MODERN WIRELESS

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Contents

Edited by
JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

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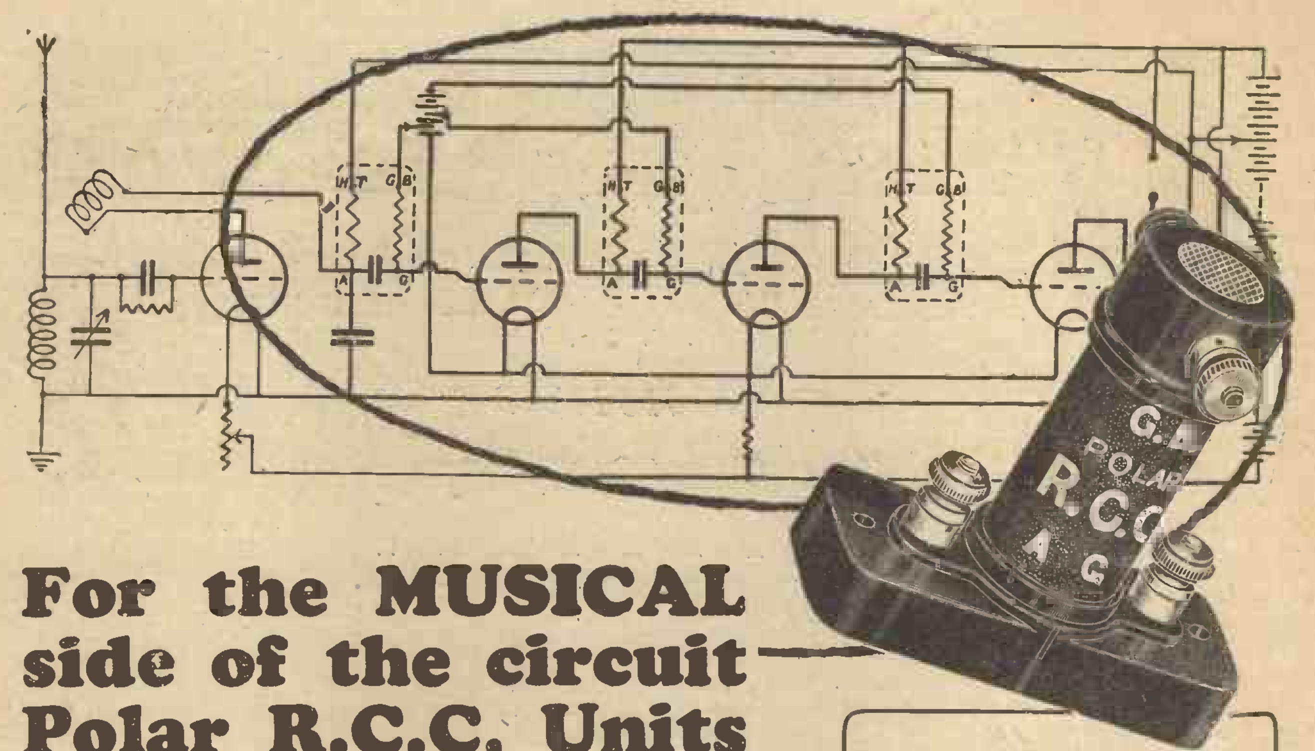

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they are the only complete units of their kind designed *especially* for L.F. Amplification purposes. They are logically designed for easy assembling of an amplifying circuit, and have four clearly-marked terminals spaced for convenient wiring-up. The Polar R.C.C. Unit consists of:—

An Anode Resistance wire-wound in such a way as to be free from crackling noises, with low self-capacity and small induction; high insulation; no joints; no danger of corrosion.

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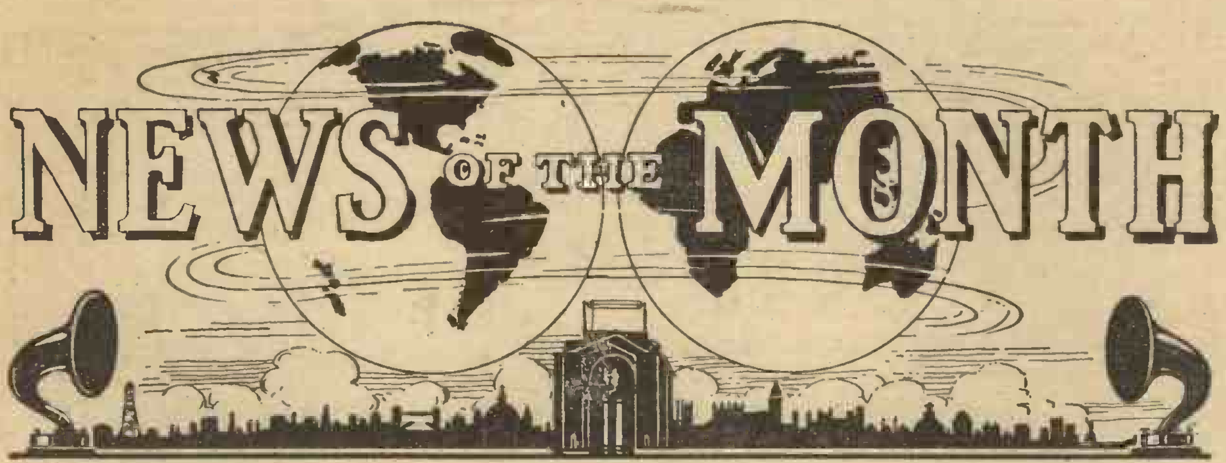


AT the time of going to press there are two events of outstanding importance in the offing. One of these is the Transatlantic Tests, from which we are expecting some very interesting results in view of the developments which have taken place during the past year. The other item is the second sitting of the Broadcasting Committee, at which evidence will be taken on behalf of the Radio Society of Great Britain, the Radio Association, the Performing Rights Society, and other bodies. Reports of both these subjects appear in the columns of our weekly publications, *Wireless Weekly* and *Wireless*, to which our readers may turn for detailed information.

Quality of Reproduction

Many people require a set which is capable of achieving a certain range and yet will give signals of a truly pleasing quality. In this issue Mr. Barber describes a set in which particular attention has been paid to this aspect of the design. Mr. Allinson describes a three-valve receiver employing a neutralised high-frequency stage followed by a simple detector and note magnifier, an arrangement which renders long distance reception comparatively simple.

Mr. Johnson-Randall describes a Reinartz receiver with a note magnifier which employs interchangeable home-wound coils, so obtaining a flexible arrangement. Finally, we have a remote control single-valve receiver designed by Mr. Underdown which enables the set to be switched on or off from a distant point, and a new type of crystal circuit described by Mr. Harris in which, by means of a simple switching arrangement, it is possible to find the best adjustment for a given aerial very quickly.

The "Quality Four."

Can Valves be Eliminated?

Many owners of crystal sets must have wondered whether it is possible to obtain loud-speaker results without the use of valve amplifiers. Capt. Crowther discusses this question, and shows that although alternative methods are available, the valve amplifier gives the best results. Some highly interesting comparisons of the selectivity of various types of aerial circuit are given by Mr. Kendall, who treats the subject in his usual conclusive style.

True Neutrodyning

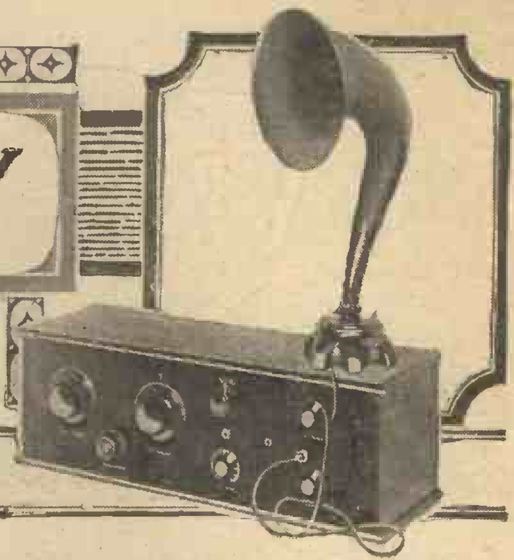
Many methods have been adopted in order to neutralise the effects of valve capacity in high-frequency amplifiers, but too often the action obtained is of the nature of negative reaction rather than true neutralisation. In an article on the subject Mr. Reyner discusses the necessity for symmetry in such circuits in order that the true action may be obtained, and gives a number of interesting examples.

Dr. Robinson answers a question which must have been asked by many readers—namely, What are harmonics?—while Mr. Barton-Chapple discusses the real significance of resistance in wireless circuits. As promised last month, we have an article on the Dublin station, and it is hoped to give a description of the Hilversum station next month.

Testing Readers' Sets

We would draw the attention of our readers to the notice on page 588 to the effect that the testing of readers' sets has now been discontinued. It was felt that this service was of assistance to such a small percentage of our readers that the resources of our Elstree laboratories would be far better employed in active research work, and we have no doubt that our readers will reap the benefit of this step in the future.

"THE QUALITY FOUR"



By JOHN W. BARBER

A sensitive receiver in which particular attention has been paid to the quality of reproduction.

PURITY of reproduction of broadcast speech and music is an ideal towards which the broadcast engineer and listener both strive, the engineer to give the most perfect sounds to his audience, and the listener to eliminate from his receiver anything that tends to introduce distortion and so destroy his ideal. We have to trust the engineer to do his part well, and, in fact, we need have no fear that he will neglect his side of the bargain, for, barring unforeseen occurrences, his transmissions are beyond reproach.

It is therefore up to the listener to complete the good work by making his set as free from distortion as possible, and as this necessitates a knowledge of the various sources from which distortion may arise, it will generally be found that the listener prefers to follow some design, when constructing his set, which is intended to fulfil the stated requirements.

Choke Coupling

The causes of distortion are many and somewhat complex in nature, and it is outside the scope of the present article to go into them all in detail.

The writer has found in his own experiments that the purest reproduction with freedom from unwanted noises is obtained by the use of reactance-capacity, or choke, coupling on the low-frequency side, and this has been borne out by the success of his instrument entitled "A Unit Choke Amplifier," which was described in the April, 1925, issue of *the Wireless Constructor*.

Suitable Valves

When this form of note magnification is employed, it is essential that a valve having a high amplification factor should be employed, as the amplification obtained by this method of coupling takes place in the valve itself, and not partly in the inter-valve coupling circuits, as in the case of transformer amplifiers. Suitable valves are those manufactured specially for resistance-capacity coupling, such as the D.E.5B, D.E.3B, D.F.A.4, and S6.

High Frequency Amplification

The present receiver has been designed for distant reception, hence the use of a high-frequency amplifying valve as seen in the circuit diagram. The tuned anode method of coupling has been employed, and in order to obviate the necessity for coil changing in this circuit a tapped anode react-

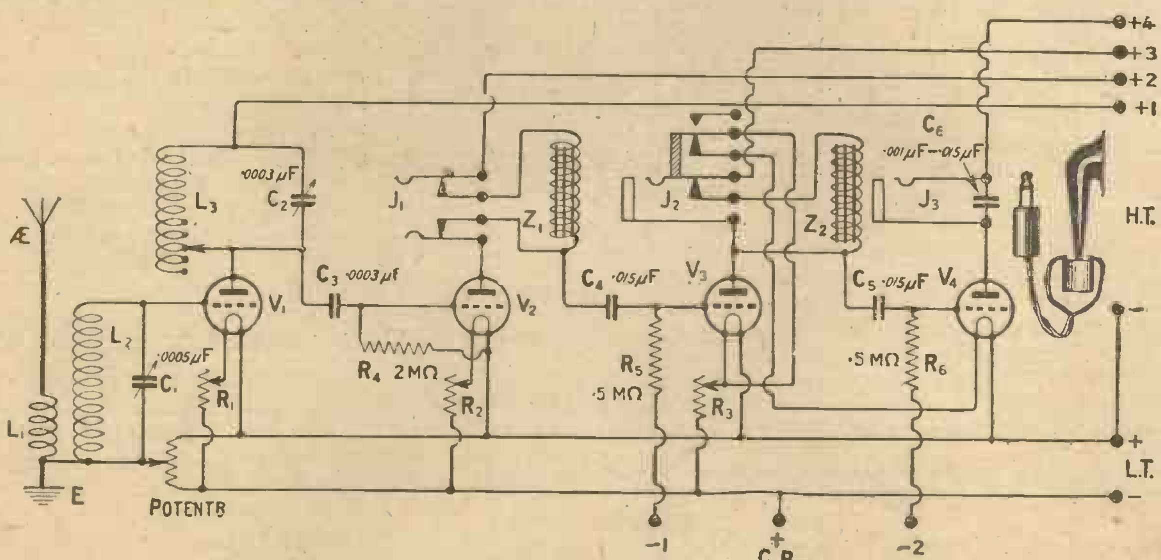


Fig. 1.—It will be observed that choke coupling is employed for the L.F. stages.

ance is incorporated, which tunes from 200 to 4,000 metres (1,500 kc to 75 kc). For stabilisation purposes, a potentiometer is used, while a tight-coupled aerial is employed, obtained by the use of Gambrell Trap Coils, in conjunction with ordinary Gambrell coils in the grid circuit. This method of aerial coupling somewhat increases the sharpness of tuning, and will sistance, thereby effecting a saving in components and panel space with no sacrifice of efficiency.

Components

Before considering in detail the constructional work, it will be advantageous to draw up a list of the components used in the receiver, and for the guidance of readers, makers' names will be found in connection with each piece of ap- .0003μF. "Cyldon" grounded rotor type (Sydney S. Bird).

One tapped anode reactancel (Radio Instruments, Ltd.).

One combined .0003μF condenser and 2MΩ grid-leak (Watmel Wireless Co., Ltd.).

Two "Success" super-chokes (Beard and Fitch, Ltd.).

Three filament resistances, dual

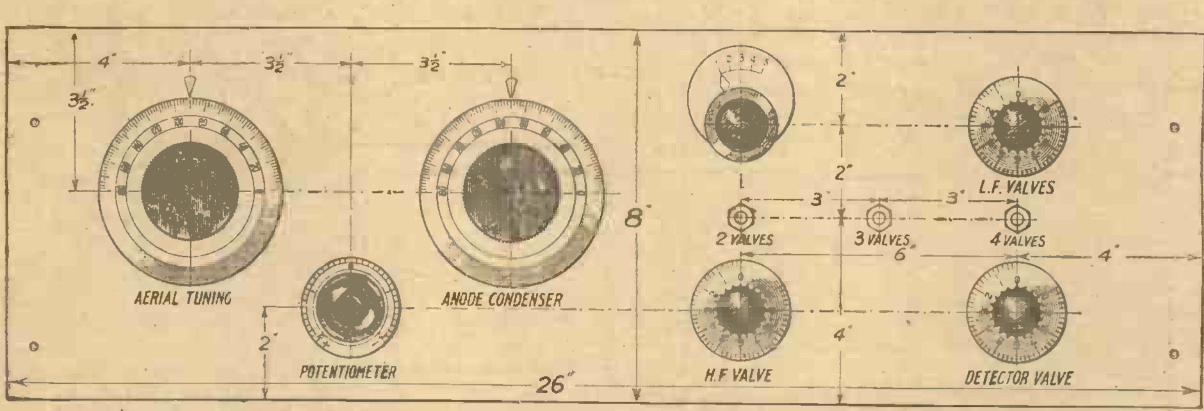


Fig. 2.—The layout of the panel is symmetrical and straightforward. Blue print No. 145a may be obtained on application (price 1/6 post free).

prove useful in the reduction of interference.

In order to permit of reception in various degrees of loudness, jacks have been inserted after the detector valve, first note magnifier, and last valve, thus rendering it possible to tune in on the phones with, say, one low-frequency amplifier, and then to switch over to the loud-speaker with all valves on.

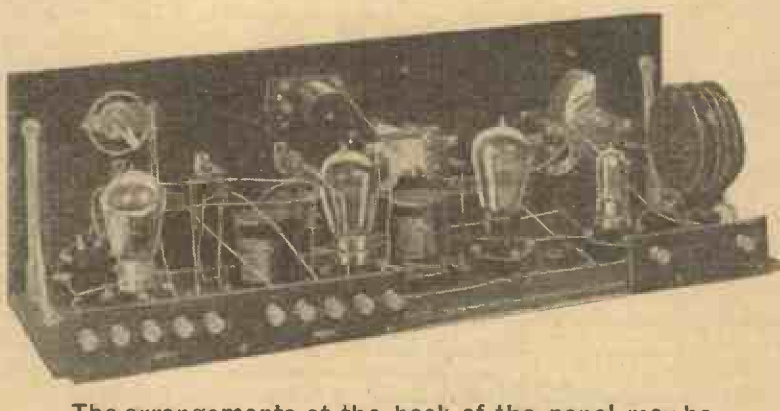
Filament Controls

The arrangement of the filament circuit calls for some comment, as it will be seen that separate rheostats are provided for the first and second valves, the last two being controlled by one resistance. Further, it will be noticed that when the telephones are inserted in the second jack, the last filament is automatically switched off. It is intended that the last two valves shall have a similar filament rating, in fact the author uses valves of the quarter ampere type throughout, the actual valves being a D.E.5, two D.E.5B.'s, and another D.E.5 in the last stage.

It is thus possible to control the last two valves from the same re-

paratus. It must not, however, be assumed that the list given need be strictly adhered to, as in most cases other components of reputable manufacture may be substituted without loss of efficiency.

One Radion panel, 26 in. by 8 in. by $\frac{3}{16}$ in. (American Hard Rubber Co., Ltd.).



The arrangements at the back of the panel may be seen from this photograph.

One mahogany cabinet, 26in. by 8 in. (Camco).

One baseboard for above, 26in. by 8in. (Camco).

One pair brackets (Camco).

Four "Clearer Tone" valve holders (Benjamin Electric Co., Ltd.).

Two square law variable condensers, one .0005μF and one

type ("Peerless"-Bedford Electrical and Radio Co., Ltd.).

One potentiometer, 300 ohms (L. McMichael, Ltd.).

Two coupling condensers, .015 μF each (Dubilier Condenser Co., Ltd.).

Two grid leaks, .5 M.Ω each, together with mounting bases (L. McMichael, Ltd.).

One terminal strip, 11 in. by 2in. containing eleven terminals, the centre one being removed in order entirely to separate the high-tension terminals from the remainder (Burne-Jones and Co., Ltd.).

One terminal strip 5½ in. by 2 in., containing two terminals at opposite ends, for aerial and earth (Burne-Jones and Co., Ltd.).

Two "Decko" dial indicators (A. F. Bulgin and Co.).

One single-coil mount (Burne-Jones and Co., Ltd.).

One double circuit jack, No. 63 (Igranic-Pacent).

One five-spring automatic jack, No. 66 (Igranic-Pacent).

One single open jack, No. 61 (Igranic-Pacent).

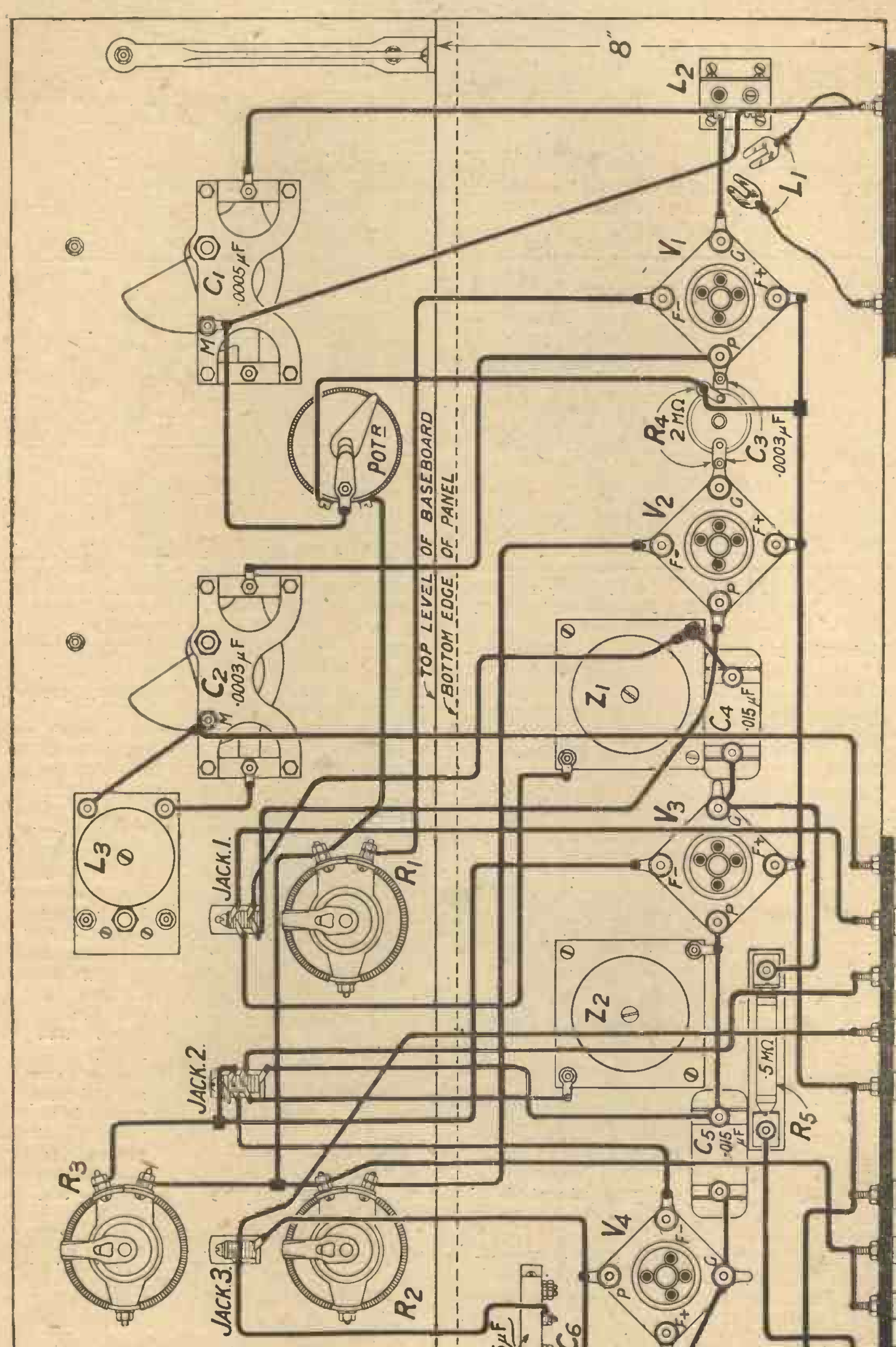


Fig. 3.—The back-of-panel layout and wiring may be followed from this diagram. Readers who prefer a blue print may obtain one (No. 145b) on application, price 1s. 6d., post free.

One universal No. 40 plug (Igranic-Pacent).

One multiple fixed condenser, .001 μF to .015 μF (C. A. Vandervell and Co., Ltd.).

Twenty feet "Glazite" for wiring up (London Electric Wire Co. and Smiths, Ltd.).

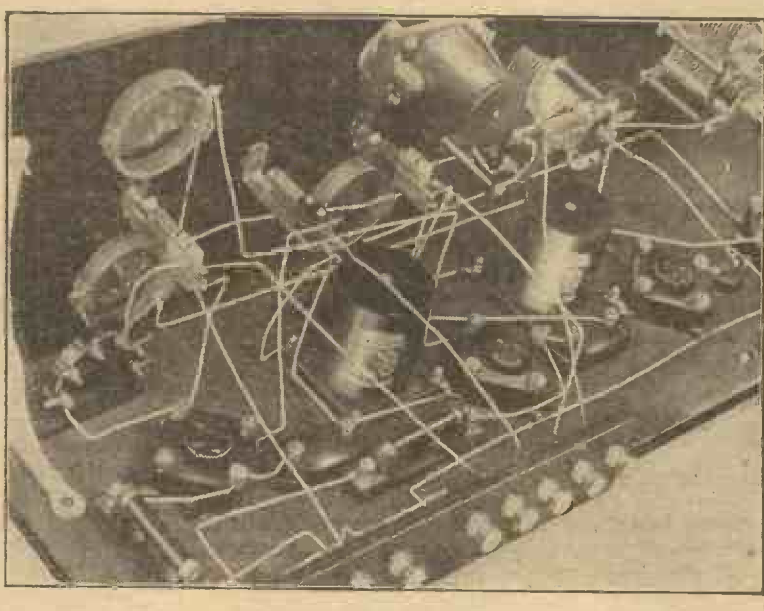
Four countersunk 6 B.A. screws with nuts and washers, for securing panel to brackets.

Several wood screws for fixing components.

Two spade tags, and a short length of flexible wire.

Set of "Trap" coils (Gambrell Bros., Ltd.).

Radio Press panel transfers.



This view shows the wiring of the L.F. end of the receiver.

Choke Coils

The choke coils, of course, are of primary importance where the tonal quality is concerned, and a good deal of disappointment will be obviated by employing only thoroughly reliable components in the first place.

Turning now to the constructional work, the panel lay out and drilling diagram is seen in Fig. 2, which also gives the details of the panel transfers. All the components, with the exception of the variable condensers, are of the one-hole fixing variety, thus greatly simplifying the routine work. Drilling templates are supplied with the variable condensers, and no difficulty will be experienced in correctly drilling the four holes necessary for each.

Mounting Up

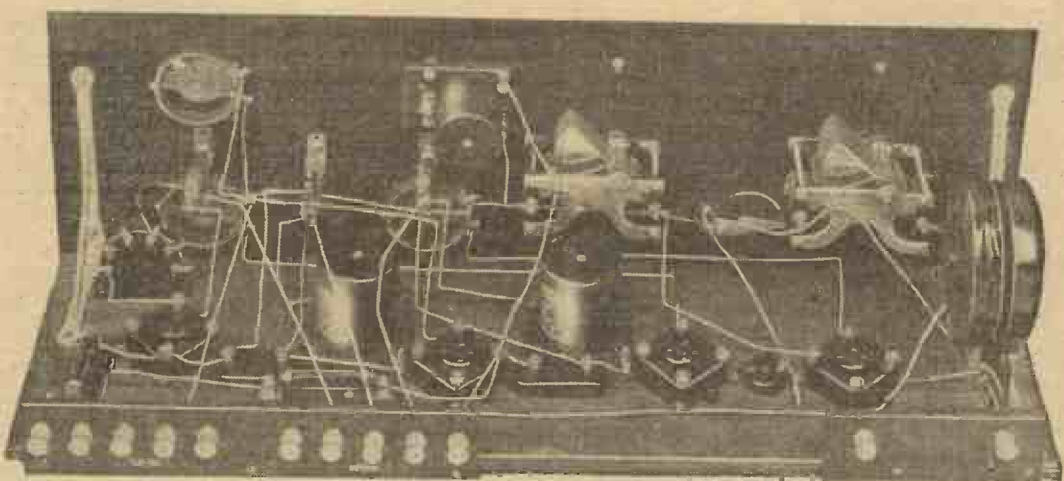
Care should be taken when drilling the four holes for fixing the panel to the brackets, in order that the whole may fit neatly into the cabinet without recourse being had to force. This part of the work should preferably be done before any parts are mounted on the panel. Appearance will be enhanced considerably if these four holes be countersunk, thus allowing the screw-heads to lie flush with the surface of the panel.

Next mount the condensers, rheostats, anode reactance, and jacks upon the panel, after which the attention may be turned to the baseboard and the components which are mounted thereon. The Watmel grid condenser and leak is provided with lugs and small screws with nuts, and by enlarging slightly the holes in the lugs of the valve-holders, these screws may be passed through the latter lugs, thus ensuring minimum length of path from the anode of the high-frequency amplifier to the grid of the rectifier. Similar short paths are arranged for in other parts of the layout, and it is advisable to adhere to these as closely as possible.

Wiring

The filament wiring is long in some parts, but this is of no consequence, and there is therefore no necessity for anxiety on this point.

A word as to the use of Glazite may not be out of place here. To bare the end of a length, run round the casing at the required position with a sharp knife, after which the piece of covering will come away quite easily. To bare a portion of wire other than an end, two such cuts should be made, at a distance apart of, say, half an inch, and then a lengthwise cut made with the



Ample space is provided at the back of the panel as will be seen from this photograph.

knife. The wire may then be rolled in the fingers, and it will be found that the cut portion will come away quite easily. The remainder of the wiring is fairly straightforward, and calls for little comment, the only connections needing special care are those to the jack switch, and in these cases the wiring diagram should be carefully followed.

Coils required

A flexible lead ending in a spade tag is joined to each of the aerial and earth terminals, to be joined later on to the trap coil, which is screwed to the side of the grid tuning coil L_2 by means of a piece of screwed rod and nuts provided with each trap coil. These coils are almost identical in form with the ordinary Gambrell coils, but are provided with terminals at the base instead of plug and socket, and it is to these terminals that the flexible leads are joined. The aT coil will be found suitable for the lower broadcast band, while for Daventry and such stations a DT coil will be necessary.

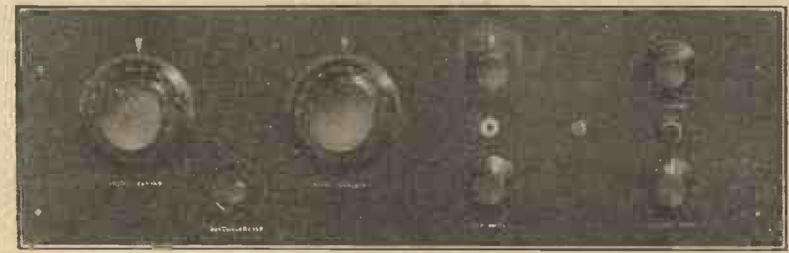
Testing Out

A Gambrell B coil will be found suitable in the grid circuit for the band of wavelengths 200 metres to 520 metres (1,500 kc. to 576.9 kc). The aT coil will serve for aerial coupling throughout this band.

It will be advisable to test the wiring of the receiver before the high-tension battery is connected, and this may be done by joining the L.T. – to H.T. – and all the H.T. + terminals (four) to L.T. +. If no valve lights up now, all may safely be assumed correct, and the batteries may be joined up in the usual manner.

Plug the telephones into the first jack, and turn on the first two valves. With the potentiometer set slightly toward the negative end, rotate both condensers slowly from the minimum position, adjusting each one in turn if necessary, until signs of oscillation are heard. This may necessitate putting the potentiometer further over o the negative side. Observe that the set will oscillate over the whole range of the condensers, by suitable adjustment of the potentiometer.

Keeping the set just off the oscillation point, the condensers are simultaneously adjusted, and it will be found quite easy to pick up several stations, provided that one is not too close to a powerful transmitter working at full strength.



The front of the panel is of neat appearance.

A Note on Valves

It has been previously mentioned that the valves having a choke in the anode circuit should be special valves of high amplification factor, and it may be of use to those who are not well versed in the various types of valves if a few notes on this subject be added. The simplest manner in which this can be done is to set out in tabular form some suitable valves for each position. Other equivalent makes may, of course, be employed.

In cases where no H.F. valve is indicated, it may be assumed that any H.F. valve of suitable filament voltage may be used, in fact, this is so in all cases, but in the first two series the valve shown is recommended.

Some suitable valves to use may be seen from this table.

High frequency amplifier	Detector.	1st note magnifier.	2nd note magnifier	Accumulator voltage.
D.E. 5	D.E. 5B	D.E. 5B	D.E. 5	6
D.E. 3	D.E. 3B	D.E. 3B	D.E. 3	4
—	D.F.A. 4	D.F.A. 4	D.F.A. 1	6
—	S6	S6	D.F.A. 0	4

As regards stations heard, the fact that Zurich (515 metres) is heard at about 152 degrees on the grid circuit condenser signifies that the coil in use (Gambrell B) amply covers the upper portions of the waveband, whilst on the lower portions of the scale several amateur transmitters on 197 metres and thereabouts have also been heard. No change of grid coil is thus necessary for the broacast band.

Test Report

London, on three valves, gives good loud-speaking at 4½ miles approximately, purity being all that can be desired, using a standard C.A.V. loud-speaker. On four valves, with suitable grid bias, no distortion is introduced, and the concert can be followed comfortably on the ground floor, with the speaker on the second. The following stations have also been heard :—Birmingham, comfortably loud on L.S.; Bournemouth (after London had closed) good 'phone strength on three valves; Union Radio, Madrid, loud on the speaker with four; Bern, Munich, San Sebastian and Hamburg—good; Radio Belge and Radio Toulouse, easily audible on ground floor using four valves; Zurich, at good loud 'phone strength on three valves. Those stations heard only on telephones were received fairly late in the evening, and were not put on the loud-speaker for purely domestic reasons, although there is every reason to believe that had the last valve been added in these cases, the loud-speaker would have been operated satisfactorily.

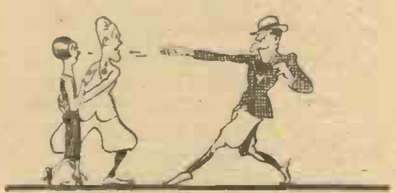
Grid Bias

Purity of reproduction is the great point of this receiver, and in this connection it may be pointed out that similar results will only be obtained when the valves are suited to their functions, and when correct grid bias is employed. Using a D.E.5B in the third socket with 80-100 volts on the anode, about 1½ volts negative bias should be applied to GB—1 terminal, whilst with a D.E.5 in the last stage, and 120 volts on the anode a negative bias on terminal G.B. — 2 of 4½ volts will be found to give satisfactory results. It is impossible to give the correct grid bias for all types of valves, and the author gives the above as examples, owing to the fact that such valves are in use with the receiver, and the voltages are as stated. In the case of other valves, the correct grid bias should be ascertained either from the maker's curves, or printed instructions.

GIFTED authors, or perhaps I should say other gifted authors, may have written thrilling stories of blood and passion with a wireless *motif*, but all I can say is that if they have I have not so far come across them. It seems to me that there is a gap here that ought to be filled, and this being the case I hasten to put before you my great new romance.

SHORT-CIRCUITED
or
TANGLED LEADS.

I should like to say by way of introduction that all rights are left and that the story may be dramatised and acted in public without fee or licence, or used, if you prefer



. . . grabbed both portions of the acid drop.

it, for wrapping up sandwiches on the same terms. All the characters are purely imaginary, and if anybody is misguided enough to identify himself with any of them, that is his funeral.

Characters in the Story.

RUPERT STRONGHEART, a rising young wireless engineer who has already obtained the highest honours in three postal courses. He is on the threshold of a wonderful career when his prospects are blighted by the villain (for details see below). Rupert is madly in love with

GWLADYS GUSHBINGLE, a beautiful and noble-hearted example of all that is best in Britain's womanhood (further particulars will be supplied on request by any of your friends who has recently become engaged. You can always stop him when you have had enough by dotting him over the head with a soldering iron). Gwladys has given her heart to Rupert, but the whole business is being badly messed up by

JASPER STONEFACE, a villain of the vilest kind, who has ground his teeth so violently all his life that they are reduced to mere stumps whilst his eyeballs are badly sprained owing to incessant rolling,

PROFESSOR STRONGHEART, Rupert's dear old father, who loves his boy and is resolved to stand by him through thick and clear when he is in the soup. And

PROFESSOR GOOP, a well renowned but absent-minded wireless inventor.

Synopsis of Previous Chapters.

Many years ago romance was weaving her fairy web round two young hearts in the old-world village of Little Sloshton. On the evening of his departure for school Rupert Strongheart broke an acid drop in two, giving one half to little Gwladys Gushbingle and keeping the other for himself. "Treasure your half," he said, "and I will treasure mine. They shall be tokens of our love." Hardly had the words left his mouth when a snarl was heard from behind the hedge, over which leapt the loathsome Jasper Stoneface who grabbed both portions of the acid drop, crammed them into his mouth and disappeared at top speed, pausing only to shake his fist in the direction of the young pair and to shout, "Foiled, Rupert Strongheart!" in a voice whose tones were made yet more unpleasant by adenoids. On the threshold of his great career Rupert proposed, and Gwladys, the local solo-whist champion, accepted automatically. Little did they know what tricks were awaiting them. Rupert obtained a splendid post with a great wireless firm. He rapidly rose to the position of right hand man of the general manager. Owing to the kindly offices of Rupert, Jasper, who could barely distinguish between impedance and reactance, was given employment by the same firm. The romance of Rupert and Gwladys appeared to be going as merrily as a dinner bell when the blow fell. During the annual stocktaking the firm's accountant discovered a terrible discrepancy, and before Rupert knew what was happening he was in the dock accused of embezzling six gridleaks. Both Professor Strongheart and Professor Goop were called for the defence as expert witnesses and did their best. The latter, however, had been called in two cases, and believing that he was giving evidence against his next-door neighbour, who was accused of howling, unintentionally denounced Rupert and diverted the whole of the court's sympathies from him. Rupert was convicted and sentenced to seven days' penal servitude. He was dismissed by the firm, and Jasper Stoneface was promoted to his position. Rupert enlisted in the Royal Engineers and, on account of his special knowledge, was drafted to the wireless section, where, having thoroughly steeled himself, he proceeded to carve out a career.

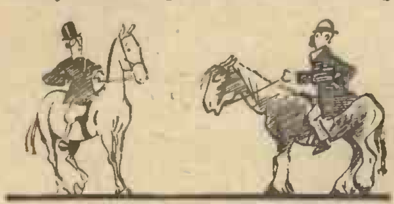
CHAPTER XXIII.

The snow was falling in great flakes, some as big as a shilling and others as large as fifteen-pence, upon the officers' mess of the 1729th Company, R.E. (and upon quite a number of other places as well), when the day dawned which

The smartest soldier in the British Army.

ushered in the memorable morning on which the never-to-be-forgotten Slocum-cum-Slushby meet of the Florn Draghounds took place. Colonel Dash-Spatterby, the gallant commander of the Sappers and also Master of the Florn, awoke feeling that yesterday had been Tuesday. This was quite correct since to-day was Wednesday.

At length, opening one eye, he observed a little notice neatly printed by the bell push, "Out of Order." "Ah, excellent Strongheart," he smiled, "always efficient, always efficient." He picked up a boot from beside his bed and lobbed it at the door. In an instant there entered Sapper Strongheart, the smartest soldier in the British Army, bearing tea and shaving



The cream of the countryside and some the skim as well.

water. Colonel Dash-Spatterby drained the former at a gulp and leapt from his bed. "A fine hunting morning," he cried. "It has frozen harder, I see, so that the going should be good." In a matter of moments he was attired in all his hunting finery, the scarlet coat with its carved pearl buttons, the yellow-spotted blue stock, the chessboard breeches, the glossy thigh boots and the gleaming gold spurs. As eleven o'clock drew on, the cream of the countryside, and a certain amount of the skim as well, came galloping to the meet on high-mettled Percherons, fleet-footed Clydesdales, and fleet Suffolk Punches. Rupert, wearing the full uniform of the hunt as the Master's second horseman, was upon the lawn operating a loudspeaker from whose spout issued hunting choruses specially transmitted from 2LO, in which all the guests joined. It was a brave sight. Hardly had the notes of the last song died away when the Master stepped out from the mess. Ringing cheers rent the welkin as he sprang into the saddle and leapt lightly over the table supporting the receiving set into the midst of the throng. "Where are we going to-day, sir?" asked one young spark. "Ah," cried the Master, "to-day we are to have a hunt indeed. Near Slocum-cum-Slushby we have harboured the famous drag that has been laying waste the countryside so long. To-day he shall pay for his misdeeds."

Chapter XXIV.

Fairest of all the splendid field that rode out that day and conspicuous for her fine horsemanship was Gwladys Gushbingle. But though she quitted herself nobly, heading the drag on no fewer than seven occasions, for which she received the Master's warmest thanks, her heart was not in the sport. She was wondering where her Rupert was, what he was doing, whether he was well. She had never so much as glanced at the Master's second horseman when he skilfully adjusted her cropper at the meet. Ah, me!

* * *

It was a long stern hunt that day for the Slocum-cum-Slushby drag with a disdainful flick of his brush had made for the stiffest part of the country. More and more saddles were emptied as the hunt went on. At length only three riders were left. Far ahead of the hounds and hard upon the brush of the drag was Gwladys Gushbingle, the long ostrich plume in her hat streaming out behind her as she flew fence or stream or gate. Behind came Colonel Dash-Spatterby and Rupert Strongheart showing what a model second horseman should be by never leaving his master for an instant and clearing every fence by his side.

* * *

At last a check, as welcome now as on Quarter Day. Scent has failed. Try as he will the Master cannot pick up the line. But stay. What is Rupert doing? From a pouch strapped to the front of his saddle he draws a pair of telephones and a tapping key. Above his head he raises an umbrella—the Master had laughed at him for carrying this instead of a hunting crop; he does not laugh now. He notices that a wire runs from Rupert's saddle to his horse's near foreshoe. "Hullo CQ," Rupert taps out, "has anybody seen our drag? Rupert Strongheart over to CQ." Rupert's face lights up. "He has just passed through Gopplesthorpe," he cries. "We must lift hounds!" thunders the Master. "Pick out the six best." Rupert does so and the Colonel helps him to place one under each of Gwladys Gushbingle's arms, takes a second pair himself and entrusts the last to Rupert. Thus the gallant three gallop like the wind for Gopplesthorpe where the hounds are dropped and pick up the line at once. The pace is a cracker now and soon the sinking drag is found not far ahead. In front gallops Gwladys down a woodland ride with Rupert close behind her. But what is that hateful slinking figure amongst the trees? Who is it that suddenly stretches a clothes-line tight across the ride? Nothing can save Gwladys. Yes, yes, something can; something does. Quick as a flash Rupert draws his revolver from its holster, and with unerring aim severs the line at a single shot. Jasper Stoneface, for 'tis he, in case you did not know, picks himself up and takes to flight, but trips over the pack just as they pull down the drag. In a moment all is confusion. The hounds are worrying the drag, and the drag, which is fastened round his knees, is seriously worrying Jasper. At last the hunted animal's eyes glaze in death, and Rupert prises open its horrid jaws. True to the teachings of his race Rupert lays his fallen foe tenderly upon a gorse bush, and borrowing the Colonel's cap fills it with water from a neighbouring ditch. The prising having been thoroughly well done Jasper's mouth is still open and into it Rupert pours the healing draught. Such is the shock of the unaccustomed beverage that Jasper opens his eyes at once and snatches the gasper from Rupert's lips.

Chapter XXV.

Meanwhile the Colonel is handing the brush to Gwladys with a courtly bow. This done he walks across to Rupert. "Kneel down!" he orders. Amazed, but ever obedient to authority, Rupert complies with the order. "That was a gallant deed of yours," cries Colonel Dash-Spatterby. And I will mark my appreciation in a fitting way." He intends to tap Rupert on the shoulder with his hunting crop, but his foot slipping, gives him a rather nasty whack on the funny bone. "Arise, Captain Strongheart," he said in clarion tones. "Captain Who?" mutters a sweet feminine voice. "Captain Strongheart," smiles the Colonel,

What was Rupert doing?

"Captain Strongheart, the smartest soldier in the British Army."

"Rupert!"

"Gwladys!"

Chapter XXVI.

And what of Jasper? Lying there he knew that he had got it in the neck and he reviewed his past—a messy business. "Rupert," he faltered, in a weak voice. "Gwladys." They went across to him, Rupert pressing him gently back into the bush from which in the last effort he was striving to raise himself. "I have wronged you," said the dying Jasper. "It was I who embezzled the gridleaks. I who . . ." His eyes closed. Rupert and the Colonel stood bareheaded. After a few moments the latter reverently wirelessed for the dust-cart. The Listener In.

What are Harmonics?

By Major JAMES ROBINSON, D.Sc., Ph.D., F.Inst.P.

The real significance of harmonics in wireless work is often not understood. This article explains the position very clearly.

THE word Harmonics has been very prevalent in wireless in the last few years. Sometimes we hear them discussed as if they are a nuisance, and at other times they are being employed for some useful purpose. Thus they have properties which need controlling or to be used with discretion.

Acoustical Effects

To understand the effect of harmonics in wireless it will be useful to consider the case of acoustics, where a very large amount of work has been done on harmonics. Most sounds with which we are familiar have certain characteristics, some of the characteristics being the same for different instruments which produce the sound. The first characteristic is the frequency of the sound which is heard. We can have notes of the same frequency produced by different instruments, but yet there are great differences in the quality of the sound which is heard. The reason for this is that there are usually many frequencies present in the same note, and when we talk about a particular note having a given pitch we refer only to one of the frequencies present, that of the lowest frequency, which also is usually of the greatest intensity. This is called the fundamental. Accompanying the fundamental there are usually a number of higher frequencies, these varying in relative intensity and in actual frequency. The number and relative intensity of these higher frequencies controls the quality and timbre of the note.

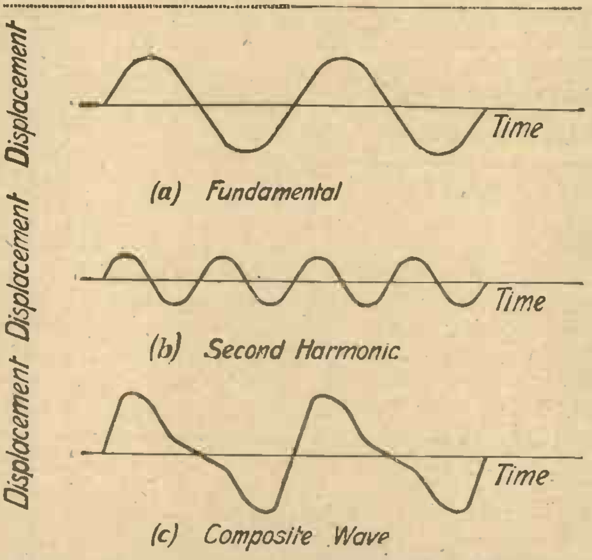


Fig. 1.—The addition of the second harmonic produces a complex waveform.

Overtones

In some musical instruments these higher frequencies are in an integral relation to the frequency of the fundamental, that is to say they are exactly 2, 3, 4, 5, etc., times the frequency of the fundamental, and when this occurs they are called harmonics. Cases arise, however, where these high frequencies are not exact multiples of the fundamental, and in such cases they are called overtones. Instruments which produce harmonics are string instruments, such as the violin and the piano, and certain wind instruments, while overtones are produced by instruments which have reeds and diaphragms, such as the harmonium and the drum.

Both types occur in wireless, but the harmonics are most prevalent.

Composite Waves

A simple wave can be represented by means of a curve as shown in the top line of Fig. 1, where we plot time along the horizontal axis, and displacement (voltage or current, as the case may be) along the vertical axis. At equal intervals of time the displacement is zero, and the whole curve is quite regular. This form of curve is due to simple harmonic motion, and is called a sine wave. The only musical instrument with a vibration somewhat of this form is the tuning fork, and its quality or timbre is, as we know, not good. Let us consider what happens if we add an oscillation to this simple oscillation of the same type, but of double the frequency. We can choose any amplitude for this frequency and a particular example is shown on the second line of Fig. 1. For convenience we have chosen the zero point of the main vibration to coincide with a zero point of the double frequency. The result is shown in the third line, and it is immediately obvious that the simple curve shown in Fig. 1 (a) has become distorted.

This combined curve thus contains two separate frequencies, the higher frequency being exactly double that of the lower frequency. It has been obtained by an actual combination of two curves. However, had we not known how the curve was obtained, there are means which make it possible to determine these two actual frequencies, and their relative amplitudes. In other words, this comparatively complicated curve can be resolved into its simple frequencies.

Other Frequencies

We can have combinations of still more frequencies by taking the fundamental, the double, treble and quadruple frequencies, etc., and combining them into one final result, and so we can obtain a large variety of curves each of which is then capable of being resolved into each of its separate frequencies. These complicated curves still possess a periodic nature in so far as they are reproduced identically time after time. Wherever we get such a periodic effect it is possible to resolve this into a combination of frequencies, these frequencies being actual multiples of the fundamental. In some cases we shall find some of these multiples absent.

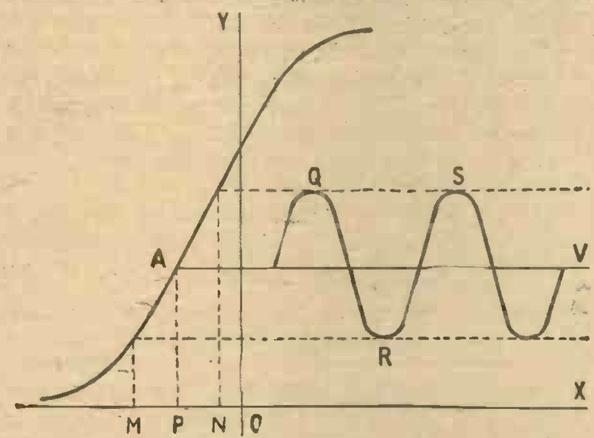


Fig. 2.—In order to produce a pure wave the valve must work on the straight line position of the characteristic.

These general principles concerning the combination of frequencies are of importance in acoustics, in electrical engineering, in wireless, and in other fields. We shall now consider the application to wireless.

One Frequency Only

As regards transmission it is essential to have only one frequency generated and transmitted. In this case we are not concerned with quality or timbre as in the case of acoustics, but it is important that there shall be no energy lost in the production of other frequencies. It is also essential that only one frequency shall be transmitted because of the interference that is caused by a number of frequencies. For instance, if we consider a high power transmitter which is working on a frequency of 30 kilocycles (10,000 metres) it is highly desirable that no higher frequencies shall be transmitted, and unless great care is taken these higher frequencies, 60 k.c., 90 k.c., 120 k.c. and so on, will accompany the fundamental frequency, and so interfere with services which are operating on or near these other frequencies.

The essential requirement for a wireless transmitter is that its wave form shall be of the simple type shown in Fig. 1 (*a*) and not of any more complicated type such as that shown in Fig. 1 (*c*). If the wave form deviates from that shown in Fig. 1 (*a*), but is still periodic, it is apparent from the preceding remarks that there are higher frequencies present, each of which must be an exact multiple of the fundamental. Depending on the amount of deviation of the actual wave form from that shown in Fig. 1 (*a*), we shall get more or less of these higher frequencies or harmonics, which may have large or small amplitudes in comparison with that of the fundamental.

Proportional Amplification

Actually it is not easy in transmission to make the wave form exactly of the type shown in Fig. 1 (*a*), but it is possible to approach fairly near to it. In the case of a valve transmitter the working point of the characteristic is all important in controlling the effect of the wave form. The correct working point to give the purest wave form is on the straight part of the characteristic. A particular anode current-grid volts characteristic is shown in Fig. 2 and the correct working point is at A, about halfway up the straight portion of the characteristic.

Now if the characteristic is actually straight over the whole portion over which oscillations are produced, a pure wave will result. The grid voltage is shown as varying on both sides of the mean potential P, to M and N, and the corresponding anode current variation is shown at Q.R.S. If the characteristic is straight over the whole working part, then equal changes of grid volts will produce equal changes of anode current, and a pure sine wave of anode current will result.

Distortion

Actually, however, in practice the characteristic is not absolutely straight, so that deviations from the pure wave form are produced. To show how distortion of the wave form arises, a rather exaggerated example is shown in Fig. 3. In this case where the mean grid volts is OP_1, and the variation is from M_1 to N_1, we get greater increase in the anode current when the grid volts change from P_1 to N_1 than decrease when the grid volts change from P_1 to M_1. The steady anode current corresponding to the grid volts OP_1 is represented by the line AV. Oscillations produced under these conditions thus give a wave form for the anode current $Q_1R_1S_1$ where the two halves of the curve about the line AV are different. This wave form thus differs from the pure wave form required

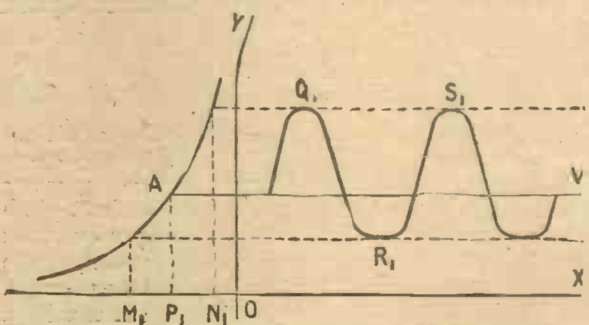


Fig. 3.—If the characteristic is curved the wave form is asymmetrical and harmonics are introduced.

Valve Adjustments

Various forms of deviation from the pure wave form of Fig. 1(a) can thus be obtained in an oscillating valve circuit, and each such distorted wave form has its own peculiar number of harmonics, with the relative intensities of the various harmonics varying according to circumstances.

Thus in valve transmitters, in order to keep the disturbing effect of harmonics down, it is essential to pay careful attention to the valve characteristics and to the adjustments of the transmission circuits.

The large transmitting stations working on low frequencies often give serious trouble with harmonics.

Interference from high power stations has been known to occur on very high harmonics greater than the 10th. The nuisance of this is that interference can be obtained on the comparatively high frequencies of the broadcasting band from stations on frequencies very much lower (of wavelengths of 3,000 metres and above).

Considerable assistance is derived by using coupled aerials at the transmitting station, and the disturbing effect of harmonics can be cut down in this way.

High power broadcasting stations are not always free from harmonic disturbances. For instance, the 4th harmonic of Daventry is very near to the frequency of the Newcastle station. Again, it is possible to hear the harmonics of the ordinary broadcasting stations on the B.B.C. band when working on higher frequencies in the neighbourhood of 5,000 k.c. (60 metres).

This is a point which those selfish people who allow their receivers to oscillate should note particularly, because they not only cause interference to their neighbours who are listening on the same frequency, but also those who are listening on some higher frequencies. Thus an oscillating receiver on a wavelength of 360 metres may cause interference on wavelengths of 180, 120, 90, 72 metres, etc.

Utility of Harmonics

The fact that harmonics generated by a valve in a closed oscillating circuit are absolutely exact multiples of the fundamental frequency is of very great importance in wireless measurements. An oscillating or heterodyne wavemeter becomes a very important instrument, as a large number of harmonics can be obtained with it. Thus if the wavemeter is set to any particular wavelength, say 1,000 metres, it can be detected on the various wavelengths, 500, 333⅓, 250, 200, 166⅔ metres, etc. This is exceedingly useful for calibration purposes.

It should be observed, however, that the overtones are only exact multiples of the fundamental in the case of oscillation generated by a valve, an arc or some such means. An ordinary aerial system possesses an infinite number of natural frequencies—a fundamental and a series of overtones. Except in the case of a simple aerial without either coil or condenser in circuit (a case which does not obtain in practice), these overtones are not true multiples of the fundamental. This, however, is a point which is not of much importance for ordinary working, since oscillations are usually supplied to the aerial from some external source, in which case the overtones are exact multiples of the fundamental.

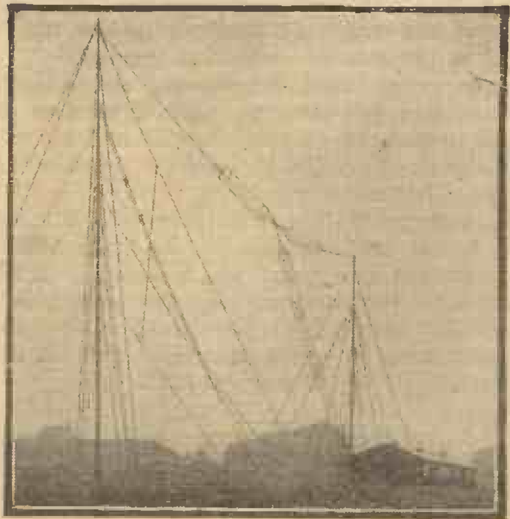
Not Correct

There have been rumours to the effect that the Sheffield Relay Station is to be closed down and that a new higher power station may be erected about twenty five miles north east of Sheffield. We understand that the B.B.C. deny that this is contemplated.

An Official Visit

The Rugby Radio Station (GBR) is now in full swing, and the Postmaster-General paid his first visit to the station on January 11th, when he witnessed the transmission of the foreign news service at mid-day. The transmissions are well received in Australia.

Television would actually appear to have been accomplished by Mr. J. L. Baird, who is to demonstrate his method shortly before the Royal Institution.



THE DUBLIN STATION

By
T. J. MONAGHAN B.Sc.(Eng.), M.I.E.E.

Mr. Monaghan is the Chief Radio Engineer of the Irish Free State Post Office, and was actively concerned in the design and construction of the new Dublin Station.

THIS is a scientific generation, and while even in comparatively recent times the general attitude towards scientific discoveries was distinctly conservative, nowadays the public is anxious to enjoy to the utmost, any new ameliorations of life that the march of science may reveal.

The studio at 2RN. Note that the Round-Sykes type of microphone is employed.

Public Welcome.

This readiness to welcome and utilise scientific development has been demonstrated in a remarkable fashion by the eagerness the public, the world over, has shown in greeting, and in taking to its hearths and homes, broadcasting. A very few years ago broadcasting did not exist; to-day one is tempted to misquote and say " to the building of broadcasting stations there is no end "; Europe and America are crowded with stations—so crowded that new problems, involving ethics, altruism and philosophy, rather than pure science, are beginning to clamour insistently for solution.

The most recent entrant to the European broadcasting ether band is a station owned by the Irish Free State Government and operated by the Department of Posts and Telegraphs, Dublin, 2RN, which made its official bow to Ireland and the world at large on January 1, and since has been giving regular evening programmes, using a wavelength of 390 metres.

Choice of Site.

When it had been decided that the site of the first Irish Free State Station should be in the neighbourhood of the capital city, the first task was to find a suitable site. The requirements of the ideal site are well known; high ground free from tall trees, remote from high buildings, especially those having steel frameworks, with the ground a really good " earth," and, let it not be forgotten, if possible, within the area of supply of a public electricity undertaking. The woes of the broadcasting engineer may not depress the public much, but they do exist, and no engineer responsible for a broadcasting station is at all anxious to have the additional load of running an electrical generating station added to his burden. Whilst it is not claimed that the site of the Dublin transmitter is ideal (ideals are seldom attainable in this work-a-day world) it can be confidently asserted that the site is an extremely good one.

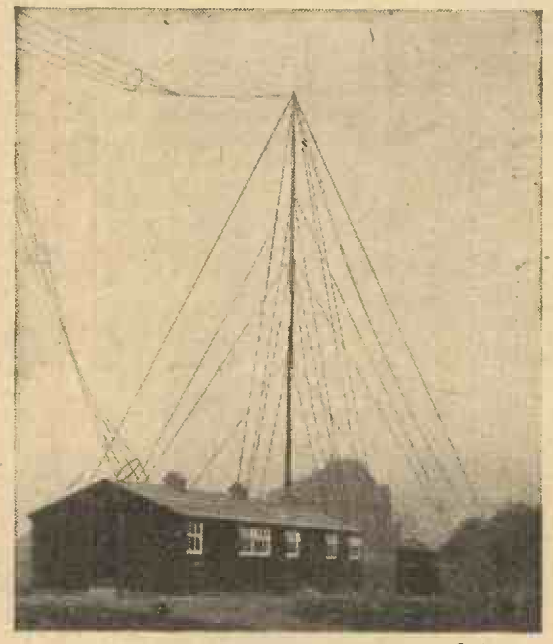
Good Situation.

Situated in a large field, adjoining McKee Barracks, and quite close to the Phœnix Park, the site is on ground as high as any in the city of Dublin, about 100 feet above sea-level, and the nature of the ground ensures a really good earth. The site is easy of access by the staff, a not unimportant consideration when the late programmes the public likes are given, and within the area of the City of Dublin Electricity Undertaking by which electrical energy at 346 volts, 3 phase, 50 periods, is supplied as the primary source of power.

The heading picture shows the general arrangement of the transmitting station. The transmitter building is the single storey one on the extreme right of the photo.

The Transmitter.

The transmitter is of the well-known Marconi Q type, with 6 k.w. A.C. power input and 1,500 watts oscillatory input to the antenna, and is housed in a wooden building about 60 feet by 20 feet. An involuntary shut down of a broadcasting station no doubt seems long to the listener, but to the station staff it is janus-faced; every second seems to be an hour while thinking of the waiting public, yet these second-hours flash by with appalling rapidity while searching for and remedying the defect. Since an open layout of the plant reduces the likelihood of faults and renders their discovery when they do occur much easier, particular care has been taken in the arrangement of the Dublin equipment to have all parts perfectly accessible. The building is divided into four rooms, housing respectively stores, rotating machinery, transmitter proper and filament battery.



The station building and one of the 120 ft. masts can be seen in this photo.

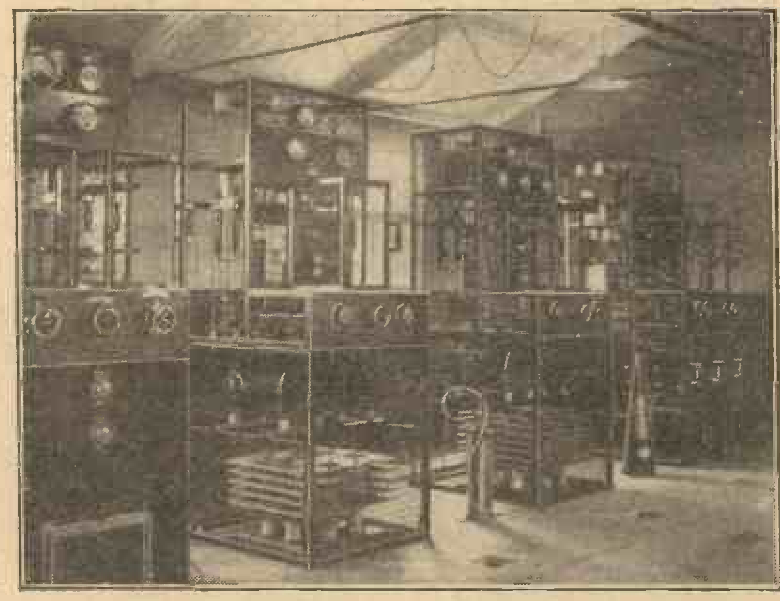
H.T. Supply.

The rotating machinery consists of a motor alternator delivering the 500 volt, 300 cycle, single phase, alternating current to the step up transformer, and a motor-driven direct current generator for charging the 24 volt, 500 ampere hour battery used for lighting the filaments of the oscillator and modulator valves. Duplicate machines were not installed at the outset, but the concrete foundations for a second set of plant were provided during construction. A view of the rotating machines and their control gear is appended.

In the next room is the transformer which steps up the 300 cycle voltage to 11,250 volts, which is fed to the first of a row of four panels or units of equipment, the rectifier unit, where the alternating current is converted to 10,000 volt direct current by means of two two-electrode rectifiers and suitable smoothing circuits.

Master Oscillator.

Alongside the rectifier is the independent drive panel which controls the wavelength of the transmitter and keeps it remarkably steady. Next comes the power oscillator unit which, controlled as to wavelength by the independent drive panel, energises the antenna. On the extreme right of our row of units is the modulator panel, with its sub-modulator valve, and three main modulating valves. The land lines over which the speech and music from the studio travel to the transmitter terminate at transformers on the modulator panel. A wooden railing normally runs the whole length of the room in front of the transformer and the transmitter units. The layout of the four transmitter units can be seen from the photograph on this page, which shows that there is ample space between the units and good natural light for daytime maintenance.



The various processes are carried out in separate and distinct units all adequately spaced.

The Antenna

The 500 ampere hour filament battery is housed by itself in a well ventilated room adjoining the transmitter.

The antenna is of the T pattern, each limb being 60 feet long, down-lead 100 feet. The limbs and down lead are all made up of 4 stranded bronze wires, equally spaced round the circumference of several duralumin hoops, 4 feet 6 inches in diameter. The antenna is supported by two masts 120 feet high, spaced 225 feet apart. The masts are of the usual ship type, in three sections, 70 feet, 45 feet and 30 feet; there is about six feet overlap between sections and the butt of the mainmast is buried about 10 feet deep. The masts were built up of ordinary telegraph poles taken from the local stock and were erected by the Post Office Engineering staff. Symmetrically placed with respect to the antenna is the main earth circle 70 feet in diameter, a continuous ring of plates, 2 feet 6 inches deep, buried vertically with their upper edges just flush with the surface of the ground. Buried earth wires fan out from the earth plate circle beneath and well beyond the spread of the antenna; the main earth connection of the transmitter passes through the wall of the building via a special insulator to insulators on the top of a short pole at the centre of the earth plate circle whence a cone of radiating wires makes connection to the earth plates. So much for the transmitter.

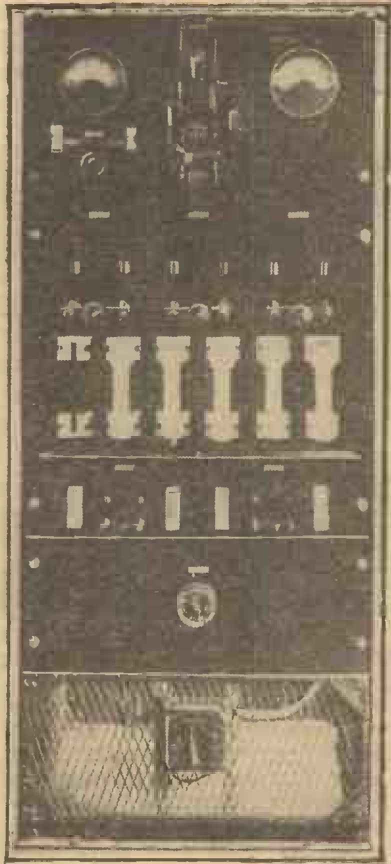
The Studio.

The Dublin Station is the fortunate possessor of a really good studio about 50 feet by 17 feet on the second floor of a building in Little Denmark Street, a traffic-free street quite close to the centre of the city. The walls and ceiling of the studio are draped with fairly heavy curtains all of which are adjustable so that any desired condition as to sound reflection effects can quite quickly be obtained. A spacious control room has a large double plate glass window through which all parts of the studio can be seen by the operator of the amplifiers, which step up the microphone output before it is put on the underground cable leading to the transmitter, distant about 1¾ miles away as the crow flies. The photo clearly shows one end of the studio; behind the microphone (which like all good sitters faces the camera for this photograph—actually, of course, the business end "faces the music") can be seen the control room observation window. Adequate visual signalling arrangements between the announcer and the control room are installed. Alongside the studio is a waiting room for the artistes, while on the floor above are offices for the Station Director and his staff.

Reports of Reception.

Many reports of reception of Dublin's transmission have been received since the station went "on the air"; we are grateful to listeners who have been so good as to write to us from Norway, Germany, Italy, Spain, France (reports of excellent reception in Paris are quite numerous), North-East Scotland, and all parts of England and Wales. At the moment we are busy collecting information from our Irish listeners, and, with some trepidation be it said, seeking to discover whether we have any home "blind spots."

That Irish Free State broadcasting will extend and develop is certain; the exact form that development will take cannot yet be definitely stated, but while this is being decided, 2 RN will welcome reports of reception from listeners wherever they may be.



The switchboard controlling the filament battery.

A view of the machinery room at the Dublin Station.

A Valve-Crystal Receiver.

SIR,—Having a few spare parts by me I decided to try the set described in the May, 1925, issue of MODERN WIRELESS, under the title "An Interesting Valve-Crystal Receiver," by Harold H. Warwick. I built the set on a panel 9 in. by 6 in., using a cheap variable condenser ·0005 μF, not square law, Peerless rheostat, General Radio transformer, Dubilier fixed condensers, and no C.A.T condenser.

Using a Marconi D.E.R. valve and 60 volts H.T., I received the following stations:—Daventry and Nottingham, 50 and 17 miles distant respectively, on a small loudspeaker at good strength for an ordinary-sized room.

All the B.B.C. main stations and two relays have been received at very good phone strength, and of the Continental stations I have received the following at very good phone strength:—Radio Paris, Koenigswusterhausen, Hilversum, Voxhaus Berlin, Munich, Frankfurt, Barcelona, Catalana, Ecole Superieure, Toulouse, Rome, Breslau, Munster, Hamburg, Madrid, Oslo, Petit Parisien, San Sebastian, Dortmund, Brussels, Elberfeldt. I have also received other Continental stations, but I have not identified them. I received these stations during two weeks' experimenting, so I think this speaks wonders for such a small set. I have not yet received KDKA, as the designer did, but hope to in the near future.

Thanking Mr. Warwick for such a splendid article and also Mr. John Scott-Taggart for a splendid circuit and for many others.—Yours truly,

W. STORER.

Loughborough.

Have you heard Boundbrook?

The new Boundbrook (New Jersey) Station, W.I.Z, is now operating on 100 and 455 metres. The input to the oscillators is 50 kilowatts.

The carrier wave is received well in this country, but so far reports of successful reception are lacking.

Resistances of Incandescent Lamps

These curves will be useful when using lamps as series resistances

IN connection with the unit described in the last issue for providing high-tension voltage from D.C. mains, the question of the lamps employed in series with the smoothing valve is one of considerable importance. The problem is somewhat complicated because the ordinary rating of the lamps employed in practice is not of very much assistance in determining their suitability.

Effect of Temperature

In the particular unit in question the lamps run at a much lower temperature than normal, and in such cases the resistance of the filament is substantially different from that at the normal white heat. In order to facilitate calculations on this subject, therefore, the resistances of a large number of lamps have been measured at varying currents. In actually working out the value of lamps required, it is more useful to know the actual voltage developed across the lamp when it is carrying a given current. This figure, therefore, has been plotted against the current for six different types of lamps.

Types of Lamp Measured

The lamps on which measurements were made are as follows :—

No. 1.—25 candle-power carbon filament lamp 220 volts.

No. 2.—50 candle-power carbon filament lamp 220 volts.

No. 3.—40 Watt metallic filament 220 volts.

No. 4.—60 Watt metallic filament 220 volts.

No. 5.—100 Watt metallic filament 220 volts.

No. 6.—60 Watt gas-filled metallic filament 220 volt.

In every case more than one lamp was tested. There were slight deviations from lamp to lamp in one or two of the cases, but generally speaking good uniformity was obtained among different lamps of the same type.

An Example

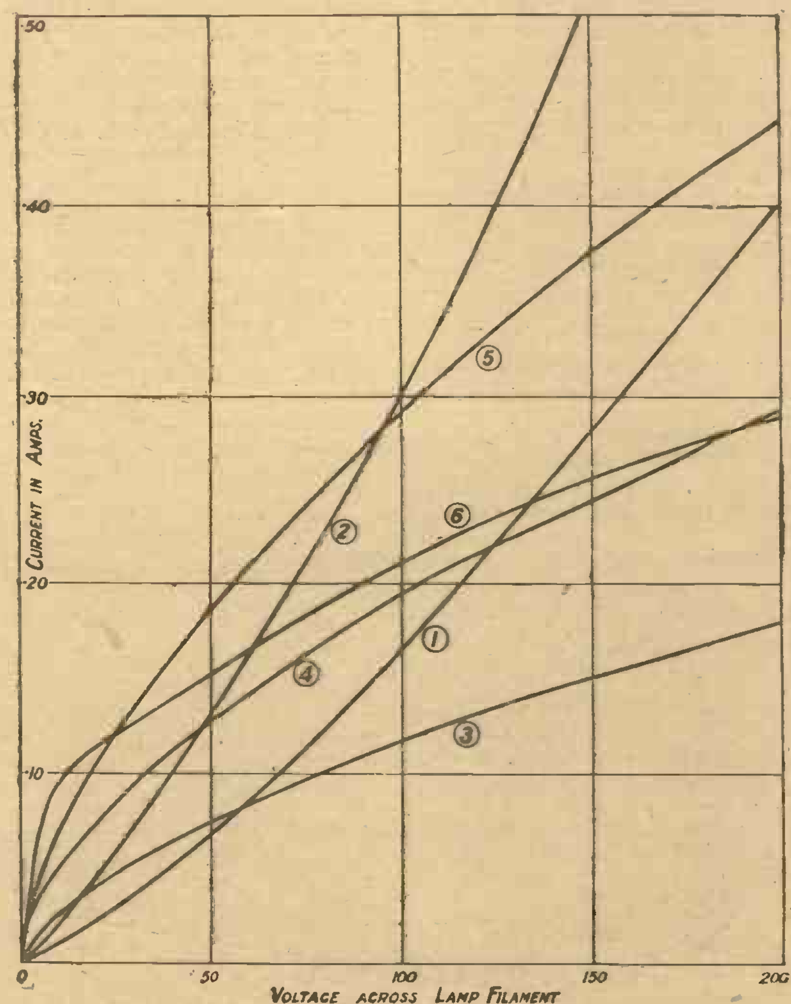
The use of these curves will be best understood if a simple example is given. Suppose we wish to run a B4 valve from 220 volt mains. Six volts are required for the filament, so that we have 214 volts to dissipate through the lamps. The current taken by the filament of the B4 valve is 0·25 amps., and reference to the curves will show that no single lamp develops 214 volts across it at this current. We must therefore use a combination of two lamps, and inspection will show that curve No. 1 has a voltage of about 135 volts across it at ·25 ampere, while curve No. 5 develops a voltage of about 80. Thus the voltage across the two lamps in series would be 215 volts, which would be of the order required.

Other Arrangements

The slight discrepancy between the required voltage and the actual voltage developed at this current is not of importance because in practice the current through the combination would adjust itself to a steady state, the current through the lamps and the valve being actually slightly less than ·25 ampere. Another satisfactory combination would be two 50 candle-power carbon lamps, curve No. 2, in series with a resistance of about 150 ohms.

Several Valves in Series

If more than one valve is required the problem is slightly modified. *E.g.*, four B4 valves in series, when the voltage required across the valves will be 24 volts instead of 6, so that the voltage developed across the lamps is required to be 196 volts. The actual combination of lamps required in this voltage can then be found in the same manner as before.



These curves show the voltage developed across different lamps when carrying a given current.

The "NEW-DAYS" CRYSTAL SET

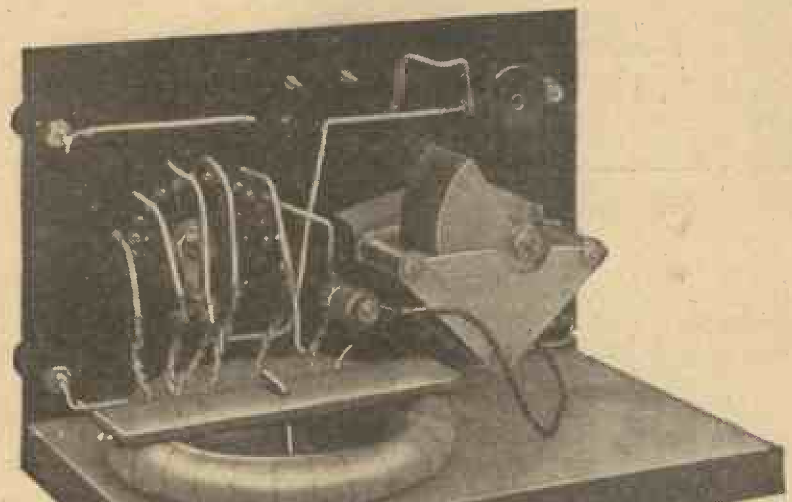
By PERCY W. HARRIS, M.I.R.E.
Assistant Editor

The circuit incorporated in this receiver is one which can rapidly be adjusted to suit a variety of aerials.

THERE is rarely any magic in a new crystal set. Every now and again we read wonderful stories in the non-technical papers of some new crystal receiver built by a humble expert for a few shillings which is able to work a loud-speaker at full volume (using no batteries or amplifiers) twenty or more miles from a broadcasting station. It is strange that whenever a really competent observer wishes to hear these wonderful crystal sets, the conditions that night happen to be particularly bad and the results are " nothing like so good as they were last evening."

A Departure

This is by way of being a preliminary to the statement that the " New-days " crystal receiver is not put forward as a means of revolutionising radio reception. The virtues I claim for it are just a signal strength somewhat above the average, a selectivity much higher than usual, rather an interesting new circuit, and a really businesslike and professional appearance. The total cost of construction will not be excessive, for although a special switch (not generally found in crystal sets) is included, the cost of this is saved in the coils, for neither Daventry nor the local station requires the purchase of a special tuning coil, as the requisite inductances can be made at home very rapidly and efficiently at the cost of a few pence.



This photograph of the inside of the set will prove helpful when wiring up.

The Circuit

I have called this receiver the " New-days " set, as it represents several points of modern practice which differentiate it from earlier crystal sets and it enables a good

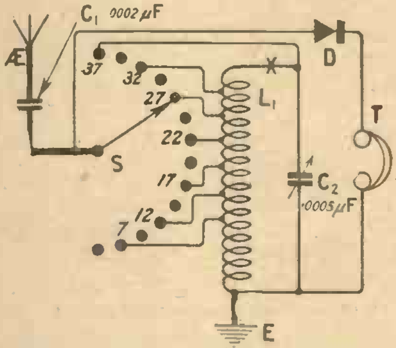


Fig. 1.—This diagram shows the circuit employed. The Daventry coil is inserted at the point X when desired.

working adjustment to be found for the particular aerial with which it is used. In the past we have been liable to overlook the electrical differences between aerials, and it is now recognised that not only is it unnecessary to place the crystal detector across the whole of the tuning inductance (thus introducing quite a considerable damping, with a consequent flattening of the tuning), but it is usually also distinctly advantageous to tap the aerial across a portion of the coil only. The circuit used is one I put forward, as a result of some experiments, some weeks ago in *Wireless Weekly*. It is shown in Fig. 1. Here it will be seen that both aerial and crystal are shunted across only a portion of the inductance, simplicity being effected by joining the aerial lead and the detector to the switch S. There will be several tuning positions for your broadcasting station according to the switch point adjustment, and one of these will give the best

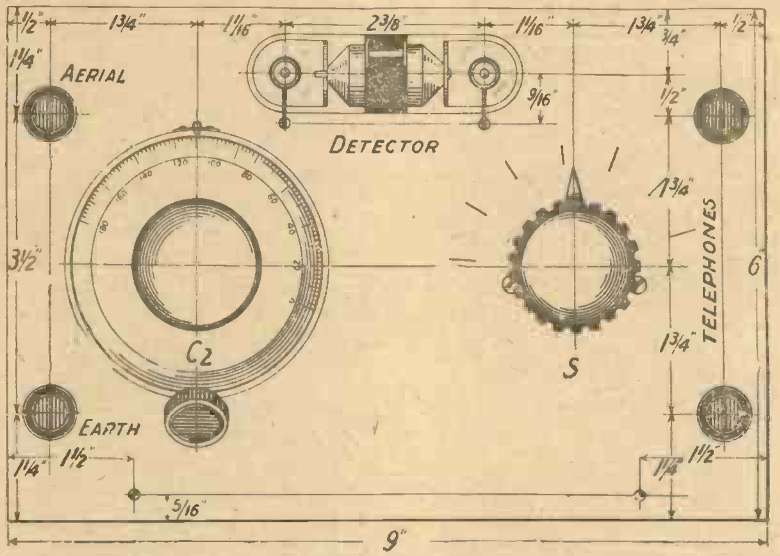


Fig. 2.—The layout may be seen from this diagram. The contacts of the switch are behind the panel.

results on your particular aerial. The series condenser in the aerial lead has a value of ·0002 μF. and has been placed there as the result of experiments made by Mr. G. P. Kendall, and described in *Wireless Weekly*. Experimenters may care to try short circuiting it.

Components Required

It may seem strange to some readers to see a variable condenser with a vernier adjustment used in a crystal set, but on some points of the switch the tuning is so sharp

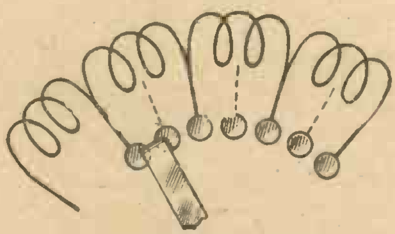


Fig. 3.—Alternate studs of the switch are left blank in order to prevent sections of the coil being shorted by the switch arm.

that many people will find it an advantage. The set would work just as well, of course, with the ordinary type of condenser without vernier, but the adjustment would not be quite so easy. The components used in this set are as follow :—

1 Oak cabinet to take an ebonite panel 9 ins. by 6 ins. (Artcraft.)
1 Ebonite panel to fit, ¼ in. thick. (Paragon.)
1 Rotary crystal detector. (Eureka.)
1 Panel mounting switch. (King Radio Products.)
4 Terminals, marked "Aerial," "Earth," and "Telephones." (Belling-Lee.)
1 ·0005 μF. square-law condenser with vernier attachment (Utility).
1 Fixed condenser, ·0002 μF. (Watmel.)
About half a pound of No. 18 S.W.G. double cotton covered wire.
About half a pound of No. 22 S.W.G. double cotton covered wire.
4 Clix.
Glazite wire for wiring up.
A few yards of Empire tape.

Notes on the Switch

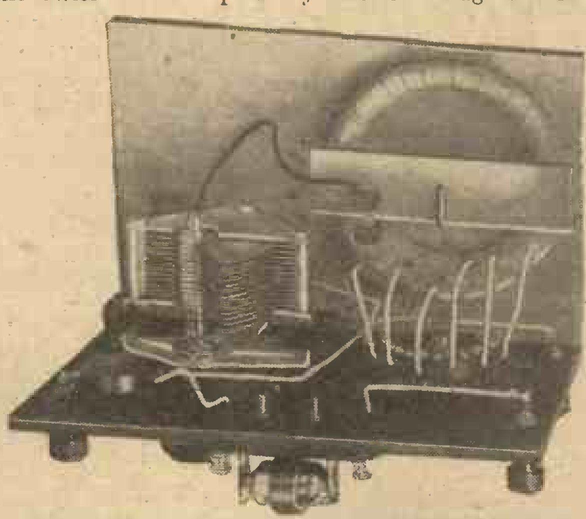
The components listed above are those I have actually used in the set, although it is possible to employ alternative makes of components to those given without sacrificing efficiency, providing, of course, the substituted components are of good quality. In the case of the switch, however, this particular type saves a great deal of trouble to the constructor, for it is mounted on the panel with only two securing screws, the switch-arm and studs being very conveniently mounted behind the panel. It is just as easily fitted to the panel as a variable condenser, and it is quite unnecessary to solder any connections to it, as a securing screw for the wire is provided for each stud. Actually the switch in question has fourteen studs. Of these I have used alternate studs only, for in this manner it is possible to avoid short circuiting any turns as the switch-arm passes from one stud to another. Remember this if you are intending to use another kind of switch.

Use of Alternate Studs

It might appear to be more advantageous to use each stud, thus giving a finer tapping division, but if you examine Fig. 3 you will see that if all the studs were used a complete section of the coil would be short-circuited when the switch-arm happened to be touching two studs at once. The presence of a short-circuited section of this coil may seriously affect its operation and should be avoided. If you use the "Utility" condenser illustrated, you will find full particulars as to how it is mounted in the maker's leaflet in the box. The switch mounting is also very easily effected.

Winding the Tapped Coil

When the four terminals, the switch, the condenser and the detector are secured in place, it is only necessary to attach the ebonite panel to the baseboard by two wood screws. The baseboard will be provided with the cabinet and will probably be thick enough to afford



The tapped coil is secured to the baseboard by means of a piece of wood and a suitable brass screw.

sufficient support without the use of any special brackets. Before proceeding further, it is now necessary to wind the two tuning coils, one for the ordinary broadcast range and the other for Daventry. For this take a cardboard tube, or any other similar cylindrical object of about 3½ ins. in diameter, and wind, not too tightly on it, seven turns of wire. Holding the seventh turn in place, twist a small loop so as to form a projecting tapping and carry on for another five turns, making a tapping at a point on the coil just in advance of that at which you have made the first loop. Carry on again for five turns, make a similar loop and so on until you have six loops, five turns apart. From the sixth loop carry on with another five turns, leave a small projecting piece, and cut the wire. Slide the coil off the former, and temporarily secure the end of the wire to the coil with cotton or string, leaving about an inch of the end projecting beyond the string. The beginning of the coil should also project about an inch, so that you will have six loops and two projecting ends.

Finishing the Coils

The next step is to place the coil in a warm oven for about half an hour to dry up the moisture in the cotton covering and wind round it the Empire tape, making sure that the turns of tape are tight and that each turn overlaps the previous one by about ⅛ in. As you come to the loops, allow them to project through the tape. When

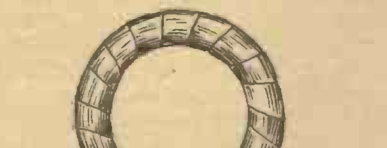


Fig. 4.—A Clix plug-socket is attached to each end of the Daventry coil for connecting purposes.

you have completely covered the coil with tape secure the end with a touch of suitable adhesive—such as Seccotine—and lay the coil aside. For the Daventry coil wind 100 turns of No. 22 wire round a 2 in. tube (or similar object, such as a tumbler of about this diameter) there being no need to take tappings. Dry the coil and wind tape around it as before.

Final Construction

In winding these two coils do not trouble to make them in a single

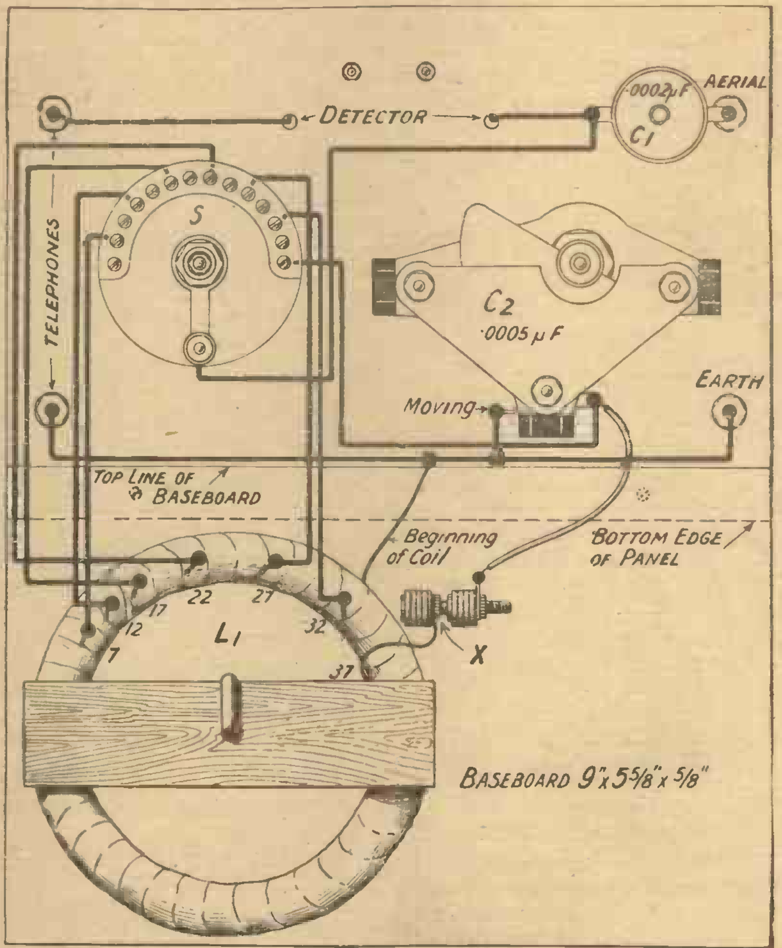


Fig. 5.—The wiring of the receiver will present no difficulties if this diagram is carefully followed.

layer, but wind them in what may be termed "hank" form so as to produce a coil of circular section. With both coils made, remove the cotton insulation from the ends of the tappings on the first coil, lay the coil with the tappings on the baseboard and secure it in place with a piece of wood held down by a brass screw of some kind. Do not use an iron or steel screw. I have used a brass dresser hook to secure my own coil. The wiring up is quite simple if the diagram is followed. Solder the connecting wires to the coil ends and loops. Mark the front panel to show the positions of the "live" switch studs.

Operating the Receiver

Aerial, earth and telephones are connected in the usual fashion, the switch arm being placed upon about the middle stud and the condenser turned backwards and forwards until the local station is heard. If you hear nothing adjust the crystal detector and try again. Once the crystal detector is adjusted you can experiment to find which is the best stud on which to work. Every new stud tried will require a different tuning position of the condenser. You will find that the fewer turns included in circuit with the aerial and crystal detector, the sharper will be the tuning. For the reception of Daventry it is only necessary to open the two clix terminals shown and to connect in series the Daventry coil, which should have attached at each end a clix terminal for the purpose. For this station the switch must be placed on the first stud.

A CORRECTION.

In two lists of components, on pages 446 and 457 in our January issue, the manufacturers of T. C. C. condensers were given as The Telephone Condenser Co. This should have read The Telegraph Condenser Co.

Is neutrodyning the same thing as reversed reaction? If not, where does the difference lie? Read this interesting article.

Split Coil Methods of Neutrodyning

By
J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

VARIOUS methods of neutralising the effects of valve inter-electrode capacity in high-frequency amplifiers have been devised and tried out. In fact practically every high-frequency circuit which is designed to-day incorporates some arrangement for neutralising the valve capacity. There is an increasing tendency to employ for this purpose coils having a tapping at the electrical centre of the coil, and this practice has much to commend it in view of the symmetry of the resulting arrangements.

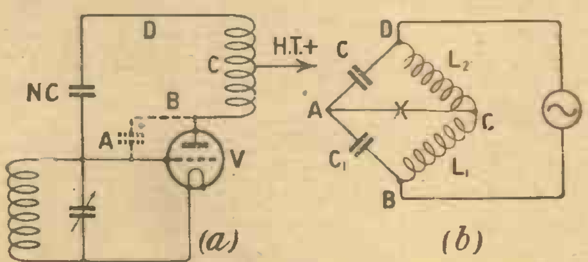


Fig. 1.—A true neutrodyne arrangement resembles a bridge.

There are, however, some difficulties which will have been encountered by experimenters in this direction, and it is proposed in this article to review the various methods which may be employed and to indicate how many of the difficulties may satisfactorily be overcome. In following the arguments put forward a brief statement of the principles involved will be of assistance.

The circuit shown in Fig. 1a is a skeleton type of circuit employing a neutralising circuit. We have a tuned grid circuit and a coil in the anode circuit which may or may not be tuned as required. The centre point of this coil is tapped and connected to the H.T. battery, while the extreme end of the coil remote from that connected to the anode is connected to the grid through a suitable neutrodyne condenser.

A Bridge Arrangement

The circuit is redrawn in Fig. 1b, from which it will be seen that the arrangement resembles a bridge. One half of the bridge contains the grid to anode capacity of the valve and one half of the split coil. The other half of the bridge contains the neutralising capacity and the other half of the split coil. The point C, which is connected to the high-tension battery, is thus at earth potential as far as high frequency oscillations are concerned, so that the grid circuit is across the points A and C.

It will be obvious that if the bridge is symmetrical, then any variation of voltage across the points BD will produce no effect across AC. This means to say that the voltages developed across the coil in the anode circuit cannot produce any voltage across the grid and filament of the valve, so that there will be no feed-back.

Very Small Capacity

From this consideration, it will be obvious that the product $L_1 C_1$ must equal $L_2 C_2$. Many of the methods of neutrodyning which have been employed utilise a smaller coil for L_2 than for L_1, and in this case the condenser C_2 must be proportionately larger. In the particular case under consideration, however, where we are employing a split coil, L_1 and L_2 are equal, so that C_1 and C_2 must also be equal. C_1, of course, is the inter-electrode capacity of the valve itself, which is of the order of 10 micro-microfarads only, so that C_2 must be very small, considerably more so than with many of the methods which have hitherto been used.

Now the coil in the anode circuit may either be the primary of a transformer, or the circuit may be arranged as a tuned anode. I shall deal in this article exclusively with the tuned anode arrangement, as there are several interesting combinations which can be evolved. The obvious circuit embodying this principle is that which is shown in Fig. 2. Here the coil in the anode circuit has been tuned and the anode of the valve is connected through a condenser to the grid of the succeeding valve, a suitable leak being taken to the filament through an appropriate grid bias battery. The centre point of the coil is connected to H.T. +, the

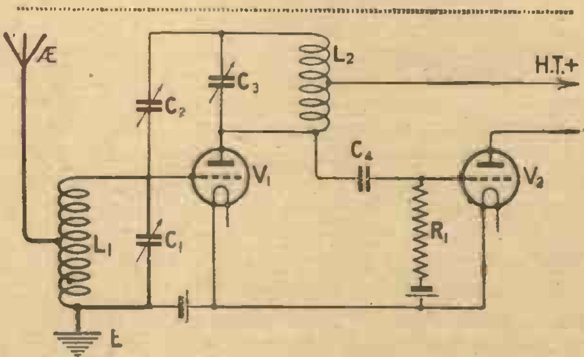


Fig. 2.—This circuit is symmetrical, but may give rise to certain secondary effects.

remote end of the coil L_2 being connected to the grid of V_1 through a neutrodyne condenser.

Symmetry Desirable

It should be observed that the arrangement shown in Fig. 2 is perfectly symmetrical. This being the case, it is possible to obtain a suitable adjustment for the neutralising condenser such that the circuit will then remain stable over the whole tuning range of the condenser C_2. Moreover, the circuit will still remain neutralised even if the coil L_2 is changed for one covering another frequency band. This is a most desirable property, and is one which can only be obtained with a symmetrical arrangement such as that shown.

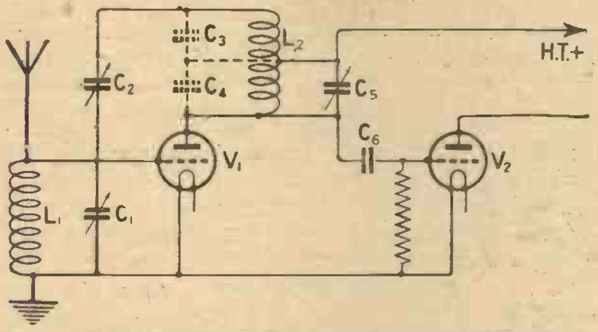


Fig. 3.—This circuit is not symmetrical and trouble may arise from this cause.

Some readers may have experienced difficulty with this type of circuit, due very often to the production of parasitic oscillations at frequencies other than that being received, but with suitable precautions these troubles may be eliminated. This trouble will be referred to later.

Tuning Half the Coil

In order to overcome such trouble, recourse is sometimes made to a circuit such as that shown in Fig. 3, where only half of the anode coil is tuned. Such a circuit certainly tends to eliminate the production of any parasitic frequencies, but it numbers several disadvantages. In the first place the symmetry is destroyed with consequent loss of such advantages as accrue from this cause, while, secondly, the arrangement is liable to become unstable towards the bottom end of the condenser scale. Obviously if the tuning condenser is completely removed then the coil is simply tuned by its own self capacity, which is evident across both halves of the coil. The tuning capacity, however, is only introduced across half the coil, thereby destroying the symmetry and causing instability.

Not True Neutralisation

There is no doubt that such circuits do function and that very good results can be obtained with them. It is not, however, a true neutralisation of the valve capacity, but is rather of the nature of a negative reaction. This point is accentuated by the fact that magnetic reaction is often obtained due to stray fields produced by the disposition of the circuit, and this has also to be neutralised by an increase in the value of the neutrodyne condenser. It stands to reason that such an arrangement is more liable to instability and is more prone to give peculiar effect than one which is essentially based on a symmetrical balance.

Several Stages

The problem becomes a little more difficult where two or more stages are employed. Fig. 4 shows a circuit in which two stages of tuned anode coupling are employed using the split coil arrangement similar to that shown in Fig. 2. Now this type of circuit is prone to a curious and somewhat puzzling effect due to the self oscillation of one half of the coils only. The lower half of L_2 is connected between the grid of V_2 and HT+. Since this latter point is substantially at earth potential, this portion of the coil is connected in effect across the grid circuit of the valve V_2. The anode circuit of this same valve, however, contains the lower half of the coil L_3. Since the coils are similar the two halves of the coils will be approximately tuned and will oscillate at their own natural frequency.

Parasitic Oscillations

For a coil suitable for the broadcast band, this frequency is of the order of 4,000 to 5,000 kilocycles (corresponding to wave lengths of 75 and 60 metres respectively). This oscillation therefore takes place independent of the signal being received and does not give rise to any of the usual heterodyning effects, the principal symptom of its presence being a marked decrease in the signal strength of the particular station being received.

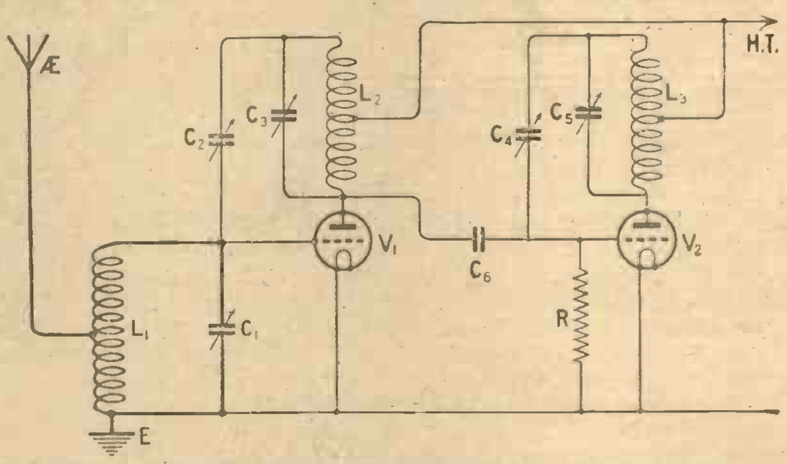


Fig. 4.—Difficulties arise in this circuit due to the presence of parasitic oscillations.

The defect may be overcome in several ways. One method is to adopt a scheme somewhat similar to the T.A.T. scheme employed in pre-neutrodyne days by Mr. John Scott-Taggart. The second coil is not centre tapped like the first one, but the H.T. connection is taken to the end of the coil. It is still necessary to neutralise the capacity effect of the valve V_2, and this may conveniently be done by connecting a neutrodyne condenser between the anode of the valve V_2 and the end of the coil L_2. The circuit then becomes as shown in Fig. 5 and the circuit is quite stable. A third stage of high-frequency coupling may be employed as shown in Fig. 5, in which case the split coil connection can be used for the third tuned anode.

In this way a perfectly stable amplifier may be built up which possesses all the advantages previously mentioned, principally that of remaining adjusted over the whole band and also remaining stable if the coils are changed to those suitable for another frequency band, always assuming that the coils are accurately matched and that the centre tappings are correctly taken in each case. This method is one which has been developed and patented by Messrs. McMichael, Ltd.

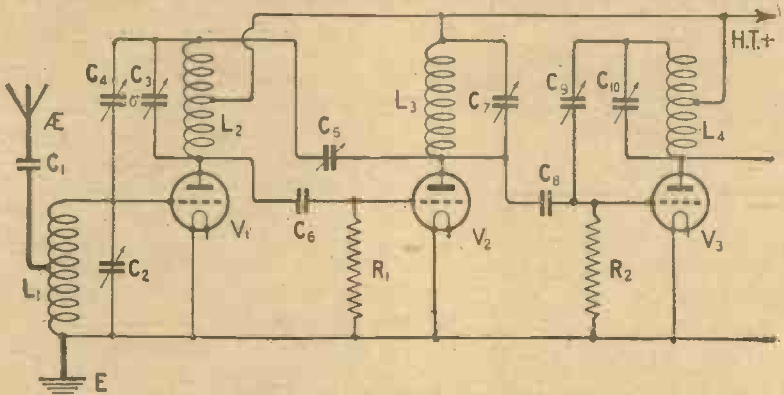


Fig. 5.—The troubles experienced with the circuit in Fig. 4 may be overcome by not employing a tapped coil for the second stage.

Another Arrangement

Another very interesting circuit employing a split coil in the anode circuit of the valve is that shown in Fig. 6. Here a series tuned anode arrangement is adopted. The coil in this case is completely broken in the middle, and a condenser is inserted. One half of the coil is connected between the anode and the H.T. + the other half being connected between the negative of the filament and the grid of the succeeding valve V_2. The condenser C_2 is connected across the whole coil, and if the condenser C_5 is made large, it will have no appreciable influence on the tuning of the circuit. Neutralisation of the capacity of the valve V_1 is effected by the condenser C_3 and of the valve V_2 by the condenser C_4.

A Similar Trouble

If two such circuits are employed in succession, we obtain a similar difficulty to that experienced in Fig. 3. Such a circuit is shown in Fig. 7. Here L_3 is in the grid circuit of the valve V_2 and L_4 in the anode circuit and these two, being similar, will produce a spurious high-frequency oscillation. This may be cured in various ways as in the previous case. One satisfactory way of doing it is to add a very small capacity across L_4 which is sufficient to throw the two circuits out of tune so that the oscillation is thus obviated. A similar condenser is also desirable across L_2. This condenser need only be 10 or 20 $\mu\mu F$, in fact the smaller it can be made the better. It has the disadvantage of increasing the effective resistance of the circuit slightly, but the effect is small if the parallel capacity is kept low.

Another method of overcoming the difficulty is to use a plain tuned anode circuit for the valve V_2, so obtaining a sort of T.A.T. scheme as in the previous case. Such a circuit is shown in Fig. 8. The third valve may either be arranged to act as a detector or may include a third stage of high-frequency amplification, the anode circuit of the valve being exactly similar to that of V_1.

Obviously the method of shunting a small capacity across a part of the coil in order to check the spurious oscillation may be applied to the previous type of circuit such as was shown in Fig. 3.

Centre Tapped Coils

It will be seen from these few remarks that the applications of a coil having a centre tapping are very numerous. At the request of Mr. Harris, Messrs. Gambrells have been making coils with a tapping at the electrical centre for some considerable period. Another coil which is particularly applicable to this type of work is the new Dimic coil manufactured by Messrs. McMichael. This coil is arranged to have the two halves accurately matched and the ends are brought out to four springs which fit into special clips. The particular advantage of this type of coil lies in the fact that it is possible to separate the two halves of the winding completely if it is so desired, thus enabling the circuits shown in Figs. 6, 7 and 8 to be constructed with the minimum of difficulty. The coil, incidentally, is of low-loss construction and has quite a low high-frequency resistance for a coil of its size.

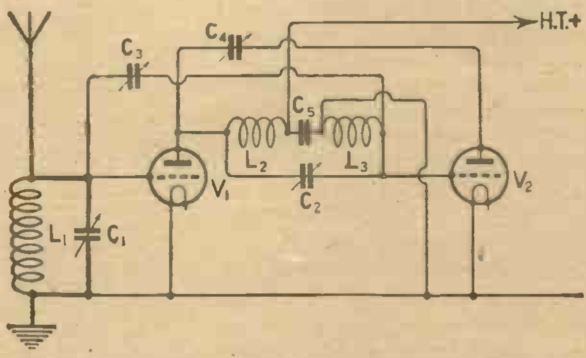


Fig. 6.—In this case a type of series tuned anode is employed.

Stray Magnetic Coupling

I pointed out earlier that there were many advantages to be derived from the use of a perfectly symmetrical arrangement such as those which have been described. In trying these circuits it should be remembered that the neutrodyne condenser required for efficient operation is quite small, and in fact is below the minimum of some of the standard types of neutrodyne condenser now marketed. Difficulty may be experienced due to stray magnetic coupling between the various coils in the circuit, and no little trouble should be taken to avoid such coupling. If magnetic coupling is present then stability can only be obtained by increasing the value of the neutrodyne condenser so that sufficient negative feed-back is obtained to counteract the defect of the magnetic reaction. It will be obvious that if this has to be done the circuit cannot be expected to remain adjusted over the whole band of frequencies, and therefore when laying out the circuit particular care should be taken to avoid stray magnetic couplings where possible, so that true neutralisation of the valve capacity only is all that has to be obtained.

Reaction Effects

The practice of using the neutralising condenser to obtain reaction is also one which is not strictly desirable. It is far better to neutralise the circuit accurately, and if a symmetrical type of circuit is employed this neutralisation then holds good even if the coils are changed. Reaction may definitely be introduced upon one of the later stages in the receiver. It is then completely under control without affecting, in any way, the stability of the receiver. Another valuable property of such an arrangement is that, even if the circuit in question is allowed to oscillate, it will not cause any interference on the aerial circuit provided that the preceding high-frequency stages have been correctly neutralised.

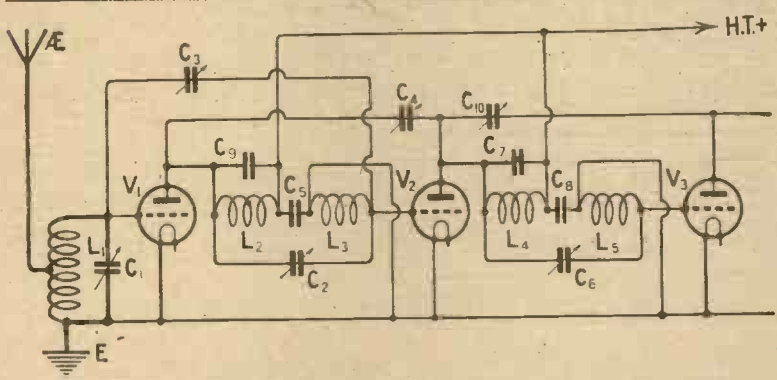


Fig. 7.—Parasitic oscillations in this circuit are checked by the condensers C_7 and C_9.

Other Methods

Neutralising is by no means fully appreciated by many amateurs. Stability in high-frequency amplifiers can be obtained, and often is, by means of reverse reaction, which is often spoken of as "neutralising." The difference between a reverse reaction receiver and a correctly neutralised receiver, however, is very marked, and I would strongly recommend experimenters to adopt methods which enable correct neutralisation to be employed, when a much more satisfactory receiver will result.

The methods described in this article are by no means the only ones, and several interesting circuits have been devised by the Radio Press Laboratories which will be described in a further article. In particular, trouble is often obtained with parasitic oscillations even when only one high-frequency valve is employed, and I shall give methods for counteracting this effect.

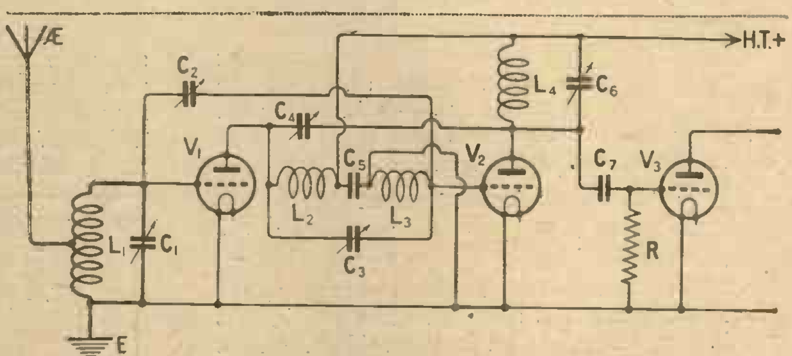


Fig. 8.—The series tuned anode may be followed by a plain parallel arrangement.

TESTING OF READERS' SETS DISCONTINUED.

The Radio Press Laboratories will in future confine their activities principally to the development of new designs and inventions which will be published in our journals. The testing of readers' sets will cease until further notice.

This testing work, while applied only to a relatively small number of sets, is exceptionally costly, and it is felt that devoting extra space and staff to experimental and design work will be to the great advantage of our readers.

Sets, of course, will continue to be on view at our Bush House offices, and if the efficacy of any of our sets is ever challenged, we shall continue to be happy to demonstrate the results at our Elstree laboratories.

Distant Reception with Three Valves

By C. P. ALLINSON, 6YF

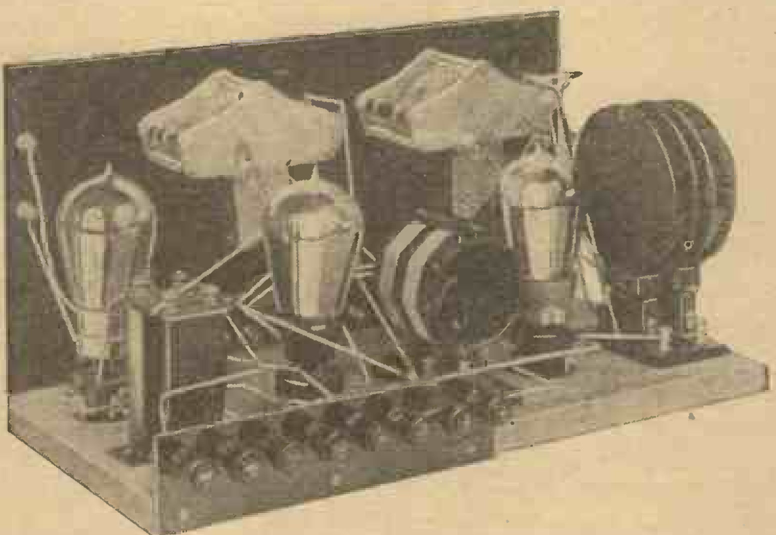
Good results may be obtained with only a single stage of high-frequency amplification followed by a detector and note magnifier.

THERE is no doubt that one of the most popular of multi-valve sets is that employing three valves functioning as high frequency, detector and L.F. valve respectively. This is not surprising, since such a receiver is not only reasonably cheap to build and run, but it also combines the advantages of loud-speaker reception on the local station up to distances of from 20 to 30 miles under average conditions, while on the phones it will give excellent strength on distant stations considerably more than ten times this distance away. Successful DX performance will depend, of course, not only on conditions being favourable for reception, but also on the skill of the operator himself.

The method of H.F. coupling adopted is one which still has a large number of adherents, the tuned anode. This method of H.F. amplification has, however, certain drawbacks, viz., it is prone to undue self oscillation, which necessitates the application of a positive potential on the grid of the high-frequency valve in order to control this oscillation, resulting in a loss of signal strength and selectivity.

Neat Appearance

If, however, a neutrodyned stage of tuned anode amplification is used it is possible to apply a negative bias to the grid of the H.F. valve thus reducing damping in this circuit, enabling maximum amplification and selectivity to be obtained, and this principle has been adopted in the receiver under consideration.



The receiver employs a special centre-tapped coil for the tuned anode winding.

It will be seen from the photographs that the set strikes a very distinctive note, the silver frosted dials presenting a striking contrast to the highly polished panel. The well-balanced and symmetrical lay-out makes the whole effect pleasing to the eye, while all coils are contained within the cabinet.

The cabinet shown in the photograph is of dark polished oak, but the choice of the wood for this purpose is, of course, a matter purely of personal preference. The terminals for connecting the batteries are carried on a special strip at the back of the baseboard which projects through the cabinet so that battery leads may be kept out of sight.

Aerial Arrangements

The circuit diagram is shown in Fig. 1 from which it will be seen that an auto-coupled aerial is employed and in order that a varying amount of inductance may be included in the aerial circuit two plug-in coils are utilised in series, being joined together at the point where the aerial is tapped. The coil L_1 may consist of a 20 or 25 turn coil, L_2 being 50 turns, the whole being tuned by the condenser C_1 which is of .0005 μF capacity. This condenser is that which is controlled by the left hand dial seen on the panel. The right hand dial controls the anode tuning condenser C_2 (capacity, .0003 μF) and it will be seen from the circuit diagram that this serves to tune one half of the anode coil L_3, the other half being used as a neutrodyne winding. The high-tension tapping is also taken to this centre point of the coil, and by connecting the moving vanes of the condenser to this point hand capacity effects may be eliminated. The neutrodyne condenser is controlled by the small knob seen on the left hand side of the panel between the aerial tuning condenser, and the aerial-earth terminals, and is thus at hand for making any adjustments that may be required.

Controls

A double pole double throw switch has been incorporated in this receiver in order that either telephones may be used in conjunction with the H.F. and detector valves or else a loud-speaker switched into circuit with the last valve. This switch, which is seen in the centre of the panel, also switches the last valve on or off, as required.

The three filament resistances are placed symmetrically at the bottom of the panel and the small knob on the right-hand side is the variable grid-leak, which is used in conjunction with the detector valve.

The components required to build this receiver are as follows, the exact makes of the various components being specified for the benefit of those who wish to duplicate this receiver exactly. As long as components of known quality are used, however, the receiver should function perfectly satisfactorily.

One ebonite panel, 16in. by 8in. by 3/16in., Radion polished black (American Hard Rubber Company).

One cabinet for same (The Artcraft Co.).

One .0005 μF square law variable condenser (Igranic Electric Co. Ltd.)

One .0003 μF square law variable condenser (Igranic Electric Co. Ltd).

One Brandes 5-1 ratio L.F. transformer (Brandes, Ltd.).

One Polar Micro Vernier condenser (Radio Communication Co., Ltd.).

Three 30 ohm filament resistances (Edison Swan Electric Co. Ltd.)

(Suitable for valves mentioned later. If other types are used suitable resistances must be employed.)

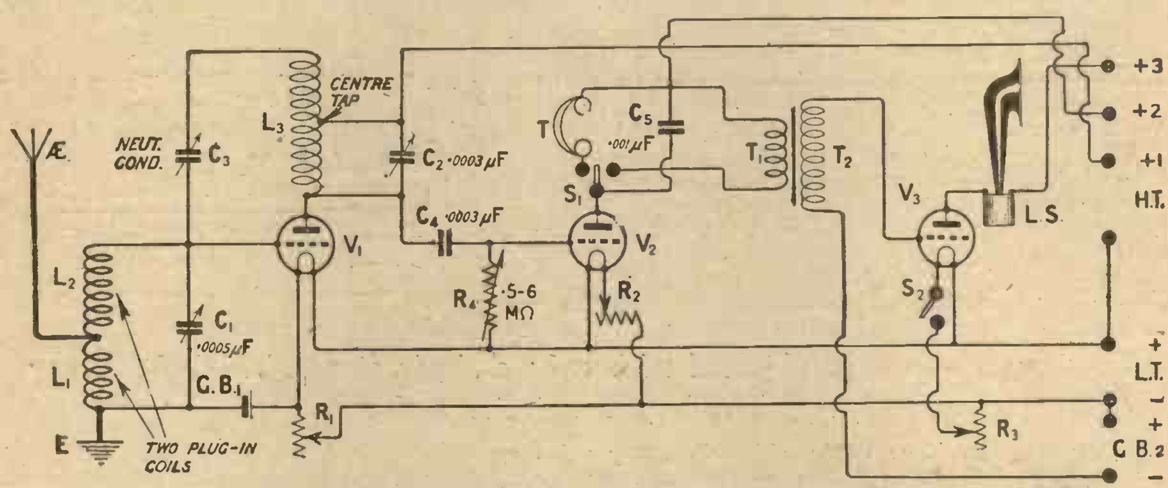


Fig. 1.—A tuned anode arrangement is employed with a neutralising winding.

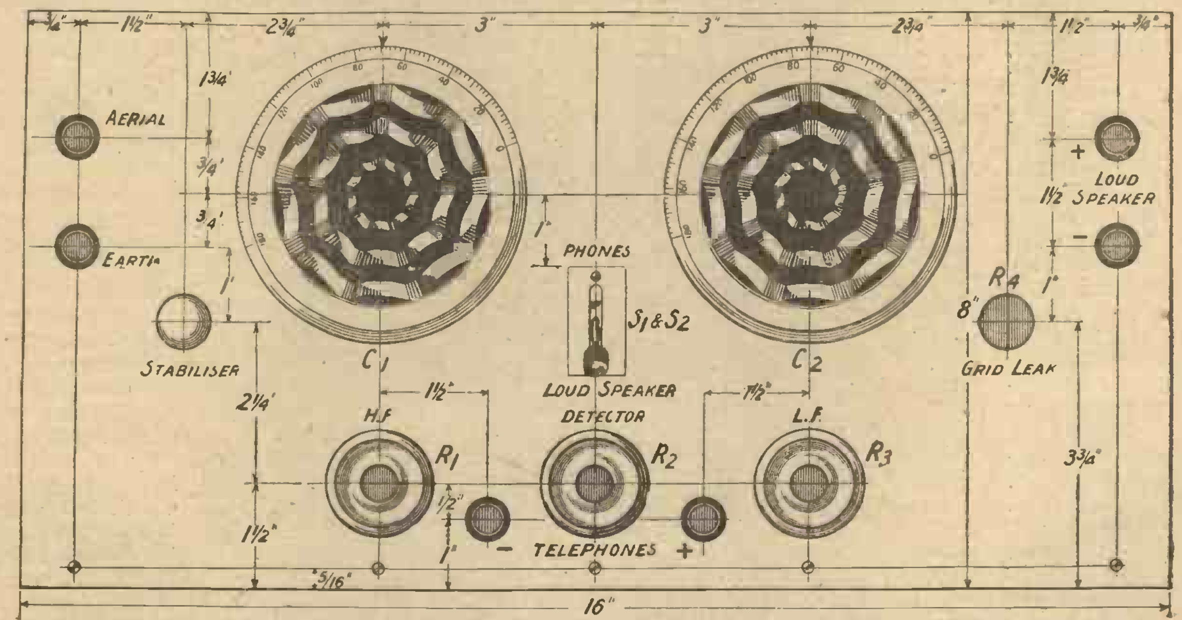


Fig. 2.—The panel layout is both neat and simple to follow. Blue print No. 146a is available on application (price 1s. 6d. post free).

Three anti - vibration valve holders (C. A. Vandervell and Co. Ltd.)

Two base mounting coil holders, and one variable grid-leak (Beard and Fitch, Ltd.).

One D.P.D.T. anti - capacity switch (Wilkins and Wright, Ltd.).

One .0003 μF capacity fixed condenser (Sel-Ezi Wireless Supply Co., Ltd.).

One .001 μF capacity fixed condenser (Watmel Wireless Co., Ltd.).

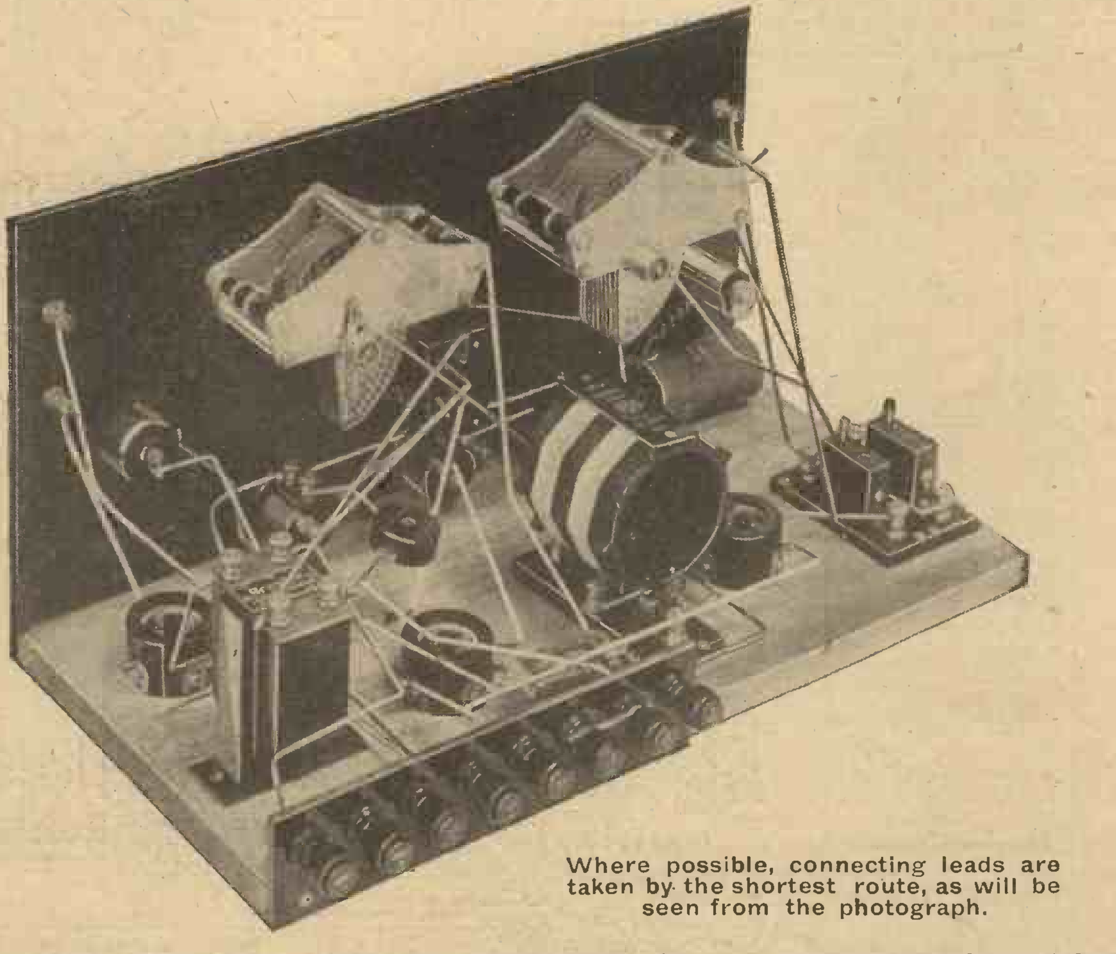
One Dimic anode unit No. 1A (L. McMichael, Ltd.).

One 1.5 volt dry cell.

determining the positions at which the various components will be fixed. Where highly polished ebonite is being used particular care should be taken not to scratch the face of the panel, otherwise the appearance of the completed receiver may be spoiled, and it is therefore advisable to mark out the positions of all holes to be drilled on the back of the panel, laying the face of the panel carefully on a piece of paper.

Mounting the Switch

The only point that is likely to



Where possible, connecting leads are taken by the shortest route, as will be seen from the photograph.

present any difficulty in preparing the panel for mounting the components is cutting the slot through which the lever of the Telephone-Loud-speaker switch works. The easiest way to do this, however, is to use the metal plate which fixes on the front of the panel as a template, running a scriber round the inside of the slot. A line is then drawn down the centre of this slot, as marked on the panel, and a number of $\frac{3}{16}$in. holes drilled along this centre line. They may then be run together with a small triangular or round file, and the slot then finished off with a small flat

file. The small metal plate previously referred to will also enable the position of the holes through which the fixing screws pass to be determined, and these may be drilled with a No. 25 drill, the size of which is $\frac{5}{32}$in.

The Condensers

The templates supplied by the makers with the variable condensers will be found to be correct for marking out the *back* of the panel, and should, of course, be used. If the reduction dials used by the writer are fitted by the

Two Gee - Haw Vernier dials (Rothermel Radio Corporation of Gt. Britain, Ltd).

Twelve indicating terminals (Belling and Lee, Ltd.), as follow:—

Aerial, earth, LT+, LT—, HT—, HT+1, HT+2, HT+3. LS+, LS—, GB+, GB—, TEL+, TEL—.

A quantity of tinned square copper wire and Glazite for making connections, soldering tags, etc.

Providing that guaranteed ebonite is used, such as that used by the writer, the panel may be drilled right away, and for this purpose the panel lay-out shown in Fig. 2 will prove of great help in

constructor, it should be noted that the holes should be deeply countersunk on the face of the panel so that the fixing screws to the condensers do not project above its surface at any point. A straight edge should be used in order to determine that this is the case.

The Telephone - Loud - speaker switch should not be mounted on the panel until certain of the connections have been made which will be specified later. The panel should now be fixed to the baseboard by means of five small wood screws and the various components which are mounted on the baseboard fixed in position. The 3 valve holders, although primarily intended for panel mounting are easily fixed to the baseboard by means of screws, a 4 B.A. tapping hole (*No. 33 drill*) being drilled in the baseboard for the purpose. It will be advisable to fix soldering tags beneath the connecting screws

Wiring up

The first step in wiring this receiver is to place the low-tension negative bus bar (which runs under the three terminals of the filament resistances) close against the panel. After this has been done the double pole double throw switch may be fitted on the panel, as the connection moving plate of the neutrodyne condenser will come out again if pushed in too far. As it was found, however, in the operation of this receiver, that it was never required to have the moving plate of the neutrodyne condenser in this position, this need not cause the constructor any anxiety.

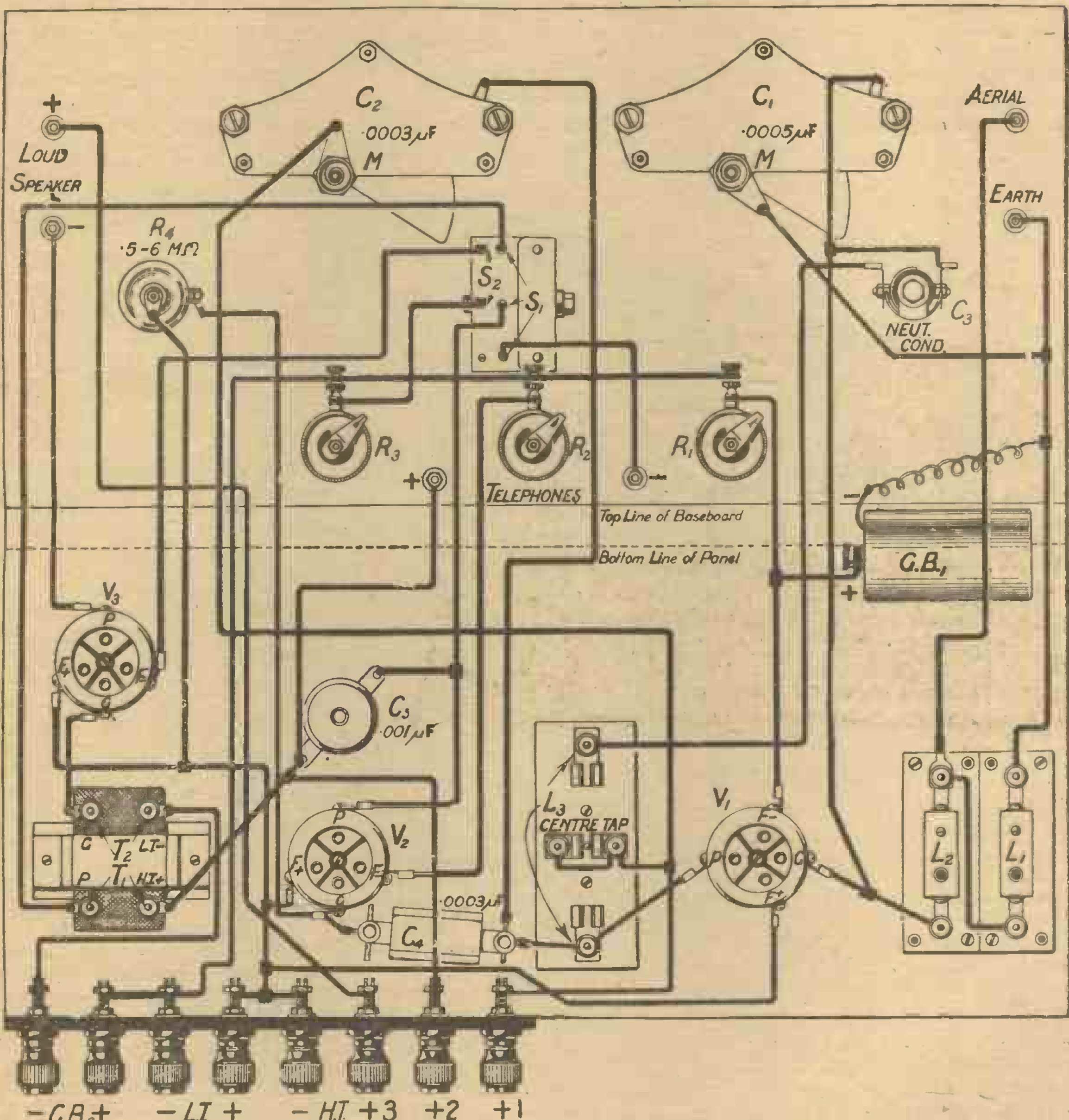


Fig. 3.—The wiring of the receiver. A full-size blue print (No. 146b) of this diagram may be obtained, if required (price 1/6 post free).

of these valve holders in order to facilitate making the connections to them.

The positions of the components on the baseboard may be determined from the wiring diagram shown in Fig. 3, and since this is drawn to scale no difficulty will be experienced in fixing their localities.

mentioned is the only one that requires to be made before mounting the switch.

It will be noticed that when a coil is in position in the inner of the two coil holders which are mounted side by side on the right hand of the baseboard looking at the receiver from the back, the

A Warning

Where a neutrodyne condenser of a different make from that specified is employed it should be ascertained that this does not short-circuit at its maximum position, for, should this occur, the H.T. battery will be placed in parallel with the L.T. battery, thus resulting in the burning out of two or more valves. Care should also, therefore, be taken to see that the plates of this condenser are not distorted in any way or bent by careless handling so that it becomes possible for them to touch at any point.

Testing Out

Having completed all the connections, these should carefully be checked over, after which the receiver may be tested out. First, connect the L.T. battery and insert the three valves suitable for use with the battery being employed. With the Telephone-Loud-speaker switch in the upper position turn on the filament of the first two valves and see that these light correctly and that they are properly controlled by the resistances. Next place the switch in the lower position and see that this closes

The panel is of pleasing appearance.

the circuit for the low-frequency valve, which should now light up.

A suitable value for the H.F. valve will be between 20 and 40 volts. The detector valve may be somewhat higher, while 100 to 120 volts will be a suitable value for the low-frequency amplifier.

Coils to Use

Suitable coils for L_1 and L_2 to cover the broadcast wavelength are a Gambrell "a" for L_1 and B for L_2. If other types are being employed suitable values are a 25 and a 50. Where it is desired to obtain increased selectivity the size of the coil L_1 should be reduced, such coils as the Gambrell a/2 being suitable. Another method of employing auto-coupling that may be used is to short the coil holder for L_1 and insert a Lissen X or a Gambrell trap coil at L_2, taking the aerial lead straight to the terminal which gives the desired tapping on the coil.

The correct Dimic anode unit to employ with this circuit for the broadcast band is No. 1A, which when tuned by the .0003 μF condenser gives a range of approximately 250 to 600 metres.

For the reception of Daventry a suitable coil will be a D for L_1 and E for L_2 (or equivalent coils) while the correct Dimic unit will be No. 3A.

The aerial and earth leads may now be attached, telephones and loud-speaker being connected to their respective terminals.

Neutralising Adjustment

A preliminary test should be made while broadcasting is not in progress in order to get the neutrodyne adjustment of the receiver. For this purpose place the anode tuning condenser about two thirds of the way in and revolve the grid tuning condenser slowly backwards and forwards. It will probably be found that at a certain point a click is heard and the set goes into oscillation. The value of the neutrodyne condenser should now be altered until the set goes out of oscillation. The grid-condenser should then be readjusted to determine whether the set once more breaks into oscillation. If it does so the neutrodyne condenser should again be adjusted. This operation should be continued until an adjustment of the neutrodyne condenser is found at which the set does not go into oscillation whatever the relative values of C_1 and C_2.

Stability

Another point to be borne in mind is that in some cases the neutrodyne condenser may not hold its setting over all adjustments of the two tuning condensers, and slight readjustments may require to be made from time to time according to the wavelength being received.

In any case the neutrodyne condenser gives a handy means of obtaining a reaction control, and it will be found in most cases that there is a certain point at which stability is obtained, and either a decrease or increase of capacity to either side of this point will result in the set going into oscillation.

Distant Reception

Having neutralised the set correctly the receiver may now be tried out during broadcast hours and the local station picked up. A distant station should next be tried for by slowly revolving the two condensers in the same direction in unison until a carrier is picked up which will be characterised by a slight hissing sound.

The receiver should not, of course, be allowed to oscillate during broadcast hours for if it does so nearby listeners will be interfered with, and for the benefit of those who have not had much experience of wireless reception it may be stated that when whistles are heard which change in pitch with the adjustment of either of the tuning condensers of the set, the set is oscillating.

Test Report

Having tuned in to the local station on the headphones it may next be put on the loud-speaker by throwing the change-over switch down, and the value of the grid-bias battery may now be adjusted to maximum negative value consistent with good reproduction. It must be remembered that too much negative bias is just as bad from the point of view of faithful reproduction as too little.

Tested on an aerial about 10 miles from 2LO excellent results were obtained with this receiver.

Using a D.E. 8 H.F., a D.E. 5 B, and a D.E. 5 valve, an a/2 and B Gambrell coils for L_1 and L_2 respectively, and a No. 1A Dimic coil, the following stations were received at good loud-speaker strength and identified:

Elberfeld, Brussels, Malmo, Hanover, Bern, *Petit Parisien*, Bournemouth, Hamburg, Münster, Franfurt, and Birmingham. Other stations, both British and Continental, were heard at varying strengths, including relays, but not definitely identified. 2LO was rather loud for comfort.

With a D and E for L_1 and L_2 and a No. 3A Dimic coil, Daventry was received at full loud-speaker strength, as was Radio Paris; Hilversum was also received on the loud-speaker.

What is High-Frequency Resistance?

By H. J. BARTON-CHAPPLE,
Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

Resistance enters into discussions of wireless circuits in a variety of ways. This article throws light on the real significance of this quantity.

IT is reasonable to suppose that readers of this journal are fairly familiar with the term resistance, but when dealing with direct current circuits it must be admitted that only a very elementary idea of the true concept of resistance is secured. When turning to the study of the high-frequency alternating currents encountered in wireless practice, however, it is necessary to take into consideration many factors which will have an important bearing on the ultimate result, although, for simple direct current working, they may be negligible or may completely fail to make their presence felt.

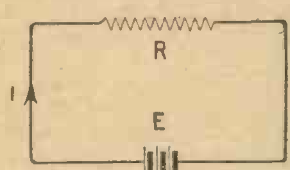


Fig. 1.—The battery E sends a current through the resistance R.

Direct Current Working

If we take the simple circuit shown in Fig. 1, we know that the pressure or electro-motive force (E.M.F.) of the battery causes a current to flow through the resistance R (which may, for example, be the filament of a valve), the circuit being completed through the battery itself. This current of electricity is really a flow of minute negative charges of electricity called electrons, the connecting wires and other apparatus merely serving as a convenient path for the travel of these electrons. The magnitude of the resistance determines the value of the current flowing from the source of E.M.F. in much the same way as the friction of an ordinary water-pipe regulates the rate at which water will flow through the system.

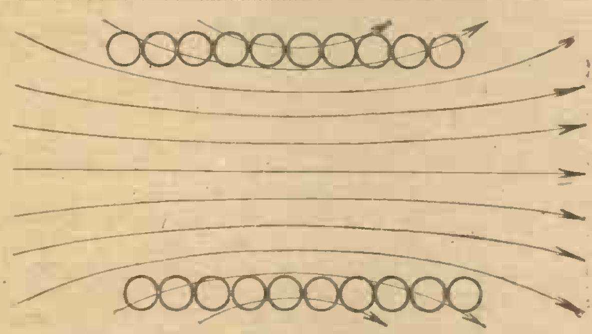


Fig. 3.—The magnetic field of a coil is distributed somewhat as shown in this diagram.

Ohm's Law

For ordinary working a simple law has been enunciated, which in itself is generally sufficient to define resistance, and expressed in terms of symbols this becomes

$$R = E/I, \text{ where}$$

R = Resistance of conductor in ohms
E = Electrical pressure (or E.M.F.) in volts
I = Resultant current in amperes.

The symbol E represents the total E.M.F. in the circuit. Thus if there is any counter or back pressure in the circuit, due, for instance, to a battery in opposition to the main voltage, then the effective E.M.F. will be the difference between the applied pressure and the "back" pressure.

Resistance from Heat Measurements

When attention is turned to alternating currents which flow first in one direction and then in the other it is found that certain additional E.M.F's. are produced due to the fact that the current is continually fluctuating. Thus the simple law just given will not hold good, and that is why the problem of high-frequency work always appears a little more difficult. We may, however, view the subject from a different aspect, which renders the problem somewhat simpler.

Fig. 2.—Due to the current, energy is transferred from X to Y.

Whenever a direct or alternating current flows through a circuit heat is generated, a fact known to all who take advantage of electrical heating methods. Now the amount of electrical energy liberated in the form of heat is proportional to I^2Rt where t = the time in seconds that the current is flowing and R and I still retain their same meaning.

Difficulties in Measurement

It would seem from this data that we have here a simple means whereby H.F. resistance could be adequately measured, and thus offer a solution to the problems which confront the experimenter seeking for knowledge of this important quantity in his circuits. By what is known as calorimeter methods it is possible to measure the heat generated with a fair degree of accuracy, but a little thought will bring to mind the many difficulties. I and t are readily found, but the measurement of the total heat generated is not easy because of the losses which will inevitably occur due to convection, radiation, conduction, etc.

Further Considerations

The important point to bear in mind with all these calculations, however, is that electrical energy may be dissipated in other forms than heat. For example, we have only to realise that we receive our broadcasting as a result of the dissipation into space of electro-magnetic energy in the form of waves from the transmitting aerial.

Another Concept

We are thus led to adopt an idea of resistance based on the question of the transference of energy from one part of a circuit to another, or vice versa. Since the time for the energy interchange will be the same both for the "transmitting" and the "receiving" portions of the circuit, we can eliminate the time element, in which case we are simply concerned with the power. Now, the power in an electrical circuit is obtained by multiplying the voltage by the effective value of the current. The practical unit of power is the watt, so that we may write $W=EI$, where W=power in watts, E and I remaining as before. But from our knowledge of Ohm's Law $E=IR$.

Hence $W=I^2R$.

Thus the power transferred is the product of the square of the current (in amperes) and the resistance (in ohms).

A high-frequency testing set recently described by Mr. Reyner in "Wireless Weekly."

Power Transference

Thus if we take two points in a part of the circuit under consideration, the resistance is found by dividing the power transferred between these two points by the square of the current. Referring to Fig. 2 this means that if we take the two points X and Y, then

$$R = \frac{\text{Power transferred between X and Y}}{I^2}$$

In this connection it must be clearly understood that the power transferred can be either entering or leaving the circuit, according to whether the power is being generated or lost. This idea may appear a trifle strange at first, but it will enable the reader to obtain a much better knowledge of high-frequency resistance, and its application will become clearer later.

Factors Influencing Resistance

Many factors contribute in a large or small measure to the resistance of a circuit at high-frequencies, and amongst the most important may be mentioned the following:—

(*a*) The resistance of the conductor itself.
(*b*) The resistance of neighbouring closed circuits considered mainly from the question of their proximity to the circuit in question.
(*c*) Various losses in the condenser dielectric when a capacity is present.
(*d*) Magnetic material which is close enough to be magnetised as a result of the stray fields produced by current flowing in the original circuit.
(*e*) Any corona losses in parts of the circuit.
(*f*) The radiation of electro-magnetic energy.

Now, these factors will be found to vary with the frequency in the circuit, and with the magnetic and electric fields set up, so that a full analysis should treat all of them in their correct perspective.

The Resistance of the Conductor

Without going into the modern electron theory we must appreciate the fact that when a voltage is applied to a conductor it causes a movement of what are termed "free electrons," and it is the summation of the individual resistances to their motion that constitutes the total normal resistance of the conductor. From these considerations it will be evident that the resistance will depend upon the type of material composing the conductor and its dimensions—*i.e.*, sectional area and length.

Now, when the conductor is carrying alternating current of high-frequency, the to and fro movements of the electrons will be confined to the outer layer of the conductor, since there is insufficient time for them to penetrate to the inner sections. Thus the sectional area of the conductor carrying current can be regarded as being reduced, and the resistance will thus be increased, giving rise to what is popularly termed "skin effect." This was referred to in an article by Mr. J. H. Reyner in MODERN WIRELESS, Vol. V., No. 3, so will not be stressed here.

Resistance of Coils

When the conductor is wound in the form of a coil the problem becomes very complicated, due to the magnetic field produced inside the coil, which in the case of a short solenoid is of the form shown in Fig. 3, so that the electrons do not take up the fairly uniform distribution as in a straight conductor. It can be shown that the current now tends to crowd into that part of the wire which is on the *inside* of the coil, see Fig. 4, so that the resistance is still further increased. It is this redistribution of the electrons across the section of the conductor that makes the calculation of the high-frequency resistance of a coil such a difficult problem.

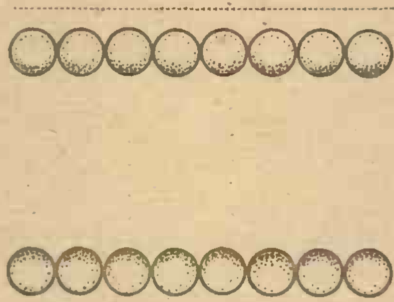


Fig. 4.—In a coil the high-frequency current all crowds towards the inside of the coil as shown here.

Neighbouring Closed Circuits

The resistance of a circuit is always increased by the presence of neighbouring circuits in which current is induced. From our power standpoint, it will be appreciated that the power for supplying the losses in the other circuit must be furnished by the coil inducing the current. Hence this effects an apparent increase in the resistance of the original coil, which will be evidenced in any method of measurement unless extreme precautions are adopted. The increase in resistance will naturally depend on the tuning of the other circuit, and problems of this nature frequently arise in wireless circuits.

Dielectric Losses

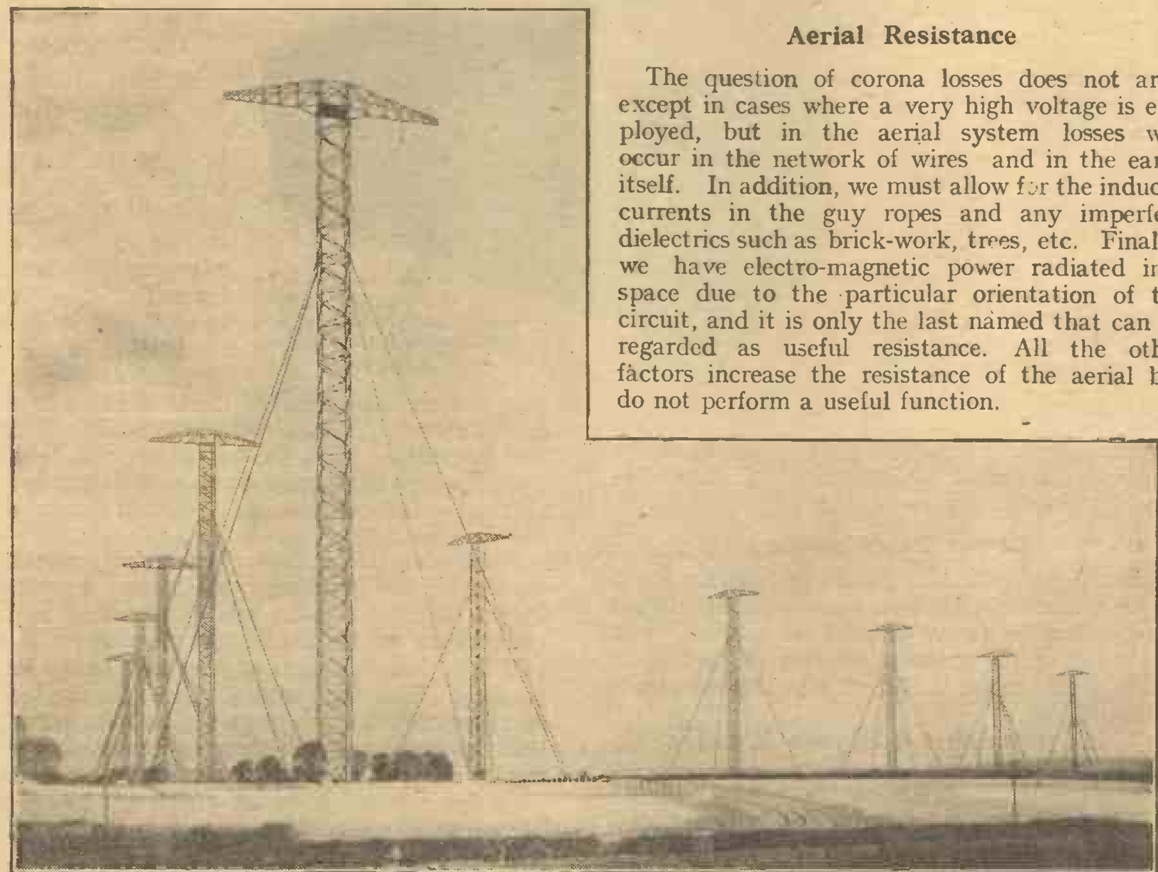
It has been shown quite recently in this journal that there is a capacity effect between the various turns and layers of a coil. This means that small high-frequency currents will flow through this resultant capacity and produce a dielectric absorption of power, which will depend in magnitude on the value of the distributed capacity, being quite large for coils with an imperfect insulation between the windings. This will still further increase the resistance.

Magnetic Material

If a magnetic material is close enough to be magnetised by the stray fields of the original circuit, what is known as "eddy currents" are produced. These currents circulate to and fro round the magnetic material and result in a waste of power. They can be greatly minimised by laminating the magnetic material, and for wireless frequencies the thickness of these laminations should not exceed a few hundredths of a millimeter.

Aerial Resistance

The question of corona losses does not arise except in cases where a very high voltage is employed, but in the aerial system losses will occur in the network of wires and in the earth itself. In addition, we must allow for the induced currents in the guy ropes and any imperfect dielectrics such as brick-work, trees, etc. Finally, we have electro-magnetic power radiated into space due to the particular orientation of the circuit, and it is only the last named that can be regarded as useful resistance. All the other factors increase the resistance of the aerial but do not perform a useful function.



A view of the masts at the Beam Receiving Station, erected by the Marconi Co. for the Post Office at Bridgwater. The masts on the left are for reception from Canada, and those on the right from South Africa.

FLEXIBILITY WITH THE REINARTZ CIRCUIT

By A. JOHNSON-RANDALL.

A simple receiver employing home-wound interchangeable coils.

RECENT coil research indicates that the resistance of coils wound with the finer gauges of wire is not so high at radio-frequencies as was considered previously. In fact the results of actual measurements point to the fact that coils wound with 30–36 gauge wire and of an inductance of the order of 150-200 μH may in many cases have a lower resistance than the more commonly known "low loss" types. In substantiation of this may be quoted the contributions of Mr. J. H. Reyner.

Fine Wire

The use of coils wound with moderately fine wire has an important advantage inasmuch as the lay-out of the receiver can be simplified to a marked extent, and in addition the construction of the coils is rendered much easier.

In the receiver described in this article an easily constructed single layer coil is employed, the wire being finer than is normally used in similar inductances.

Flexibility

The receiver may therefore be said to employ a "low-loss" type of coil of moderately low H.F. resistance which, coupled with the tight coupled type of aerial arrangement, tends to increase selectivity. The wavelength range is not limited to the 250-550 metre band, since the construction of coils with a suitable number of turns will enable the keen experimenter to cover a large field. For reception on wavelengths in the vicinity of Daventry, however, an extra radio choke in series with that in the set may be found necessary.

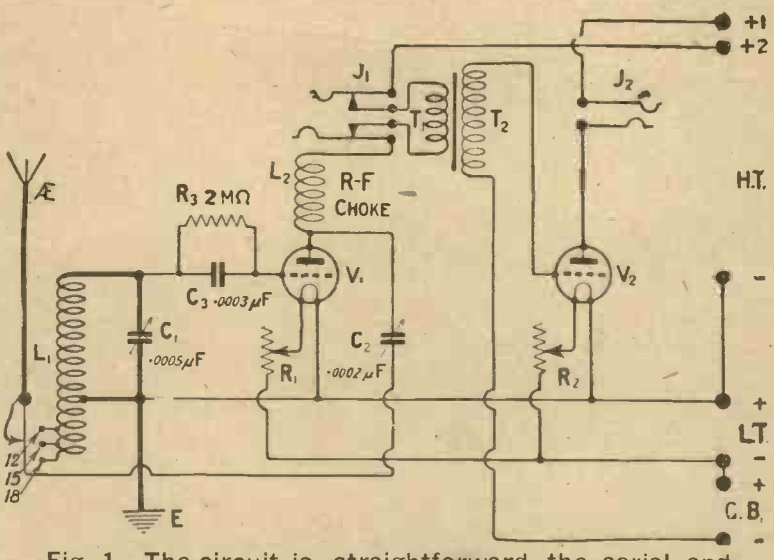


Fig. 1.—The circuit is straightforward, the aerial and reaction coils being combined.

The Circuit

The circuit employed is simple and is a well-known modified Reinartz arrangement, whereby the untuned aerial turns are also employed as the reaction coil. By means of a clip a suitable adjustment of the turns to combine good selectivity and reaction control may be obtained. A plug and jack switching system enables either one or both valves to be used.

Components

The foll wing components are necessary, but it is not essential to use those makes mentioned, since the efficiency of the receiver should not suffer provided those substituted are of equal quality.

1 cabinet 14 in. by 7 in., with a loose baseboard 7 in. deep (W. H. Agar.)
1 insulating panel 14 in. by 7 in. by 3-16 in. (Radion.)
1 ·0005 μF variable condenser, square-law pattern. (Bowyer-Lowe Co., Ltd.)
1 ·0002 μF variable condenser, square-law pattern. (Bowyer-Lowe Co., Ltd.)
1 Radio-frequency choke. (Lissen, Ltd.)
1 L.F. transformer ratio 5:1 (Brandes, Ltd.)
1 double circuit jack. (Igranic-Pacent.)
1 single circuit jack. (Igranic-Pacent.)
1 ·0003 μF. grid condenser. (Dorwood Precision.)
1 grid leak of 1 or 2 MΩ (Ediswan Electric Co.)
2 "Vibro" valve holders. (Burne-Jones and Co., Ltd.)
2 terminal strips, one 3 in. by 2 in., one 7 in. by 2 in.
2 angle brackets.

2 filament rheostats, dual type. (Radio Instruments, Ltd.)
1 spring clip. (Peto-Scott Co., Ltd.)
1 set Radio Press panel transfers.
A quantity of 16 S.W.G. glazite wire and a few wood screws and 4.B.A. screws with nuts and washers.

Construction

In constructing the receiver work should be commenced first of all on the panel, and it should be ascertained whether or not it fits the cabinet. If the panel is a little tight the application of a smooth file will remove sufficient from the edges to ensure a good fit. The panel should then be marked out and drilled in accordance with the dimensions given in the drilling diagram.

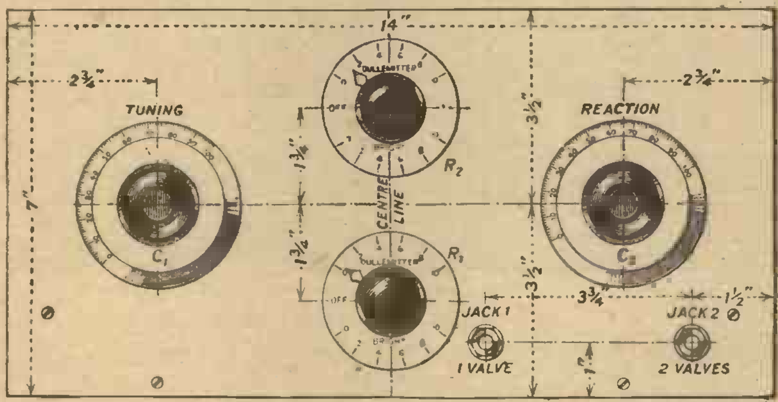


Fig. 2.—The lay-out of the panel is straightforward. Blue print No. 147a (price 1/6 post free) is obtainable on application.

The two variable condensers make use of the three point suspension system, and a template is supplied by the maker to facilitate mounting. The ⅜ in. drill used for drilling the spindle clearing holes serves also for the single-hole-fixing dual rheostats. In drilling holes of this type the use of a 1-16 in. pilot drill ensures a correctly centred hole. A 7-16 in. drill should be employed for the two jacks.

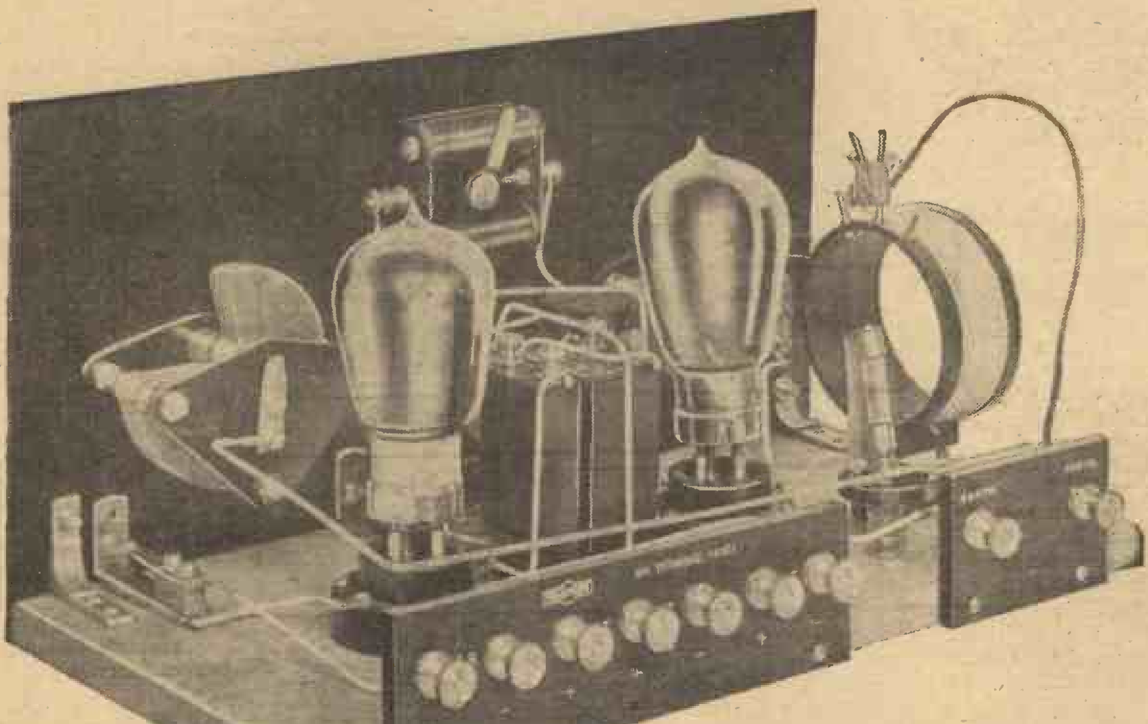
Baseboard Layout

Fix the baseboard to the panel by means of two small angle brackets and two wood screws. The holes for the wood screws should be drilled and countersunk ¼ in. vertically from the bottom of the panel, since the baseboard has a thickness of ½ in. For all countersinking work use a rose bit and an ordinary carpenter's brace.

Assuming that all the components have been secured to the panel, and that the panel has been fixed to the baseboard, the next operation will be to screw the remaining components to the baseboard as shown in Fig. 3. It is not necessary to adhere to any specified dimensions, but the lay-out of the wiring diagram should be followed as closely as possible. One of the chief points to bear in mind is to allow adequate clearance between the valve holders and the components in their immediate vicinity for the largest types of valves.

Wiring Up

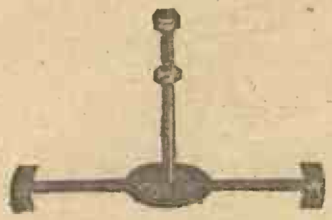
The two terminal strips are mounted one inch from each end of the baseboard, the terminals of



Ample space is provided for the various components.

LISSENIUM

A Tambourine and the Lissenola will make a Loud Speaker



FIRST fit the LISSEN REED to the LISSENOLA as shown below—then lightly rest the skin of the tambourine on top of the LISSEN REED, and you will be pleasantly surprised with this simple loud-speaker arrangement.

The LISSENOLA is a real loud-speaking, sound-reproducing base. Fitted with the LISSEN REED you can use a dozen different things to give you loud-speaker effect—all worth listening to, and all so economical.

Even the lid of a cardboard box can be turned into a loud speaker, if you use a good high-tension supply (LISSEN CELLS will shortly be introduced for this purpose).

AND YOU CAN ALSO BUILD YOURSELF A PROVED HORN, for with each LISSENOLA unit you are given a FULL-SIZE, EXACT PATTERN and clear instructions, which show you how to make a horn for a few pence, so that your total cost will be less than 15/-. YET YOUR COMPLETED LOUD SPEAKER WILL COMPARE WITH THE BEST, because the electro-magnetic sound-reproducing mechanism of the LISSENOLA is concentrated in the most effective manner yet achieved.

Make this Test—Before You Buy:—

Go to your nearest dealer—ask him to put on the best loud speaker in his stock—then have the horn put on the LISSENOLA—keep the input voltage the same, no matter how high—AND SEE IF YOU CAN NOTICE ANY DIFFERENCE.

LISSENOLA LOUD SPEAKING UNIT Price only

(*Patent pending.*)

If with LISSEN REED ... **14/6** **13/6**

The LISSEN REED (patent pending) is sold separately for 1/-. Takes only a moment to fit.

THE LISSENOLA FITS THE TONE ARM OF ANY GRAMOPHONE TOO.

Your Dealer will gladly Demonstrate

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Discard Your Telephones — Build Your Own Loud Speaker

the larger strip being spaced 1 in. apart and those on the aerial-earth strip 2 in. The wiring-up should be commenced by joining the necessary leads to the terminals on the filament rheostats and then proceeding with those to the contacts of the double circuit jack. The remainder of the wiring is straightforward.

action coil. Tappings are arranged at 12 and 15 turns on this coil. Two valve pins are screwed to the ebonite tubing for the purpose of plugging in to a small base consisting of two valve sockets.

The distance between the centres of these pins is 1⅛ in. One end of the winding is joined to one of the pins, and after 35 turns have

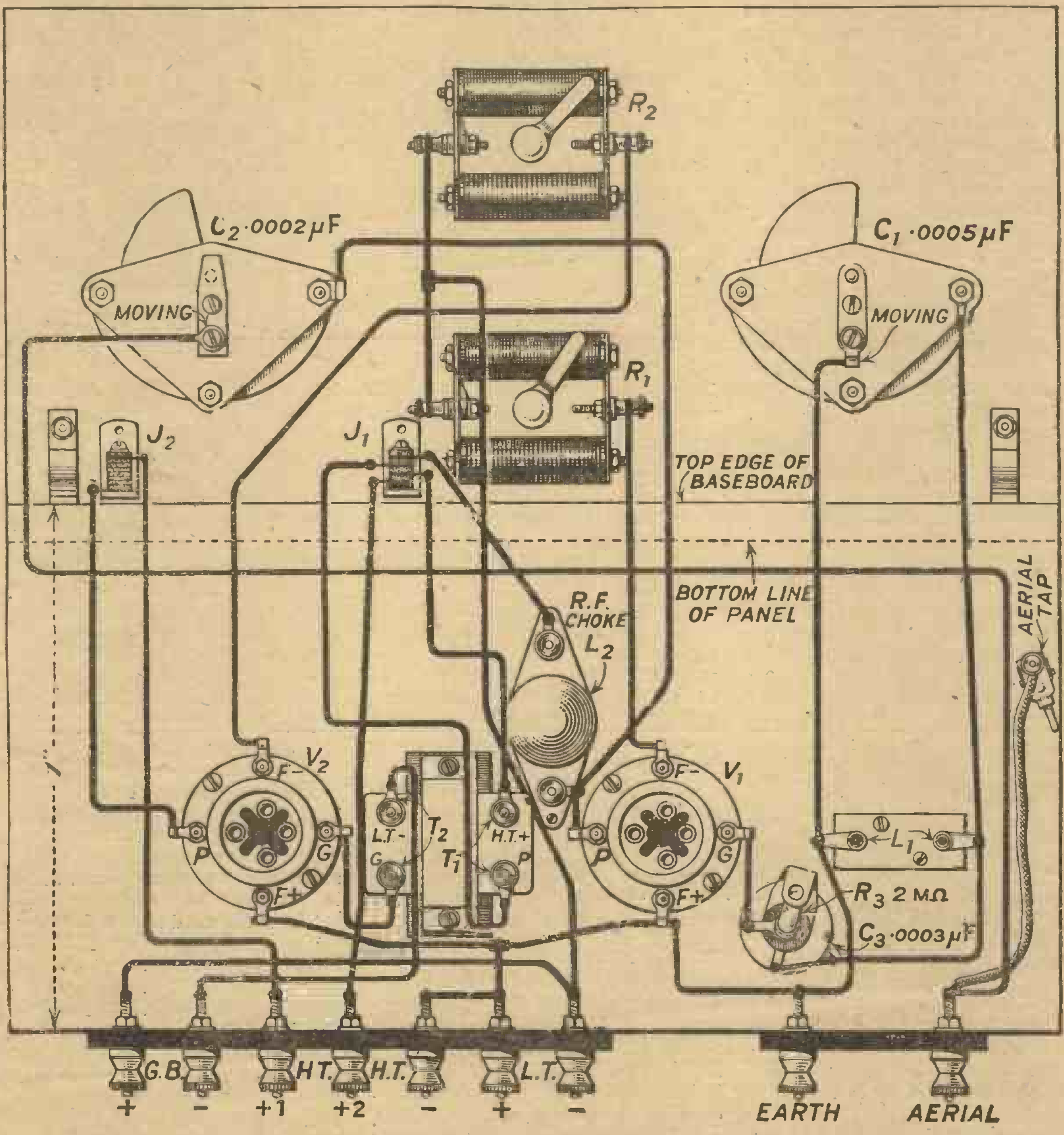


Fig. 3.—The layout of the components and the wiring up may be seen from this figure. Blue print No. 147b may be obtained if desired, price 1/6 post free.

1 in., the 12 turn tapping being joined to the first pin, the 15 turn tapping to the second, and the end of the coil to the third. Connection is made to the tappings by means of a spring clip or valve socket attached to a short length of flexible wire. The free end of the coil, that is, the commencement of the winding, is joined via the coil base to the grid condenser. The other end of the grid coil is joined to the earth terminal and to the moving vanes of the grid circuit and tuning condenser. This coil may be purchased ready made by those who do not wish to make it, from Messrs. Burne-Jones & Co., Ltd.

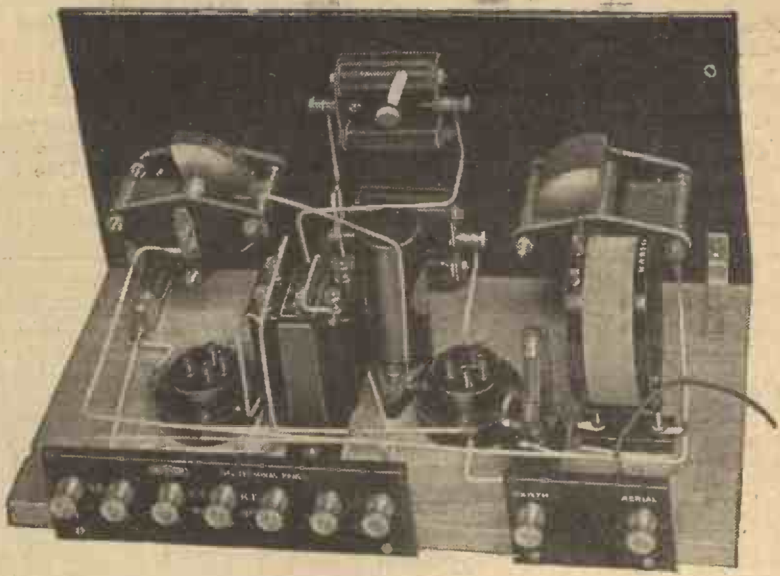
The Coil

The coil L_1 consists of a length of 3 in. diameter ebonite tube wound with 53 turns of 30 S.W.G. d.s.c. wire unspaced. The first 35 turns with the variable condenser C_1 form the tuned grid circuit, the remaining 18 turns comprising the aerial-reaction coil. Tappings are arranged at 12 and 15 turns on this coil, been wound a tapping is taken to the other pin. The grid coil is therefore connected across the two pins.

The aerial-reaction tappings are taken to three more valve pins attached to the outside edge of the ebonite tube at intervals of about

Operation

The operation of the receiver is quite simple, since there are but two controls. Having connected the H.T. G.B. and L.T. leads to their respective terminals and noted whether the valves light correctly, the telephones should be plugged into, say, the first jack and the aerial and earth leads joined up. For the ordinary B.B.C. waveband the 15 turn tapping should first be tried, the condenser C_1 being slowly rotated until the local station is heard. The value of the reaction condenser C_2 should then be increased from zero until signals are obtained at their maximum volume free from distortion. Distortion is prone to occur if excessive reaction is used, and the receiver will certainly oscillate if the value of the reaction condenser is increased too much.



This photograph shows the wiring clearly.

Valves to Use

The 12 turn and 18 turn tappings may next be tried with a suitable readjustment of C_2 and slight alteration of C_1. The grid coil will tune from about 250-550 metres. The detector valve should preferably be of the D.E.5b or D.E.3b type, and a suitable valve of the same filament rating should be chosen for the low-frequency stage.

For use with the D.E.5b as detector the LF valve may be a B.4, D.E.5., D.F.A.1 or similar type. With the D. E. 3b type a D. E. 3, B.5, A.R. 06 or a small power valve of the B.6 type would be suitable. It is not necessary to use a small power valve with this receiver, but I personally use them in all L.F. work, particularly if a loud-speaker is employed.

Test Report

The set was tested upon an outdoor aerial 100 feet in length, 35 feet high, at a distance of 15 miles from 2LO. Using the two valves, this station was received at fair loud-speaker strength, and a number of German stations were heard at good telephone strength, while Brussels was clear on the lower end of the grid tuning condenser. The anode voltage was 120 with a negative grid-bias of 6 volts.

Short wave reception was possible by using a different coil. For this purpose a special coil was wound upon a 3 in. former of 18 S.W.G. d.c.c. wire, ten turns forming the grid coil and five turns the aerial-reaction coil. A number of amateur transmitting stations were logged in the neighbourhood of 60-80 metres and some weak telephony was heard. A ·00005 μF condenser was used in series with the aerial in this case.

A Reader's Experiences with the D.X.5

SIR,—I wish to tell you of the very excellent results I have obtained from the D.X.5 Set described in the December, 1925, MODERN WIRELESS, by Mr. D. J. S. Hartt, B.Sc.

I am situated 2½ miles from 2LO and use an unselective single wire aerial approximately 30 ft. high and 50 ft. long. The lead-in passes through two rooms before reaching the set, and the aerial is partially shielded by adjacent high buildings, and, therefore, cannot be termed efficient.

The results so far obtained have exceeded my expectations, and the following stations have been received at loud speaker strength whilst 2LO has been working:—Bournemouth x, Cardiff, Birmingham x, Newcastle, Glasgow, Aberdeen x, Plymouth, Hull, Belfast, Radio Toulouse x, Rome, Radio Iberica, Frankfort, Munster, Stuttgart, Seville, Oslo.

The stations marked "x" have to be detuned with 5 valves, as they are too powerful for a moderate sized room.

As a firm believer in adhering strictly to the layout given by the designer, no modifications have been made except in the following components:— (1) No switching arrangement; (2) Igranic L. F. Transformers; (3) Burndept Rheostats; (4) Igranic condensers.

Apart from these, the Components used are exactly as described in MODERN WIRELESS.

The valves used were as follows:—

	H.T.	G.B.
H.F. D.E.5	90	3
Rectifier D.E.5.B ...	66	—
1st L.F., D.E.8 ...	100	3
2nd L.F., D.E.5 ...	120	4½

In conclusion I found the selectivity so great that low-geared vernier dials are absolutely essential.—Yours truly,

ALFRED A. COOPER.

Kennington, S.E.11.

A Troublesome Friend

How often is your evening spoilt by the man who pesters you with questions! Why not recommend him to purchase "500 Wireless Questions Answered," by G. P. Kendall, B.Sc. and E. Redpath. price 2/6, or 2/8, post free?

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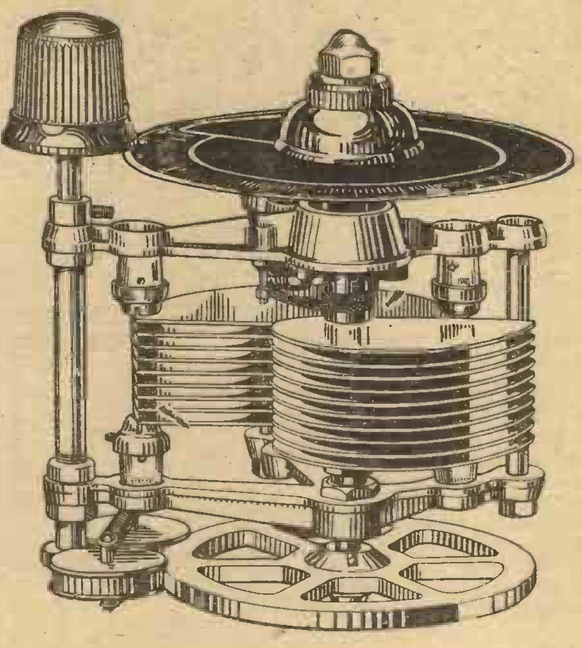
The Condensers that make tuning a pleasure. They give "straight-line" tuning, are compact in assembly and made of the finest materials procurable. Sterling Condensers have almost zero capacity, are suitable for "low loss" working, and are the best obtainable for all radio requirements.



The New "Miniloss" Type

THESE condensers have a high maximum to minimum capacity ratio. The novel slow-motion movement has a ratio of 7-1, it is very smooth in operation, and allows of no back-lash or grating.

"Pyrex" glass plugs are used for insulating the fixed plates, these plugs are outside the electrostatic field, consequently High Frequency losses are reduced to the minimum. Sterling, first to introduce the vernier and square-law, are now the first in England to use "Pyrex" (a proved insulator of the highest quality) as a condenser insulator.

The moving vanes are so mounted that there can be no side-play, they are attached permanently to the framework with a flexible connection. This obviates the possibility of grating due to bad or high resistance contact, an essential feature when working on very short wavelengths or Super Receivers.

The conveniently shaped control knob is clear of the dial, this, together with the fixed scale and movable pointer, makes the operation of these condensers quicker and less trying than with the usual type.

One hole is needed for fixing and another small one for the control spindle, allowance is made for mounting on any thickness of panel up to ⅜ in.

Made in three capacities:

.00025 mfd.	Price **21/-**
.0005 mfd.	„ **24/-**
.001 mfd.	„ **30/-**

Types for every Radio purpose

PANEL TYPES.

With Vernier Adjustment.

No.	Capacity.	Price.
R.2724	.00025 mfd.	£1 : 0 : 6
R.2725	.0005 mfd.	£1 : 4 : 0
R.2726	.001 mfd.	£1 : 8 : 6

Without Vernier Adjustment.

No.	Capacity.	Price.
R.2729	.00025 mfd.	£0 18 : 0
R.2730	.0005 mfd.	£1 : 1 : 0
R.2731	.001 mfd.	£1 : 6 : 0

ENCLOSED TYPES IN METAL CASE.

With Vernier Adjustment.

No.	Capacity.	Price.
R.2733	.00025 mfd.	£1 : 19 : 0
R.2734	.0005 mfd.	£2 : 2 : 0
R.2735	.001 mfd.	£2 : 6 : 0

Without Vernier Adjustment.

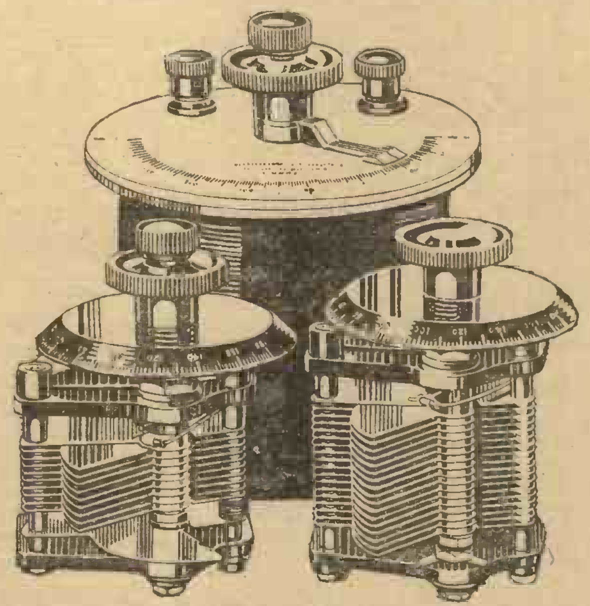
No.	Capacity.	Price.
R.2737	.00025 mfd.	£1 : 17 : 0
R.2738	.0005 mfd.	£2 : 0 : 0
R.2739	.001 mfd.	£2 : 4 : 0

GEARED TYPE.

No.	Capacity.	Price.
R.2720	.00025 mfd.	£1 : 3 : 0
R.2721	.0005 mfd.	£1 : 6 : 6
R.2722	.001 mfd.	£1 : 10 : 6

FOR TUNED RADIO FREQUENCY AMPLIFICATION.

No.	Capacity each unit.	Price.
R.2740 (Double)	.00025 mfd.	£1 : 4 : 0
R.2743 (Triple)	.00025 mfd.	£1 : 10 : 0



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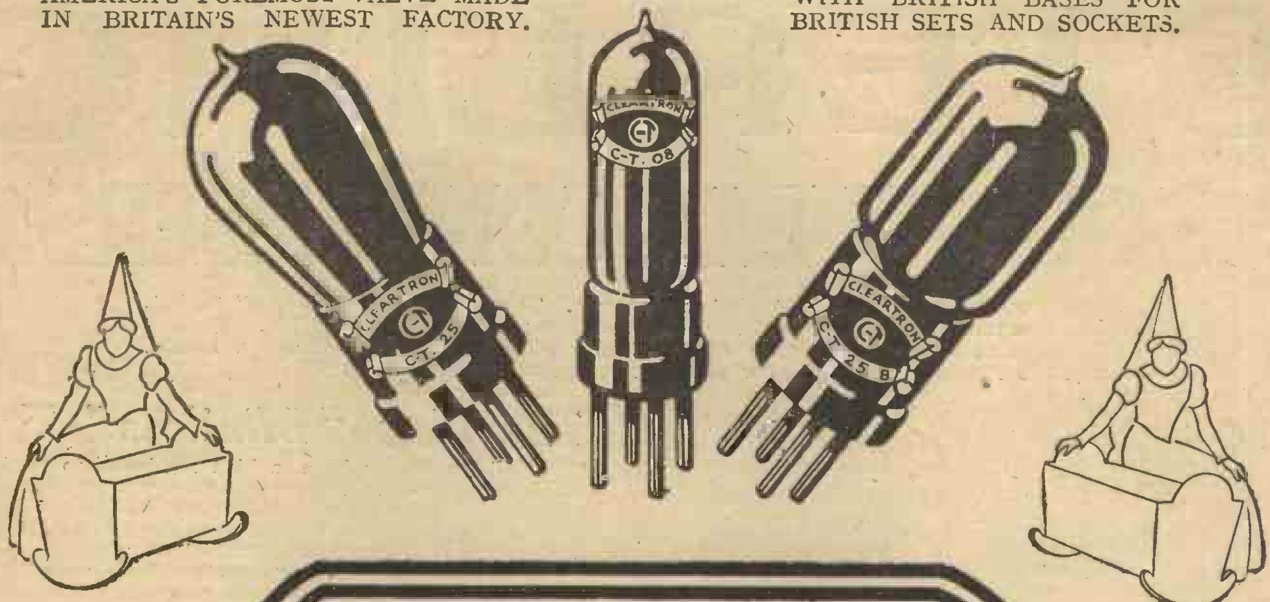
CLEARTRON
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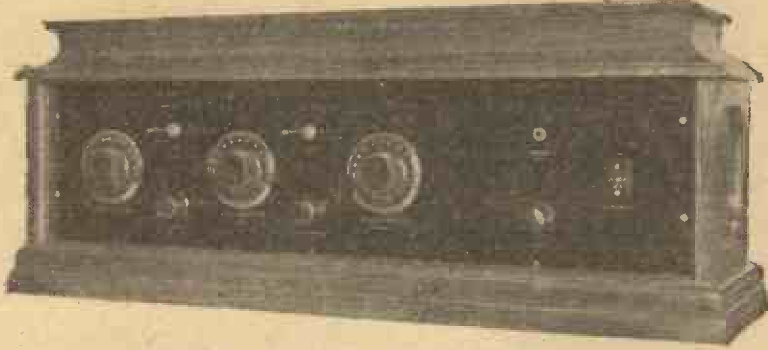
Some Interesting Letters

Readers' results with the "Special Five," a Three-Valve Set, the "Harmony Four" and the "All-Concert de Luxe.



This handsome "Special Five" receiver, built by Mr. Anspach, has an elaborate cabinet.

The "Special Five"

SIR,—I am enclosing a photo of my "Special Five" in all its glory, which I have made to Mr. Percy W. Harris's instructions in the November, 1925, issue of MODERN WIRELESS. I do hope you will have some little corner in your publication to show it. The results are very wonderful now I have got used to it. With many thanks.—Yours truly,

HARRY ANSPACH.

Dartford.

"Full Volume from Three Valves"

SIR,—With reference to the description of the set published in the July, 1925, number of MODERN WIRELESS, under the title "Full Volume from Three Valves," by Mr. A. Johnson-Randall, I wish to congratulate the designer of this receiver.

I made up the set on an old panel with very untidy wiring, etc., but the results were so good that I made the set up in style, using best components. I also constructed the Combined Filter and Tone Control Unit described in the same number of MODERN WIRELESS by Mr. C. P. Allinson.

The result is that I consider I now possess as good a set as money can buy. The volume is tremendous and the tone absolutely perfect on the loud-speaker; in fact, on London it is impossible to use the three valves, two being quite sufficient to give all the volume one requires. The tone control unit is a very useful addition to the set. I have also received many other stations on the speaker, although the set is not really made for distance. You will be interested to hear also that a friend of mine made this set up for a relative and took it 30 miles south of London, and by a movement of the vernier was able to tune in five Continental stations on the speaker. I am not exaggerating when I inform you that someone who heard the set, and realised its possibilities, promptly started to dismantle his "Super-het." which he was building in the hope of getting purity and distance.

Personally I have been commissioned to make three other similar sets for friends, and after having tried nearly all the Radio Press circuits from one to six valves, I am keeping this one as a stock set.—Yours truly,

B. GLADSTONE.

Kensington, W.

The "Harmony Four"

SIR,—You may be interested to know of the results I have obtained with the "Harmony Four" receiver which I constructed recently from Mr. Percy Harris's instructions (always so clear) in the September, 1925, issue of MODERN WIRELESS. I am surprised at the strength and purity with which the numerous stations come in on the loud-speaker. I find C.A.T. the most useful method to use for all the 200–500 metre band, as it makes tuning so selective.

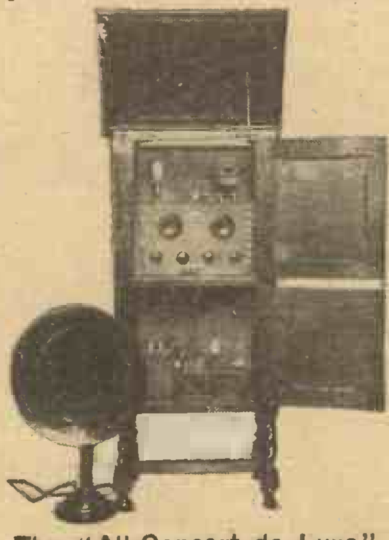
I am giving my results, and would point out that I am situated 20 miles and 18 miles from the Manchester and Liverpool B.B.C. stations respectively

Stations received (using outside aerial, 35 ft. high, single wire) are Manchester, Liverpool and most relay stations, Birmingham, Daventry, Madrid, EAJ12, EAJ3, Stuttgart, Leipzig, Berlin, Toulouse, Radio Paris, Radio Belge, Belfast and Hanover. Received on loud-speaker with ease most nights. American stations: KDKA (309 metres), 1.50 to 3 a.m., good phone and up to fair loud-speaker strength; WGY, 2-30 a.m., good phone; WBZ, 3.40 a.m., good phone; also two Chicago stations, but could not get the call signs owing to bad atmospherics developing.

Frame aerial, 2 ft. square, 10 turns No. 22 enamelled wire. Manchester, Liverpool, Daventry; loud-speaker strength. Several others on phones.—Yours truly,

H. H. DARBY.

Gathurst.



The "All-Concert de Luxe" receiver constructed by Mr. Sheward.

Envelope No. 4

SIR,—I enclose photograph of my three-valve "All-Concert de Luxe" Receiver described by Mr. Percy W. Harris, M.I.R.E., in Radio Press Envelope No. 4.

I have added another stage of L.F., using a power valve, each valve having separate H.T. control.

Excellent results are obtained from both British and Continental stations.

Wishing Mr. Harris and all the Radio Press publications every success.—Yours truly,

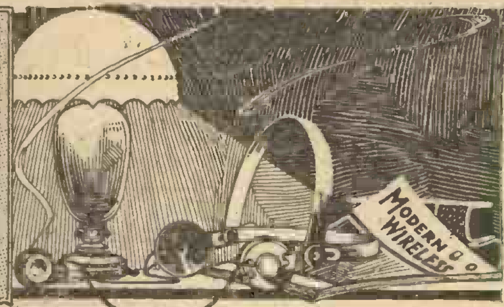
F. H. SHEWARD.

Stoke-on-Trent.

The Choice of a Coil

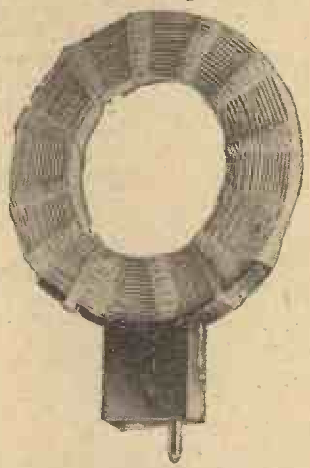
By

W. S. PERCIVAL, B.Sc. (Hons.), A.R.C.S.



There are many factors which influence the efficiency of a tuning coil, and this article summarises a few of the more important considerations

THERE are so many different coils on the market at the present time, that the would-be purchaser often finds it a matter of some difficulty to select the best coil for his particular purpose. It is thought, therefore, that an article on this subject will assist those numerous amateurs who wish to render their sets as efficient as possible, and yet have neither the time nor money to test a large number of coils for themselves.



A home-made plug-in coil

Initially the choice of a coil generally resolves itself into balancing advantages and disadvantages. Thus a coil which is highly efficient from the electrical standpoint, may be bulky and thus unsuitable for use in certain receivers.

Points to be Considered.

The main qualities of a coil which it is necessary to consider may be grouped roughly under two headings, *i.e.* (A) Mechanical and general, and (B) Electrical, as follows :—

MECHANICAL AND GENERAL.

1. Appearance.
2. Price.
3. Weight, size, and shape.
4. Rigidity and mechanical strength.
5. Nomenclature.

ELECTRICAL.

1. Inductance.
2. High-frequency Resistance.
3. Self-capacity and natural frequency.
4. External field.
5. Resistance to exposure.
6. Nature of mounting.

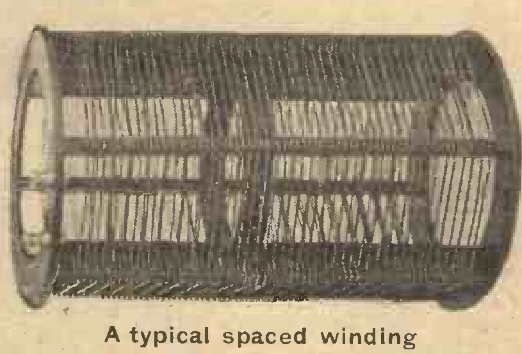
Appearance and Price

The first thing that strikes one about a coil is its appearance. If the coil is to be housed within the cabinet this is often of secondary importance, but it must not be forgotten that a coil of poor appearance will probably reveal its bad workmanship in actual performance. The reverse is not necessarily the case, however, and many coils of the most prepossessing external appearance have been found on test to be unsatisfactory from the electrical point of view.

Price alone is not a good guide to the quality of a coil, and the purchaser who chooses the most expensive coil, under the impression that it is the best, may be sadly disillusioned. On the other hand, it is false economy to buy a cheap coil, when inspection indicates that it is of an inefficient or unsuitable type.

Weight, Size and Shape

Considerations of weight, size and shape are of importance, and yet too frequently are overlooked. When a two- or three-way coil-holder is used in certain positions a heavy coil will often not keep in position, and much time and energy may be spent in trying to increase the friction of the coil-holder. In this connection those coil-holders in which the degree of friction is adjustable are invaluable. In designing a compact set it is very easy to allow just sufficient clearance for a coil which is handy at the moment, and if a larger and perhaps more efficient coil is purchased later much annoyance may be caused on finding that it fouls other components. At the present time low-loss coils are generally conspicuous by their large size, and in some receivers this is sufficient to render their use out of the question.



A typical spaced winding

Rigidity and Mechanical Strength

The majority of plug-in coils are satisfactory as regards rigidity and mechanical strength for

FADA Radio

This is the switch that changes over from long to short waves—in one simple flick!

The "long-short" set illustrated above is the 5-valve FADA RADIO receiver No. 175-AL otherwise similar to the FADA Neutroceiver ... **£45.**

Manufactured under Hazeltine Neutrodyne Patents granted in Great Britain.

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RADIO circles had always said it couldn't be done. Certainly the obstacles were many—but FADA RADIO has overcome them and developed the "long-short wave" receiver—*a Neutrodyne that covers the whole band of broadcasting wave-lengths!*

This new set solves the growing problem of Morse interference for coastal listeners. Switch *down* for 200-600 metres—switch *up* for 1050-2500—that's *all* that is needed, besides the simple dial-setting, to bring in the wanted station perfectly. And with this big new advantage the wonderful FADA combination of selectivity, distance and volume is retained in full measure.

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M.W.

ordinary reception purposes. For use in wavemeters, as in all measuring instruments, rigidity is of prime consideration. Home-made coils are often not very rigid or durable, but an improvement in these respects may be obtained by the use of some binding material. This should not be too thick, or too heavily impregnated, as lack of electrical efficiency will result.

Importance of Inductance

Perhaps there is no point which is more perplexing to the beginner than the nomenclature of coils. It is a very common practice to give the turn number of a coil, *e.g.*, a No. 75 coil is a coil with 75 turns. When we remember that the inductance of a coil depends not only on the number of turns, but also upon their spacing and the area enclosed by each, it is clear that the turn number is a very unsatisfactory indication of the performance of a coil. The only real guide is the inductance, and it is unfortunate that this is not always stated by the manufacturers.

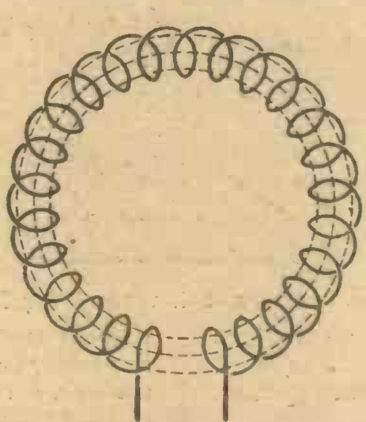


Fig. 1.—A toroid is equivalent to a single turn as far as the external field is concerned.

This brings us to the electrical properties of coils, and the best value of inductance to use in different circumstances. While space does not permit a full discussion of this very interesting subject, a few general remarks may prove useful.

Aerial Coil

In the case of a crystal set the tuning inductance should, on an efficient aerial, be of such a size that it tunes as nearly as possible without any added capacity. There should also be some provision for tapping the crystal across an optimum number of turns.

In a single-valve detector the aerial coil should be as large as is consistent with the necessity to tune the required maximum frequency. The problem is rather different from that of the crystal receiver, as each coil is generally required to cover a band of frequencies instead of to receive on one frequency. The reaction coil should be no larger than is necessary to make the receiver oscillate on the frequency band to be covered.

Intervalve Coupling

In the case of tuned anode and tuned transformer couplings between valves, the best inductance value to employ depends on a variety of factors. There is always an optimum value of inductance for any given frequency, but the calculation of this quantity is rendered extremely difficult owing to stray reaction effects.

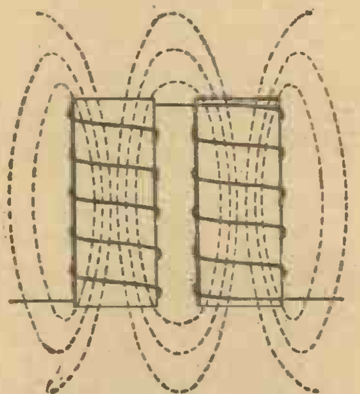


Fig 2.—By the use of an astatic winding the external field may be made very small.

The best value of the inductance for the untuned winding of a transformer is largely a matter of experiment, and it is not easy to lay down any definite rules.

Self-Capacity

Closely associated with the inductance of a coil is its self-capacity. These two constants determine its natural frequency, which can be obtained from the formula $f = \frac{159.2}{\sqrt{LC}}$ where f is the natural frequency in kilocycles, L the inductance in microhenries, and C its self-capacity in microfarads.

Among other things, self-capacity restricts the tuning range, and in certain cases increases the apparent high-frequency resistance of a coil. For a discussion on the effects of self capacity the reader is referred to an article by H. J. Barton Chapple, in the November, 1925, issue of MODERN WIRELESS.

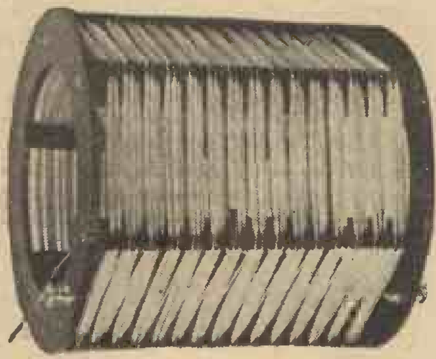
It is almost impossible to gauge the self-capacity of a coil by merely looking at it, but there are certain indications which may be borne in mind. Thus a coil with well-spaced turns will probably have a smaller self-capacity than one less spaced. The use of thick wire and impregnating material also tends to increase the self-capacity, while a constant source of self-capacity is in the coil-holder.

H.F. Resistance

We now come to the high-frequency resistance of a coil, which next to inductance is probably its main characteristic. It is perhaps unnecessary to say that the high-frequency resistance of a coil is very different from its D.C. resistance, but it is interesting to note that the higher the frequency the greater the resistance of a coil and the more care must be expended in producing a good design. At the very highest frequencies it is necessary to discard all attempts to produce a coil of the ordinary plug-in type, and recourse must be made to bare wire skeleton coils.

The high-frequency resistance of a coil is due to several factors, the most important of which are skin effect and dielectric losses. Skin effect is due to the current travelling backwards and forwards on the surface of the wire, there being no time between reversal for it to penetrate into the interior, and this effect is increased by winding the wire in the form of a coil. For a given frequency there is an optimum diameter of wire and a given inductance of the coil at which the resistance is least. Thus coils should not necessarily be wound with thick wire. Dielectric loss is due to losses in the imperfect dielectric between the turns of a coil, and increases with self-capacity owing to the greater current flowing in the dielectric.

It is an exceedingly difficult matter to estimate the high-frequency resistance of a coil without recourse to somewhat elaborate experiments. It must not be forgotten, however, that there is no point in using an ultra low-loss coil where other losses are much larger than those in the coil. Generally speaking, it may be said that the lower the losses in other parts of the circuit the more will be the gain in using good coils.



A Three-step coil wound for 5XX

Field of a Coil

The next property of a coil to be considered is its magnetic field, a feature which is often overlooked. Unlike other properties of a coil it is difficult to generalise upon it, for sometimes we want the magnetic field of a coil to be large, while at other times great care must be expended to reduce it as much as possible.

In a single-valve detector it is clear that both the aerial and reaction coils must have external magnetic fields. On the other hand, in receivers employing several stages of high-frequency amplification, the fields of the intermediate transformers should be restricted where possible, otherwise there will be interaction between the different stages and consequent instability. Generally speaking, a small coil or transformer will have a smaller external field than a large one.

Special Coils

With toroidal coils the external field is very small as shown in Fig. 1, this being really a solenoidal coil with its ends bent round until they meet, thus forming a complete ring. Here the magnetic flux surges backwards and forwards round the circular axis of the coil, and causes little interference elsewhere. Toroidal coils are, however, awkward to make, are often clumsy in appearance and have a higher resistance at high-frequencies than an equivalent coil wound in a straightforward manner so that they are seldom employed.

Binocular coils are more frequently employed in America than in this country, and are composed of two solenoidal coils side by side, wound so that the flux travels up the axis of one coil and down that of the other. Thus the external field is reduced, except near the ends of the coils.

Another disadvantage of coils with considerable magnetic field is that they are liable to act as miniature loops and pick up incoming waves directly, thus decreasing the selectivity of a receiver.

Exposure

It might be thought that the question of exposure would be a small matter, and not worth taking into consideration owing to the sheltered conditions under which a coil is generally used. This is, however, not always the case, and due attention should be paid to the means adopted to shield the coil from the effects of dampness. This becomes much more important when the turns of a coil press heavily upon each other, and corrosion must be considered when using bare wire coils on low-loss formers.

The Coil Plug

In conclusion, mention must be made of the coil plug, and the electrical connections between the plug and socket and ends of the coil. The latter should preferably be soldered, while the ebonite of the coil plug should always be examined to see that it is of good quality and therefore not likely to produce bad leakage.

The machinery room at the Post Office Beam Station at Bodmin, in Cornwall.

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100	4/3
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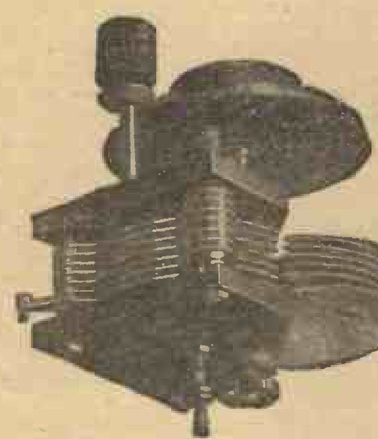

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These are true low loss condensers with direct reading vernier movement. Complete with dial and knob.

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Conscientious Constructors are considering the choke method of intervalve coupling, it has many points in its favour, besides that of making better radio reproduction possible.

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M.W. Feb. 26.

Issued by the Publicity Department A.J.S.

Regular Programmes from American Broadcasting Stations

Hours of transmission given in Greenwich mean time and in local time prevailing.

Telephony only. Corrected up to January 18th, 1926.

Edited by Captain L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. Duration
			WEEK-DAYS.				
A. 97	10.30 p.m.	4.30 p.m. C.S.T.	Fort Worth Star Telegram	WBAP 475.9 m.	Fort Worth, Texas	Police News	½ hr.
A. 10	10.45 a.m.	5.45 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Children's Hour	½ hr.
A. 1	11.0 p.m.	6.0 p.m. E.S.T.	Willard Storage Battery	WTAM 389.4 m.	Cleveland, Ohio	Dinner Concert	1 hr.
A. 65	11.0 p.m.	6.0 p.m. E.S.T.	American Tel. & Tel. Co.	WEAF 492 m.	New York	Musical Programme	5 hrs.
A. 61	11.0 p.m.	6.0 p.m. E.S.T.	"The Detroit News"	WWJ 352.7 m.	Detroit, Mich.	Dinner Concert (except Sat.)	2 hr.
A. 4	11.15 p.m.	6.15 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Dinner Concert	¾ hr.
A. 98	11.15 p.m.	6.15 p.m. E.S.T.	L. Bamberger & Co.	WOR 405 m.	Newark, N.J.	Talk, Sports, News	15 min.
A. 99	11.30 p.m.	6.30 p.m. E.S.T.	L. Bamberger & Co.	WOR 405 m.	Newark, N.J.	Dinner Music (except Tues. and Fri.)	1 hr.
A. 15	11.30 p.m.	6.30 p.m. E.S.T.	General Electric Co.	WGY 379.5 m.	Schenectady, N.Y.	Music and/or Talks (except Fri. and Sat.)	30 min.
A. 100	11.30 p.m.	6.30 p.m. E.S.T.	Pittsburg Press, Kaufmann & Baer Co.	WCAE 461.3 m.	Pittsburg, Pa.	Dinner Concert	1 hr.
A. 5	11.50 p.m.	5.50 p.m. C.S.T.	"Kansas City Star"	WDAF 365.6 m.	Kansas City, Mo.	Market, Weather, Time and Road Report	10 min.
A. 80	Midnight	7.0 p.m. E.S.T.	Gimbell Bros.	WIP 508.2 m.	Philadelphia, Pa.	Children's Corner	1 hr.
A. 6	Midnight	6.0 p.m. C.S.T.	"Kansas City Star"	WDAF 365.6 m.	Kansas City, Mo.	Talks, Stories, Music	1 hr.
A. 8	Midnight	6.0 p.m. C.S.T.	Westinghouse Elec. & Mfg. Co.	KYW 536 m.	Chicago, Ill.	Dinner Music	1 hr.
A. 66	Midnight	6.0 p.m. C.S.T.	Chicago Tribune Broadcasting Co.	WGN 370 m.	Chicago, Ill.	Dinner Concert	—
A. 9	Midnight	7.0 p.m. E.S.T.	Goodyear Tyre & Rubber Co.	WEAR 389.4 m.	Cleveland, Ohio	Orchestra (except Saturday)	1 hr.
A. 12	Midnight.	6.0 p.m. C.S.T.	Woodmen of the World	WOAW 526 m.	Omaha, Nebraska	Talk or Concert (except Wed.)	1 hr.
A. 89	Midnight	7.0 p.m. E.S.T.	Henry Field Seed Co.	KFNF 266 m.	Shenandoah, Iowa	Concert	2 hrs.
A. 101	Midnight	6.0 p.m. C.S.T.	Fort Worth Star Telegram	WBAP 475.9 m.	Forth Worth, Texas	Dinner Music (except Sat.)	½ hr.
A. 102	Midnight	7.0 p.m. E.S.T.	Jewett Radio & Phonograph Co.	WJR 517 m.	Detroit, Mich.	Orchestra and Paige Six	2 hrs.
A. 103	Midnight	7.0 p.m. E.S.T.	Chesapeake Tel. Co.	WCAP 469 m.	Washington	Market News followed by Concert (Mon., Wed. and Fri.)	4 hrs.
A. 17	12.15 a.m.	6.15 p.m. C.S.T.	Sears-Roebuck & Co.	WIS 345 m.	Chicago, Ill.	Music and Concert (except Sat.)	2 hrs.
A. 104	12.30 a.m.	7.30 p.m. E.S.T.	John Wanamaker	WOO 508.2 m.	Philadelphia, Pa.	Dinner Concert (Mon., Tues. and Fri.)	1 hr.
A. 105	12.30 a.m.	7.30 p.m. E.S.T.	Pittsburg Press, Kaufmann & Baer Co.	WCAE 461.3 m.	Pittsburg, Pa.	Children's Hour (except Mon. and Tues.)	15 min.

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.

WEEK DAYS (Contd.).

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.
A. 16	12.35 a.m.	6.35 p.m. C.S.T.	Westinghouse Elec. & Mfg. Co.	KYW 536 m.	Chicago, Ill.	Children's Hour	25 min.
A. 106	12.45 a.m.	7.45 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 m. and 64 m.	Pittsburg, Pa.	Address from University (except Sat.)	¾ hr.
A. 70	1.0 a.m.	7.0 p.m. C.S.T.	St. Louis Post Dispatch	KSD 545.1 m.	St. Louis	Concert (except Tues. and Thurs.)	2 hrs.
A. 64	1.0 a.m.	8.0 p.m. E.S.T.	The Shepherd Stores	WNAC 280.3 m.	Boston, Mass.	Concert	1½ hrs.
A. 107	1.0 a.m.	7.0 p.m. C.S.T.	Westinghouse Elec. & Mfg. Co.	KYW 536 m.	Chicago, Ill.	Dinner Concert	½hr.
A. 108	1.0 a.m.	8.0 p.m. E.S.T.	Watch Tower	WBBR 272.6 m.	Staten I., N.Y.	Concert and News (Mon., Thur. and Sat.)	1 hr.
A. 85	1.0 a.m.	8.0 p.m. E.S.T.	"The Detroit News"	WWJ 352.7 m.	Detroit, Mich.	News and Music (Mon., Wed., Fri.)	1 hr.
A. 11	1.0 a.m.	8.0 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	WBZ 333.1 m.	Springfield, Mass.	Concert or Musical Programme (except Sat.)	30 min.
A. 13	1.10 a.m.	8.10 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	News, Talk, Market Reports (except Sat.)	15 min.
A. 63	1.15 a.m.	8.15 p.m. E.S.T.	Radio Lighthouse	WEMC 286 m.	Berrion Springs, Mich.	Concert	1¼ hr.
A. 19	1.30 a.m.	7.30 p.m. C.S.T.	Fort Worth Star Telegram	WBAP 475.9 m.	Fort Worth, Texas	Musical Programme (except Sat.)	1 hr.
A. 28	2.0 a.m.	8.0 p.m. C.S.T.	Westinghouse Elec. & Mfg. Co.	KYW 536 m.	Chicago, Ill.	Musical Entertainment (except Mon.)	1-2 hrs.
A. 81	2.0 a.m.	9.0 p.m. E.S.T.	American Radio Co.	KFQX 394 m.	Washington, D.C.	Concert (Thurs., Silent)	—
A. 20	2.0 a.m.	8.0 p.m. C.S.T.	"Kansas City Star"	WDAF 365.6 m.	Kansas City, Mo.	Musical Programme	2 hrs.
A. 67	2.0 a.m.	8.0 p.m. C.S.T.	Chicago Tribune Broadcasting Co.	WGN 370 m.	Chicago, Ill.	Vocal and Instrumental Music (except Mon.)	1 hr.
A. 109	2.0 a.m.	9.0 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 m. and 64 m.	Pittsburg, Pa.	Concert or Variety Entertainment (8.30 Wed., Sat.)	50 min.
A. 110	2.0 a.m.	9.0 p.m. E.S.T.	Rensselaer Polytechnic	WHAZ 379.5 m.	Troy, N.Y.	Concert, Address, Dance Music (Mon. only)	2 hrs.
A. 111	2.0 a.m.	6.0 p.m. P.S.T.	"Morning Oregon"	KGW 491.5 m.	Portland, Oregon	Dinner Concert	1 hr.
A. 86	2.0 a.m.	8.0 p.m. C.S.T.	Wilbur Glenn Voliva	WCBD 344.6 m.	Zion, Ill.	Concert (Tues. and Thurs.)	2 hrs.
A. 87	2.0 a.m.	9.0 p.m. E.S.T.	Pittsburg Press, Kaufman & Baer Co.	WCAE 461.3 m.	Pittsburg, Pa.	Concert, Music (Mon., Tues., Wed and Thurs.)	1 hr.
A. 21	2.55 a.m.	9.55 p.m. E.S.T.	John Wanamaker	WOO 508.2 m.	Philadelphia, Pa.	U.S. Naval Observatory Time Signal, followed by U.S. weather forecast	—
A. 22	2.55 a.m.	9.55 p.m. E.S.T.	Westinghouse Elec. & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Do. do.	—
A. 24	3.0 a.m.	9.0 p.m. C.S.T.	Woodmen of the World.	WOAW 526 m.	Omaha, Nebraska.	Concert (Ex. Wed.).	—
A. 88	3.0 a.m.	7.0 p.m. P.S.T.	General Electric Co. Pacific Coast Broadcasting Station	KGO 361 m.	Oakland, California	News, Baseball Scores, Weather Report, Stocks and Shares (except Sat.)	—
A. 73	3.0 a.m.	7.0 p.m. P.S.T.	Radio Central Super Station	KFI 467 m.	Los Angeles, Cal.	Musical Programme	4 hrs.
A. 27	3.30 a.m.	9.30 p.m. C.S.T.	Fort Worth Star Telegram	WBAP 475.9 m.	Fort Worth, Texas	Musical Programme (except Sat.)	1¼ hr.
A. 26	3.30 a.m.	7.30 p.m. P.S.T.	"Morning Oregonian"	KGW 491.5 m.	Portland, Oregon	Market, Weather, News, Police reports	15 min.

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.

WEEK DAYS (Contd.).

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.
A. 62	3.30 a.m.	7.30 p.m. P.S.T.	State College of Washington	KFAE 384.6 m.	Pullman's Washington	Concert (Mon., Wed. and Fri.)	1½ hr.
A. 82	4.0 a.m.	8.0 p.m. P.S.T.	"The Times"	KHJ 405.2 m.	Los Angeles	Concert	—
A. 68	4.0 a.m.	10.0 p.m. C.S.T.	Chicago Tribune Broadcasting Co.	WGN 370 m.	Chicago, Ill.	Dance Orchestra and popular songs (except Mon.)	1 hr.
A. 112	4.30 a.m.	11.30 p.m. E.S.T.	Jewett Radio & Phonograph Co.	WJR 517 m.	Detriot, Mich.	"Jewett Jesters" (except Thur.)	1 hr.
A. 29	5.45 a.m.	11.45 p.m. C.S.T.	"Kansas City Star"	WDAF 365.6 m.	Kansas City, Mo.	Musical Entertainment	1¼ hr.

SUNDAYS.

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.
A. 113	9.45 p.m.	4.45 p.m.	Westinghouse Electric & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Vesper Service	1 hr.
A. 91	11.0 p.m.	6.0 p.m. E.S.T.	John Wanamaker	WOO 508.2 m.	Philadelphia, Pa.	Organ Recital	—
A. 90	11.30 p.m.	6.30 p.m. E.S.T.	Henry Field Seed Co.	KFNF 266 m.	Shenandoah, Iowa	Divine Service	1 hr.
A. 115	11.30 p.m.	6.30 p.m.	Pittsburg Press	WCAE 461.3 m.	Pittsburg, Pa.	Dinner Concert, Will. Penn. Hotel	45 mins.
A. 116	11.30 p.m.	6.30 p.m.	Westinghouse Electric & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Dinner Concert	1 hr.
A. 40	Midnight	7.0 p.m. E.S.T.	Westinghouse Electric & Mfg. Co.	WBZ 333.1 m.	Springfield, Mass.	Concert or Music, etc.	—
A. 79	Midnight	7.20 p.m. E.S.T.	Chesapeake Tel. Co.	WCAP 469 m.	Washington, D.C.	Musical Programme and Organ Recital	2 hrs.
A. 31	Midnight	6.0 p.m. C.S.T.	Woodmen of the World	WOAW 526 m.	Omaha, Nebraska	Bible Study Hour	1 hr.
A. 117	Midnight	7.0 p.m. E.S.T.	General Elec. Co.	WGY 379.5 m.	Schenectady, N.Y.	Carillon Programme	½ hr.
A. 118	Midnight	7.0 p.m. E.S.T.	Carletone College	KFMY 337 m.	Worthfield, Minnesota	College Vesper Service	1 hr.
A. 114	12.30 a.m. (Monday)	7.30 p.m. E.S.T.	Shepherd Stores	WNAC 280.3 m.	Boston, Mass	Church Service	1 hr.
A. 66	12.20 a.m. (Monday)	7.20 p.m. E.S.T.	American Tel. & Tel. Co.	WEAF 492 m.	New York	Musical Programme	2 hrs.
A. 33	12.30 a.m. (Monday)	7.30 p.m. E.S.T.	General Elec. Co.	WGY 379.5 m.	Schenectady, N.Y.	Church Service	1 hr.
A. 32	12.30 a.m. (Monday)	7.30 p.m. E.S.T.	Strawbridge & Clothier	WFI 394.5 m.	Philadelphia, Pa.	Church Service	—
A. 92	12.30 a.m. (Monday)	7.30 p.m. E.S.T.	Henry Field Seed Co.	KFNF 266 m.	Shenandoah, Iowa	Divine Service	1 hr.
A. 30	12.45 a.m. (Monday)	7.45 p.m. E.S.T.	Westinghouse Electric & Mfg. Co.	KDKA 309 and 64 m.	Pittsburg, Pa.	Divine Service	1 hr.
A. 36	1.0 a.m. (Monday)	7.0 p.m. C.S.T.	Westinghouse Electric & Mfg. Co.	KYW 536 m.	Chicago, Ill.	Service and Musical Programme	2 hrs.
A. 77	1.0 a.m. (Monday)	7.0 p.m. C.S.T.	Sear-Roebuck & Co.	WLS 345 m.	Chicago, Ill.	Church Service	1 hr.
A. 93	2.0 a.m. (Monday)	8.0 p.m. C.S.T.	Wilbur Glenn Voliva	WCBD 344.6 m.	Zion, Ill.	Concert	2 hrs.
A. 119	3.0 a.m. (Monday)	10.0 p.m. E.S.T.	Watch Tower	WBBR 272.6 m.	Staten I., N.Y.	Bible Lecture and Sacred Music	1½ hrs.
A 120	3.10 a.m. (Monday)	9.10 p.m. C.S.T.	Woodmen of the World	WOAW 526 m.	Omaha, Nebraska	Chapel Service	1 hr.
A. 38	3.25 a.m. (Monday)	7.25 p.m. P.S.T.	"Morning Oregonian"	KGW 491.5 m.	Portland, Oregon	Church Service	1½ hrs.
A. 94	4.0 a.m. (Monday)	8.0 p.m. P.S.T.	General Electric Co. Pacific Coast Broadcasting Station	KGO 361 m.	Oakland, California	Divine Service	—
A. 43	5.0 a.m. (Monday)	11.0 p.m. C.S.T.	Fort Worth Star Telegram	WBAP 475.9 m.	Fort Worth, Texas	Concert	1 hr.

No.	G.M.T.	Local Time prevailing.	Station.	Call Sign and Wave-length.	Town.	Nature of Transmission.	Approx. duration.
			SPECIAL DAYS. (Days refer to local time)				
A. 47	12.30 a.m.	7.30 p.m. E.S.T.	John Wanamaker	WOO 508.2 m.	Philadelphia, Pa.	Except Tues.—Organ or Orchestral Concerts, Talks	3½ hrs.
A. 96	1.0 a.m.	8.0 p.m. E.S.T.	Strawbridge & Clothier	WFI 394.5 m.	Philadelphia, Pa.	Tues. and Sat.—Concert	—
A. 50	1.0 a.m.	8.0 p.m. E.S.T.	Willard Storage Battery Co.	WTAM 389.4	Cleveland, Ohio	Mon and Wed.—Concert	3 hrs.
A. 51	2.0 a.m.	9.0 p.m. E.S.T.	Willard Storage Battery Co.	WTAM 389.4	Cleveland, Ohio	Saturday—Dance Programme	3 hrs.

Feminine Wireless Fans

Another woman reader's experiences with wireless as a hobby

SIR,—Mrs. Lee Booker's very charming article in the December, 1925, issue of MODERN WIRELESS tempts another woman to put her experiences on paper, in the hope of giving further encouragement to women in the hobby

In February, 1925, I knew nothing whatever about wireless, but the February number of a wireless magazine fell into my hands during a tedious journey—and that was my undoing!

I live in the country with no wireless neighbours to advise me, so my only hope was to buy wireless literature and plod through the elements in a lonely furrow.

What was it?

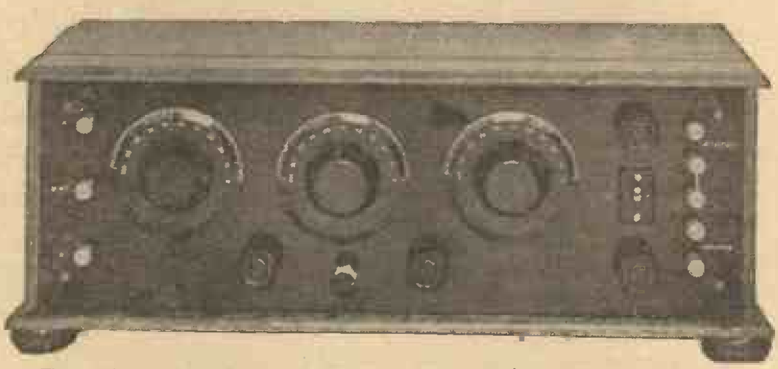
Unfortunately no book seemed to tell one what exactly a variable condenser looked like, and as for a rheostat or a potentiometer, it took me some time to fathom what they were like in appearance, and their function. I cannot help a smile now, when I think of myself being shown a double coil-holder in a shop and the salesman holding forth on the advantages of the vernier. I did not want to show my ignorance by asking exactly what it was he was holding, but how was I to know that it was a coil-holder?

Soldering Difficulties

By July I embarked on drilling the panel, and set to work on a "four-valver." I took great pains over my aerial and earth—the former is a beauty—and I do not regret my pains taken over either of them.

My chief stumbling block was teaching myself how to solder. No one knows what I went through getting the blow-lamp to work, watching it and pumping it, then keeping an eye on the soldering-iron to ensure it was hot *and clean*, while trying to keep one's mind on the wiring. I did mine out of doors then, for fear of an explosion with the blow-lamp. Since then I have found a valued friend in a Lamb blow-lamp. It is far cleaner and safer, and I should recommend it for any woman who has not gas or electricity for heating.

By the end of July I had made the cabinet in mahogany, ready cut and planed by Hobbies. The hinges were the trouble, but a brother's help with that was my only outside assistance. I did not dovetail the joints, I fear, but careful screwing and putty overcame the difficulty.

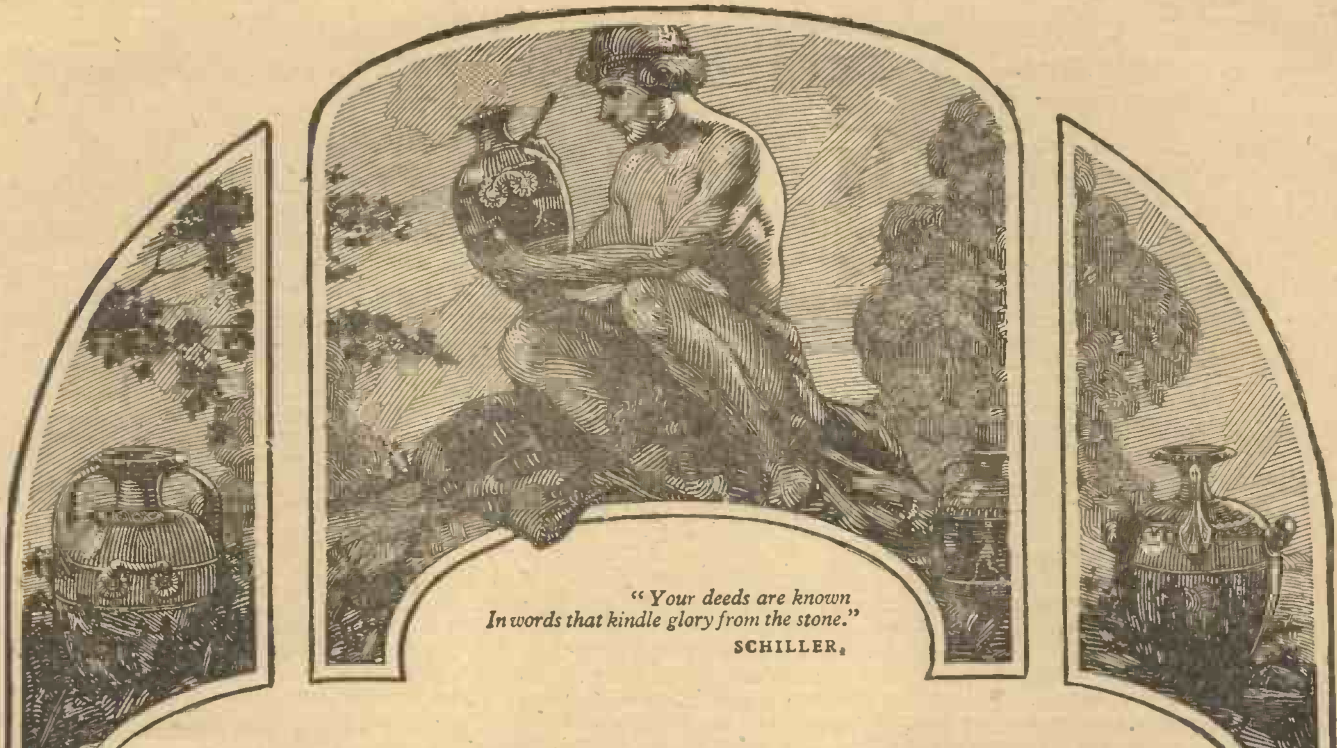


The Harmony Four, a good example of modern design.

Excessive Caution

Then the accumulator was connected up, and in great fear of burning out a valve I just lit the valves, and for 24 hours listened in vain. At last I had to seek the aid of a wireless expert from a shop, who just increased the filament current, and behold, signals were heard, clear and strong.

Imagine my joy and pride! Since then I have also made, this time quite unassisted, even over the hinges of the cabinets, the simplicity three-valver of the Radio Press series, a two-valver and a four-valver; all of them are very satisfactory. So all I can say is — Courage, Mesdames.—Yours truly, C. TEMPEST.



"'Tis deeds must win the prize"

IN years to come, when the story of the Valve is written, certain developments will stand out like landmarks and win imperishable fame for their inventors.

First, the discovery of the electron theory. Later, Dr. Fleming's great contribution to the cause of Radio—the original two-electrode valve and the father of all valves. Afterwards, the addition by Dr. Lee de Forest of the grid, which resulted in the three-electrode valve. And then Valve development halted for several years. A long straight filament enclosed by a spiral grid—the whole being surrounded by a tubular anode.

This was the standard Valve until the year 1922. Obviously it had many disadvantages. A large proportion of its electron emission inevitably escaped from each end of the anode and served no useful purpose. This clearly caused a very serious loss in efficiency.

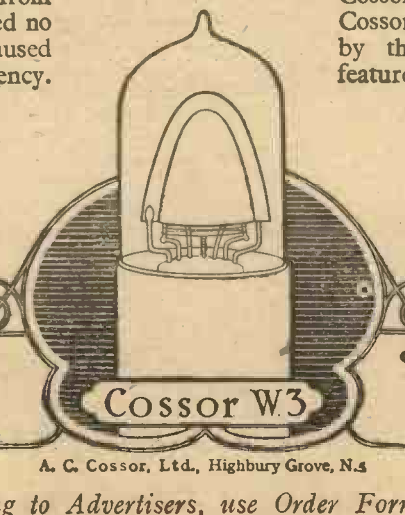
The spiral grid—owing to its lack of rigidity—was a fruitful cause of microphonic noises. The straight filament—tightly stretched to prevent sag—readily fractured and the Valve became useless. In 1922 there appeared a new Valve—one destined to win immediate recognition—the Cossor.

For the first time there was used in any Valve an arched self-supporting filament. A grid so rigid as to be utterly vibration-proof. And a hood-shaped anode which enclosed practically the whole of the electron stream. All of which were entirely original and exclusive features.

In three short years Cossor has triumphantly vindicated that its unique principles of design are correct. More than one of its features have been adopted by other makers. But Cossor users are not misled—for Cossor results are obtainable only by the combination of *all* these features.

For 2-volt Accumulators.

W.1.	For Detector and L.F. use. Consumption: .3 amp.	14/-
W.2.	(With red top) For H.F. use. Consumption: .3 amp.	14/-
W.3.	The Loud Speaker Valve. Consumption: .5 amp.	18/6



For 2, 4 or 6 Volts.

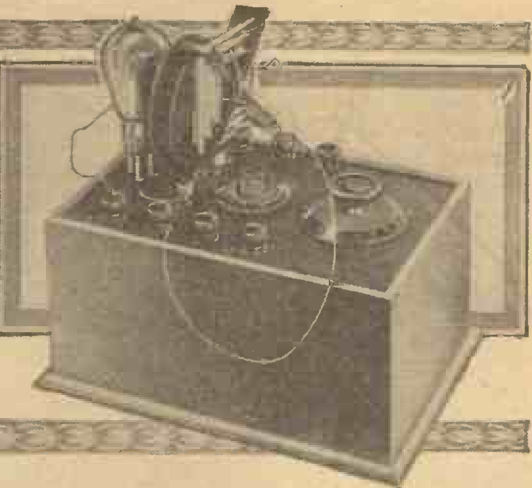
W.R.1.	Similar to W.1 but with special resistance which can be short-circuited when not required	16/-
W.R.2.	Similar to W.2 but with resistance as above	16/-

Cossor Valves

A. C. Cossor, Ltd., Highbury Grove, N.5

Gilbert Ad. 4348.

Some COMPARISONS of SELECTIVITY



By G. P. Kendall, B.Sc.

An interesting article explaining why some circuits give better results than others.

MOST experimenters who have had a certain amount of experience of different types of receiving sets must have noticed that there are noteworthy differences in selectivity between sets of closely similar character, some small variation in the circuits being responsible for the different behaviour. Selectivity is, of course, largely a matter of the actual resistance of the tuning circuits, so that a change of make of tuning coil, an improvement in the earth connection, and so on, will all affect the sharpness of tuning; but most of us will have noticed that the actual circuit employed appears to affect selectivity in a way which is by no means obvious.

Loose Coupling

An example of a change in the circuit which produces a marked alteration in selectivity that will probably be familiar to many readers is to be found in the use of the loose-coupled type of circuit with fully tuned primary and secondary. The introduction of such an arrangement, of course, leads to a considerable improvement in selectivity under proper conditions, but there are other cases where a change in circuit may produce an alteration in selectivity when the reasons are by no means so apparent. For example, many experimenters have reported a very marked improvement in selectivity following upon the incorporation of "constant aerial tuning" in a set and some have expressed surprise thereat.

There are obviously a number of problems involved requiring investigation, and the writer has been carrying out considerable experimental work of a simple nature intended to elucidate some of these points. Some decidedly interesting results have been obtained, and it is proposed in the present article to present such of them as have a bearing upon the question of the relative selectivity which can be expected from a number of the common types of tuning arrangements.

Definition of Selectivity

The methods employed have all been simple, and a description of them will be necessary in order that the reader may follow the results obtained without difficulty. First, it is necessary to decide upon a definition of selectivity which can be used as a test of the tuning properties of a given circuit. To the user of a receiving set, the degree of selectivity or sharp tuning would appear to be the property of a set which decides whether the signals of a given station disappear sharply upon either side of the correct adjustment upon the tuning dials, or whether they persist over a considerable number of degrees. Such a definition, however, is not entirely satisfactory when we try to make comparisons of different circuits, since it does not make allowances for differences in the capacities of the condensers, the frequency of the signal, and so on, and therefore we must decide upon a more universally applicable one.

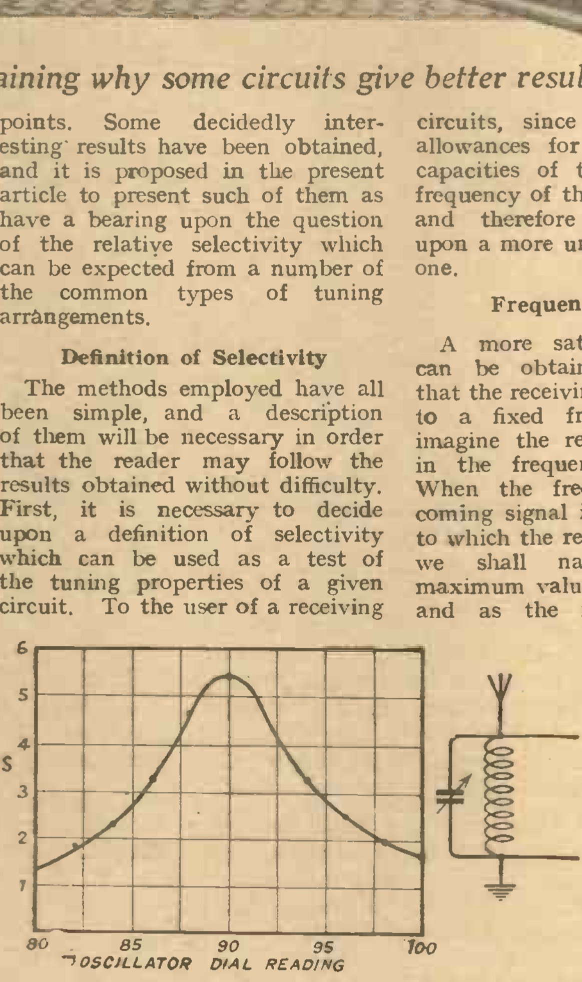


Fig. 1.—With a parallel condenser, rather flat tuning is obtained.

Frequency Variation

A more satisfactory definition can be obtained if we assume that the receiving set shall be tuned to a fixed frequency and then imagine the result of a variation in the frequency of the signal. When the frequency of the incoming signal is the same as that to which the receiving set is tuned, we shall naturally obtain a maximum value of signal strength, and as the incoming signal is gradually detuned from that frequency, signal strength will fall off, and the relative rapidity of that falling off can be taken as a measure of the selectivity of the circuit.

Sharp Tuning

Thus, if the signal strength falls off rapidly, we may say that it is a highly selective circuit, whereas if a considerable alteration can be made in the frequency of the incoming signals without very much affecting the strength of those signals in the receiver, we should say that the tuning was flat. It is evidently possible that we might obtain a working definition of selectivity by saying that the selectivity of a circuit bears a direct relationship to the number of kilocycles by which the incoming signal must be detuned on the receiving circuit to produce a given reduction of signal strength, say to one half the value obtained at resonance.

Resonance Curves

For rough comparative purposes such a definition is quite satisfactory; and given a method of carrying out the measurements involved, one can obtain useful results. Somewhat more readily interpreted results can be obtained, however, if we make use of the graphs known as resonance curves. To plot a resonance curve, it is necessary, in the method used by the writer, to provide an incoming signal whose frequency can be varied in steps of a certain number of kilocycles at a time, and one then measures the strength of signals produced at each frequency, and proceeds to transfer these results to squared paper. Horizontally the *frequency* of the signal is plotted, and vertically the *strength* of signal which results in the receiver. The curve which is thereby produced takes the form of a more or less sharp peak, and the actual degree of sharpness can be taken as a measure of the selectivity of the circuit under examination. Thus, one can compare the selectivities of different arrangements at a glance, in a way which is very difficult by any except a graphical method.

Apparatus Employed

In carrying out such experiments in practice, we obviously need two more or less separate pieces of apparatus, these being the receiving set or receiving circuit whose properties are to be investigated, with some means of measuring signal strength, and the other a source of "signals" of which the frequency can be varied at will, and which shall be capable of being so adjusted that it shall reproduce the conditions given by the reception of the signals of a more or less distant station.

As regards the first piece of apparatus, it is evident that we need some arrangement whereby it is possible to connect up the various types of circuit which we desire to investigate, and for this purpose the writer used the "Experimenter's Tuner" described in MODERN WIRELESS for September, 1924. With this piece of apparatus it is easy to obtain direct coupled circuits, loose coupled circuits, and so on, by the simple use of switches and terminals without loss of time, and across this instrument was connected a simple valve detector, which formed part of the convenient arrangement for measuring signal strength known as the "Moullin Voltmeter."

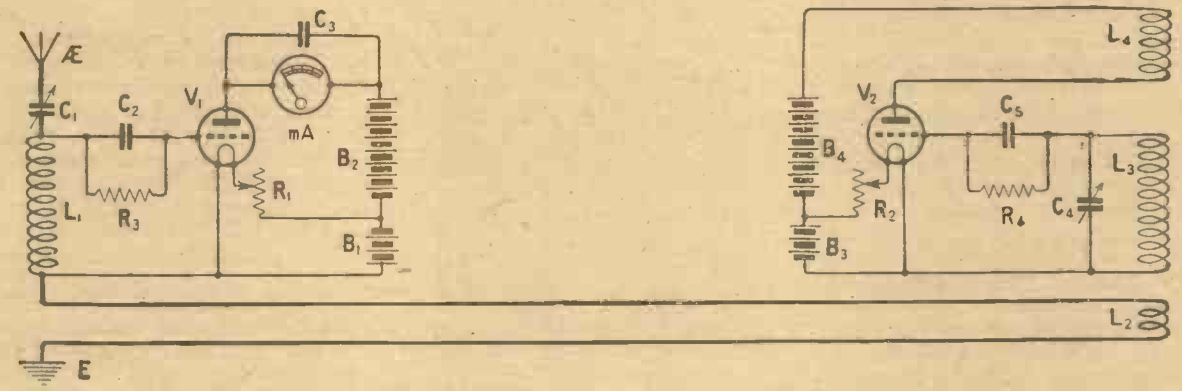
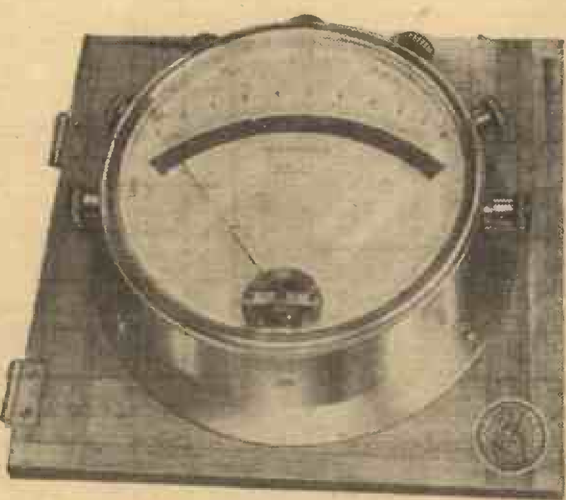


Fig. 2.—A local oscillator supplies current to the circuit under test, and the voltage across the coil L_1 is measured as explained in the text.

Current Change

This arrangement, it may be remembered, operates by virtue of the fact that when a valve detector is connected across a receiving circuit and a fairly strong signal comes in, a quite considerable change in the anode current of the valve takes place as a result of the building up on its grid of a considerable negative charge by virtue of the action of the grid condenser and leak. If, therefore, we include in the anode circuit of the rectifying valve a suitable measuring instrument to record this change of current, we have a ready means of determining the signal strength. In the experiments to be described a fine-reading milliammeter was used for this purpose, the full scale reading of this instrument being from 0 to 10 milliamps. on the particular range which was used. It is actually a combination instrument, giving a variety of ranges, and on the one in question each scale division represents one-tenth of a milliampere, and these divisions are so far apart that it is easy to interpolate the next place of decimals by eye.



A milliammeter with an open scale is desirable in taking measurements. Note the halfpenny by comparison.

Signal Strength

A valve of the D.E.5 B. type was used for the rectifier, since it was found that this type gives conveniently large values of the signal strength, and the procedure was to adjust the normal anode current when no signals were being received to the figure of 2 milliamps. Upon the reception of a strong signal this value would drop to something in the neighbourhood of 1 to 1½ milliamperes, and the change in the reading was recorded under the heading of "signal strength."

Thus, for example, if the reception of the signal caused the anode current to drop from 2 milliamps to 1.3 milliamps, there was a change of .7 milliamps, and this was called a signal strength of 7.

The actual magnitude of signal voltage to which this corresponded is immaterial, since all that we desire is a means of making comparisons in order that resonance curves may be drawn, but it will give the reader an idea of the order of the signal employed to state that a signal strength in the neighbourhood of 8 or 9 upon this scale is given by the carrier wave of 2LO at a distance of approximately 8 miles when the receiving set is connected to a full size outdoor aerial.

Valve Oscillator

To obtain proper comparisons it is obvious that the source of signals should be a continuous wave, without modulation or interruption, in order that the damping of the circuit under investigation should be the main factor affecting the shape of the resonance curve, and therefore an ordinary valve oscillator was set up to provide the necessary "signals." Since it was desired to investigate the properties of complete receiving circuits attached to aerial and earth, the oscillations from the local source of signals were fed into the aerial circuit in the following manner. A small coil consisting of two turns with a diameter of about 3 inches was coupled at a distance of 3 inches from one of the coils of the oscillator, and this coil was connected in series with the earth lead of the receiving circuit undergoing investigation.

The oscillator consisted of the usual tuned grid circuit with reaction coil, a bright emitter valve being used with a fairly high value of plate voltage in order to produce strong oscillations capable of giving a fair value of signal strength with the weak degree of coupling used.

The tight-coupled aerial coil was wound over the secondary.

Method Adopted

The tuning condenser used in the local oscillator was of the straight line frequency variety, and the experimental method was to adjust this condenser to a reading which had been determined to produce oscillations with a frequency of 750 kilocycles (equivalent to a wavelength of 400 metres), to tune the receiving circuit to this frequency by noting the reading upon the tuning condenser which gave the maximum deflection upon the milliammeter, and then to vary the reading of the condenser in the local oscillator in steps of two degrees at a time, recording the signal strength produced in the receiver at each reading. This signal strength, of course, fell off upon either side of the true resonance point and provided the figures for the plotting of the desired resonance curve.

Shunting Condenser

A diagram of the complete arrangement is given in Fig. 2, and upon the left will be seen the receiving circuit with the necessary appliances for the measurement of signal strength, but it should be noted that the milliammeter must be shunted by a good sized condenser (C3 in the diagram) in order to minimise any reaction effects which might be produced by the windings of the instrument.

Upon the right will be seen the circuit of the local oscillator with the coil in the earth lead of the receiving circuit which was provided to pick up the oscillations. This coil is indicated by L_2 in the diagram, L_3 and L_4 being the grid coil and reaction coil of the oscillator. C_4 is the straight line frequency condenser to which reference has been made, and C_5 is a grid condenser which was provided for the oscillator, since it was found that with the aid of a grid condenser and leak a greater uniformity in the strength of the oscillations could be obtained during the course of alterations of the adjustment of the condenser C_4. Without the grid condenser and leak, variations made in the capacity of the condenser C_4 produced great alterations in the strength of oscillation generated by the valve, with disturbing effects upon the measurements in progress.

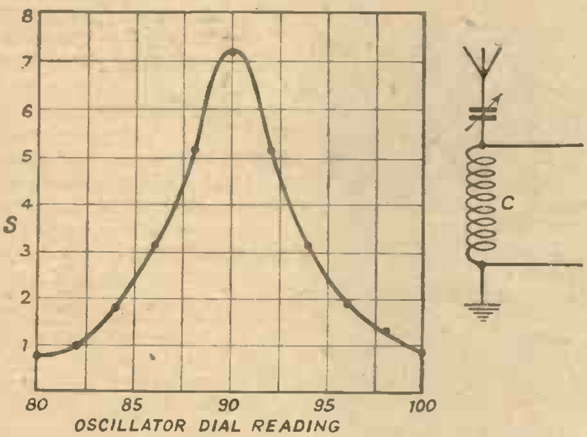


Fig. 3.—Sharper tuning is obtained with a series arrangement.

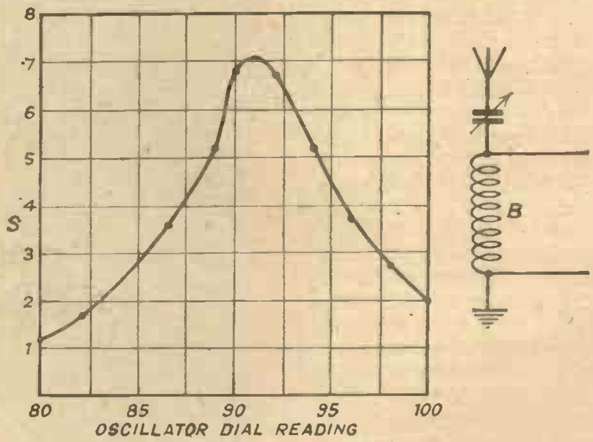
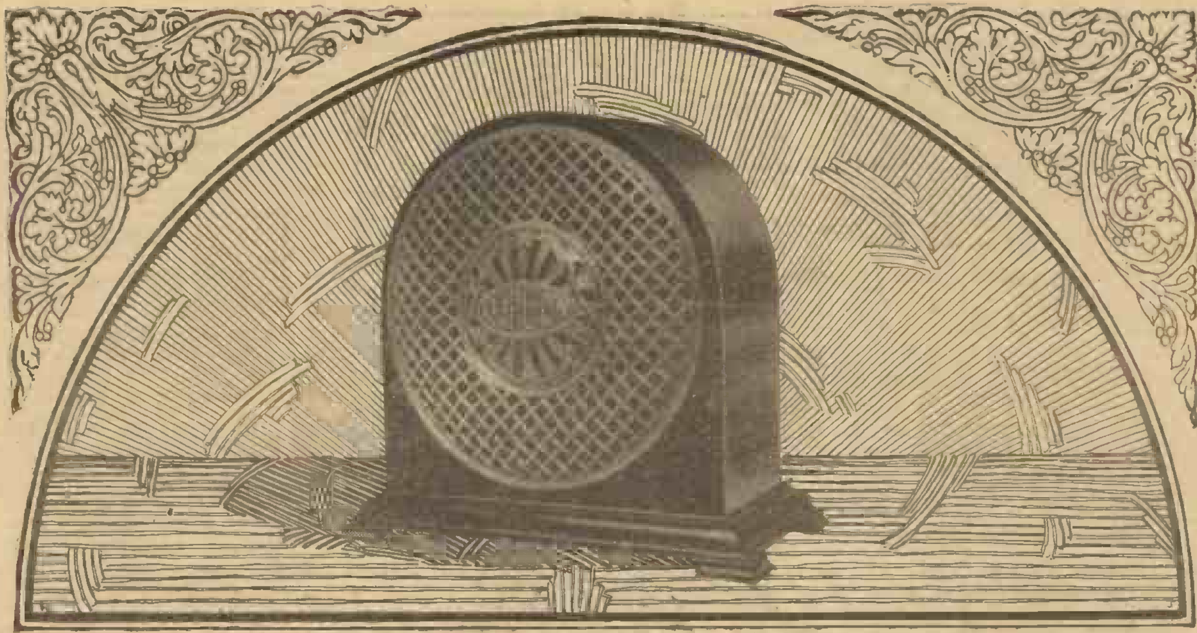


Fig. 4.—A slightly smaller coil gave somewhat poorer results.



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Parallel Condenser

The circuit with which many of us are most familiar is probably the ordinary tuned aerial circuit, consisting of aerial and earth, the tuning coil and variable condenser in parallel. Accordingly, the first experiment was to plot resonance curves for such a circuit in order to obtain a standard for purposes of comparison. Resonance curves were therefore plotted for a variety of different makes and sizes of coil and a general idea was obtained of the degree of sharpness of the peak which should be obtained.

For comparative purposes the curve reproduced in Fig. 1 was adopted, this being obtained with a Gambrell A coil in circuit. In this diagram, it should perhaps be explained, the dial reading of the oscillator condenser is plotted horizontally, and vertically the signal strength resulting in the receiving circuit. It will be observed that the maximum signal strength was obtained with a dial setting of 90 deg., and this corresponds to a frequency of 750 kilocycles (400 metres).

Series Arrangement

Next, the tuning condenser was switched into the series position and resonance curves plotted for various sizes of coil. Curious variations were found in the sharpness of the peaks of the resonance curves with different sizes of coil, the larger coil giving in general a sharper peak than a smaller sized one. Fig. 3, for example, gives the resonance curve obtained with a Gambrell C coil in the aerial circuit, while Fig. 4 is that resulting from the use of a B coil. It will be observed that in both cases the curves are more sharply peaked than that of Fig. 2, and this agrees with general experience, viz., that there is a slight advantage in favour of the series circuit from the point of view of selectivity in most cases.

It is probable that these effects are liable to considerable modification by different aerial and earth systems, and it should be borne in mind that throughout the experiments we are considering one particular aerial and earth only. The general effect, however, giving a comparison between the series and parallel condenser arrangement for an average amateur aerial, still holds good.

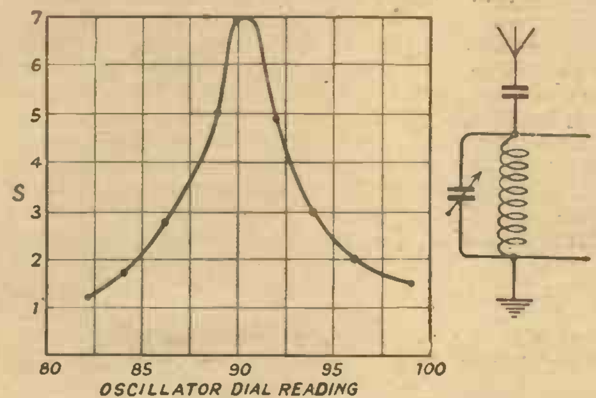


Fig. 5.—Constant aerial tuning gives a sharp peak, but a wide skirt.

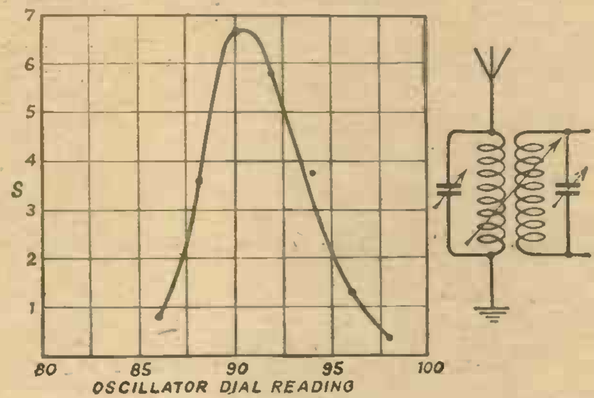


Fig. 6.—Loose-coupled circuits are more flat-topped.

Constant Aerial Tuning

Next the effect of a constant aerial tuning condenser was investigated, and the result expressed in Fig. 5. It will be seen that a decidedly sharper resonance curve is obtained, the coil being a Gambrell B. Although the peak of the curve is definitely much sharper, the width of its base is still very considerable, the slope flattening out very much to each side, so that as the receiver is detuned from a strong station there is little reduction in strength once signals have fallen to a certain value, giving the familiar effect of the local station being heard "all over the dial."

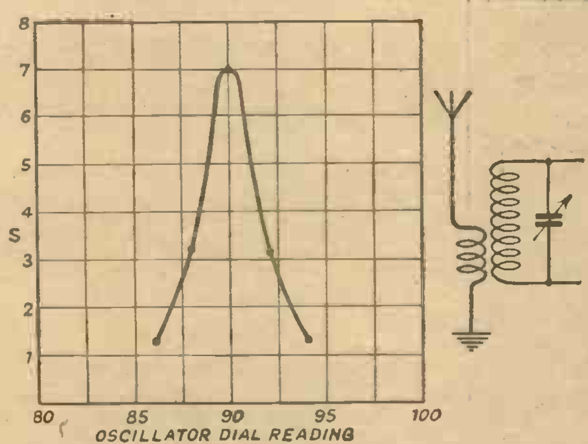


Fig. 7.—The tight-coupled aerial gives both sharp tuning and selectivity.

Coupled Circuits

It is not possible to get rid of this very wide base to the resonance curve when only a single circuit is used, even by a great increase in the sharpness of the actual peak itself, the only remedy being found in the use of two or more tuned circuits coupled in some way in cascade. This point is well illustrated in the next resonance curve, namely that of Fig. 6, which is that of a typical loose-coupled circuit. This circuit was arranged with the usual pair of plug-in coils, each of the circuits being tuned with variable condensers. The primary coil was a Gambrell A and the secondary a Gambrell B.

Flat Top

It will be seen that the base of the resonance curve has been narrowed very considerably, as compared with any of the preceding curves, while the peak, though reasonably sharp, is more flat-topped, which is very desirable for the reception of telephony.

Light Coupled Aerial

A circuit which is usually regarded as a substitute for the fully tuned primary and secondary loose-coupled arrangement, and is often referred to rather apologetically as giving many of the advantages of the more complicated arrangement, is that sometimes called the "aperiodic aerial circuit." A good deal of attention has been devoted to this circuit of late, and it has been shown that the aerial circuit is by no means aperiodic, but is, on the contrary, tuned in the ordinary manner by the number of turns of wire in circuit. The degree of coupling employed between primary and secondary is so great, however, that an exceedingly flat resonance curve is obtained by varying the number of turns upon the primary and quite a considerable band of frequencies can be covered by means of a primary with a fixed number of turns.

A Good Arrangement

It would seem that this arrangement should not be regarded as a poor substitute for the fully tuned primary and secondary scheme, since the signal strength which it gives is usually fully equal to that of the older method and it is relatively easier to obtain a good degree of selectivity with it. Fig. 7 shows the resonance curve obtained from one of these arrangements, the coil unit consisting of a secondary wound upon a skeleton former and consisting of a single spaced layer of No. 28 enamelled wire, a fifteen-turn primary being overwound on top of this at the filament end.

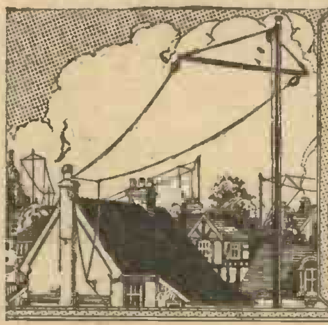
It is interesting to note that the peak of the curve obtained from the last arrangement is decidedly sharper than that given by the fully tuned primary and secondary circuit, and this again has been confirmed in actual reception of distant stations through the transmission of a local one.

Two Tunes Unnecessary

Under practical conditions, therefore, we can say fairly definitely that the use of a further tuning control for the aerial circuit is not justified, but, on the contrary, better results can be obtained without it. A possible objection to the omission of a tuning control for the aerial circuit, however, is to be found in the fact that a primary coil of fixed turn numbers will not cover the whole of the frequency band obtained in the broadcasting range with anything like uniformity. By a careful selection of turn numbers such a degree of uniformity may perhaps be obtained that at one end of the range something like 60 per cent. of the signal strength given at the other may be obtained, but by the expedient of providing one or two tappings upon the primary winding this objection can be completely removed.

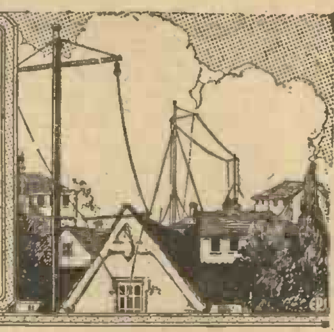
Different Aerials

A final word of warning should be given in regard to the interpretation of the curves which have been presented in this article. They were all obtained upon the same aerial and earth and that aerial and earth are known to be of slightly more than the average resistance. It is therefore probable that from a really efficient aerial and earth system the results would be somewhat modified, in the general direction of making the single circuit arrangements show up rather more favourably in comparison with the coupled circuits. Further, it is possible that the use of constant aerial tuning would not have quite such a marked effect. It is probable, however, that the average experimenter's aerial will not be very much superior to the one upon which these measurements were carried out.



Readers' Results

Some interesting experiences with Radio Press Sets.



Short Wave Reception

SIR,—You may be interested to hear of the results I have obtained with the short wave receiver described by Mr. D. J. S. Hartt in the November MODERN WIRELESS.

In the first place I used several parts I had at hand, fitted a variable grid leak and added a stage of L.F.

My coils are all of heavy bare copper wire, with minimum dielectric; valves, Mullard S.6 and P.M.4.

However, the design itself is all that could be desired and my receiver tunes much further down than is claimed.

A 20 turn coil goes down to 22m., but as my wavemeter is only accurately calibrated to 18m., I do not know the exact tuning range of 10 or 5 turn coils, though both of them oscillate freely well below 18 metres.

Perhaps I have been lucky, but these are the facts.

My log book for the first week on the 40-48 metre-band includes British, French, Italian, Belgian, Dutch, South African, Danish, Peruvian, Argentine and Australian amateurs.—Yours truly,

A. M. HOUSTON FERGUS
(Operating G2 Z.C., M.A.G.)

La Moye,
Jersey, C.I.

The "Special Five"

SIR,—I feel I must write you regarding the results I have had with The "Special Five," described in the November issue of MODERN WIRELESS by Mr. Harris.

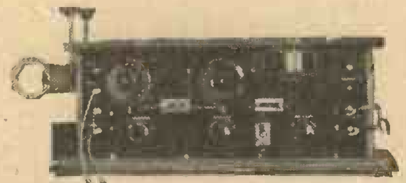
The set has been constructed exactly to your specification, and I am using the D.E.5 and D.E.5b valves as recommended.

Using a tapped 60 Lissen and a Radiax 25 or Burndept C, I have received the following stations during the usual broadcasting hours: Berne, Cardiff, Bournemouth, Madrid, Manchester, Glasgow, Swansea, Birmingham, Ecole Sup., Frankfurt, Hamburg and Oslo, all at loud-speaker strength. Tuning is exceedingly sharp, and I contemplate fitting geared condenser dials, as I am sure it will make tuning easier. Of course I am very pleased, but at the same time I feel very strongly that none of these stations are worth listening to if you live anywhere near the coast, as interference from Morse is incessant.

Long Wave Working

I am more than pleased with the results I am getting when using the 900-1,800 metres H.F. transformers, using aperiodic A.T.a 200 Igranic coil in L_2, and 100 Radiax in L_1 Konigswusterhausen, Geneva (subject to fading), Daventry and Radio Paris, are all received without trouble at full loud-speaker strength. Radio Paris is clear of interference from Daventry.

For reception of Daventry I have tried using the detector and 2 L.F. valves only, but I presume that owing to the distance my installation is from Daventry (about 170 miles) and the location of my aerial, which is badly screened, reception of this station by this method is too quiet to be of any use for the loud-speaker. For the best loud-speaker results from Daventry I short the first H.F. valve, place a Marconi R.5.v valve in the second H.F. valve socket, and use 150 coil in L_2. This method gives full loud-speaker results, and I consider that the tone is better if a R.5.v or ordinary Pink Top Cossor valve is used for the H.F. stage than a D.E5.



Mr. Kitching's Series-Tuned-Anode Receiver.

An Amusing Announcement

The set is quite the most selective I have ever used, and I have made up a considerable number of MODERN WIRELESS sets. It is a joy to be able to listen to Radio Paris again whenever she is transmitting, without hearing the voice of Daventry as well.

I was amused last night when listening to Konigswusterhausen, to hear the announcer's good night: "Gute Nacht, Geehrten Herren und Damen, vergessen sie nicht ihre Antennae zu erden." (Good night, Ladies and Gentlemen, don't forget to earth your aerial). During the summer it might be a good thing if some of our own stations took a tip from Berlin.

Thank you so much for evolving such an interesting circuit.—Yours truly, A KEEN AMATEUR.

A Series-Tuned-Anode Set

SIR,—I am enclosing a photograph of the "Series-Tuned-Anode 3-Valve Set," described by Mr. D. J. S. Hartt in *Wireless Weekly* April 1st, 1925, which I thought might be of interest to your readers. I have kept almost exactly to the component specification, and when using 2 ft. of flexible wire as an aerial, loud-speaker results are obtained all over the house without distortion. Using a 4 ft. frame aerial, the tuning is quite simple, and the volume from the loud speaker is sufficient to fill a small hall. I am 7 miles from 2LO, and so far have not tried searching. My very best thanks to Mr. Hartt for his wonderful circuit.—Yours truly, C. E. KITCHING.

Tooting, S.W.17.

A Little Knowledge . . .

A correspondent to the daily press, writing on the subject of spark interference, says "Apparently the wavebands (of these stations) extend many metres either side of the true, and consequently numerous stations are *heterodyned* if not 'jammed' by the Morse."

The italics are ours. The fact that spark stations have added heterodyning to their undesirable properties will be viewed with grave alarm. How they manage it is a mystery, because they never used to.

THE NEW MH "DIMIC" COIL

and some of its many applications

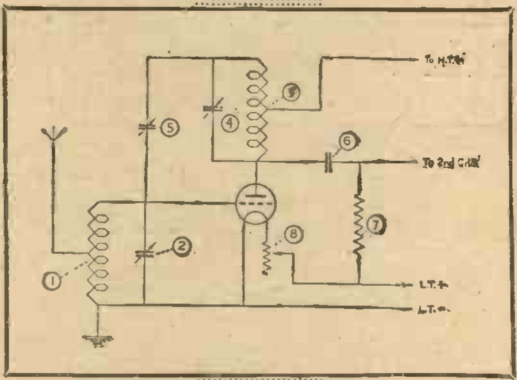


Diagram No. 1

ONE of the most important applications of the "Dimic" Coil is that of neutrodyning, *i.e.*, it enables the ultra-efficiency of the "Dimic" windings to be taken full advantage of for the purpose of high-frequency amplification with perfect stability. We claim that the particular principle of neutrodyning employed with "Dimic" coils is the only basically sound method, since the neutralising component is of necessity in its proper phase relationship with the effects to be neutralised. Neutrodyning is effected on the Diagram shown, but the construction of the Coil is such as to permit of variations in the method of application.

KEY TO DIAGRAM No. 1.

1. No. 1 "DIMIC" Coil Pri-es as Centre Tapped Aerial Inductance... 10/-; Base and Clips ... 2/6
2. Aerial Tuning Condenser ·0005 μF ... 10/6
3. "DIMIC" COIL No. 1 as Tuned Anode for H.F. amplification ... 10/-; Base and Clips ... 2/6
4. Anode Tuning Condenser ·0005 μF ... 10/6
5. Neutrodyne Condenser 2/10
6. Transfer Condenser (MH Fixed Condenser ·00025 μF) ... 2/6; Base and Clips ... 1/-
7. MH Grid Leak 1 megohm ... ... 2/6; Base and Clips ... 1/-
8. MH Dual Rheostat 7/6

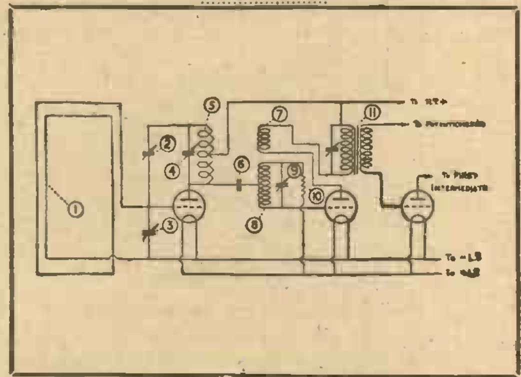


Diagram No. 2

IN Diagram No. 2 we indicate the application of the "Dimic" Coil to an H.F. stage preceding a supersonic receiver of the autodyne type. The excellent results obtained with MH supersonic outfits are enhanced enormously by this addition. It has a double advantage, giving even greater range to the set and increasing the selectivity without interfering with the perfect tonal properties associated with MH Supersonic outfits. It is applicable to any supersonic system, however. The Diagram is self-explanatory, and the circuit is strongly recommended, giving as it does a very high degree of efficiency, ease of control and simplicity of layout.

KEY TO DIAGRAM No. 2.

1. Loop Aerial ...
2. Neutrodyne Condenser 2/10
3. Aerial Tuning Condenser ·0005 μF ... 10/6
4. H.F. Tuning Condensers ·0005 μF ... 10/6
5. "DIMIC" COIL No. 1 10/-; Base and Clips ... 2/6
6. MH Mica Condenser ·0003 ... ... 2/6; Base and Clips ... 1/-
7. Reactor (MH Reactor) }
8. MH Autodyne unit 300-600 m. } Combined Unit 21/-
9. Autodyne Tuning Condenser ·0003 μF 8/6
10. MH Grid Leak 1 MΩ ... ... 2/6; Base and Clips ... 1/-
11. MH Supersonic Filter 21/-

Succeeding stages as usual.

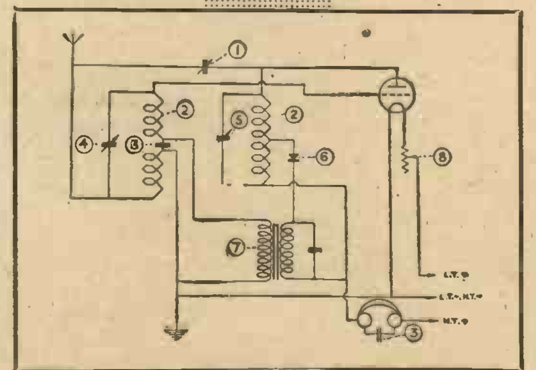


Diagram No. 3.

THIS represents a one-valve reflex circuit, which follows the general lines of S.T.100, with the important modification that the reflex transformer is removed from the earth lead. Reaction is effected by means of the Neutrodyne Condenser (No. 1) and two "Dimic" Coils are used, advantage being taken of the special construction adopted (Patents pending) for obtaining a divided centre point on the aerial coil, this division of the coil being obtainable and automatically effected by the special base clips in any case where desired.

KEY TO DIAGRAM No. 3.

1. Neutrodyne Condenser 2/10
2. "DIMIC" COILS No. 1 ... ... 10/-; Base and Clips ... 2/6
3. MH Mica Fixed Condenser ·001 μF 3/-; Base and Clips ... 1/-
4. Aerial Tuning Condenser ·0005 μF ... 10/6
5. Anode Tuning Condenser ·0005 μF ... 10/6
6. Crystal Detector...
7. MH L.F. Transformer with MH Mica Condenser ·001 μF 21/- and 3/-
8. MH Dual Rheostat 7/6

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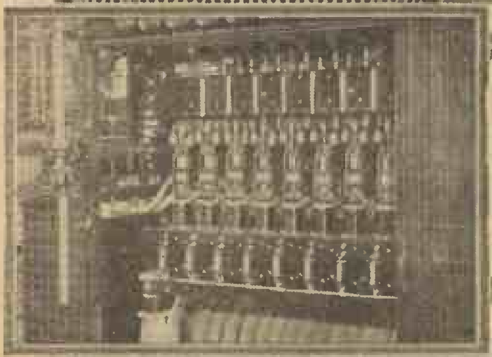

WHY ARE VALVES NECESSARY?

By CAPT. H.L. CROWTHER, M.Sc.

Various methods have been tried for eliminating valves in wireless sets, but the valve still remains the most satisfactory device.

I EXPECT this question has been asked by many persons, especially by those who have only taken an interest in wireless since the commencement of broadcasting. Cannot the same results be obtained with something more simple and more easily handled? Valves are somewhat expensive both as regards first cost and also upkeep, for they are easily broken or burnt out and generally require accumulators and high-tension batteries for their operation, and these in turn require constant attention.

A Crystal Set and Strong Signals

Why could not a crystal set be used for giving strong enough signals for loud-speaker work if one were sufficiently near to the broadcasting station, or if the B.B.C. increased the power of their stations? A crystal, however, is incapable of dealing with sufficient power to operate a loud-speaker independent of the strength of the incoming signals. This can be easily seen from the ordinary characteristic of a crystal (see Fig. 1). If the amplitude of the incoming signal exceeds a certain value the crystal becomes conducting in both directions, and the rectification consequently becomes inefficient, with the result that the effective current through the loud-speaker does not appreciably increase. Also damage may be done to the crystal if attempts are made to deal with too strong a signal.

Amplification Essential

When using a crystal, therefore, some form of audio-frequency amplification is essential, however near one is to a broadcasting station. High-frequency amplification of any description would be useless owing to the limiting factor of the crystal. The only way in which loud-speaker results can be obtained from a crystal is by amplifying the signals after they have been rectified by the crystal.

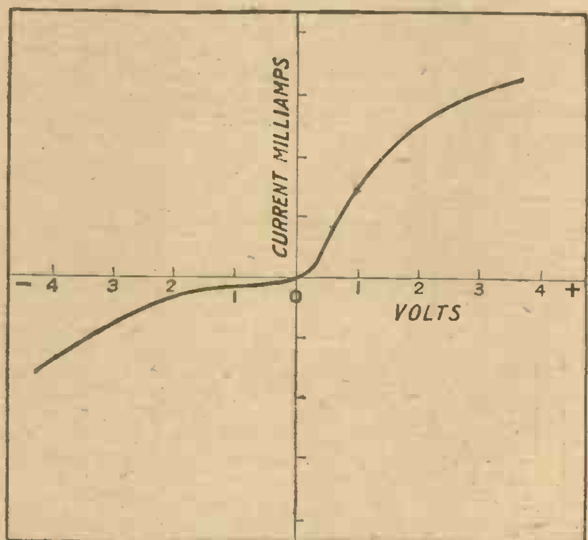

Fig. 1.—After a certain point the rectification effect becomes very small.

Other Devices

What devices, apart from valves, are possible for the amplification of audio-frequency signals? Obviously anything of the relay type which definitely makes and breaks the circuit is quite impossible for the purposes of telephony. A relay for this class of work must amplify varying currents in a strictly proportional manner. The microphone type of relay or amplifier suggests itself, for in this type of relay the resistance across the contacts depends on the pressure applied between them. The relay might consist of a single point contact, the resistance of which could be made to alter by variation of pressure caused by the received signal.

Microphone Amplifiers

A more convenient type is one in which a small carbon granule microphone is used, the pressure between the diaphragm and the carbon granules being made to vary by the incoming signals. Such a device is capable of giving very good amplification if the initial signal is fairly strong, *e.g.*, of good telephone strength. If two such microphone amplifiers are used in series or cascade sufficient strength can be obtained to operate even a large loud-speaker. The power required to operate such an amplifier is small, and is derived from a small accumulator or dry battery. This method probably sounds a much simpler and a more economic method of amplifying signals for the operation of a loud-speaker than by the use of valves.

Objections

There are disadvantages of such an amplifier when compared with valves. In the first place any form of relay or amplifier of this type is

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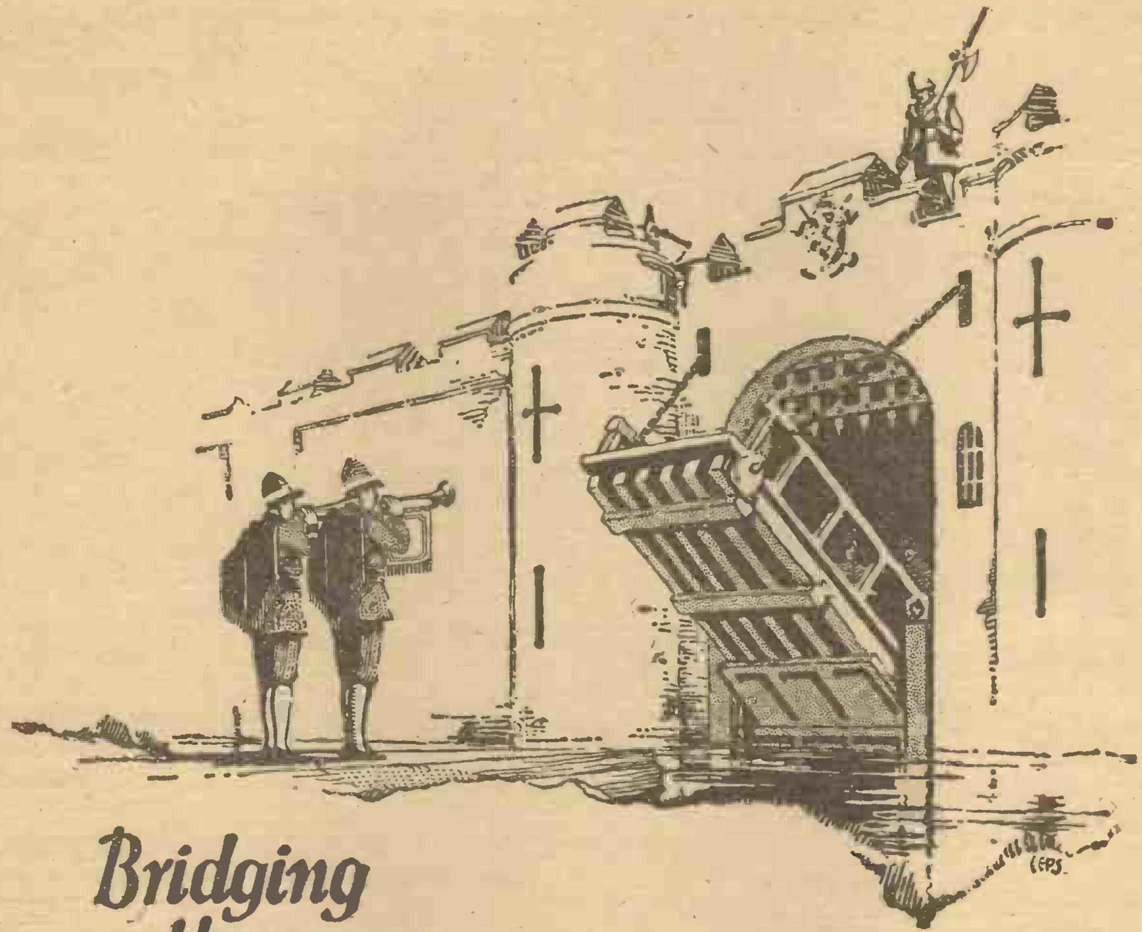

Bridging the gap

Among the many specialised requirements of the Wireless Experimenter, the need undoubtedly exists for a condenser designed to give an unbroken tuning range when a "change-over" is necessary from series to parallel working. With an ordinary variable condenser a gap occurs in the wave-length range at the point where the "change-over" is necessary.

The Duwatcon, however, has been specially designed to overcome this difficulty. It is so constructed that when used in the series position its *normal* maximum wave-length is obtained at about 120° on the scale. Further rotation of the knob, however, causes a further increase in the wave-length until, when the movement is completed at 180°, the wave-length is slightly greater than that which would be obtained by switching the condenser to "parallel" and turning the knob to zero again.

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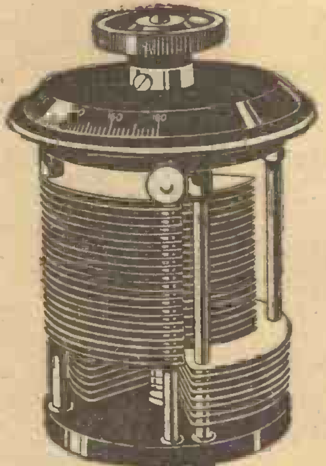

The Dubilier Duwatcon Variable Condenser. Capacity 0·0007 mfd. Price 30/-

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critical in adjustment, particularly if two are used in series or cascade. They also require a fair strength of initial signal to operate them, and are easily liable to go out of adjustment. The chief objection, however, to this type of amplification is that the reproduction is not as good as with a valve. It is true that quite intelligible speech can be obtained, but there is a big difference between intelligible speech and speech and music of really good quality. The reason for this poor reproduction is that it is difficult to get such amplifiers to respond to the higher frequencies which are essential for the reproduction of good tone and quality of both speech and music. Also the magnification of a variable contact type of amplifier is not uniform for weak and strong signals, with the result that the variations in the strength of speech and music are not faithfully reproduced.

Another Type of Relay or Amplifier

Another interesting type of relay which has been used for the amplification of speech and music consists of a rotating cylinder of agate or slate, over which there is a flexible metal band kept in contact with the cylinder by means of a spring. The general principle of this method of amplification, which was developed by Johnsen and Rahbek is shown in the accompanying Fig. 2. The agate cylinder should be about 1½ ins. to 2ins. in diameter and 2 ins. or 3 ins. long, and must be highly polished on its surface. The flexible metal band is attached at one end to the diaphragm of a loud speaker and is kept in close contact with the cylinder by means of a strong spring attached to the other end of the band. The principle of the apparatus depends on the fact that when an E.M.F. is applied between the agate cylinder and the metal band, the latter is attracted to the cylinder, with the result that there is an increase in the friction between the band and the rotating cylinder. This causes an increase in the force applied to the loud-speaker diaphragm.

Polarising Voltage

A fixed polarising voltage operates between the cylinder and the metal band so as to produce a definite pull on the loud-speaker diaphragm, which is increased and decreased by any alternating current that is passed through the primary of the input transformer. If current from a microphone is passed through the input transformer, the voice or any other sound can be reproduced from the loud-speaker in a greatly amplified form. For instance, by speaking in an ordinary voice into the microphone intelligible speech from the loud-speaker can be heard up to at least a quarter of a mile.

It might seem that such a powerful amplifier could take the place of valves for loud-speaker work. Unfortunately it requires a comparatively loud signal to operate it, and it is necessary to amplify any ordinary wireless signal by means of one or more valves before it can be applied to the relay. Such a device is therefore out of the question as an alternative for valves for ordinary loud-speaker work.

The valve is the only device at present known which is capable of amplifying weak signals and giving faithful reproduction of broadcast transmission. This alone would make the valve worth while in spite of its many disadvantages.

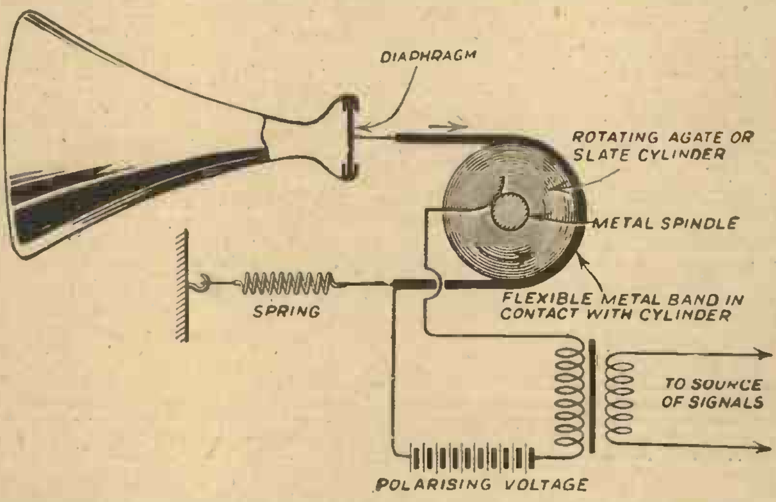


Fig. 2.—The Johnsen-Rahbek relay depends for its action upon the friction between an agate cylinder and a metal band.

Other Features of the Valve

The thermionic valve, however, has many additional features which are not possessed by any other type of electrical apparatus. It is the only apparatus known that will amplify the weakest possible electrical oscillation or signal, independent of whether it is an oscillation of fifty million cycles per second, or of only a few cycles per second, and at the same time give a faithful reproduction of the wave form of the oscillation. By using a number of valves in series practically any desired degree of amplification of signals or oscillations at any frequency can be obtained.

Limitations

If this is true one might wonder why it is not possible to receive the most distant stations, even if they only transmit the smallest amount of energy, and amplify the signals so as to give loud-speaker results. Unfortunately very serious difficulties arise which limit the amount of amplification that can be employed when receiving a distant station. A very sensitive valve amplifier will not only amplify the distant signal it is desired to receive, but also any other electrical disturbance which happens to be picked up by the aerial. However selective the receiving circuits are made, it is at present impossible to eliminate the effects of atmospherics, electrical storms, and what is generally known as "mush." It is thus obvious that however much amplification is used, a signal cannot be received if its strength is much below that of the general electrical disturbances existing at that time, and which are also picked up by the aerial, and amplified by the receiver.

Good Reproduction

To obtain good reproduction from a broadcasting station it is essential that the strength of the signal as picked up by the aerial be considerably greater than the "strength level" of the general electrical disturbances. Anyone who has attempted long distance reception knows that from an entertainment point of view there is nothing to equal the transmission from the local station, and possibly from the high-power station at Daventry, if situated within about 150 miles of the latter. Of course there are times when a distant station will come in wonderfully loud and clear, but if it is a question of entertainment, it is only the local station and the not too distant high-power station that can be relied upon.

Limit of Range easily reached by means of Valves

Until some means has been devised for overcoming the difficulties experienced by interference from general extraneous electrical disturbances, it appears that satisfactory reception will be limited to the near by stations, in which case valve receivers are perfectly satisfactory, even without taking full advantage of the maximum amplification that can be obtained by means of valves. The same range can be secured with a small receiving aerial, such as a 2 ft. square loop, as is obtained with a large aerial 200 ft. in height, the only difference being that a greater number of valves is required for receiving on the loop than for receiving on the large aerial. Thus one advantage in using a large aerial is to simplify the necessary receiving apparatus, for no increase in range is obtained. This was not true before the introduction of valves, as reception on a small loop was a practical impossibility except over a distance of one or two miles.

Use of Valves in Transmission

Valves, of course, are not limited to reception work, but are used very extensively for radio transmission of continuous waves, either for telegraphy or telephony. Although there are several alternative means of transmission, the valve has a great many advantages, and is essential for certain requirements. For instance, a valve is capable of maintaining continuous electrical oscillations of practically any frequency, and this is not possible with any other type of electrical device.

Although radio telephony can be transmitted by means of the arc, it is generally limited to comparatively low-frequencies, as above 150 kilocycles there are serious difficulties. The valve on the other hand can be used for radio telephony at frequencies approaching 100,000 k.c. In addition it has many other advantages over the arc for radio telephony.

Uses of Valves apart from Broadcasting

Valves have many other uses apart from broadcasting, as in land line telegraphy and telephony, submarine signalling, measurement, medical work, etc.

From what has been said there should be little doubt as to why valves are worth while in spite of any disadvantages. It is fairly safe to say that if it were not for the discovery and development of the thermionic valve, broadcasting as it is known to-day would not have been possible.

A Reader's Results

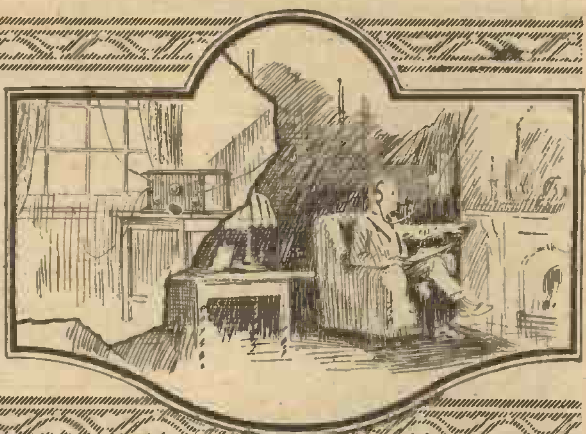
SIR,—I have just finished making the Eight-Valve Supersonic Receiver, described by Mr. Fuller in the September issue of MODERN WIRELESS. As might be expected, I am not yet skilled in its usage, but the results are very remarkable. So far I have logged six stations, most of them well up to loud-speaker strength, using only a 2 ft. frame. All of them, except Oslo, came in well on the loud-speaker. To get Oslo under existing conditions is in itself a triumph of sensitivity. My frame is midway between a large iron stove and a water tank, but in spite of this Oslo was quite audible in the phones in the morning.

J. MAURICE LEA.

Kew.

A REMOTE-CONTROL SINGLE-VALVE SET

By John Underdown



Many readers will have felt the need for a set which can be switched on and off from a distant point. This article describes a simple receiver incorporating this principle.

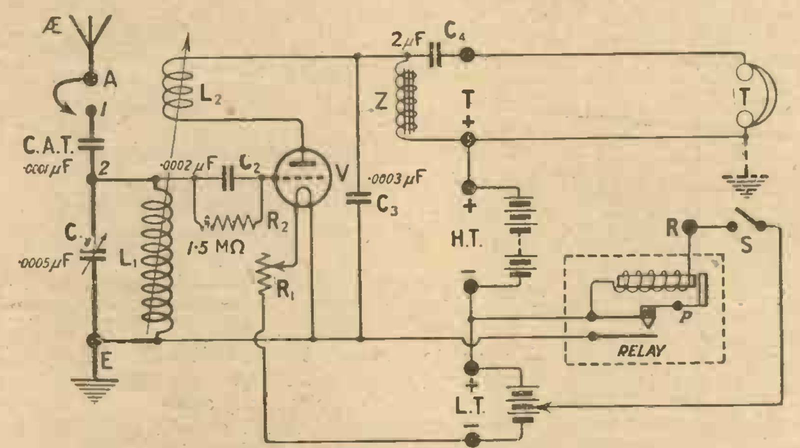


Fig. 1.—The relay makes or breaks the filament circuit as required.

TO be able to switch a set on and off from a distance is a very desirable feature where of necessity the receiver has to be placed in a room remote from that in which the listener wishes to have the programmes available. In the receiver about to be described a relay is incorporated for this purpose, giving a simple, convenient and reliable arrangement which I myself have employed for some considerable time without experiencing any trouble.

Points in Design

When designing a set which will normally only be employed for the reception of programmes from the local station it is desirable that coils and valves should be enclosed within the cabinet out of harm's way, and consequently this has been done in the present case, necessitating that the cabinet should be of larger size than is usually associated with a single-valve instrument. The type of valve to use also has to be decided upon, and provision has been made for one of the ·06 ampere general purpose type, since this permits of a dry battery supplying the necessary filament current, thus obviating frequent recharging, which in some localities presents difficulty.

The Circuit

The theoretical circuit diagram of the receiver will be seen in Fig. 1, whence it will be observed that the tuning circuit proper is of a popular and well tried type. Either constant aerial tuning or plain parallel tuning may be obtained by connecting the aerial to the points 1 or 2 respectively.

The controls on the panel are very simple.

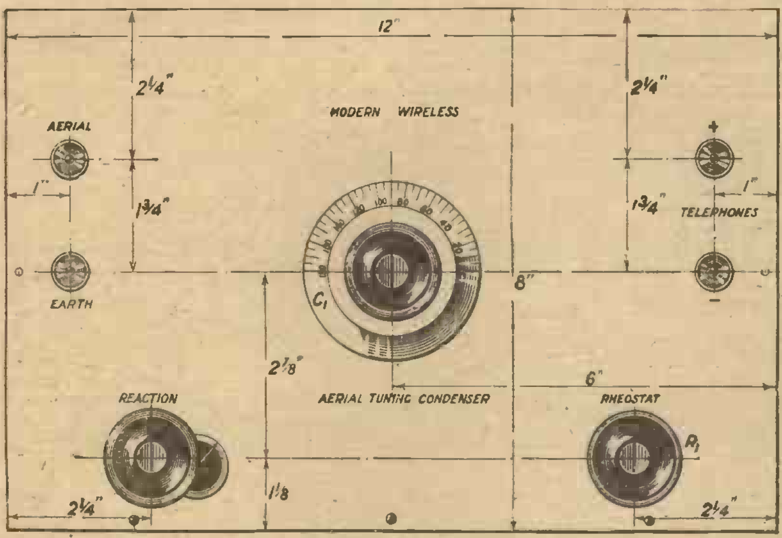


Fig. 2.—The layout of the panel is clearly shown in this diagram.

Leaky - grid rectification is employed, and here I have used a grid condenser of ·0002 μF and a leak of 1·5 megohms. There is, however, no reason why the more standard values of ·0003 μF and 2 megohms should not be adhered to if desired. Ordinary electromagnetic reaction is obtained by coupling the reaction coil L_2 to the aerial coil L_1 and C_3 of ·0003 μF acts as a by-pass condenser across the choke coil Z and the high-tension battery, giving smooth reaction control.

The Filter Circuit

The choke coil Z in conjunction with the Mansbridge 2 μF condenser C_4 forms a filter circuit, and has been incorporated with the twofold object of preventing the direct anode current to the valve from traversing the telephone windings, since in certain cases where long leads are used this gives rise to undesired effects, and also to enable one telephone lead to be dispensed with in favour of an earth return where this method is applicable. In the case where the telephones are placed in a room with facilities for obtaining an ordinary buried earth, the lead from the telephone terminal indicated by a positive sign, to the lower telephone terminal may be dispensed with if this latter is earthed by means, for example, of an ordinary earth tube driven into the ground outside the room.

The Relay

The part of the circuit with which many readers will not be familiar is that showing the relay. This latter is a standard telephone line relay. Its function is to make and break the filament circuit of the valve so that, the set being once tuned to a given station, operating the relay switches the receiver in and out of use.

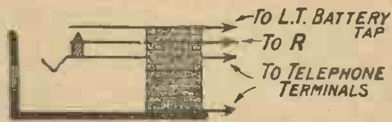
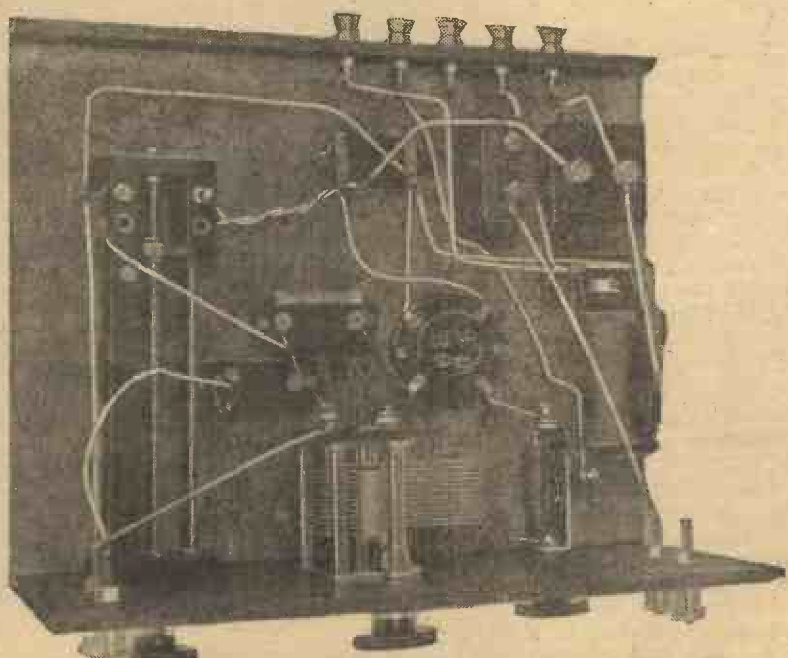


Fig. 3.—A jack may be employed for switching on the set.

A word of explanation as to the working of this device will be of interest. Stated briefly, a relay consists of an electro-magnet so arranged that a weak current through its coil attracts an armature, and this being suitably pivoted, when attracted closes certain contacts which complete a local circuit. In the case in question, again referring to the theoretical circuit, it will be seen that the filament circuit of the valve is only closed when the two relay contacts are closed, which can only happen when the electro-magnet attracts its armature. To cause this to happen a current must flow through the magnet coil, which current is furnished by closing the switch S, placing the coil across part of the filament battery. To this switch and to the telephones, long leads may be employed, so that these latter may be placed where desired. In practice these leads may be sufficiently long to reach to almost any room in the average six- or nine-roomed house.

The earth return arrangement I have employed successfully with a 2-valve receiver up to a distance of 50 yards from the set, although at the full distance a drop in signal strength was noticed. Normally the relay has been used with the switch S at a distance of 15 yards away from the set, and in this case tapping across 2 volts of a 4-volt accumulator gave satisfactory working, a current of about 10 milliamperes being taken. When a 4½-volt dry cell is employed for filament lighting it will be necessary to tap off 3 volts, since 1½ volts is insufficient to actuate the relay properly. At greater distances it may be found desirable to use the



The relay may be seen on the right of the receiver.

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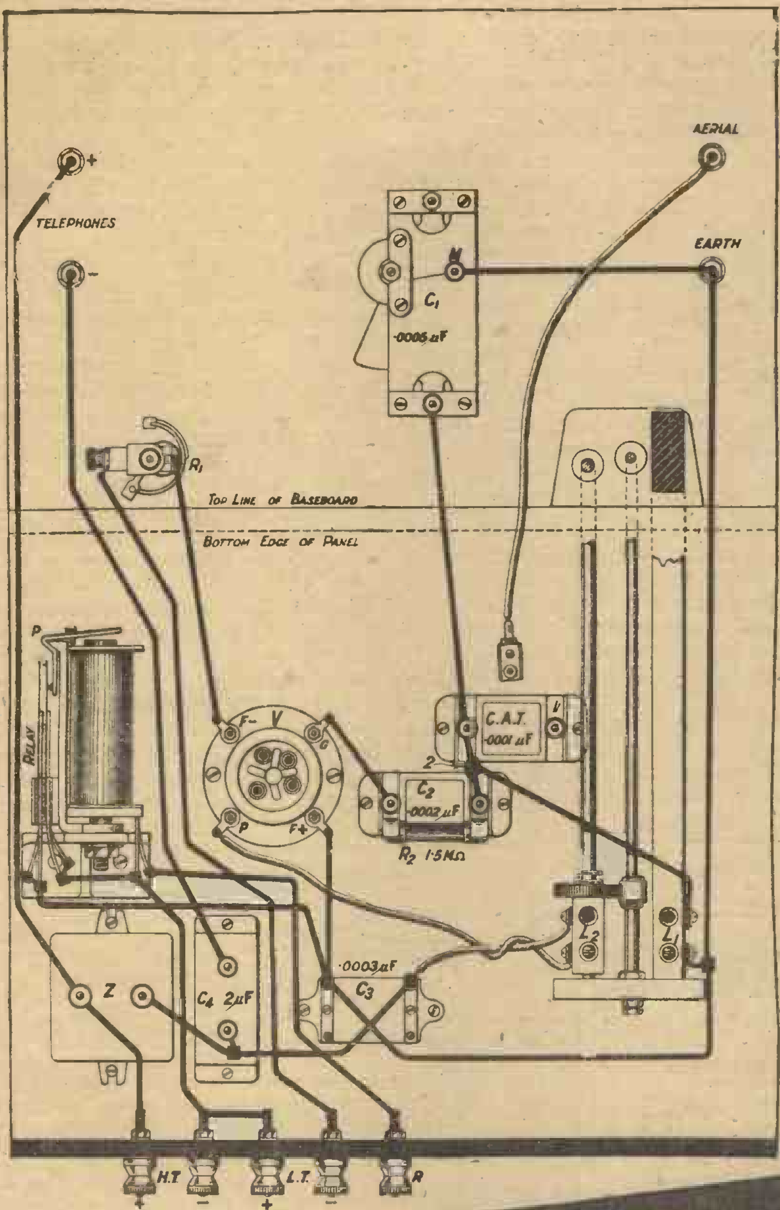


Fig. 4.—The relay employed has two sets of contacts which are wired in parallel.

whole 4 or 4½ volts of the low-tension battery, depending, of course, upon the resistance of the leads used, which will be determined by their length and the gauge of wire employed. Ordinary bell wire serves admirably for both relay and telephone leads.

Components Required

To build the receiver as shown in the photographs the following components will be required, and, as is usual, the makers' names are given for those who desire such information.

One guaranteed ebonite panel, 12 in. by 8 in. by ¼ in.

One cabinet for above panel and with a 9 in. baseboard.

One ebonite terminal strip, 12 in. by 1½ in. by ¼ in. (All three are made by the Peto-Scott Co. Ltd., and are as supplied for the new S.T.100 receiver.)

One ·0005 μF variable condenser (Jackson Bros.)

One ·0001 μF fixed condenser, type 610.

One ·0002 μF fixed condenser, type 610.

One ·0003 μF fixed condenser, type 600.

One 1·5 megohm grid leak.

One 2 μF Mansbridge condenser, (All by Dubilier Condenser Co., Ltd.)

One Ironclad choke, type C.A. (Fuller's United Electric Works, Ltd.)

One 2-coil holder, type B. moving coil on right-hand side. (Peto-Scott Co., Ltd.)

One 30-ohm rheostat. (C. A. Vandervell & Co., Ltd.)

One vibro anti-capacity valve holder. (Burne-Jones and Co., Ltd.)

One standard telephone line relay. (That used was made by Siemens Bros. (type Q.3120, unmounted) and had a resistance of 200 ohms. It was obtained from W. H. Agar.)

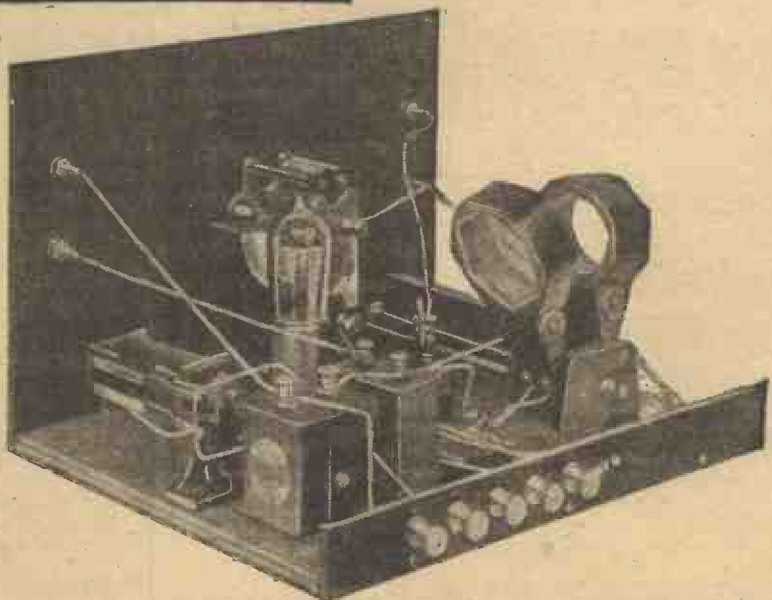
Four 2 B.A. terminals } Burne-Jones
Five 4 B.A. terminals } and Co., Ltd.

Quantity of Glazite wire, rubber-covered flex, and spring clip.

Radio Press panel transfers.

General Layout

The symmetrical arrangement of the panel, on which the aerial condenser dial appears in the centre, with the reaction control knob on the left and that of the rheostat on the right, will be appreciated on referring to the drilling diagram



By the use of a special form of holder the tuning coils are kept at the back of the set.

of Fig. 2. Although only one aerial terminal is seen on front of the panel, a flex lead therefrom terminated by a spring clip is arranged to connect behind the panel to the points 1 or 2, so that C.A.T. may be employed if desired. The wiring diagram and photographs show the disposition of the components on the wooden baseboard, so that little need be said about this part of the set.

Wiring

The wiring of the receiver is quite simple and in practice can be carried out with the panel affixed to the baseboard. Glazite wire has been used throughout, excepting where flexibility is necessary, in which cases leads have been carried out with rubber-covered flex.

The only other point which may call for any comment is the fact that with the relay employed there are two sets of contacts which are wired in parallel, the right-hand and left-hand contacts being joined as shown.

Testing

The wiring of the receiver being completed, it will be found best for a preliminary test to cut out the long leads which will be employed later and to connect the telephones directly across the telephone terminals on the panel, whilst joining the relay contact R direct to a suitable terminal of the low tension battery, which will be at 2 or 3 volts from its positive end. First test the filament circuit to see that the relay is working correctly by inserting the valve into the valve holder, switching the filament resistance slightly on, when, providing all is correct, the valve should light. Now try the effect of disconnecting the lead from the battery to R, when the valve should automatically be extinguished.

The Distant Point

Now join the aerial and earth to the receiver, employing either constant aerial tuning or the plain parallel arrangement, as desired, with suitably sized coils in the coil sockets, connect the high tension battery in circuit, and test the receiver for signals in the usual way.

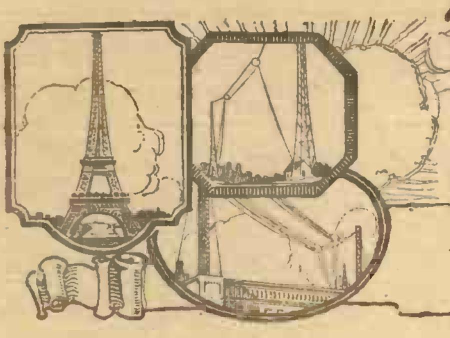
The next step is to take the leads to the room in which the telephones will normally be used, where the switch S should also be placed, this latter being of any suitable single-pole type, such, for example, as those used by electricians.

Alternatively, a single-filament jack, wired as shown in Fig. 3, may be substituted, when the insertion of the telephone plug into the jack will automatically bring the set into operation.

Coils to Use

For the ordinary broadcast band of frequencies a number 50 coil for L_1 and a 50 or 75 for L_2 is suitable with the constant aerial tuning arrangement, whilst when parallel tuning is used L_1 should be either a number 25, 35 or 50. For the reception of 5XX the aerial should be connected to 2, a number 150 should be used for L_1 and a number 200 for L_2.

In the last issue of *Modern Wireless* the components given in the article entitled "Simultaneous Reception of Two Stations" included two .001 μF fixed condensers. This should have read ·002 μF to tally with the drawings, but no trouble will arise if the stated values have actually been employed.



Regular Programmes from Continental Broadcast Stations

Edited by CAPTAIN L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

Corrected up to January 18, 1926.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
				WEEK DAYS.			
	a.m.						
1	5.55	Hamburg ..	HA 392.5 m.	Germany ..	Time Signal, Weather Report..	15 mins.	10 Kw.
401	6.35	Lausanne ..	HB 2 850m.	Switzerland	Weather Forecast	5 mins.	300 Watts.
2	6.40	Eiffel Tower ..	FL 2650 m.	Paris ..	Weather Forecast	5 mins.	5 Kw.
402	7.40	Lyngby ..	— 2400 m.	Denmark ..	Weather Report	10 mins.	2 Kw.
9	7.55	Vaz Diaz ..	PCFF 1950 m.	Amsterdam	Stocks, Shares and News ..	10 mins.	2 Kw.
211	8.0	Radio-Wien ..	— 530 m.	Austria ..	Market Prices	10 mins.	1.4 Kw.
403	8.0	Leipzig ..	— 452 m.	Germany ..	Stock and Weather Report ..	10 mins.	1.5 Kw.
10	8.2	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Sidereal Time (Spark)	5 mins.	60 Kw.
8	9.26	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark)	3 mins.	60 Kw.
238	9.55	Vaz Diaz ..	PCFF 1950m.	Amsterdam	Time Signal	3 mins.	2 Kw.
303	10.0	Radio-Wien ..	— 530 m.	Vienna ..	Morning Concert .. .. (Mon., Tues. and Thurs.)	1½ hrs.	1.4 Kw.
404	10.0	Konigsberg ..	— 463 m.	East Prussia	Weather Forecast	5 mins.	1 Kw.
405	10.0	Oslo	— 382 m.	Norway ..	Stock Exchange News	5 mins.	1 Kw.
407	10.0	Toulouse ..	— 441 m.	France ..	Market Prices	10 mins.	2 Kw.
408	10.25	Royal Dutch Meteorological Inst.	— 1100 m.	Utrecht (De Bilt)	Weather Reports	10 mins.	2 Kw.
406	10.40	Prague.. ..	— 368 m.	Czecho-Slovakia	Morning Concert	11.0 a.m.	5 Kw.
409	10.45	Munich ..	— 485 m.	Bavaria ..	Weather and Time Signal ..	8 mins.	1.5 Kw.
15	11.0	Frankfurt ..	— 470 m.	Frankfurt	News, followed by Exchange ..	5 mins.	1.5 Kw.
410	11.0	Graz	— 404 m.	Tyrol ..	Market Prices	5 mins.	1 Kw.
411	11.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Stock Exchange Quotations, followed by Time Signal and Weather Forecast	20 mins.	5 Kw.
182	11.0	Leipzig ..	— 452 m.	Germany ..	Mid-day Concert	11.50 a.m.	1.5 Kw.
184	11.0	Zurich ..	— 515 m.	Switzerland	Weather Report	5 mins.	500 Watts.
14	11.20	Eiffel Tower ..	FL 2650 m.	Paris ..	Time, Fish Market Quotations, Cotton Exchange	10 mins.	5 Kw.
20	11.13	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Exchange Opening Prices ..	10 mins.	1.5 and 4.5 Kw.
30	11.30	Stockholm ..	SASA 428 m.	Sweden ..	Weather Forecast, followed by Exchange and Time Signal from Nauen	Noon	2.5 Kw.
412	11.30	Munster ..	MS 410 m.	Westphalia	Stock Exchange and News ..	10 mins.	3 Kw.
249	11.30	Breslau ..	— 418 m.	Silesia ..	Morning Concert	12.25 p.m.	1.5 Kw.
260	11.40	Hilversum ..	NSF 1050 m.	Holland ..	News Bulletin	10 mins.	3 Kw.
23	11.57	Nauen ..	POZ 3000 m.	Berlin ..	Mid-day Time Signal in G.M.T. (Spark). This Signal is relayed by all German, Swiss and Swedish stations, except Stuttgart, Lausanne and Geneva	8 mins.	50 Kw.
	Noon						
157	12.0	Zurich ..	— 515 m.	Switzerland	Weather Forecast, Shares and News	5 mins.	500 Watts.
	p.m.						
202	12.15	Munster ..	MS 410 m.	Westphalia	Concert or Lecture	1.30 p.m.	3 Kw.
32	12.30	Radio-Paris ..	CFR 1750 m.	Clichy ..	Concert, followed by News ..	2 p.m.	4 Kw.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
					WEEK DAYS (Contd.)		
239	12.35	Royal Dutch Meteorological Inst.	—— 1100 m.	Utrecht (De Bilt)	Weather Report	10 mins.	2 Kw.
324	12.40	Agen	—— 318 m.	France ..	Weather Report, Market Prices	10 mins.	250 Watts.
34	12.55	Munich ..	—— 485 m.	Bavaria ..	Time Signal, News and Weather Report	10 mins.	1.5 Kw.
	1.0	Radio-Toulouse	—— 441 m.	France ..	Time, Weather, News	15 mins.	2 Kw.
37	1.20	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Stock Exchange News .. .. (Sat. at 12.30 p.m.)	5 mins.	1.5 and 4.5 Kw.
413	2.0	Budapest ..	—— 546 m.	Hungary ..	News	15 min.	2 Kw.
181	2.0	Breslau ..	—— 418 m.	Silesia ..	News and Exchange Quotations	10 mins.	1.5 Kw.
40	2.15	Munster ..	MS 410 m.	Westphalia	Stocks, Shares and News ..	10 mins.	3 Kw.
414	2.30	Moscow ..	—— 1450 m.	Russia ..	Lecture	1 hour	1.5 Kw.
415	2.30	Union-Radio ..	EAJ7 373 m.	Madrid ..	Orchestral Concert	3.30 p.m.	2 Kw.
39	2.45	Eiffel Tower ..	FL 2650 m.	Paris ..	Exchange Opening Prices (Saturday excepted)	8 mins.	5 Kw.
250	3.0	Munich ..	—— 485 m.	Bavaria ..	Concert	5 p.m.	1.5 Kw.
159	3.0	Radio-Wien ..	—— 530 m.	Vienna ..	News, followed by Concert ..	5 p.m.	1.4 Kw.
226	3.0	Stuttgart ..	—— 446 m.	Wurtemberg	Concert	5 p.m.	1.5 Kw.
416	3.0	Bern	—— 315 m.	Switzerland	Orchestral Concert	1 hour	1.5 Kw.
46	3.0	Leipzig ..	—— 452 m.	Germany ..	Concert	4.30 p.m.	1.5 Kw
325	3.15	Hamburg ..	HA 392.5 m	Germany ..	Music	4 p.m.	10 Kw.
43	3.15	Konigsberg ..	—— 463 m.	East Prussia	Light Orchestra (Mon., Wed. and Sat., Children's Hour till 4 p.m.)	5.30 p.m.	2 Kw.
44	3.20	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Concert	5 p.m.	1.5 and 4.5 Kw.
417	3.30	Milan	IMI 320 m.	Italy ..	Concert	5 p.m.	1.2 Kw.
42	3.30	Frankfurt ..	—— 470 m.	Germany ..	Light Orchestra	5 p.m.	1.5 Kw.
158	4.0	Zurich ..	—— 515 m.	Switzerland	Concert by Hotel Baur-au-Lac, relayed	5 p.m.	500 Watts.
418	4.0	Budapest ..	—— 546 m.	Hungary ..	Concert	5.30 p.m.	2 Kw.
419	4.0	Radio-Wien ..	—— 530 m.	Vienna ..	Concert and Lecture	6.30 p.m.	1.4 Kw.
420	4.0	Prague ..	—— 368 m.	Czecho-Slovakia	Concert	5 p.m.	5 Kw.
309	4.0	Unione Radiofonica Italiana	IRO 425 m.	Rome ..	Concert relayed from Hotel de Russie, Rome	6.30 p.m.	1.5 Kw.
160	4.0	Breslau ..	—— 418 m.	Silesia ..	Light Orchestra	5 p.m.	1.5 Kw.
326	4.0	Munster ..	MS 410 m.	Westphalia	Concert	5 p.m.	3 Kw.
240	4.10	Vaz Diaz ..	PCFF 1950m.	Amsterdam	Time Signal, Stocks and Shares	3 mins.	2 Kw.
421	4.30	Moscow ..	—— 1450 m.	Russia ..	Concert	6 p.m.	1.5 Kw.
52	4.45	Eiffel Tower ..	FL 2650 m.	Paris ..	Exchange Closing Prices (except Saturday)	8 mins.	5 Kw.
308	4.45	Radio-Paris ..	CFR 1750 m.	Clichy ..	Concert (except Fridays) ..	1 hour	4 Kw.
422	5.0	Leningrad ..	—— 940 m.	Russia ..	Lectures, followed by News and Short Concert	8 p.m.	1.5 Kw.
186	5.0	Frankfurt ..	—— 470 m.	Germany ..	Lectures	5.30 p.m.	1.5 Kw.
423	5.0	Brünn	—— 750 m.	Czecho-Slovakia	Children's Hour	5.20 p.m.	1.5 Kw.
162	6.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Concert, at 7, News Bulletin and Weather	7.55 p.m.	5 Kw.
310	6.0	Union-Radio ..	EAJ7 408 m.	Madrid ..	Concert (3 alternate days a week)	8 p.m.	1.5 Kw.
424	6.0	Brünn	—— 750 m.	Czecho-Slovakia	Evening Concert	8 p.m.	1.5 Kw.
298	6.0	Radio-Barcelona	EAJ1 325 m.	Spain ..	Concert, followed by News ..	7 p.m.	1 Kw.
425	6.30	Stockholm ..	SHSA 428 m.	Sweden ..	Evening Concert	10 to 11	2 Kw.
63	7.0	Stuttgart ..	—— 446 m.	Wurtemburg	News, followed by Evening Programme	10 p.m.	1.5 Kw.
426	7.0	Göteborg ..	SHSB 288 m.	Sweden ..	Evening Concert	9.30 p.m.	.5 Kw.
427	7.0	Malmo ..	SHSC 270 m.	Sweden ..	Evening Concert	9.30 p.m.	.5 Kw.
428	7.0	Sunsvall ..	SHSD 545 m.	Sweden ..	Evening Concert	9.30 p.m.	.5 Kw.
429	7.0	Boden	SHSE 1200m.	Sweden ..	Evening Concert	9.30 p.m.	1.5 Kw.
204	7.0	Oslo	—— 382 m.	Norway ..	Time Signal, Concert and News	9 p.m.	1 Kw.
61	7.0	Konigsberg ..	—— 463 m.	East Prussia	Concert and Late News ..	9 p.m.	2 Kw.
62	7.0	Hamburg ..	HA 392.5 m.	Germany ..	Concert, Late News and Dance Music	10 p.m.	10 Kw.
66	7.0	Lausanne ..	HB2 850 m.	Switzerland	Time Signal, Concert (Wednesdays excepted)	8.30 p.m.	300 Watts.
430	7.0	Copenhagen ..	—— 340 m.	Denmark ..	Concert, followed by News ..	1 to 3 hrs.	1 Kw.
431	7.0	Radio-Cadiz ..	EAJ3 350 m.	Spain ..	Concert	9 p.m.	1 Kw.

Silvertown

WIRELESS ACCESSORIES

Quality guaranteed by over 50 years' electrical manufacturing experience.

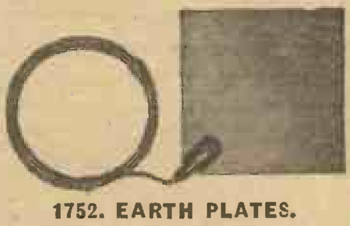
B.570. 10-WAY INDUCTANCE OR CAPACITY SWITCH. (Patent 226245.)

This switch is of the under panel mounting type, and is fitted to the panel by means of the two countersunk head screws supplied. It enables the experimenter to build up large capacities, and is an invaluable addition to any set. Price 5/6 each.

VARIABLE CONDENSERS

(For panel mounting).

Strongly constructed. Moving vanes are shaped to give low minimum capacity. Fitted with a stop to allow of a movement of 180 degs. only. From 5/6 each.

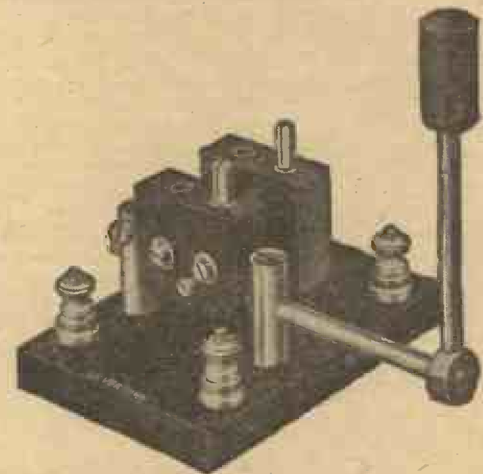


1752. EARTH PLATES.

Size, one foot square, complete with 10 feet of insulated lead-in wire well soldered on. Price 4/- each.

B.565. DOUBLE COIL HOLDERS.

Comprising one fixed and one moving coil holder, mounted on ebonite panel 3⅞ in. x 2 9/16in. x ⅜in. thick, together with four finished and lacquered double terminals. Weight 8½ oz, Price 6/6 each.

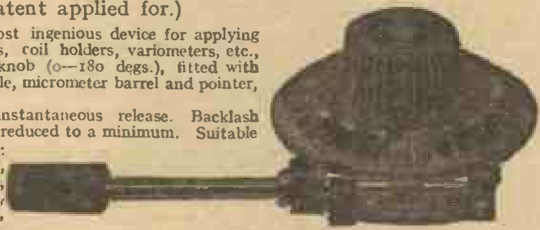


No. B.601. SILVERTOWN VERNIOMETER.

(Patent applied for.)

The Silvertown Verniometer is a most ingenious device for applying slow motion to variable condensers, coil holders, variometers, etc., consisting of an ebonite dial and knob (0—180 degs.), fitted with wormwheel-bracket and worm-spindle, micrometer barrel and pointer, complete with fixing screws.

Gear ratio 240–1. Fitted with instantaneous release. Backlash entirely eliminated. Hand capacity reduced to a minimum. Suitable for the following makes of condensers: Silvertown, Burndept, Igranic, Polar, Sterling, Ormond, Jackson, Devicon, Utility, Ashdown, Lamplugh, Ediswan, Edison-Bell, Bowyer-Lowe, Atlas, W. & M., A.J.S., etc., etc. Price 6/- each.



AN AID TO ENTHUSIASTS.

We have prepared a logging chart for recording wavelengths, condenser settings, etc., of those stations which require careful calibration to tune in. A copy of this chart, printed on stiff card, with hanger, can be obtained free of charge at any of our Branches or from any high-class dealer.

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THE SILVERTOWN COMPANY

106, Cannon Street, London, E.C.4.

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BIRMINGHAM: 15, Martineau Street.
BRISTOL: 4, Victoria Street.
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SILVERTOWN RADIO COMPONENTS

K. RAYMOND

Hours of Business 9 to 8 DAILY. 9 to 9 SATURDAY. 11 to 1 SUNDAY.

TWO SHOPS—so you will ALWAYS find ONE OPEN.

27 & 28a, LISLE ST., LEICESTER SQUARE, W.C.2.

Opposite DALY'S Gallery Door.

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ALSO AT

7, GRAPE STREET, Shaftesbury Avenue, W.C.2.

Back of Princes Theatre.

All Post Orders to this Address.

AMERICA OUTDONE!!

KAY-RAY LOW LOSS

STRAIGHT LINE FREQUENCY VARIABLE CONDENSERS

Supreme selectivity! Old time crowding eliminated! Simplified Tuning! Precision workmanship! Solid Brass Plates, Pigtail Rotor connection, Special spring top bush which gives a firm but easy movement.

LOW LOSS SKELETON ENDS, OR EBONITE PLATES.

(Kindly state which required).

All Technical Editors agree this is the future tuning, and costs you no more than out of date condensers.

£2 2s. given for the best article not exceeding 100 words being a fair and unbiased report on this condenser. Entries close Febuary 28th, 1926. Open to customers only.

.0005......6/6
.0003.....5/11

With geared dial. 12-1 ratio
.0005 ....12/6
.0003 ..11/11

With vernier.
.0005......8/6
.0003....7/11

Post 6d. set

H.F. TRANSFORMERS.—Barrel Type, Stradia, 6/6; Bowyer-Lowe, 7/-; Magnum, 7/-; McMichael, 10/-; Do., Supersonic A7, 12/6; Energo Standard B.B.C., 3/11; 5XX, 4 6.

VARIABLE CONDENSERS.—Polar Standard, 10/6; Junior 5/6 each; Igranic, 24/-; .0005, 21/-; .0003, R.I., 24/-, 21/-; Utility, 8/9, 10 6. With vernier, 2/6 each extra. Collinson's, 21/-, 20/-.

LOUD-SPEAKERS. — Dinkie, 30/-; Baby Sterling, 50/-; Floral, 55/-; Amplion AR 111, 50/-; 114, 65/-; A.R. 19, £5 5s.; Radiolux Models from £4 15s.; Ultra, 27/6; Sparta, 50/-, 95/-; Beco Hornless, 50/-; C.A.V., 27/6; Brown's, all models.

CRYSTAL DETECTORS.—Enclosed.—Burndept, 4/-; Kay-Ray Micrometer, 2/6; Permanent R.I., 6/-; One-hole fixing, 7/6; Kay-Ray 2 6; Liberty, 3/6.

FIXED CONDENSERS.—Dubilier, .0001, 2, 3, 4, 5, each 2/6; .001, 2, 3, 4, 5, 6, each 3/-; Grid Leak, 2 6; Edison Bell, .001, .0001, 2, 3, 4, 5, 1/-; .002, 3, 4, 5, 6, 1/6; .0003 and grid leak, 2/-; post 2d. each; Theria guaranteed capacity, 1/3 and 2/-; McMichael, with clips, same price as Dubilier.

MOUNTED COILS, GOSWELL.—25, 1/6; 35, 1/9; 50, 2/-; 75, 2/3; 100, 2/9; 150, 3/-; 175, 3/6; 200, 3/9; 250, 5/3; 300, 6/-. STAR.—25, 1/3; 35, 1/6; 50, 1/9; 75, 2/-; 100, 2/3; 150, 2/6; 175, 2/9; 250, 3/-; 300, 3/3. IGRANIC.—Honeycomb, 25, 35, 4/3; 50, 4/6; 75, 4/10; 100, 6/3; 150, 7/-; 200, 8/-; 250, 8/6; 300, 9/-; 400, 10/-; 500, 10/3; 600, 11/-; 750, 12/6; 1,250, 15/6; 1,500, 17/6. LISSEN.—25, 35, 4/10 each; 50, 5/-; 60, 75, 5/4 each; 100, 6/9; 150, 7/-; 200, 8 5; Lissen X50, 6/-; 60, 6/4; 75, 6/5; 250, 9/9.

VAR. GRID LEAKS.—Lissen, 2/6; Watmel, 2/6; Bretwood, 3/-. Anode Res., Lissen, 2/6; Watmel, 3/6; Bretwood, 3/-.

CHOKES.—Lissen H.F., or L.F., 10/-; R.L., 10/-; Success, 10/-.

PHILLIPS 4 ELECTRODE (4-pin), for UNIDYNE. Can be used on ordinary circuit. 10/- post free.

L.F. TRANSFORMERS.—Ferranti, 17/6; New Model, 25/-; Ormond, 14/11; Shrouded, 17/6; Royal, 20/-; Powquip, 14/6; Formo, 10/6; Croix, 9/-; Wates Supra, 12/6; Lissen T1, 21/-; T2, 15/-; T3, 12/6; Eureka Concert Grand, 15/-; 2nd Stage, 21/-; Baby Grand, 15/-; Reflex, 15/-; Success L.F., Black, 21/-; Croix, 6/11.

VALVES.—Bright, 8/- each; Mullard Red or Green Ring, Marconi R, R5, B.T.H., "R," Ediswan AR, Cossor P, P2, 14/- each; Mullard D3, Cossor W1, W2, Ediswan ARDE, B.T.H. B3, Marconi DER, 16/6 each; Mullard .06, DE3, Cossor WR1, WR2, Ediswan, B.T.H. B, Marconi DE3, 18/6 each; Cossor W3, Marconi DE6, 22/6; Mullard DF, "AO," "A1," Ediswan PV1, 2, 5, 8, B.T.H. B4, B6, Marconi DE4, 5B, etc.

HEADPHONES. — 4,000 ohms, Ericsson E.V. Continental. Lovely tone, exquisitely finished, 10/6 pr. DR. NESPER. — Adjustable; the perfect 'phone, 12/11 pr. N. and K.—Absolutely genuine, Standard Model, 12/11; New Lightweight, 13/6; Both stamped on outside of case: N. and K. "BRUNET."—The old original. As good as ever; new design, 12/6 pr. TELEFUNKEN. — Adjustable; lighter than a feather, 15/11 pr. ADJUSTABLE "KAY-RAY."—Limited number, fine value, 8/11 pr. SIEMENS.—Too well known to need comment; includes free, extra ladies' attachment, 20/- pr. BROWN'S A2-type, 30/-; B.T.H., 20/-; Western Electric 20/-; Sterling, 22/6; Do., Lilliput, 20/-; British Ericsson, 22/6; Brandes, 20/-; Brown's, 20/- pr. N. and K. PATTERN—High-class splendid tone, 8/6.

SIEMENS' EBONITE.—Cut to size, squared edges: ¼in., sq. in., ¼ in. is ¾ sq. in. Postage extra.

VERNIER CONDENSERS.—3-plate, 3/11; 5-plate, 4/6; Michrom., 2/6; Colvern, 2/6; Ormond, 2/6; Gambrell, 5/6.

VALVE HOLDERS.—Sterling, 4/3; Burndept or Magnum, 5/-, 2/6; Benjamin, 2/9; Apex, 1/6; Aermonic, 1/6; Standard, 1 3; Anti-cap shrouded, red for plate, 1/3; or 3 for 3/-; Ditto, nickel legs, 1/3; Athol, 1/3; H.T.C. 1/6, O.P., 1/9.

RECOGNISED WEST-END DISTRIBUTOR of the Manufactures of Edison Bell, Jackson's (J.B), Polar, Igranic, Peerless, Eureka, Magnum, Burndept, Lotus, Dubilier, Marconi, Dorwood, Sterling, Success, B.T.H., McMichael, Lissen, Woodhall, Utility, R.I., Bowyer-Lowe, Amplion, Formo, Brunet, Ormond, Newey, P. and M., and everything that is worth stocking. Every endeavour made to obtain goods not listed.

COLUMN FOR CALLERS ONLY.

CABINETS AMERICAN TYPE, covered leather cloth 12 x 8 x 8, 8/-; 16 x 8 x 8, 10/9; 8 x 8 x 8, 11/6; 20 x 8 x 8, 12/6. All with base board, open front, hinged lid. Open boxes, imitation crocodile, 7 x 5 x 5, 1/4; 8 x 6 x 6, 1/6; 9 x 6 x 6, 1/11; 10 x 8 x 6, 2 6. Polished 6 x 6 or 7 x 5, 3/3; 8 x 6, 3/6; 9 x 6, 3/9; 1 x 8, 4/6, upwards.

ACCUMULATORS.—High class 2v. 40, 7/11; 60, 8/11; 80, 10/11; 100, 14/6. 4v. 40, 13/11; 60, 17/6; 80, 23/6. 6v. 60, 26/6; 80, 35/-. These are a very special line.

EBONITE, SIEMENS. — 3/16. ½d. sq. in. ¼ for ¼ in., cut while you wait. Grade B for crystal sets, 6 x 6 or 7 x 5, 1/-; 8 x 6, 1/4; 9 x 6, 1/8; 1 x 8, 2/4. Many sizes stocked.

TERMINALS. — Complete. Brass Pillar, WO, 1d.; Nickel, 3 for 4d. Studs, Stop pins, 2 a 1d.; Nick 1, 4 for 3d. Screwed spades or pins, 2 for 1½d.; Nickel, 1d. Tags, 6 a 1d.; Nickel, 4 a 1d. Red or Black spades, 3d. pr.; Do. screwed plug and socket, 3d. and 6d. Wander plugs, 2d., 2½d., 4½d. pr. Ormond screws and nuts, 2 a 1d. Flush panel sockets and nuts, 10d. doz.; 1d. each.

SWITCH ARMS, LARGE.—With 12 studs, 10½d.; Small, 1/-; Nickel 4d. extra. 8 twist drills 1/2. Copper earth tubes, 3/3. Aerial 7/22, 1/11; 100 feet (extra heavy 2/3). Ins. Rubb. lead in 10 yds. 1/-; Extra heavy 2/6 dozen; 3d., 4d. yd. Twin maroon flex, 12 yds., 1/4; Red and Black, 12 yds. 1/6. Min. silk, 6 yds. 6d. Wonder aerial, 110 feet, 3/-; Phosphor Bronze, 39 strands, 1/8 100 feet. O.V. indoor, 2/6. Empire tape, 12 yds. 6d. 10 ft. coild. connecting wire, 10d. Glazite, 1 ft., 1/2. Shaws genuine sealed hertzite, 8d.

EBONITE COIL STANDS.—2-way, generous size, 2/-, 2/6. Cam Vernier or geared, 2/11, 3/3, 4/6. Ebonite shaped plugs, extra qual., 6d. or 2/9 for 6; With fibre strip, 7d. Push and pull switches, 1/3.

DCC WIRE.—¼ lb. 20g., 9d.; 22g., 10d.; 24g, 11d.; 26g., 1/-; 28g., 1/2. Tinned copper 16, 18, 20, 22g., all 11d. Reel square bus bar. Tinned copp., 16 or 18, 6d. 10 feet. Enclosed Detectors, small 9d.; Large, 1/-, 1/2, 1/4, 1/6, Brass and Nickel. Noted micrometre, nickel, 1/9. Lead-in tubes, good quality, 6d, 8d., 10d., or made to size. Panel switches, nickel, D, DT, 10d., SPDT, 9d. Ins. hooks or eggs, 2 for 1½d. 6 in. panel brackets, 10½d. pair.

H.T. BATTERIES. — BBC, 60v, 6/11; Extra large, 8/11; 36v, 5/6. Crown long life, 60v, 6/11. Adico, 6/11. Grid bias, 1/9, 1/11, 2/3 (gv. tapped, 1½) Neutron 4 batteries 4½d., 6 for 2/-.

VALVE HOLDERS of every kind from 8d.

HEADPHONES ALL 4000 ohms —Ericsson E.V. Continental, 10/6 pair, 3 pairs 30/- Adjustable, Nesper style, 8/6 pair, Standard N. & K. pattern, 8/1, Brunet 11/9. Latest improved models, 12/6, 14/11. Genuine N. & K. stamped name on outside cases, 12/11; Lightweight new model, 3/6; Genuine Telefunken, sealed boxes, 14/11; Dr. Nesper, genuine, 12/11, (adjustable) all 4,000 ohms.

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Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
				WEEK DAYS (Contd.)			
433	7.0	Radio-Sevilla	EAJ17 300m.	Spain ..	Evening Concert	9 p.m.	1.5 Kw.
73	7.0	Munich ..	—— 485 m.	Bavaria ..	Concert and News	10 p.m.	1.5 Kw.
234	7.0	Prague ..	—— 368 m.	Czecho-Slovakia ..	Concert, followed by News ..	9 p.m.	5 Kw.
69	7.15	Breslau ..	—— 418 m.	Silesia ..	Lecture or Talk, followed by Concert	9 p.m.	1.5 Kw.
432	7.15	Radio-Wien ..	—— 530 m.	Vienna ..	Evening Programme (Saturday till 10 p.m.)	8.30 p.m.	1.4 Kw.
64	7.15	Zurich ..	—— 515 m.	Switzerland	Lecture and Concert, followed by Late News	9 p.m.	500 Watts.
65	7.15	Leipzig ..	—— 452 m.	Germany ..	Concert and News (3 days a week until 10.30 p.m.)	9 p.m.	1.5 Kw.
323	7.30	Geneva ..	—— 1100 m.	Switzerland	Concert relayed from Hotel Metropole	9 p.m.	600 Watts.
434	7.30	Bern	—— 315 m.	Switzerland	Orchestral Concert	1 hour	1.5 Kw.
67	7.30	Frankfurt ..	—— 470 m.	Germany ..	Concert and News	10 p.m.	1.5 Kw.
59	7.30	Munster ..	MS 410 m.	Westphalia	Concert, followed by News ..	9.45 p.m.	3 Kw.
72	7.30	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Concert, followed by News and Weather Report	9 p.m.	1.5 and 4.5 Kw.
435	7.30	Budapest ..	—— 546 m.	Hungary ..	Concert or Opera relayed ..	2 hours	2 Kw.
164	7.30	Unione Radio-fonica Italiana	IRO 425 m.	Rome ..	Concert, followed by New d Dance Music	10 p.m.	1.5 Kw.
317	7.30	Konigswuster-hausen	AFT 1300 m.	Berlin ..	Evening Programme relayed from Voxhaus on High Power	11 p.m.	18 Kw.
228	7.40	Hilversum ..	NSF 1050 m.	Holland ..	Concert, preceded by News ..	9.10 p.m.	3 Kw.
253	8.0	Agen	—— 318 m.	France ..	Exchange Quotations and News Bulletin (Concert Friday 8.30 p.m. to 10 p.m.)	15 mins.	250 Watts.
436	8.0	Radio-Cartagena	EAJ16 335m.	Spain ..	Concert	10 p.m.	1 Kw.
437	8.0	Milan	IMI 320 m.	Italy ..	Concert	9 p.m.	1.2 Kw.
245	8.0	Lyngby ..	—— 2400 m.	Denmark ..	Press News by Berlingske Tidende	8.15 p.m.	1.5 Kw.
320	8.10	Eiffel Tower ..	FL 2740 m.	Paris ..	Concert	10.10 p.m.	2.5 Kw.
74	8.15	Radio-Belge ..	SBR 265 m.	Brussels ..	Concert, preceded and followed by News	10.10 p.m.	2.5 Kw.
76	8.15	Radio-Paris ..	CFR 1750 m.	Clichy ..	Detailed News Bulletin.. ..	8.30 p.m.	4 Kw.
242	8.15	Royal Dutch Meteorological Inst.	KNML 1100 m.	Utrecht (De Bilt)	Weather Report	5 mins.	2 Kw.
254	8.30	Radio Toulouse	—— 441 m.	France ..	News, followed by Concert ..	10 p.m.	2 Kw.
252	8.30	Radio-Lyons ..	—— 280 m.	France ..	Concert (preceded by Weather)	10 p.m.	500 Watts.
75	8.30	Ecole Sup. des Postes	FPTT 458 m.	Paris ..	Concert, sometimes preceded by Lecture	11 p.m.	500 Watts.
77	8.30	Radio-Paris ..	CFR 1750 m.	Clichy ..	Concert	10 p.m.	4 Kw.
177	9.0	Radio-Barcelona	EAJ1 325 m.	Barcelona ..	Concert	2 to 3 hrs.	1 Kw.
312	9.0	Radio Club, Sevillano	EAJ5 357 m.	Seville ..	Concert	11 p.m.	1.5 Kw.
300	9.0	Radio-Catalana	EAJ13 460 m.	Barcelona	Concert, preceded by News ..	Midnight	1 Kw.
301	10.0	Radio-Vizcayo, Bilbao	EAJ11 418 m.	Spain ..	Concert	Midnight	1.5 Kw.
78	10.0	Radio-Iberica..	RI 392 m.	Madrid ..	Concert	2 to 3 hrs. (Time varies to 4 p.m. and 6 p.m. on alternate days of month)	3 Kw.
438	10.0	Union-Radio ..	EAJ7 373 m.	Madrid ..	Concert (not every evening) (alternates with Radio Iberica)	1 a.m.	2 Kw.
80	10.10	Eiffel Tower ..	FL 2650 m.	Paris ..	Weather Forecast	5 mins.	5 Kw.
81	10.46	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark) ..	3 mins.	60 Kw.
82	11.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in G.M.T. (Spark)	8 mins.	50 Kw.
				SUNDAYS.			
	a.m.						
83	7.30	Frankfurt ..	—— 470 m.	Germany ..	Morning Prayer	8 a.m.	1.5 Kw.
85	7.30	Leipzig ..	—— 452 m.	Germany ..	Morning Prayer	9.30 a.m.	1.5 Kw.
165	8.0	Konigsberg ..	—— 463 m.	E. Prussia	Morning Prayer	8.45 a.m.	2 Kw.
212	8.0	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Morning Prayer	9 a.m.	1.5 and 4.5 Kw.

SUNDAYS (Contd.)

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
328	8.0	Dortmund	—— 283 m.	Germany	Morning Prayer	9 a.m.	1.5 Kw.
214	8.0	Munster	MS 410 m.	Westphalia	Morning Prayer	9 a.m.	3 Kw.
329	8.0	Hamburg	HA 392.5 m.	Germany	Morning Prayer	9 a.m.	1.5 and 10 Kw.
89	8.2	Eiffel Tower	—— 530 m.	Paris	Time Signal in Sidereal Time (Spark)	5 mins.	60 Kw.
86	9.0	Brünn	—— 750 m.	Czecho-Slovakia	Sacred Concert	1 hour	1.4 Kw.
440	9.0	Budapest	—— 546 m.	Hungary	Divine Service	1 hour	2 Kw.
346	9.0	Ryvang	—— 1150 m.	Sweden	Divine Service	10 a.m.	800 Watts.
256	9.0	Copenhagen	—— 775 m.	Denmark	Divine Service	10.15 a.m.	1.5 Kw.
87	9.26	Eiffel Tower	FL 2650 m.	Paris	Time Signal in G.M.T. (Spark)	3 mins.	60 Kw.
213	9.40	Bloemendaal	—— 315 m.	Holland	Divine Service	2 hours	40 Watts.
330	9.40	Hilversum	NSF 1050 m.	Holland	Divine Service	11.10 a.m.	10 Kw.
207	10.0	Oslo	—— 382 m.	Norway	Divine Service	11.15 a.m.	1 Kw.
90	10.0	Prague	—— 368 m.	Czecho-Slovakia	Classical Music	1 hour	5 Kw.
498	10.0	Radio-Wien	—— 515 m.	Vienna	Concert	11.50 a.m.	1.5 Kw.
441	10.0	Zurich	FL 2650 m.	Switzerland	Morning Concert	11 a.m.	500 Watts.
442	10.0	Breslau	—— 418 m.	Silesia	Morning Prayer	11 a.m.	1.5 Kw.
443	10.0	Radio-Catalana	EAJ13 460 m	Spain	Religious Address	1 hour	1.5 Kw.
98	10.0	Stockholm	SASA 440 m.	Sweden	Divine Service	11.15 a.m.	1.5 Kw.
192	10.0	Munich	—— 485 m.	Bavaria	Town Hall Clock, Morris Dancers	10 mins.	1.5 Kw.
64	10.30	Stuttgart	—— 446 m.	Wurtemberg	Classical Concert	1 hour	1.5 Kw.
96	10.30	Konigswusterhausen	AFT 1300 m.	Berlin	Concert (at 11.5 mins. Esperanto)	11.50 a.m.	18 Kw.
444	11.0	Frankfurt	—— 470 m.	Frankfurt	Mid-day Concert	12 noon.	1.5 Kw.
97	11.15	Eiffel Tower	FL 2650 m.	Paris	Time, Weather and Fish Market Quotations	10 mins.	5 Kw.
101	11.57 Noon	Nauen	POZ 3000 m.	Berlin	Mid-day Time Signal in G.M.T. (Spark)	3 mins.	50 Kw.
273	12.0	Breslau	—— 418 m.	Silesia	Mid-day Concert	1.55 p.m.	1.5 Kw.
	p.m.						
445	12.40	Radio-Agen	—— 318 m.	France	Weather and News	15 mins.	250 Watts.
102	12.45	Radio-Paris	CFR 1750 m.	Clichy	Concert, followed by News	1.45 p.m.	4 Kw.
446	1.0	Radio-Toulouse	—— 441 m.	France	Time Signal, Weather Report and News	5 mins.	2 Kw.
331	2.30	Radio-Iberica	RI 392 m.	Spain	Concert (not every Sunday)	5.30 p.m.	1.5 Kw.
447	2.30	Copenhagen	—— 340 m.	Denmark	Afternoon Concert	4.30 p.m.	1 Kw.
448	2.30	Moscow	—— 1450 m.	Russia	Lecture	1 hour	1.5 Kw.
168	2.30	Konigsberg	—— 463 m.	East Prussia	Light Orchestra	5.30 .m.	2 Kw.
108	2.30	Munich	—— 485 m.	Bavaria	Concert	4.0 p.m.	1.5 Kw.
449	3.0	Ecole Superieur des Postes	FPTT 458 m.	Paris	Concert	5 p.m.	500 Watts.
107	3.0	Frankfurt	—— 470 m.	Germany	Children's Corner	4.0 p.m.	1.5 Kw.
450	3.0	Bern	—— 315 m.	Switzerland	Orchestral Concert	1 hour	1.5 Kw.
106	3.0	Radio-Wien	—— 530 m.	Vienna	Afternoon Concert	4.30 p.m.	1.4 Kw.
170	3.0	Leipzig	—— 452 m.	Germany	Light Orchestra	5.0 p.m.	1.5 Kw.
105	3.0	Stuttgart	—— 446 m.	Wurtemberg	Light Orchestra	5.0 p.m.	1.5 Kw.
215	3.30	Munster	—— 410 m.	Westphalia	Concert	5.30 p.m.	3 kw.
169	3.30	Voxhaus	B 505 m. and 576 m.	Berlin	Light Orchestra	5.0 p.m.	1.5 and 4.5 Kw.
167	4.0	Zurich	—— 515 m.	Switzerland	Hotel Baur-au-lac, Concert relayed	5.0 p.m.	500 Watts.
451	4.0	Prague	—— 368 m.	Czecho-Slovakia	Concert	5 p.m.	5 Kw.
452	4.0	Radio-Lyons	—— 250 m.	France	Orchestral Concert	1 hour	500 Watts.
453	4.0	Budapest	—— 546 m.	Hungary	Concert	5.30 p.m.	2 Kw.
171	4.0	Frankfurt	—— 470 m.	Germany	Light Orchestra or Lecture	5 p.m.	1.5 Kw.
454	4.30	Moscow	—— 1450 m.	Russia	Concert and Lectures separated by short intervals	9 p.m.	1.5 Kw.
257	4.30	Hamburg	HA 392.5 m.	Germany	Concert	7.0 p.m.	10 Kw.
217	4.40	Bloemendaal	—— 315 m.	Holland	Divine Service	2 hours	40 Watts.
455	5.0	Leningrad	—— 940 m.	Russia	Lectures, followed by News and Short Concert	8 p.m.	1.5 Kw.
219	5.0	Malmo	SASC 270 m.	Sweden	Concert	7.0 p.m.	1 Kw.
456	5.15	Zurich	—— 515 m.	Switzerland	Church Service, relayed from Neumunster	6.30 p.m.	500 Watts.
333	5.30	Radio Barcelona	EAJ1 325 m.	Spain	Concert	9 p.m.	1 Kw.
500	5.45	Kbely	—— 1160 m.	Czecho-Slovakia	German Transmission	1 hr.	1 Kw.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
				SUNDAYS (Contd.)			
112	6.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Concert, Weather and News at 7 p.m.	7.55 p.m	5 Kw.
334	6.0	Helsingfors ..	—— 318 m.	Finland ..	Concert	8.30 p.m.	750 Watts
220	6.30	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Evening Programme, followed by Dance Music	11.0 p.m.	4.5 Kw.
335	6.30	Dortmund ..	—— 283 m.	Germany ..	Concert	9.30 p.m.	1.5 Kw.
174	6.30	Munich ..	—— 485 m.	Bavaria ..	Concert	9.30 p.m.	1 Kw.
269	7.0	Oslo	—— 382 m.	Norway ..	Concert, followed by Dance Music from Hotel Bristol	10 p.m.	1 Kw.
338	7.0	Bern	—— 315 m.	Switzerland	Concert	9.30 p.m.	.5 Kw.
237	7.0	Prague ..	—— 368 m.	Czecho-Slovakia	Concert	9.0 p.m.	5 Kw.
176	7.0	Copenhagen ..	—— 340 m.	Denmark ..	Concert, followed by News ..	11.0 p.m.	1 Kw.
114	7.0	Radio-Wien ..	—— 530 m.	Vienna ..	Concert	9.30 p.m.	1.4 Kw.
173	7.0	Frankfurt ..	—— 470 m.	Germany ..	Lecture, followed by Evening Programme	10.0 p.m.	1.5 Kw.
457	7.0	Radio-Cartagena	EAJ16 335 m.	Spain	Evening Concert	9.0 p.m.	1 Kw.
121	7.0	Lausanne ..	HB2 850 m.	Switzerland	Concert or Religious Talk ..	8.30 p.m.	300 Watts
119	7.0	Hamburg ..	HA 392.5 m.	Germany ..	Concert, followed by News ..	9.0 p.m.	10 Kw.
125	7.0	Stuttgart ..	—— 446 m.	Wurtemberg	Concert, preceded by News ..	10.0 p.m.	1.5 Kw.
124	7.0	Breslau ..	—— 418 m.	Silesia ..	Light Orchestra, Dance Music from 9.0 p.m.	10.0 p.m.	1.5 Kw.
118	7.0	Konigsberg ..	—— 463 m.	E. Prussia	Concert	9.0 p.m.	2 Kw.
458	7.0	Radio-Cadiz ..	EAJ3 350 m.	Spain ..	Concert	9.0 p.m.	1 Kw.
459	7.0	Radio-Sevilla	EAJ17 300 m.	Spain ..	Concert	9.0 p.m.	1.5 Kw.
116	7.0	Munster ..	MS 410 m.	Westphalia	Classical Concert	10.0 p.m.	3 Kw.
122	7.15	Zurich ..	—— 515 m.	Switzerland	Concert, followed by News ..	9.0 p.m.	500 Watts.
460	7.15	Geneva ..	—— 1100 m.	Switzerland	Religious Address	1 hour	600 Watts.
123	7.15	Leipzig ..	—— 452 m.	Germany ..	Symphony Concert	9.0 p.m.	1.5 Kw.
461	7.30	Milan	IMI 320 m.	Italy ..	Concert	9.0 p.m.	1.2 Kw.
175	7.30	Radiofonica-Italiana	IRO 425 m.	Rome ..	Concert, followed by late News	10.0 p.m.	3 Kw.
270	7.40	Hilversum ..	NSF 1050 m.	Holland ..	Concert	9.40 p.m.	10 Kw.
339	8.0	Radio Agen ..	—— 318 m.	France ..	Weather Forecast and News ..	15 mins.	250 Watts.
462	8.10	Eiffel Tower ..	FL 2740 m.	Paris ..	Concert	9.55 p.m.	2.5 Kw.
128	8.15	Radio-Paris ..	CFR 1750 m.	Clichy ..	Detailed News Bulletin	9.0 p.m.	4 Kw.
127	8.30	Radio-Belge ..	SBR 262 m.	Brussels ..	Concert, followed by News ..	10.10 p.m.	2.5 Kw.
129	8.30	Ecole Superieure	FPTT 458 m.	Paris ..	Concert or Lecture (May begin 15 mins. earlier or later)	11.0 p.m.	500 Watts
463	8.30	Radio-Lyons ..	—— 250 m.	France ..	Orchestral Concert	10 p.m.	500 Watts.
341	8.45	Radio-Toulouse	—— 441 m.	France ..	Concert	11 p.m.	1.5 Kw.
130	8.45	Radio Paris ..	CFR 1750 m.	Clichy ..	"Radio Ball" Programme of Dance Music	10.30 p.m.	4 Kw.
343	9.0	Radio Club-Sevillano	EAJ5 357 m.	Spain ..	Concert	11 p.m.	1.5 Kw.
340	9.0	Radio-Catalana	EAJ13 460 m	Spain ..	Concert	Midnight	1.5 Kw.
131	9.15	Petit-Parisien..	—— 345 m.	Paris ..	Concert (Items announced in English as well as French)	10.30 p.m.	500 Watts.
464	10.0	Radio-Iberica..	RI 392 m.	Madrid ..	Concert (every alternate Sunday)	2 hours	3 Kw.
465	10.0	Union-Radio ..	EAJ7 373 m.	Madrid ..	Concert (every alternate Sunday)	1 a.m.	2 Kw.
133	10.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Greenwich Sidereal Time (Spark)	3 mins.	60 Kw.
344	10.0	Radio-Vizcaya Bilbao	EAJ11 418 m.	Spain ..	Concert	11 p.m.	1.5 Kw.
134	10.46	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Greenwich Mean Time (Spark)	3 mins.	60 Kw.
135	11.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in Greenwich Mean Time (Spark)	8 mins.	50 Kw.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature and Day of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
				SPECIAL DAYS.			
	p.m.						
142	4.40	Hilversum ..	NSF 1050 m.	Holland ..	Monday, Children's Hour ..	5.40 p.m.	2 Kw.
203	5.0	Gotenborg ..	SMZX 460 m.	Sweden ..	Tuesday, Concert	8.0 p.m.	300 Watts.
470	5.0	Radio-Belgique	SBR 262 m.	Brussels ..	Tues., Thurs. and Sat., Concert, followed by News	6 p.m.	2.5 Kw.
271	5.0	Helsingfors ..	—— 318 m. and 522 m.	Finland ..	Tues., Thurs. and Sat., Concert ..	7 p.m.	1 Kw.
137	5.0	Lausanne ..	HB2 850 m.	Switzerland	Wednesday, Children's Corner ..	1 hour	300 Watts.
147	6.0	Stockholm ..	—— 440 m.	Sweden ..	Wed., Thurs., Fri., Sat., Concert	7 p.m.	—
258	7.30	Ryvang ..	—— 1150 m.	Denmark ..	Tues., Wed. and Sat., Concert	8.30 p.m.	1 Kw.
223	8.0	Malmo ..	SASC 270 m.	Sweden ..	Thurs. and Sat., Dance Music	10 p.m.	500 Watts.
225	8.30	Le Matin ..	CFR 1750 m.	Paris ..	Saturday, Special Gala Concert	11 p.m.	4 Kw.
232	9.0	Voxhaus ..	B 505 m. and 576 m.	Berlin ..	Thurs. and Sat., Dance Music	11 p.m.	1.5 and 4.5 Kw.
471	9.0	Oslo	—— 382 m.	Norway ..	Wed. and Sat., Dance Music from Hotel Bristol	10 p.m.	1 Kw.
210	9.0	Radio-Wien ..	—— 530 m.	Vienna ..	Wed. and Sat., Dance Music ..	11.30 p.m.	1.5 Kw.
154	9.15	Petit-Parisien ..	—— 345 m.	Paris ..	Tues., Thurs. and Sat., Concert (Items announced in English as well as French)	11 p.m.	500 Watts.
272	9.45	Munich ..	—— 485 m.	Bavaria ..	Saturday, Dance Music	10.45 p.m.	1.5 Kw.
155	10.0	Radio-Paris ..	CFR 1750 m.	Clichy ..	Two evenings per week, Dance Music	10.45 p.m.	4 Kw.

The following are Relay Stations :—

Kassel, 273.5 m., 1.5 kw. ; relays Frankfurt.
Elberfeld, 259 m., 1.5 kw., and Dortmund, 283 m., 1.5 kw., relay Munster.
Nuremberg, 340 m., 1.5 kw., relays Munich.
Gleiwitz, 251 m., 1.5 kw., relays Breslau.
Stettin 241 m., relays Voxhaus.
Dresden, 292 m., 1.5 kw., relays Leipzig.
Bremen, 279 m., 1.5 kw., and Hanover, 296 m., 1.5 kw., relay Hamburg.
Graz, 404 m., relays Radio-Wien Sun., Mon., Thurs. and Sat.
Hjorring, 1250 m., and Odense, 950 m., relay Copenhagen ; sometimes Ryvang.
Lyons La Doua, 480 m., Marseilles, 350 m., and Toulouse, 310 m., relay Ecole Superieure, Paris.

The following Swedish Relay Stations are now working, using 200 watts :—

Gavle, 208 m. ; Umea, 215 m. ; Eskilstuna, 243 m. ; Saffle, 245 m. ; Kalmar, 253 m. ; Norrkoping, 260 m. ; Jonkoping, 265 m. ; Orebro, 237 m. ; Trollhattan, 322 m. ; Varberg, 340 m. ; Karlstad, 355 m. ; Falum, 370 m. (400 watts); Linkoping, 467 m. ; Karlsborg, 1350 m. ; and Karlskrona, 195 m.

These stations relay Stockholm as a rule, but also occasionally one of the other four main Swedish stations.

GREAT interest has been aroused recently by the statements of an inventor regarding apparatus which, he claims, renders television an accomplished fact. Whether or not the long-sought goal has been reached one cannot say, but for many years it has been possible to transmit photographs by telephone wires, and more recently by wireless. The subject is dealt with in an interesting article, entitled "Sending Pictures by Wire and Wireless," in the February issue of the *Wireless Constructor*.

A Trigger Circuit

In the same publication Mr. C. P. Allinson gives complete constructional details of a long-range 3-valve receiver employing the trigger circuit, originated by Major Prince.

Mr. J. H. Reyner introduces another of his delightful analogies in a discussion entitled "How Far Can Low-Loss Go?" illustrated by further simple pendulum experiments to show the effect of damping in both transmitting and receiving circuits. "Your Batteries," by Mr. A. Johnson-Randall, will prove useful to those about to commence valve work.

Is Television Possible?

Reception on 8 Metres

Short-wave (or had we better say "high-frequency"?) work seems to retain its popularity, and space is regularly devoted to this subject in *Wireless Weekly*. In the January 6th issue Mr. C. P. Allinson describes a receiver for 37,500 kc., and it is interesting to note that there are several amateurs transmitting at this frequency, which corresponds to a wavelength of 8 metres!

Those who make up receivers of their own often fail to realise the considerable effect on the operation of the set which may be caused by stray coil and other fields. This interesting subject is dealt with by Mr. Percy W. Harris in an article in the January 15th issue of *Wireless Weekly*.

A new series of articles, entitled "Circuits for the Experimenter," starts in the January 20th issue of the same journal, the first circuit to be dealt with being a "Split-anode" 4-valve neutrodyne.

Valve Detector Taps

The advantages of tapping a crystal detector across only part of the tuned circuit are well known, but little attention is given as a rule to similar methods of connecting a valve. That the matter deserves greater consideration is shown by Mr. G. P. Kendall in "The Use of a Detector Tap in Valve Circuits" in the January 20th issue of *Wireless Weekly*.

Several points of interest to the home constructor are dealt with by Mr. H. J. Barton-Chapple in the January 2nd issue of *Wireless*, the One-Word Weekly, where he discusses the question of earth leads, followed by an article entitled "What is Distortion?" in the January 16th issue.

New Set Designs

Of the many sets which have been described in the same journal during the past month may be mentioned a variometer crystal set, by Mr. John Underdown (January 9th); H.F. amplification with one valve, by Mr. G. T. Kelsey (January 2nd); a loud-speaker set for the local station, by Mr. E. H. Berry (January 16th), in addition to the usual selection of interesting articles.

Say one word

to your newsagent or bookstall attendant and for twopence he will hand you the brightest and most informative popular weekly wireless paper on sale.

Sound advice, hints and tips, and clear instructions to help you build a new set are given in every issue.

The latest circuits are discussed, and news is given about your favourite radio artists. Articles helpful and enjoyable to every listener, beginner in set building, and amateur on the look out for the latest interesting developments in radio are always to be found.

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The One-Word Weekly
Obtainable from all Bookstalls and Newsagents:
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Radio Press Ltd., Bush House, Strand, London. W.C.2.

THE WORD TO SAY IS JUST

RADIO PRESS

WIRELESS 2D

THE ONE—WORD WEEKLY

Published by Radio Press Ltd., Bush House, Strand, London, W.C. 2.

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Courage inevitably brings its due reward. Bunyan, Milton, Galileo and a hundred others possessed the moral courage to foreswear that which they could not reconcile with their ideals. They suffered, but the world to-day pays tribute to their courage.

Eureka entered a highly competitive field with new ideals and new ideas. Eureka was the first to possess the courage to make radical improvements in transformer design. A non-laminated core, a coppered steel case, hermetically sealed contents, huge windings—all these transformer improvements date back to the first Eureka Concert Grand.

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Eureka Concert Grand . 25/- No. 2 . . 21/-
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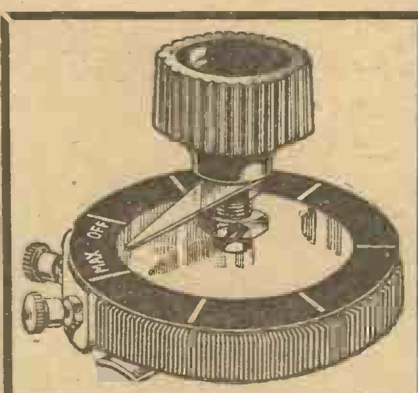
Advertisement of Portable Utilities Co., Ltd., Fisher St., London, W.C.2. Gilber Ad. 4361.



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FILAMENT RESISTANCES
ON BAKELITE MOULDINGS

7 ohms	2/3
15 ohms	2/6
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GRID BIAS BATTERY HOLDER

Fits any standard dry-cell. Screws on to base-board. No space wasted

Price 6d. pair.

7½d. post free.

From all dealers or direct from—

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LEYTON, E.10.

Trade enquiries invited. Tel.: Walthamstow 107

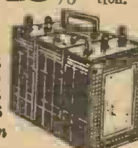
2,000 BRAND NEW ACCUMULATORS

Made by well-known London Electrical House.

For Wireless, Lighting, or Ignition.

At the following Nett Prices, which are :- 25% Reduction.

AMPS Igntn.	2 volts ea.	4 volts ea.	6 volts ea.
20	7/-	12/-	16/9
40	8/6	15/9	23/3
60	10/9	19/-	28/6
80	12/9	24/-	33/9
100	14/6	27/3	40/6
120	16/9	34/6	47/6



These bargains can be had on approval against remittance.

SPECIAL TERMS for TRADE on application.

WM. HURLOCK, JUNR., Ltd (Dept. W.),
55, EFFRA ROAD, BRIXTON, S.W.2.
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LITTLE WIRELESS GADGETS

M.A.P

Flush Coil Brasses, No. 99.

M.A.P. Co. 246 Gt. Lister St., Birmingham.

MAGNUM
COMPONENTS

MAGNUM "VIBRO" ANTI-CAPACITY VALVE-HOLDER.
Price 5/- each.
As used in several Radio Press Sets.

MAGNUM H.F. TRANSFORMERS.

An entirely new Design with Protected Windings.

Wavelength Range.

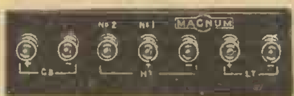
With .0003 Condenser.

No. 0...150—300
*No. 0A 250—525
*Special Neutrodyne Unit for Broadcast Range.

No. 1 ... 300— 600
No. 2 ... 550—1200
No. 3 ... 1100—3000
No. 4 ... 2500—7000

Price 7/- each.

SPECIAL H.F. TRANSFORMERS.
As used in the D.X.5 described in MODERN WIRELESS (December issue). Price per set of 3, including mounting brackets, **£1 17s. 6d.**



MAGNUM TERMINAL PANELS.
As used on several Radio Press Sets. Drilled and engraved, fitted with 7 terminals, 4/6.

Ditto as above, but NOT engraved (drilled only), supplied in any length up to 24 in. (Terminals are spaced 1 in. apart.)
Price 6d. per Terminal.
E.g.—12 in. Terminal Strip 6/-.
With Terminals.

"THE QUALITY 4."
As described in this issue by Mr. J. W. Barber.

		£	s.	d.
1	Radion Panel, 26 by 8 by 3/16, undrilled ...	£1	2	0
1	Mahogany Cabinet and Baseboard	2	2	0
1	Pair Magnum Aluminium Angle Brackets	0	3	0
4	Benjamin Valve Holders	0	11	0
1	Cyldon Var. Condenser, .0005	0	17	6
1	Cyldon Var. Condenser, .0003	0	16	6
1	R.I. Tapped Anode Reactance	1	5	0
1	Watmel Grid Leak and Condenser, .0003 mfd., and 2 meg.	0	3	0
2	Success Super Chokes	1	17	0
3	Peerless Dual Rheostats	0	11	3
1	M.-H. Potentiometer	0	7	6
2	Dubilier Condensers, .015 mfd.	0	9	0
2	M.H. 0.5 Ω Gird Leaks on base	0	7	0
1	Magnum Terminal Strip and 10 Terminals ...	0	5	0
1	Magnum Terminal Strip, A and E	0	1	6
2	Decko Dial Indicators...	0	0	9
1	Magnum Single Coil Holder	0	1	9
1	Igranic Pacent Jack, No. 63	0	2	6
1	Igranic Pacent Jack, No. 66...	0	3	0
1	Igranic Pacent Jack, No. 61...	0	2	0
1	Igranic Pacent Plug	0	1	6
1	C.A.V. Multiple Fixed Condenser, .001-.015 ...	0	5	0
24	feet Glazite	0	3	0
	Assorted Screws	0	0	6
2	Spade Tags and 1 yard Flex	0	0	3
1	Set R.P. Transfers	0	0	6
		£11	**19**	**0**

THE 2-VALVE REINARTZ.
As described in this issue by Mr. Johnson Randall.

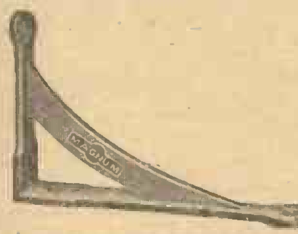
		£	s.	d.
1	Radion Panel, 14 by 7 by 3/16, drilled	£0	12	0
1	Cabinet and Baseboard	1	4	0
1	Magnum No. 1 Terminal Panel	0	4	6
1	Magnum A and E Terminal Panel	0	1	0
2	R.I. Dual Rheostats	0	15	0
2	Magnum Vibro Valve Holders	0	10	0
1	Lissen Choke	0	10	0
1	Dorwood Condenser, .0003 mfd.	0	2	6
1	Ediswan 1 meg. Leak	0	2	6
2	Small Angle Brackets	0	1	0
1	Brandes L.F. Transformer	0	17	6
1	Magnum Special Coil and Base, as described ...	0	12	6
1	Bowyer Lowe Var. Condenser, .0005	0	17	0
1	Bowyer Lowe Var. Condenser, .0002	0	14	0
1	Igranic Pacent Jack, No. P61	0	2	0
1	Igranic Pacent Jack, No. P63	0	2	6
1	Igranic Pacent Plug	0	1	6
4	Glazite, 2 feet lengths...	0	1	0
1	Spring Clip and 6 in. Flex	0	0	6
		£7	**11**	**0**

Special Coil, as fitted to The 2-Valve Reinartz, described in this issue, with 3 Tappings and 2 Pin base ... £0 12 6

THE D.X. 5.
As described in December and January issues of MODERN WIRELESS.

A Highly Selective Set.
Eliminates 2LO at 1½ miles, and receives B.B.C. and Continental Stations on the Loud Speaker.

	£	s.	d.
Complete Set of Components	£19	10	0
As above, ready wired and aerial tested	£22	0	0
Plus Marconi Royalties ...	£3	2	6



MAGNUM ANGLE BRACKETS.
As fitted to several Radio Press Sets.
Price per pair, 3/-.
Small size, 2/- per pair.

PURCHASE OUT OF INCOME.
To meet those cases where it is not convenient to purchase outright, we have arranged to supply the undernoted Complete Sets on the Instalment system.

	£	s.	d.
Magnadyne Super-Het ...	£35	0	0
Magnum De Luxe Receiver...	£40	0	0
Anglo-American Six	£22	0	0

(Royalties Extra.)

MAGNUM TERMINALS.
High-grade terminals 2 B.A., with drilled stems, nuts and washers, supplied in the following finish: Oxydized Copper, Lacquered Brass, Nickel Plated.
Price 3/- per doz.

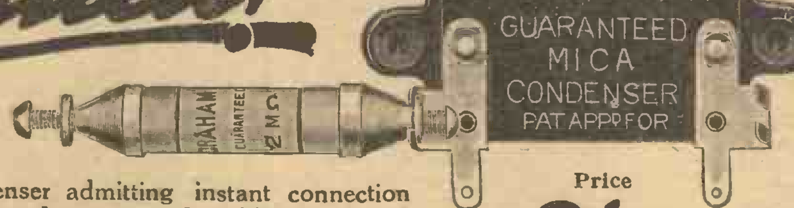
MAGNUM FLEX LEADS.
Neat and convenient Leads, 7-way, for H.T., L.T., and Grid Bias, to suit Magnum No. 1 Terminal Panel. 3/6.

Send stamp for Latest Lists dealing with 15 Radio Press Sets, and new Illustrated Catalogues.

NOTE.—Where a complete set of components, together, with a drilled panel, is purchased, Royalties at the rate of 12/6 per valve holder are payable.

BURNE-JONES & CO., LTD., MAGNUM HOUSE, 296, BOROUGH HIGH STREET, LONDON, S.E. 1.
Telephone: Hop 6257. Telegrams: Burjomag, Sedist, London.
Cables: Burjomag, London. *Trade Enquiries Invited.*

ACCURACY
Guaranteed!



The only grid leak and condenser admitting instant connection in series or parallel. Tested and guaranteed. Thousands of satisfied users. From all dealers, or post free from—

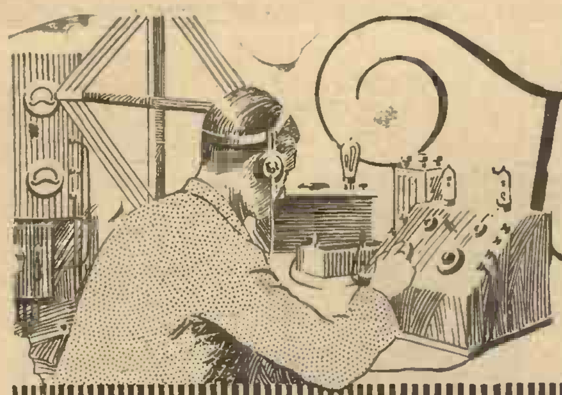
THE GRAHAM FARISH MFG. CO., Wray Works, BROMLEY, KENT.
Liberal Trade Terms on application.

Price
2/-
Complete.

Grid leaks (all sizes), 1/3

Condensers.
·0001—·002 ... 1/-
·003—·006 ... 1/6

 In replying to Advertisers, use Order Form enclosed.



Tested by Ourselves

Crystal Detector

MESSRS. McLEOD & McLEOD have submitted an M. & M. crystal detector for our examination and report.

Makers' Claims

It is a precision instrument in every sense of the word, is absolutely dustproof, and the face of the crystal can be wholly explored. A micrometer adjustment for the catwhisker gives a sensitive control.

Description of Component

The crystal and catwhisker are housed in a glass tube $1\frac{1}{2}$ in. long and nearly 1 in. in diameter, which is

On the M. and M. Crystal Detector the catwhisker and crystal sections are interchangeable.

held in two metal collars. These collars are mounted on an insulating base, the screw threads and nuts brought out below the base being for the purpose of panel mounting and making connection to the detector. The crystal cup has a friction-tight fit over a hollow cylinder, good contact with the crystal being secured through the agency of a spring. This cup is incorporated in a metal end plate, which fits friction-tight into the metal collar and can be rotated by means of a milled insulating knob. The catwhisker is held in a jaw attached to a small "crank arm." This can be rotated bodily by means of a metal end plate similar to that for the crystal cup. Lateral movement is given to the catwhisker through the aid of a small milled knob and screw.

The face of the crystal can be wholly explored and the micrometer adjustment for the catwhisker gives a very sensitive control. The crystal and catwhisker sections are interchangeable, giving the advantage of right or left-handed control.

General Remarks

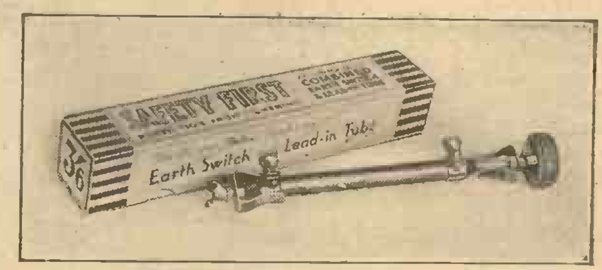
The workmanship of this component is particularly noteworthy, the ease of operation and fineness of control being good features.

Combined Earth Switch and Lead-in Tube

A COMBINED earth switch and lead-in tube has been sent by Messrs. E. Shipton & Co., Ltd., for test at our Laboratories.

Description of Component

This component consists of a $\frac{1}{2}$ in. insulating tube 6 in. in length, with a plated metal clip and terminal fixed at each end. An $\frac{1}{8}$ in. square section metal rod passes through the centre of the tube, one end terminating in a V-shaped metal clip and wing nut terminal, while the opposite end has a similar clip and milled knob. The wing nut terminal is connected to the aerial down lead, and the clip and terminal close to the knob is connected to the receiving set. The remaining terminal on the tube is provided for the earth lead.



The "Safety First" combined aerial lead-in insulator and earth switch.

Laboratory Tests

The tube was inserted in place of an ordinary lead-in tube. On pushing the knob the aerial was connected to the set, and on pulling the rod until the back clip registered with the earth terminal the aerial was earthed.

The component was in use during a week of very bad weather. No trace of loss in signal strength was noticed due to leakage, and the insulation resistance before and after test was infinite. No corrosion was perceptible on the clips or terminals, and the component, which was strong mechanically, adequately fulfilled its function.

Aerial Insulator

A SAMPLE aerial insulator has been sent to us for test by Mr. W. J. Scott.

Description of Component

This insulator consists of two flat egg-shaped pieces of ebonite, $\frac{5}{16}$ in. thick, which are held together by four brass screws and nuts. A groove is cut on the inner face of each half so that when the ebonite halves are clamped together a 7/22 aerial wire is tightly gripped. The shape of this groove enables the aerial and lead-in wire to be continuous without the necessity for twisting round the insulator. A $\frac{1}{4}$ in. hole is provided through the complete insulator for attaching the stay wire, and the

Constructors!
Insist on L.E.W. Covered wire


THERE is over forty years of specialised knowledge behind LEW Wire. Manufactured for the electrical industries during this period, LEW Wire of quality has stood the test of time. Constructors of wireless sets who use products bearing the LEW seal can be sure of quality and satisfaction. Next time you buy wire, insist upon reels bearing the LEW seal.

Products guaranteed, by the LEW seal

COTTON COVERED WIRE
SILK COVERED WIRE
ENAMEL INSULATED WIRE

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LTD

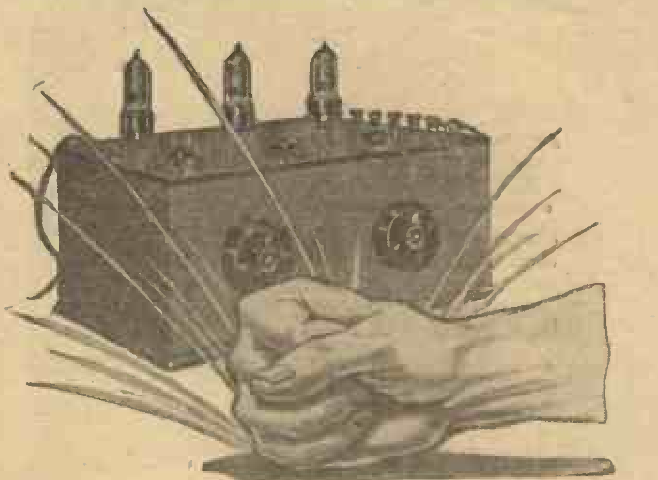
The LONDON ELECTRIC WIRE Co. & SMITHS Ltd.

(Makers of Electric Wire for over 40 years)

PLAYHOUSE YARD, GOLDEN LANE, LONDON, E.C.1

Telegrams: "Electric, London." *Telephone: Clerkenwell* 1388, 1389, 1390, 1391.

JUDD.



Bang! and not a complaint from Neutron Valves!

No need for "anti-microphonic" valve-holders now. Vibration doesn't produce a sound from Neutron Valves with their long-lasting, robust filaments.
With ordinary care, the Neutron Dull-Emitter will last indefinitely, giving full volume and distortionless reproduction; it is more robust than other D.E. Valves, being made to work safely on 3.5 to 4 volts. And what extraordinary volume is given by Neutron Valves will be demonstrated by your Dealer, if you ask him. Clear, bell-like reproduction, too. Change over to Neutron Valves to-day.

NEUTRON VALVE

H.F.—Red Spot	L.F.—Green Spot
CHARACTERISTICS:	CHARACTERISTICS:
Filament Voltage: 3.5 to 4 Volts.	Filament Voltage: 3.5 to 4 Volts.
Filament Current: .06 Amperes.	Filament Current: .06 Amperes.
Anode Voltage: 20–100 Volts.	Anode Voltage: 20–100 Volts.
Total Emission: 9 Milli-amperes.	Total Emission: 15 Milli-amperes.
Impedance (Approx.): 22,000 Ohms.	Impedance (Approx.): 12,000 Ohms.
	Grid Bias Voltage: Up to 6 Volts.
Amplification Factor: 9.	Amplification Factor: 6 to 7.

Sold by Radio dealers everywhere. In case of difficulty send P.O. 12/6 for sample valve, post free. Address "Valve Dept. A." Neutron Distributors, Sentinel House, London, W.C.1. British made and guaranteed by Neutron, Ltd.

·06 for 12/6

edge of the insulator is grooved, thus providing additional leakage path.

Laboratory Tests

The insulation resistance of the component was initially found to be infinity. The insulator was then placed in position on an outside aerial and left for a period of one month, during which time extreme atmospheric conditions were experienced. No trace of signal strength reduction was noticed, and after dismantling and retesting for insulation resistance, it was found to be unimpaired.

General Remarks

The ebonite appeared to be of very good quality, but the four screws should not have been screwed into the ebonite, as the fit is too tight. It would be better to provide a clearance hole in the ebonite and allow the final fixing to be brought about by the brass nuts.

The advantage of allowing aerial and lead-in to be continuous is a feature worthy of note, and the component can be confidently recommended.

Variable Condensers

MESSRS. WILKINS & WRIGHT have submitted to us for test samples of their "Utility" Square Law Variable Condensers, *i.e.*, two ·0003 μF and one ·0005 μF condensers.

of ebonite so arranged that the dielectric loss is negligible.

Substantial soldering tags are provided, but no terminals. The knob and dial are made in one piece of black moulded material, and half the circumference is divided into

A partially enclosed "Utility" variable condenser.

100 divisions. The dial is secured to a ¼-in. shaft by a set screw.

Laboratory Tests

The movement of this condenser was found to be very easy and uniform. The results of further tests are shown in the table.

The resistance between moving vanes and terminals was less than ·01 ohm.

Rated Capacity in μF.	Actual Capacity in μF.	Minimum Capacity in μF.	H.F. Res. at 833·3 Kilocycles.	Insulation Resistance.
·0003 ·0003 ·0005	·00027 ·00027 ·000485	·000010 ·000010 ·000012	Negligible	Infinity

Description of Condensers

These variable condensers, which are of the square law pattern, possess several novel and interesting features. All the plates are of aluminium, and the fixed plates are enclosed on the sides remote from the shaft on which the moving vanes are mounted. The moving vanes are mounted on a screwed shaft, which screws into the inside of a screwed bearing in the end plate nearest to the dial. Thus as the moving vanes revolve through the 180 degrees allowed, the shaft screws and unscrews, but the amount is of course too small to allow the two sets of plates to approach each other appreciably.

The upper end plate is separated from the fixed plates by three pieces

General Remarks

This condenser is quite good and can be thoroughly recommended to the constructor.

Collapsible Frame Aerial

OUR Elstree Laboratories have received a sample collapsible Frame Aerial ("Amplifex") from the Penton Engineering Co., for test purposes and subsequent report.

Description

The wooden frame is mounted on a stand so that the frame can be easily rotated. The diagonal cross pieces are just over 3 ft. in length, and with the aid of a clamping screw and wing nut, operating in the vertical slotted wooden upright, it is possible to

CYLDON

GROUNDED ROTOR
SQUARE LAW
VARIABLE CONDENSERS

THE ARISTOCRAT OF BRITISH MADE VARIABLE CONDENSERS

PRICES WITH 4in. KNOB DIAL

·0005 Mfd.	. .	17s. 6d.
·0003 ,,	. .	16s. 6d.
·00025 ,,	. .	16s. 0d.
·0002 ,,	. .	15s. 6d.

FROM DEALERS OR DIRECT POST FREE

SYDNEY S. BIRD
"CYLDON WORKS"
SARNESFIELD ROAD
ENFIELD TOWN
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Telephone . . ENFIELD 672

MADE BY B. B. C. (BRITISH BATTERY CO. LTD.) WATFORD — **WIRELESS DRY BATTERIES** — FOR **B. B. C.** SETS

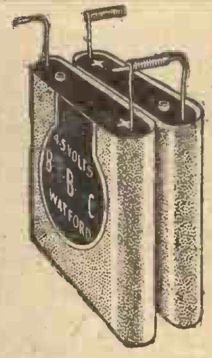
No. 1 W.

Standard Pocket Lamp Size—4½ Volt *with* patent spiral wire terminals *and* plug sockets to take Wander Plugs.

Note:—1 doz. = 54 volts.

Used units replaced easily.

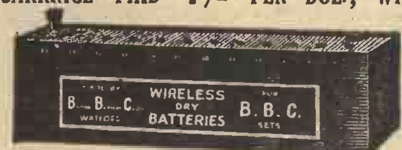
Connect as illustrated



To connect in Series insert straight Terminal in Spiral of next battery. Bend spiral and thus ensure permanent electrical connection without soldering.

Guaranteed BRITISH MADE at our Watford Works.
Patent No. 202760.

PRICE CARRIAGE PAID 7/- PER DOZ., WITH PLUG



Prices include Wander Plug. Carriage paid.

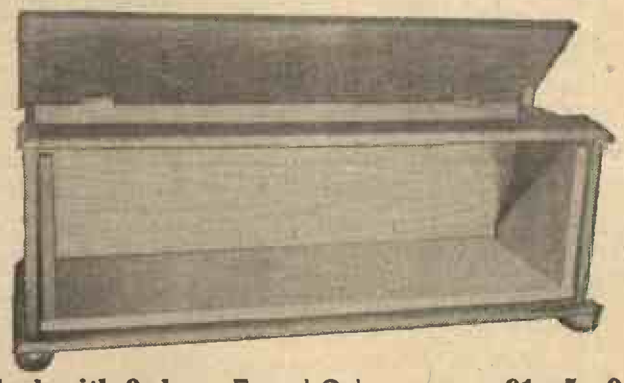
		Each.
No. 2W, 16½ volts, 3 volt tappings.	Price	3/-
No. 4W, 36 ,, ,, ,, ,,	,,	6/6
No. 5W, 60 ,, ,, ,, ,,	,,	12/-
No. 6W, 9 volts, Grid, 1½ volts tapping	,,	2/3

BRITISH BATTERY CO., Ltd.
CLARENDON ROAD, WATFORD, HERTS. (*Telephone: Watford* 617.

Barclays 1029

CAXTON 4-VALVE CABINET

Made for Editor of Wireless Magazine for Set "As good as money can buy" described in issue February, 1925.



Cash with Order. Fumed Oak ... **£1 5 0**
or Real Mahogany polished **£1 14 0**

With detachable recess fitted Base Board to mount 21 in. by 7 in. panel to slide out of Cabinet front.

Extra 10/- with two beaded front doors totally enclosing fitted panel.

Cabinet overall length 22½ ins. Width 8½ ins. Height 9 ins.

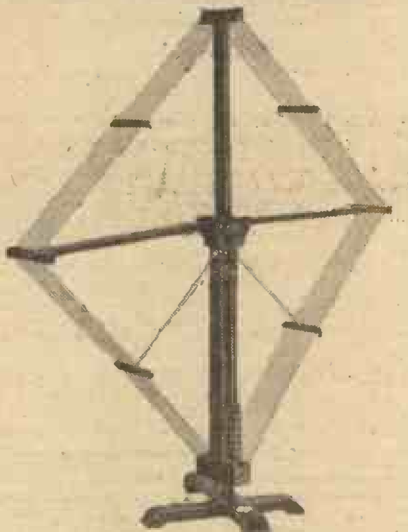
Polished with the new enamel that gives a glass hard surface that cannot be soiled or scratched.

SENT FREE.—Catalogue of standard Wireless Cabinets in various sizes and woods. Special Cabinets made to customer's orders.

PACKED AND DELIVERED FREE IN U.K.

CAXTON WOOD TURNERY CO., Market Harborough

open the frame to its full size (about 2 ft. each side). With the same device it can be folded into a relatively small compass. The aerial wire consists of 13 turns of silk covered wire spaced about ¼ in. apart, and clamped in eight positions by wooden strips. Six terminals are provided, one for each end of the frame, while the terminals 2 and 3, and 4 and 5, represent the ends of two breaks in the aerial circuit. It is thus necessary to short circuit these terminals by wire links as occasion demands. When shunted by a 0.0005 μF condenser the wavelength ranges



This collapsible frame aerial gives good results.

were 120 to 260 metres, 224 to 600 metres and 290 to 812 metres. A compass is sunk into one of the four wooden supporting feet, thus enabling bearings to be taken when necessary.

Laboratory Tests

The frame aerial was used in conjunction with a Radio Press eight-valve Superheterodyne Receiver. Good signals were observed on several B.B.C. and Continental Stations when compared with our own standard hexagonal frame of slightly larger dimensions (see *Wireless Weekly*, Vol. 5, No. 9). The usual directional effects were obtained with this frame, and the insulation resistance between individual turns was infinite.

On a measurement of high-frequency resistance the following approximate results were obtained:

Tappings 1–4.

Kilocycles.	Wave-length.	Resistance.
825	364	6 ohms.

Tappings 1–6.

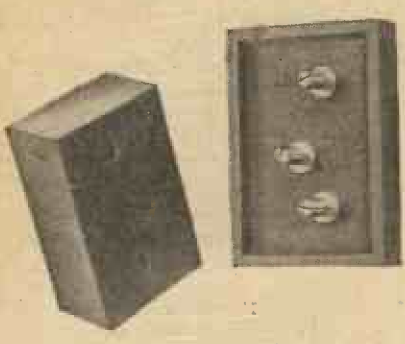
600	500	7 ohms.

Can'tcross Connector

MESSRS. J. & W. BARTON have sent us a Can'tcross Connector for report at our Elstree Laboratories.

Makers' Claims

Once fitted it always prevents wrong connections being made, thus assuring full life to valve filaments. It acts as a triple switch, as by the withdrawal of the socket element the H.T., L.T. and grid bias supplies are simultaneously cut off from the set. The live member is fully insulated, and thus prevents damage to batteries by shorting.



The plug and the socket parts of the "Can't-cross Connector.

Description of Component

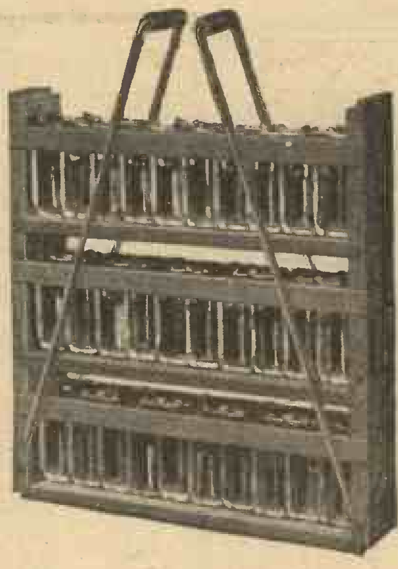
The connector consists of a moulded base $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. This base is hollowed out to a depth of $\frac{3}{4}$ in. and three split pins project from the base, being stamped (H.T. +), (H.T.— and L.T.), and (L.T.). On the underside of the base, screw ends, $\frac{7}{8}$ in. in length, are provided for making connections to the pins and also for panel mounting. A moulded block fits into the hollowed base, and has three sunk sockets which fit on the pins. Connections to these three sockets are made along channels cut in the material, and a moulded lid is screwed over these terminals so that they are completely insulated.

General Remarks

This connector is adaptable to any circuit where one H.T. terminal is required, but additional terminals would be needed for further H.T. tappings. When in position the battery terminals on the set are well insulated, and short circuits cannot occur. An insulation test produced good results, and the component should prove very useful.

Circuits for the Experimenter

Readers who wish to try fresh circuits will derive much assistance from the information given periodically in "Wireless," the One-Word Weekly. The present issue contains three good arrangements by Mr. A. Johnson-Randall.



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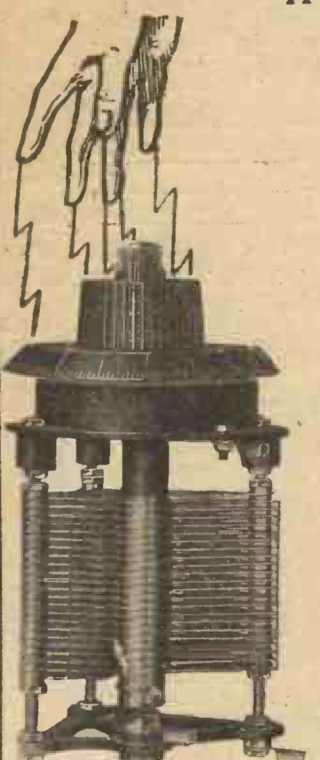
Fulstop



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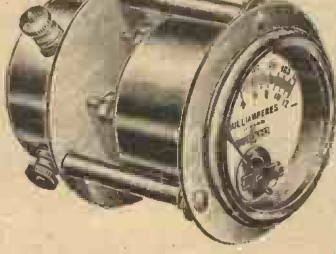

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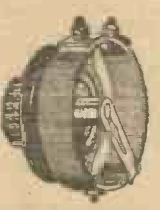

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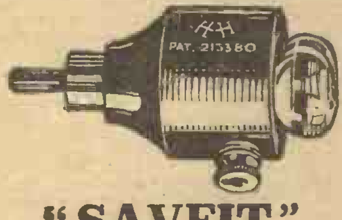

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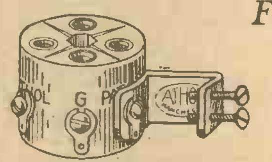

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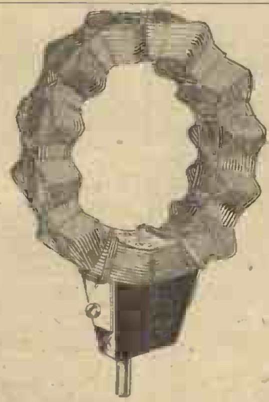

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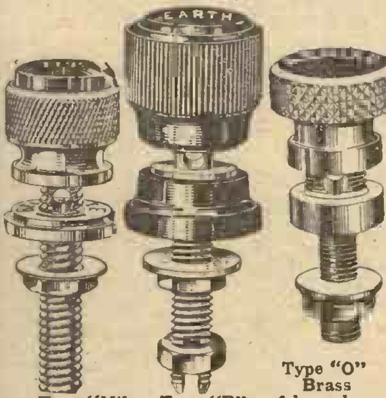

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