.—H. A. G., 147, Shirley Road, Croydon.

Home Charging!

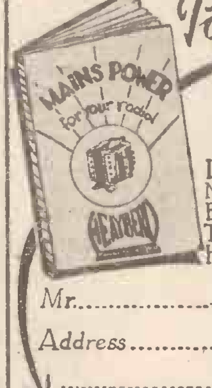
Do you take your accumulators to a service station? Heayberd have a quicker and better way. Install a Heayberd Portable Charger and charge your accumulators at home. Under your own personal supervision you can be sure that they are charged efficiently.



Model	Charges
AO.2	—2, 4, or 6v. accumulators at ½ amp. 40/-
AO.3	—2, 6 or 12v. accumulators at 1 amp. 50/-

Heayberd can also supply many other models complete or Kits of Parts for building your own.

Post Coupon



for Heayberd handbook on Mains Working

I enclose 3d. stamps for New Handbook of Mains Equipment. Packed with Technical Tips, Service Hints and diagrams

Mr.................................

Address.................................

PRA.

F. C. HEAYBERD & Co.,
10 FINSBURY STREET, LONDON. E.C.2
One minute from Moorgate Stn

VAUXHALL.—Magnavox Permanent Magnet Loudspeakers, universal, suitable for Class B power or pentode; 7in. cone, 17/6; 10in. cone, 23/-. Energised 2,500 or 6,500, 10in. cone, 22/-; 7in. cone, 15/3. All new with humbucking coils.

VAUXHALL, U.S.A. Rola Energised 8in. diameter, 2,500, 6,500 ohms, 17/6; 10in. diameter, 25/-; P.M. 8in. diameter, 28/-; 10in. diameter, 33/-.

VAUXHALL.—Radiophone Radiopaks, Band-pass superhet, with Lucerne wavelength station-named scales, medium and long, complete, 32/6.

VAUXHALL.—Radiophone I.F. transformers, with terminals, 6/-. Radiophone volume controls, with switch, 3/6.

VAUXHALL.—Three-gang condensers, with covers —superhet., 14/6; ordinary type, 12/6. Disc drives, complete, 4/9.

VAUXHALL.—Pick-ups. Write for quotation. State make, B.T.H. Collaro Motors, 32/6. Gramophone switches, 3/6.

VAUXHALL.—Westinghouse Rectifiers. H.T.8, 9/6; H.T.9, 10/-; Westectors', W4, WX6, 5/9.

VAUXHALL.—Dubilier 4-8mfd. Electrolytic Condensers, 3/6; Mains Transformers, suitable for H.T.8, with terminals, 11/6.

CASH with Order, post paid over 2/6, or c.o.d.; all goods unused manufacturers' surplus; guaranteed perfect. Lists free.

VAUXHALL UTILITIES, 163a, Strand, W.C.2. 'Phone: Temple Bar 9338. (Facing Bush House, over Dennys.)

PEARL & PEARL

190, Bishopsgate, London, E.C.2. All the following bargains guaranteed new goods. Cash or C.O.D. Carriage Paid.

SPECIAL OFFER. Lissen 3-ganged superhet coil units for A.C. or battery sets; with circuits and diagrams. Over 250 already sold to "P.W." readers. List price 30/-, now offered at special price 6/6 only.

AMPLION Class B Driver Transformers. 1-1, 1.5-1, or 2-1. Specially large core, as listed, at 9/6. Our price 5/6. Amplion Class B Output Chokes, tapped 1-1, 1.5-1 and 3-1. Ideal for matching m/c speakers. List 9/6. Our price 5/6.

M.C. SPEAKERS. LINCOLN-STEWART Permanent magnet moving-coil speakers. Special universal transformer enables speaker to be used with any receiver. List price 39/6. Our price 16/11.

SPEAKER UNITS. TRIOTRON 4-pole balanced armature speaker Units, type "B."; sensitive, beautiful tone. List 22/6. Our price 6/11.

LUCERNE COILS. NEW LUCERNE dual-range coils 1/8 each. Screened Iron Cored Dual coils with circuits, 1/11 each.

CONDENSERS. IGRANIC 2-gang variable condensers .0005 mfd. each side. Complete with trimmers and dust cover; can be fitted on baseboard or panel. List, 17/6. Our price, 6/9.

AMPLION Binocular H.F. Chokes. Totally enclosed in bakelite case. List, 4/6. Our price, 2/9.

COLUMBIA 2-Valve Battery Receivers with Speaker and Marconi valves, in attractive Oak cabinet. List 4 gns. Our price 32/6. Carriage forward.

CABINETS.—100 only Walnut receiver cabinets, well finished and polished, size 18 ins. high, 15 ins. wide, 8½ ins. deep, to clear at 4/11 each. Carriage forward.

SPECIAL SUNDRY BARGAINS
(Cash with order only)

EDISON-BELL double pole change-over Switches 9d. each; Single pole, 7d. each. Lots of 3 dozen assorted *Dubilier* fixed condensers, 1/9 each lot. 4-pin Chassis mounting Valveholders, 5d. each; 6 for 2/-. 7-pin type, 7d. each, 6 for 3/-. *Variable* tuning condensers .0003 mfd. 1/- each. *Igranic* 2-pole rotary switches, 1/- each. *Igranic* Short-wave chokes, 1/- each. Double reading voltmeters, 1/9 each.

All Mail Orders Direct to PEARL & PEARL, 190, Bishopsgate, London, E.C.2. Tele: Bishopsgate 1212.

WOBURN RADIO Offer Following Bankrupt Stock:—

POLAR Midget Condensers, new type, boxed, 0.0005 fully screened, with trimmers, 2-gang 6/6, 3-gang 9/9; Arcuate drives, with lamp holder and escutcheon, 4/-.

RESISTANCES.—Bargain parcels of 13 wire wound resistances, 1½ watt, made by Truwind, accurate to 1%, values 100 ohms to 100,000; 3/9.

FORMO 2 mfd., 1,000v. test, bakelite, 1/3; Wego, 750v. test, 1 mfd. 1/-, 2 mfd. 1/3, 4 mfd. 2/3; tubulars, 0.01, 0.02, 0.1, 6d.; 0.001, 4d.; Polymet 0.0001 tags, 1/- half dozen; Telsen Tag condensers, boxed, 0.002, 0.0001, 0.0002, 0.0003, 4d.; chassis valve holders, 4-5 pin, 1/3 half dozen; toggles, 6d.; Edison condensers, 0.005, 0.006, 3d.; British Radiophone curved drives, with escutcheon and light, 3/9; Columbia L.F. transformers, 3-1 and 5-1, 2/9; Class B drivers and chokes, 8/6 pair; with B.V.A. valve and 7-pin holder, 17/-; Easton iron cored coils, 2/6; Popular iron cored canned coils, 2/6; J.B. condensers, 0.0005, with drive and escutcheon, and light, 2/6; 3-gang condensers, 0.0005, with trimmers, 6/6.

WESTERN Electric Microphones, very sensitive, 2/3; microphone transformers for above, ratio 85-1, 2/3; Marconi microphone transformers, ratio 100-1, 3/6; H.F. chokes, snap type, 10d.; binocular chokes, 1/2; S.W.H.F. chokes, 10d.; Wego interference eliminators, few only, 3/6; Westinghouse H.T.9, 8/11.

W.R.C. Eliminators, 150v. 30 m.a., 3 positive H.T. tappings, all guaranteed 12 months: D.C. model, 9/6; A.C. model, 21/-; A.C. model with trickle charger (2v., 4v., or 6v. .5 amp.), 32/6 (carriage 1/- extra on all).

TRADE List Now Ready, kindly enclose trade heading and stamp.

WOBURN RADIO Co., 9, Sandland St., Bedford Row, W.C.1. Holborn 7289.

REPAIRS—REWINDING. Any component, mains transformers, etc., rewound. New cones/coils fitted, any speaker. Guaranteed, quick service.—Write Dept. C., WEEDON P.L.R. Co., 80, Lonsdale Avenue, London, E.6.

F. J. CAMM'S £5 Super-Het Three specified Kit 70/- (7/7 monthly). ST. 600 66/8 Complete Kit, Lists Free.—"Melfo-Rad," Queen's Place, Hove. (Trade supplied.)

CONSTRUCTORS of Coils, Chokes, and Transformers will find our List of great assistance. Send immediately.—Lumen Electric Coy., 9, Scarisbrick Ave., Litherland, Liverpool 21.

RADIALADDIN (Disposals) Ltd. Exchange your old set for any new model, balance cash or H.P. Write for free quotation to largest radio exchange in U.K. Also clearance sale of reconditioned sets and radiograms at gift prices £1 to £10. Write for list.—46, Brewer Street, Piccadilly Circus, W.1. Gerrard 4055.

FREE ADVICE BUREAU
COUPON
This coupon is available until November 17, 1934, and must be attached to all letters containing queries.
PRACTICAL WIRELESS, 10/11/34.

GIVE GENEROUSLY FOR YOUR POPPY ON NOV. 10th FOR REMEMBRANCE DAY NOV. 11th.

T8 See p. 277

AB-3

Printed in Great Britain by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH, LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.